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Going from pocket money to a salary, a budget and life savings

Explaining inflation, interest rates, wealth creation etc.

The basics of Bitcoin and crypto

Your personality and emotions impact how you invest

THE ECONOMY + YOU

ACADEMY OF SCIENCE OF SOUTH AFRICA



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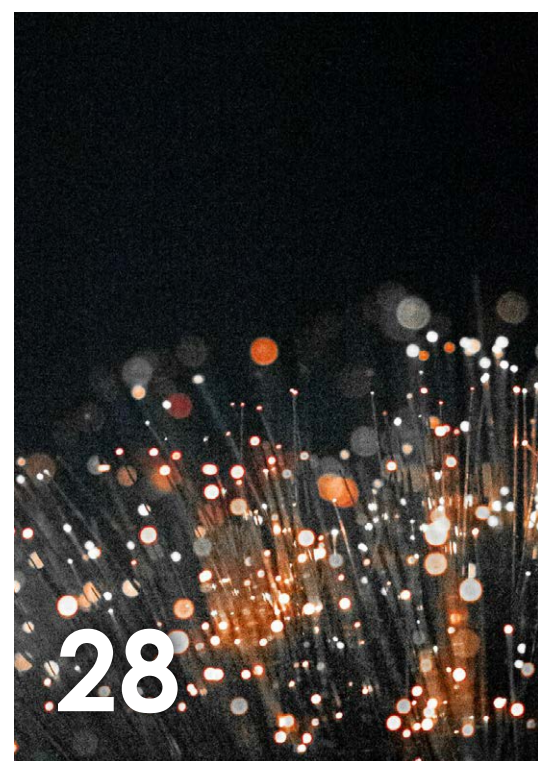
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Cover image

We all have different needs and requirements when it comes to the money in our pocket and in our bank accounts. But sound spending, investing and saving habits can benefit everyone. We hope this edition will help you understand the forces at play in the economy, and to make the money in your pocket go further. Photo: Depositphotos.

The economy, and you

The economy, and how to work with your money, doesn't need to be a mystery. Although it can inevitably get complicated, the basic concepts are actually deceptively simple: Spend less than you earn, don't live above your means, be allergic to debt, only invest what you are willing to lose, saving a little consistently can go a very long way, etc. That is what this edition is about – to help empower you to leave school or enter a career or start a family with the confidence that you know enough about the economy and personal finance to not make unnecessary or costly mistakes.

I never used to care about the economy, until I FOMO'ed into Bitcoin in 2017 and learned a ton of valuable (and some costly) lessons simply due to the fact that I was emotionally invested – I had “skin in the game” as it were. I learned how a small investment in the right opportunity at the right time can create a lot of wealth quickly. I also learned that not all “opportunities” are in fact opportunities (like many crypto “altcoin” projects or scams) and that you can lose money as quickly as you can make it if you don't do your own research and take a conservative stance on risk. I learned how to read candle charts, major chart trends and patterns and I learned how supply and demand drives price. Most importantly (for me), I learned how the global economy is kind of a big experiment where Central Banks frequently basically print money out of thin air (since the Gold Standard was abandoned in 1971) in order to keep things

afloat – which is why I am enthusiastic about Bitcoin, a decentralised (like the internet), unalterable, transparent digital currency of which there can only ever be a fixed amount (21 million). Time will tell.

What matters for you is, we have assembled articles to answer questions such as “What is inflation?”, “How do interest rates work”? And “Why is tax so hard?” So that you can get a little wiser about the economy and how to make the best use of your money to create long-term wealth. We even look at how your emotions and personality can impact how you invest, whether you should trust ChatGPT for investment advice, and some advice on how to turn a science idea into a viable business.

We hope it will give you some food for thought, and perhaps give you some financial tools to make the most of your festive season and your budget or investment plans for 2024. Either way, be safe, save when you can, and enjoy the holidays from the QUEST team.

With regards,



Fanie (RS) van Rooyen (Editor)

Ikonomi, le gore o šoma bjang ka tšhelete ya gago, ga go nyakege gore e be sephiri. Le ge e ka raragana ka mo go sa phemegego, dikgopolo tša motheo ge e le gabotse di bonolo ka mo go forago: Diriša tšhelete e nyenyane go feta yeo o e hwetšago, o se ke wa phela ka godimo ga bokgoni bja gago, o be le allergy go dikoloto, beeletša feela seo o ikemišeditšego go se lahlegelwa, go boloka go se nene ka go se fetoge go ka ya a tsela ye telele kudu. Ke seo kgatišo ye e lego ka ga sona – go thuša go go matlafatša go tlogela sekolo goba go tsena mošomong goba go thoma lapa ka tšhepo ya gore o tseba ka mo go lekanego ka ga ekonomi le ditšhelete tša motho ka noši gore o se dire diphošo tše di sa nyakegego goba tše di bitšago tšhelete ye ntši. Eka e ka go fa didirišwa tše dingwe tša go šomiša sehla sa gago sa monyanya ka mo go holago le tekanyetšo ya gago goba dipeeletšo ka 2024!

Translated into Sesotho sa Leboa/Northern Sotho by Tebatso Isaac Makwala

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MONEY 101:

Going from pocket money to a salary, a budget and life savings

As you step out of school and into the workforce, your financial landscape undergoes a significant transformation. Gone are the days when your primary financial concern was managing pocket money. Now, as you earn a salary, you're faced with new responsibilities and choices. These include budgeting, saving, investing, and understanding various financial obligations like taxes, medical aid, and pension funds. Your perspective on spending will inevitably change, and that little voice of reason becomes crucial in guiding your financial decisions.

Understanding your paycheck

Your first paycheck is a mix of earnings and essential deductions. It reflects not only your hard work but also your contributions to broader societal and personal needs. Key deductions include income tax known as pay as you earn (PAYE), medical aid, and pension funds, each playing a crucial role in your present and future security. Make sure you understand that your gross salary (your total cost to company) is not the same as your net income, which is the money you actually receive in your bank account after all the necessary deductions have been made.

Taxes

Among various financial responsibilities, understanding and handling taxes stands out, especially for young adults who are new to the workforce. In South Africa, dealing with taxes primarily involves understanding the PAYE system, filing tax returns, and recognising what counts as tax-deductible.

The PAYE system is a method where tax is deducted from your monthly salary by your employer. This means you're paying your taxes incrementally throughout the year. While this simplifies the process of tax payment, you still need to



be aware of your responsibilities when it comes to filing tax returns. As a taxpayer in South Africa, you're required to file an annual tax return with the South African Revenue Service (SARS). Here's a simplified guide:

1. Registration for e-Filing

If you're not already registered, you'll need to sign up on the SARS e-Filing website (www.sarsefiling.co.za). This online system streamlines the process of filing your tax return.

2. When should you file?

Tax season in South Africa usually runs from July to November for non-provisional taxpayers. Keep an eye on SARS announcements for specific dates each year.

3. The filing processes.

Through the e-Filing portal, all of your information will be linked to your ID but in some instances, you'll be required to submit your tax return (ITR12 form). The system is user-friendly and guides you through the process. You'll need to provide information about your income, deductions and other relevant financial details.

Another important thing to take note of is tax deductions. These are specific expenses that the government allows you to subtract from your gross income before calculating your tax liability. This means these expenses can lower the amount of income tax you owe. Common tax-deductible items include retirement annuity contributions, medical expenses, travel expenses (if you use your vehicle for work purposes beyond commuting, you may be able to claim these costs). It's important to keep records and receipts of these expenses throughout the year, as they will be required when you file your tax return.

The art of budgeting

Lend me your ears, it's time to listen up! Budgeting, simply put, is about knowing your income, outlining essential expenses (rent, food, transport), and then allocating the remaining funds between savings and leisure.

Begin by setting clear short-term and long-term financial goals, as these will guide your budgeting efforts. Consistently track your income and all your expenses, including essentials like rent and utilities, and discretionary spending such as entertainment. Using budgeting apps like 22seven can simplify this process, allowing you to see where your money is going immediately.

It's crucial to allocate a portion of your income to savings immediately upon receiving your paycheck, treating it as an essential expense.

Don't forget to factor in debt repayments, especially those with high interest rates, as prompt payments can save you lots of money in the long run. Remember, a budget is flexible; it should adapt to changes in your life circumstances. Include a buffer for unexpected expenses to avoid financial strain. Remember, budgeting doesn't mean cutting out all the fun; ensure you set aside a little something for enjoyment or rewards, making the process sustainable and balanced.

Saving for a rainy day

Savings serve as a buffer against life's unpredictabilities. A good rule of thumb is to save up enough to cover at least one month of living expenses. Depositing this in a high-interest savings account can enhance its growth, maximising the benefits of your savings with minimal effort.

Growing your wealth wisely

Investing is crucial for financial growth, especially considering inflation and the need for your savings to outpace it.

For a young professional, passive investing (you don't buy and sell shares yourself) is a practical and effective strategy. A few ways in which you can grow your wealth is with pension funds, where your contributions are typically invested in a diverse mix of assets. Over time,

It's crucial to allocate a portion of your income to savings immediately upon receiving your paycheck, treating it as an essential expense.

thanks to the power of compounding interest, these grow significantly. Another one is mutual funds. These types of funds allow you to invest in a diversified portfolio managed by professionals, spreading risk and requiring minimal active management from you. Lastly, a Tax-Free Savings Account (TFSA) stands out as an excellent investment option for young individuals entering the workforce. It's an enticing vehicle because it offers tax benefits that extend not only to the amounts you contribute but also to the growth of those investments over time.

Let's say you invest your money in a TFSA; not only is your initial capital protected from taxes, but any interest, dividends or capital gains it generates are also tax-free. This can significantly enhance the value of your investment over time. Here's the kicker: unlike retirement funds, which are typically locked in until you reach a certain age, a TFSA offers more flexibility. You can withdraw your money when you need it without incurring penalties or taxes. However, it is wise to use this flexibility

wisely since the aim is to allow your investment to grow over the long term.

The annual and lifetime contribution limits on TFSAs ensure that this investment tool remains targeted towards savings and growth, rather than just another transactional account. For young workers, adhering to these limits and making consistent contributions can lead to substantial financial benefits.

By investing early and taking advantage of the compound growth within a TFSA, you're not just saving money; you are building a tax-free foundation for your future financial milestones. Whether it's for education, a significant purchase, or even a head start on retirement savings, a TFSA is a powerful and prudent choice for anyone.

Starting your career is an opportunity to lay the groundwork for financial stability. By managing your paycheck effectively, budgeting wisely, saving for emergencies, and investing smartly, you're setting the stage for a secure financial future.

Article written by Johnny Jansen van Rensburg , a lecturer at the North-West University (NWU) School of Economic Sciences, who specialises in financial markets, derivative instruments and investment management.

Ge o dutše o e-tšwa sekolong le go tsena mošomong, boemo bja gago bja tša ditšhelete bo fetoga kudu. Go fetile matšatši ao ka ona selo se segolo seo o bego o tshwenyegile ka tša ditšhelete e bego e le go laola tšhelete ya ka potleng. Bjale, ge o dutše o hwetša mogolo, you're faced with new responsibilities and choices. Tše di akaretša tekanyetšo, go boloka, go beeletša, le go kwešiša ditlamo tše di fapafapanego tša ditšhelete go swana le metšhelo, thušo ya kalafo, le ditšhelete tša phenšene. Pono ya gago ka go diriša tšhelete e tla fetoga ka mo go sa phemegego, gomme lentšu leo le lenyenyane la mabaka e ba la bohlokwa kudu go hlahlala diphetho tša gago tša tša ditšhelete.

Translated into Sesotho sa Leboa/Northern Sotho by Tebatso Isaac Makwala





THE BASICS OF THE ECONOMY - AND YOU

So how does the economy even work, and how can I understand something that seems so complex? By sticking to the basics. If you have a general grasp of the concepts that drive the economy, you will do just fine in becoming part of it.

What is inflation?

Inflation simply means that prices go up, while deflation means prices go down. The economy is primarily driven by supply and demand. If there is a low supply of a certain type of good (like wheat or oil or the Playstation 5) and a high demand for that good, then prices go up. If there is an oversupply or a low demand, prices go down. Governments make use of interest rates on borrowed money to help regulate inflation in a country's economy, so that inflation doesn't get out of control.

How do interest rates work?

When you borrow money, you pay interest, which is usually expressed as an annual percentage of the amount borrowed. When you save money in an account, the bank will pay you an interest rate based on how much you save, and your total saving balance will grow over time. The interest is the money that someone earns on their savings or charged on the amount borrowed. Simple interest (SI) is calculated as a percentage of the principal (P)* annual

interest rate (R)*, time (T), amount of interest ($SI = P \cdot R \cdot T$), and compound interest, where compound interest includes accrued interest along with the principal.

Most savings and loan deposits use compound interest. For example, if you borrow \$100 at 5% interest, you will pay back \$105 to the lender. The lender will profit by \$5.

In addition, each loan has an interest rate that determines the total amount owed. The reserve bank of a government determines the interest rates for that country's economy, in other words how much interest you will pay if you borrow from your bank to buy a car or a house or how much interest the bank will pay you on your savings.

How can I start a small business?

You need a business idea to start a small business. For example, I want to open a men's-only salon. You should also conduct an environment scan, which means determining where you want to set up your business, whether the

market is available, and who the people in that location are (if they are viable potential customers).

Furthermore, having a business plan is critical. What are the requirements for capital, both financial and human capital, marketing skills, budgeting, and record-keeping?

Why is tax so hard?

Overall, tax is complicated, making it difficult and costly to understand, particularly for the majority of individual taxpayers. It is constantly competing with people's needs and is difficult to calculate for many. There are many reasons why tax is so difficult. The majority of people are ignorant about tax, how to compute it, policy compliance, and so on, and many people simply avoid it by not paying tax, but this is risky since you are always eligible for back-payment of unpaid tax debt. However, a registered business must pay taxes.

What are the best ways to save money or invest?

You can save money in a variety of ways, such as through a bank savings account. Banks offer their customers savings accounts to help them save. You can also specify how much you want to save and how often you want to save (daily, weekly, monthly, etc.). Furthermore, the bank offers fixed accounts in which a client can deposit a certain amount of money with the bank for a set period and then withdraw that money; otherwise, if you breach the contract, you are likely to pay the consequences. With these two accounts, the bank continues to add a daily interest rate to your account based on the bank's performance.

Saving groups – Savings and Credit Cooperative Organisations (SACCOs) – are also used by some people. SACCOs are governed by the government and managed by their members. They offer opportunities for members to save and borrow at low-interest rates. A SACCO can be formed at the local, regional, national, or international level. People with similar interests pool their money and save for their future or a specific need, but most of the time, SACCOs are seen to financially empower people while also assisting them in improving their lives.

The use of a money box or piggy bank is a simple and easy way to teach family members to save at the family level. A money box typically has a small hole that serves as a door for storing money. They are also commonly referred to as pigeon boxes. Someone can save money in a box for a particular period for a specific goal, such as one year, and the goal is met. However, this method requires a lot of financial discipline so that one does not keep using the money whenever one is in a financial crisis.

We also have village saving loan associations (VSLA), which are typically at the village level and consist of small groups of people. Its members control all of the money saved and participate in decision-making. Members are typically low-income earners who save a small amount of money weekly or monthly before participating in cash rounds in which each member receives money to add to or start a business. This method is widely used in rural areas.

Again, with the advancement of technology, different individuals can use their phones as a form of savings. This is possible with mobile money. You can save and invest with the communication companies themselves, and you can get your money back at any time.



Furthermore, one can save in assets like property such as land, rentals, animals, poultry, treasury bills, bonds, and so on.

Recently, insurance companies have offered various ways for people to save money with them. For example, through the unit trust policy, and so on. You open an account with the insurance company and begin depositing premiums on a monthly basis, and the company pays you back with interest at maturity. Other policies include investment policies, child policies, and so on.

What are the best tips for creating long-term wealth?

There are many tips for creating long-term wealth, including but not limited to the following: one, you must be passionate about acquiring wealth; this will motivate you to work hard and put in extra effort where necessary; and two, having good people and personal relationships is essential.

You cannot create wealth without people, and no business can exist without customers. Know your financial advisers, and find reliable people to go into business with. Time management is also essential. It is critical to manage time when opening and closing a business, as well as knowing when to add more money to the business and when to commit to work. Also, one must be respectful to maintain friendly relations with the people in one's business and those who have previously been in business. Good relationships can help you grow steady wealth.

Article written by Dr Hellen Namaweje , a research fellow in the Future Africa Research Leadership Fellowship (FAR-LeaF) programme of the University of Pretoria (UP), a research-oriented programme addressing the interlinked challenges of health, well-being, and environmental risks in Africa. Prof. Stephanie Burton  is the Programme Director.

Ka gona ikonomi e bile e šoma bjang, gomme nka kwešiša bjang selo seo se bonagalago se raragane gakaakaa? Ka go kgomarela dilo tša motheo. Ge e ba o na le kwešišo ya kakaretšo ya dikgopolo tšeo di sepedišago ekonomi, o tla dira gabotse ka go ba karolo ya yona.

Translated into Sesotho sa Leboa/Northern Sotho by Tebatso Isaac Makwala



How do your personality and your feelings

play a role in investing?

Imagine making your money work for you... Imagine finding a safe place where you can store your money and when you return, you find more than what you put in... Earning a positive return on any investment is the goal of every investor. But you might be surprised to find out that knowing your own personality and being aware of your emotions can play a huge role in how successful you are at investing.

How many stories have you heard of people making “lots” of money by investing in Bitcoin? While that may be true for some, it’s not true for all. Firstly, the more people jump on the bandwagon, the less profit is available per person (you’re dividing the same amount of profit between more people).

Secondly, if more people jump on the bandwagon, you’re going to increase the price (more demand whilst supply stays the same means that price will increase). You then see how your “wise” decision to follow the crowd is paying off because you bought at the right time. This “confidence” is just a self-fulfilling prophecy that was bound to happen to the economic fundamentals of supply and demand.

Understanding risk and return is key not just to investment decisions but to life in general. Risk and return are the foundations of any finance course at university. Students are taught that, in theory, risk and return are positively related. In other words, if you take on more risk, you should earn a higher return. In practice, this relationship

doesn’t always hold for a variety of reasons. Did you know that one of those factors is your emotions and personality? Let’s explore how emotions and personality can influence your investment decisions.

Homo economicus vs Homo dramaticus

Textbooks describe financial market participants as rational decision makers, known as *Homo economicus*. These decision-makers crunch numbers in their heads (or on the PC) and make a logical, reasonable decision to buy or sell shares in the market. However, making a rational decision is easier said than done, especially when emotions enter the equation. To take an extreme, dramatic example – if you just got married before going to work at 9am, will your emotions influence your productivity or the decisions you make that day? Or, if you just had an accident or were stuck in traffic for a really long time before arriving at work, would your bad mood influence your productivity or decisions? It’s easy to see that what happens around us can influence how “rational” we are in making what seem like easy decisions.

This deviation from the textbook has emerged as a field called “behavioural finance”. It focuses on how investors make decisions and uses principles from various fields such as psychology, biology and computer science in an attempt to better understand how and why investment decisions are made.

Behavioural finance has shown that investors don't always make rational decisions – we are “quasi-rational”. In fact, our emotional state and personalities are indeed needed in making investment decisions.

Being aware of our emotional state when making important decisions helps us to re-think whether our chosen course of action is thought through, or needs to be paused until further notice.

Here are some common findings from behavioural finance on how emotions and personality play a role in investment decision-making:

1. **Overconfidence**

Your outlook on life plays a major role in whether you want to take on that investment risk. If you relate to the Bitcoin example above, by consistently “winning”, you are now more optimistic, leading you to have more confidence in your investing skills and therefore wanting to take on more risk. This overconfidence eventually leads you to making a poor investment decision.

Conversely, pessimists are typically more cautious, and while they don't take on more risk, they do miss potentially lucrative opportunities, once risk has been accounted for. Be aware of which camp you fall in to ensure that this doesn't cloud your judgement.

You can avoid being overconfident by simply trading less and investing more. What does that mean? When you want to earn a return, do so by thinking about the long term. We human beings want things now – so we tend to be satisfied with what we get immediately as opposed to waiting for a greater payoff at some point in the future. If you invest, you are thinking with a longer-term horizon compared to trading (which can be just for a day or even shorter).

2. **Patience**

Do you act on instinct? Or do you like to crunch the numbers and think things through carefully? While both can certainly pay off, it's again important not to become overconfident in relying on what worked well in the past. In other words, each investment opportunity you're presented with calls for a “clean”



investigation, regardless of what worked for you before. If you're patient, you might miss the chance to gain a high return; however, if you're impulsive, you might invest only to lose your money. This helps us avoid feeling regret at losing. We see from research that many traders or investors would rather not sell shares to avoid feeling the regret of having sold “too soon” or having to feel the loss of their investment. You can minimise this feeling by having trading rules which help you to decide whether to sell or not.

3. **Open-mindedness**

An open mind can sometimes eliminate old (bad) habits, or cultivate new ones. Being open-minded can help you diversify your portfolio by investing in various asset classes – like equity, bonds, property or even cryptocurrency; whereas being closed-minded can sometimes help you preserve (protect) what you have and avoid losses. Of course, with an open mind, we sometimes can look to the wrong sources of information to help us make a decision. If your role model bought Bitcoin, would you just blindly do the same? Knowing what to focus on to make decisions is as important as making the decision itself.

What's important from the above is that there is no simple recipe for making a good return on your investment. If there were, then every student who's ever studied finance for years at university, or every person who spent a few hours reading a book on the subject, would be a millionaire. Knowing who you are, how you react, and what emotional state you're in whilst making investment decisions all point to being alert to these kinds of biases that we all have; and then taking the necessary steps to minimise their negative impact on our investing decisions.

Article written by Prof. Yudhvir Seetharam , associate professor in the School of Economics and Finance at the University of the Witwatersrand (Wits). Seetharam's research focuses on Behavioural Finance and Financial Data Science, drawn from a passion of helping to empower the next generation through understanding and modelling why and how financial market participants behave.



You've all heard of ChatGPT, the amazing chatbot that can help answer "any" question that you may have... What exactly is it and how does it work? And importantly, can you – and should you – use it to make investment decisions?

Think of ChatGPT as "Google on steroids". If you had to find an answer to a question you have, you'd probably type it into Google, then spend time going through each link to read the content on that particular website. ChatGPT is an example of a Generative Artificial Intelligence tool, in this case a Large Language Model (LLM), that uses algorithms and natural language processing to speed up the search that you would have done by yourself. The model learns each time it's asked a question, and the respondent can either give the answer a thumbs up or down. This helps improve the accuracy of the output so that future questions can be answered faster, more accurately and of course, have relevance to the user.

So, you could ask ChatGPT to help you answer a maths problem. Or help you critically examine a poem. Could you

ask the bot to help you invest? That's a tricky question, but the answer leans towards a "no".

Investing is based on key principles taught in many finance courses at universities (and the wide range of books available to the public). It relies on understanding the relationship between risk and return; and also your risk appetite. If you are young, you can typically take on more risk compared to someone who is retired or about to retire. While the risk-return relationship remains the same, it must be applied in a contextual manner (including factors such as your life stage).

Intrinsic value-savviness

ChatGPT certainly can help give you information from textbooks on how to find a good investment; however,

cannot (reliably) tell you which security or asset to buy. ChatGPT is not a financial advisor, and neither does it give you personalised (contextual) advice – it won't know how young you are or other relevant information about your life.

If we look at this practically... when someone wants to buy or sell any security (such as shares, bonds, cryptocurrency, derivatives or foreign exchange), they would look at the current price in the market and compare it to their intrinsic value. Intrinsic value simply means its worth – what is the worth of this security based on tried and tested models. As a simple yet dramatic example, if I offer you a bottle of water for R1 million, chances are you would not buy it and would laugh at me. The value of the bottled water to you is not worth the price. You would only buy that bottled water from me if you were absolutely certain that its actual value was the same, or more than, R1 million. Similarly, you need to find the value of the security you want to buy; and compare it to the current market price.

ChatGPT can help with giving you information about the security, but it wouldn't necessarily know its intrinsic value. These valuation models are based on assumptions that the user makes (for example, if you think that bottled water is the only type of water to drink, then you're going to value it more than someone who just drinks tap water). So ChatGPT can give you the framework or principles or rules, but it cannot apply it on your behalf. As such, it won't be able to tell you the intrinsic value of securities with any high level of accuracy. Second, the current market price of any security can change slowly or rapidly. Property prices, for example, change slowly, whereas the value of shares or cryptocurrencies can change within seconds. Unless that new market price is "downloaded" to ChatGPT's "brain", it wouldn't know that the price has changed. So it may tell you that the bottled water is something you should buy for R1 million, whereas in fact the price just decreased a second ago. In other words, the free version of ChatGPT (3.5) does not update information in real time. And even if though the paid version (4.5 Turbo) does, you still face the first dilemma I mentioned above.

Investment knowledge dump


So what can it do? It can help you with a theoretical list of advantages and disadvantages of investing in each asset class – would you rather invest in shares, property, cryptocurrency, etc. It can give you this information and then inform you what people in your age group typically invest in (assuming that you told ChatGPT how old you were).

Second, it can compare different investment options available for you and also help you simulate what potential return you could make on your investment. For those



Marvel fans out there, simulations are like the multiverse – they give you all the different possibilities from each action. You can then look at the simulation results and figure out whether they are acceptable to you or not.

What all of this means is quite simple – use ChatGPT as an assistant to help you make an informed decision, based on data. The assistant simply helps instead of doing the work for you. You are still responsible for your investment decisions at the end of the day. And remember, while many students study finance each year, we don't have the same number of millionaires in the country. What this means is that the textbook can provide you with the foundations of investing, but you need to gain practical experience (sometimes from learning from mistakes) in order for you to be a successful investor. So let ChatGPT help you to learn about smart investment, but don't let it invest for you.

Article written by Prof. Yudhvir Seetharam , associate professor in the School of Economics and Finance at the University of the Witwatersrand (Wits). Seetharam's research focuses on Behavioural Finance and Financial Data Science, drawn from a passion of helping to empower the next generation through understanding and modelling why and how financial market participants behave.



Crypto isn't dead:

The basics of Bitcoin and cryptocurrency investment

In recent months there has been a "crypto winter" of sorts, with prices in a cool-down phase after a large bull run in 2021. But in the background, blockchain and cryptocurrency innovation has continued. There is even talk of a Bitcoin Exchange Traded Fund (ETF) being approved in the United States, which could see significant institutional investment. Luno, a leading South African cryptocurrency investment platform, believes the large-scale adoption of applications for cryptocurrencies will be driven mostly by developing economies, and South Africa is one of the largest markets in this regard. Let's unpack what you need to know about cryptocurrency and how to get started in a few simple steps.

What is cryptocurrency?

The simplest explanation is that cryptocurrency is a digital asset (something that has economic value and only exists digitally). Cryptocurrency is used as a way to invest in applications for the technology on which crypto is based – whether as digital currency, smart contract platforms or apps built on top of smart contract platforms. With cryptocurrency, you only need an internet connection and a computer or smartphone to be able to send or receive money from anyone around the world, so it's really the world's first globally accessible type of money.

Cryptocurrencies allow us to imagine and implement things in a completely different way; a true paradigm shift. It is enabling us to reimagine the financial system, to upgrade the world to something better: money that can be moved around cheaper, faster and safer, cutting out unnecessary intermediaries and ensuring that consumers benefit instead.

Bitcoin is a relatively new technology that is unlike anything we have seen before, so a better way to think of it is as a combination of a few different things we are

familiar with. Because it allows you to move money so easily, Bitcoin functions as a payment system, similar to bank transfers or credit cards. Bitcoin is similar to gold in a sense – it can be considered as using gold for money, except it is much easier to move. Finally, Bitcoin is like the internet in that no single person or entity controls it, so people can use it as they wish, and this gives it some very unique characteristics. Bitcoin is a mix of a credit card, a piece of gold and a hint of the internet.



A chart showing the Bitcoin price movement (in US dollars) over the last few years.

Is cryptocurrency for the fringe?

Since Luno launched in 2013, we've seen many price spikes and we've seen many drops. At Luno, we do not take a position on the price of Bitcoin and instead focus on being the trusted platform to safely buy, sell and learn about cryptocurrencies. We recognise the value of crypto as part of a sensible, long-term investment approach and see the potential it has to upgrade our current financial system.

Many declare Bitcoin dead (or dying), simply based on the latest changes in the price. Bitcoin should become less volatile as there is increased liquidity and market acceptance, and Bitcoin will continue to play a dominant role in the cryptocurrency industry.

We encourage responsible investing which includes never investing in something you don't understand and never spending more on speculative technologies like Bitcoin than you can afford to lose.

Although there are many cryptocurrencies, several do not have solid fundamentals. For this reason, we limit the cryptocurrencies available on Luno to those which have been carefully reviewed using a thorough and rigorous process.

We also encourage regulation of cryptocurrency and have worked with the South African Reserve Bank on appropriate regulation of the industry. The Financial Services Conduct Authority (FSCA) classifies crypto assets as financial products, and consequently, crypto asset service providers are required to apply for a licence before 30 November 2023.

How is the price of Bitcoin calculated?

The price of Bitcoin works in the same way as it would with other currencies or objects. It's based on supply and demand, the price a buyer and seller agree upon.

Other currencies also work like this. While you observe your currency as stable, its value actually continuously changes. When you want to exchange it for another currency at a currency desk, the price fluctuates. Bitcoin works in the same way.

A key differentiator of Bitcoin is that there is a finite supply. Once the 21 million in existence are in circulation, Bitcoin cannot be reproduced, nor can more currency be printed as with hard currency.

How much should I buy?

The same intuitive rules that apply to traditional money also apply to Bitcoin: don't invest more than you can afford to lose and don't put all your eggs in one basket.

Start small – you don't need to buy a whole Bitcoin, currently valued at about R650 000, you can make an investment from as little as R20.

With more than 10 000 cryptocurrencies in existence, you need to use credible exchanges that offer only cryptocurrencies they have carefully evaluated, similar to how you would buy shares online.

Cryptocurrencies are still relatively new and therefore very volatile. The first step is to learn more about cryptocurrencies by visiting resources like Luno's free learning portal.

Cryptocurrencies continue to attract interest from investors, and many draw comparisons with traditional markets. It is important to do your own research, to understand the asset you want to invest in, and to use your own judgement. Be wary of any scheme that promises a guaranteed return on investment.

Article written by Christo de Wit, South Africa's country manager for Luno, a leading local cryptocurrency exchange.





OPINION:

Only degrowth can save us

The world's obsession with more wealth, more produce, more comfort etc. has created the conditions for a planetary climate that threatens to collapse, and an inflationary global economic system stuck in an ever-worsening debt spiral. To save the planet, and the economy, only degrowth can save us.

Degrowth means the controlled adaptation to the Earth's natural limits (which today are exceeded by far). By the beginning of April, Sweden had already exhausted its share of the Earth's resources. The remaining months we steal from future generations as if we had 4 Earths (South Africa would need 2.5 Earths). Today, there is a naïve and dangerous overconfidence, for example among lightly disguised lobbyists for the fossil fuel and nuclear industries, that mere technological solutions will save us – one example out of many being artificial CO₂ capture, which in reality cannot bind a fraction of the billions of tons per year that would be required.

The report “Limits to Growth”, based on several simulation scenarios at MIT in 1972, was heavily criticised from the outset by industry leaders and economists, despite the fact that its most pessimistic scenario, “Business as

usual” – where a global collapse occurs around 2050 as a result of increasing ecological pressures in the first half of the 2000s (just what we see today) – has proved to fit the world's real development frighteningly well since then. The dream that “new technology” could save us is also included as a simulation scenario, “Comprehensive technology”, but only extends the deadline by a few years, while the collapse becomes even worse when it inevitably comes. Mere “green industry” – the new favourite slogan of business and politicians – unfortunately will *not* save us.

Degrowth is also included as a simulation scenario (“Stabilised Earth”), the *only one* of all 12 that does *not* lead to collapse, but unfortunately does not match the actual evolution of the world. It is crazy to think that what has plunged us into today's crisis – uncontrolled technological “development” and exploitation driven by unbridled,

increasingly unequal, galloping raw capitalism – will save us: If you are sitting on a tree branch you are sawing off, and the ground underneath is burning, the solution is *not* to switch to a better saw – it is to stop sawing. And don't send economists to put out the fire (why not "firefighters"? – with knowledge of how nature actually works).

It is a tragic fact that the world today in practice is governed exclusively by economists and economic considerations. Economics is not a natural science, but just a human invention. ("The Nobel Prize" in economics does not exist; it is a prize invented by the Swedish Central Bank (Sveriges Riksbank) to celebrate its own 300th anniversary in 1968 "in memory of Alfred Nobel".) Even so, there are purely **physical limits to economics** that most economists do not seem to understand.

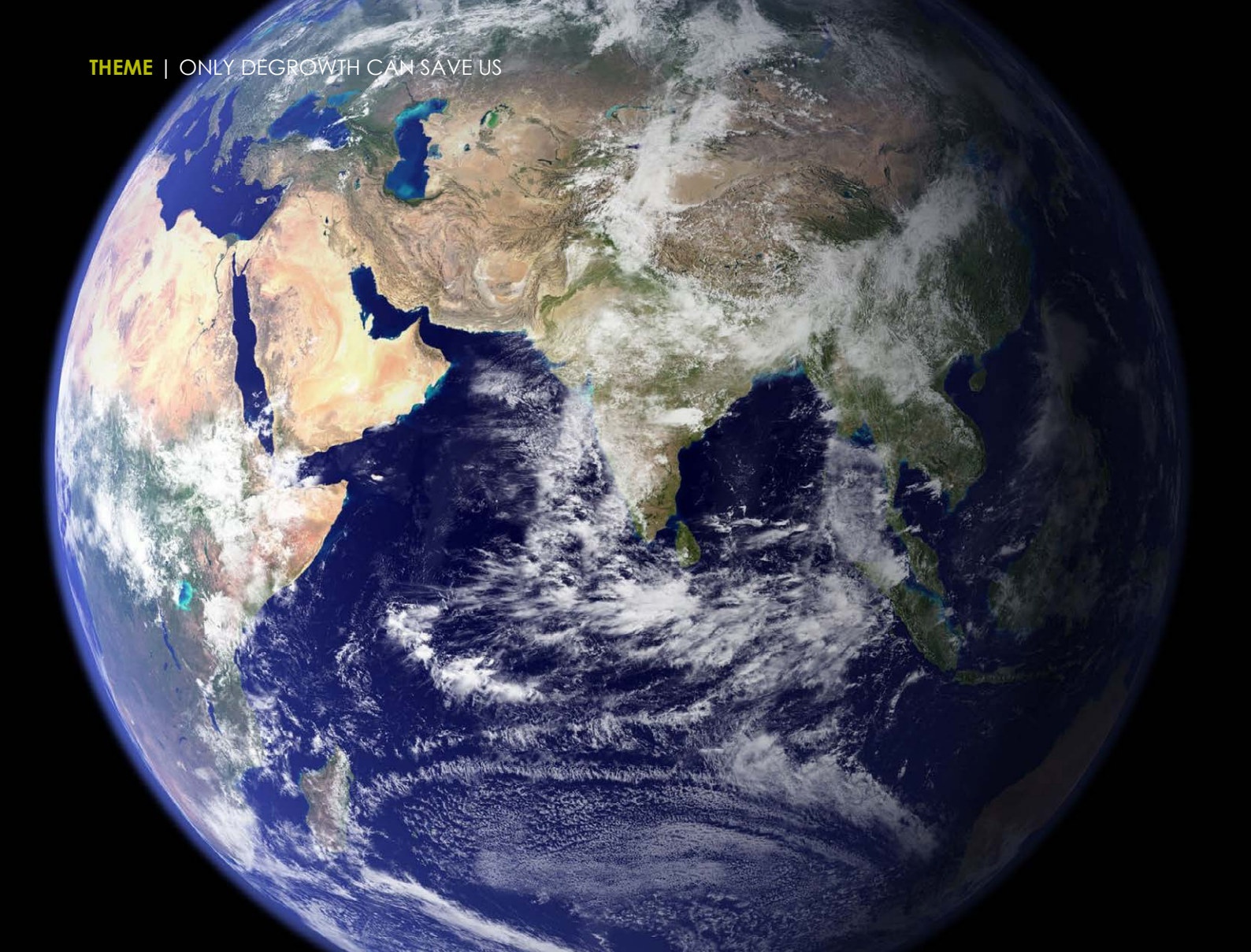
Seen from space, it is obvious that the earth is a rather small, isolated, and vulnerable spaceship – then some economists may mistakenly rant about "decoupling" of the economy from the real and strictly limited assets best they want. **Even pure "information" has physical limits.** Just as the exponential growth of bacteria in a Petri dish dies off when nutrients and space run out, there are non-negotiable limits to "growth" also for humans on Earth. And just like viruses and bacteria, fast-forwarding humanity's last centuries would show how we and our

economy first are growing slowly, but exponentially, and today are well on our way to destroying the living conditions of the entire planet – at least for mankind. Rats and cockroaches usually survive.

Nature does not care one bit about our economic considerations and calculations when it decides how to exterminate humanity. Economic growth was from the outset meant to help people, for example lift them out of poverty. But today, humanity has instead become a slave to the sacred growth – which has become an end in itself, a monster completely out of control. The concept of GDP was invented in 1934 by Simon Kuznets, but he *himself* warned against using such a crudely simplified concept as some kind of naïve numerical measure of welfare in an extremely complex world.

In **one indigenous civilisation**, people thought about how at least seven generations into the future would be affected before important decisions were made. In contrast, politicians today have a time perspective of four years (next election) and industry/business/shareholders only three months (next quarterly report). For example, what moral right do we have to convert the small amount of uranium on Earth into "eternal" extremely hazardous waste – a process hazardous at all stages – for just a few decades of electricity for the "growth" of *our*





generation? About as little as we had to burn up a large part of the planet's fossil fuels in just over 100 years, which had taken 100s of millions of years to be created, and whose previously bound carbon has now ended up in the atmosphere as carbon dioxide and disrupted the climate.

Renewable energy is potentially so much larger in magnitude (and also much cheaper) that most people who are "in favour" of nuclear power can hardly have a clue about how it works, its limitations and real dangers.

Role models like Greta Thunberg are not only trying to save other climate "activists" (should be called climate *realists*) but also all those who, for some reason, have not yet understood how serious the situation actually is. To reach the 1.5-degree target, *all* use of fossil fuels must have completely ceased by 2035, while *all* deforestation must have been stopped, and all other greenhouse gas emissions must have been drastically reduced. "Growth" is still spelled in terms of fossil energy: "84% of the world's energy today comes from fossil fuels." (International Energy Agency).

Only **degrowth can save us**. And degrowth is also inevitable. The only thing we can influence is whether it will be planned and controlled, or forced and catastrophic (global collapse):

1. **Perpetual growth is impossible in a finite world.** Our "one-time inheritance" of fossil fuels – created by the Sun and deposited as a "solar battery" charged over 100s of millions of years – is what really has driven the explosive exponential growth of the last century but will soon be gone forever. The overexploitation of this "fossil" stored solar energy, besides creating the climate emergency, enabled industrialisation and brainwashed generations of economists into believing that growth could continue forever. Increased energy consumption and economic growth have always gone hand in hand. To illustrate the *impossibility* of perpetual growth, **let us assume a "modest" annual growth rate of 2.3%** (less than the average since 1850), which means a tenfold increase every 100 years. In two hours, as much solar energy reaches the Earth as all of humanity today consumes in an entire year. But this "modest" growth means that we would be using *all* incoming

solar energy in just over 300 years (a blink of an eye in humanity's history), the *total* energy of the whole sun in just under 1,300 years, and the energy of *all 100s of billions of stars in our galaxy* in just 2,400 years. The laws of thermodynamics then say that the *Earth's average temperature* would be body temperature (well above deadly) in 300 years, the boiling point in 400 years, the melting point of steel in 700 years, and as hot as the surface of the sun in 900 years. Note that this is *regardless* of the energy source we use: fossil, nuclear (fission/fusion), renewable or even hypothetical energy sources we don't even know about yet. Politicians, industry leaders, journalists or economists – irrespective of their name or how famous they are – cannot do anything about the laws of nature.

2. In 1992, more than 1,700 of the world's most prominent scientists, including the majority of then living Nobel Laureates in the natural sciences, wrote "*World Scientists' Warning to Humanity*" to all world leaders: "No more than a few decades remain before the chance to avert the threats we now confront will be lost and the prospects for humanity immeasurably diminished... Current economic practices cannot be continued. Developed nations must greatly reduce their overconsumption". *Nothing happened*. In 2017, the sequel "*Warning to Humanity: A Second Notice*" came with the same message: "Soon it will be too late to shift course... and time is running out". *Nothing happened this time either*.
3. As early as 1972, the harrowing report "*Limits to Growth*" was published, the message of which was that humanity was heading for catastrophic overconsumption and subsequent collapse around 2050. Why have people today foolishly begun to discuss mining at the bottom of the sea? Well, because the resources above ground have begun to run out, which was predicted as early as 1972. If global changes had been introduced back then, *when the Earth's resources had barely been exceeded*, relatively mild ones would have sufficed. *Nothing happened*. That is

why the vital changes we are facing now are so much greater.

4. Early economists like Adam Smith, *Thomas Malthus*, and *David Ricardo* (who were also knowledgeable in science) realised that *growth can only be a time-limited phase*. Today's mainstream economists seem to have repressed this. All living people, and several generations before us, have lived in this temporary growth phase, so it is easy to understand the mistake. Today's political economy prioritises short-term financial growth at the expense of functioning vital ecosystems – which have taken nature billions of years to build and humans just under two centuries to destroy. Growth is thus not just a time-limited phase, but an existential threat to humanity. I would like to see how long the economists who believe in "*decoupling of the economy from natural resources*" could do without air (three minutes), water (three days) and food (three weeks). A "service" economy can only exist on top of a material economy, not instead of. For example, the internet alone already consumes 2% of the world's energy.
5. The ozone hole and COVID-19 were solved through rapid global alliance and action. We should be able to do the same with today's much more serious problems. Covid would have gone away on its own no matter what we did, however, the same is not true for the much more alarming and urgent threats facing all of humanity.
6. You must choose: Do we want i.) Planned and controlled degrowth to what the planet can tolerate and a bright future, or ii.) Catastrophic and forced degrowth and global collapse in the middle of this century? Make up your mind – the time for option i.) is rapidly running out and requires a downsizing of production and overconsumption in the richest countries to well below the Earth's ecological limits.

Article written by Prof. Johan Hansson , professor of theoretical physics at the Luleå University of Technology in Sweden.

Go tshwenyega kudu ga lefase ka lehumo le legolo, tšweletšo ye ntši, boiketlo bjo bo oketšegilego bj.bj.. go hlotše maemo a boso bja polanete bjo bo tšhošetšago go phuhlama, le tshepedišo ya ekonomi ya lefase ka bophara ya infleišene yeo e kgomaretšwego ka gare ga lepheko la dikoloto leo le mpefalago ka mehla. Go phološa polanete, le ekonomi, ke fela degrowth yeo e ka re phološago.

Translated into Sesotho sa Leboa/Northern Sotho by Tebatso Isaac Makwala

TURNING
INTO

SCIENCE
BUSINESS



One of the winners of the National Science and Technology Forum's NSTF–South32 Awards hopes to help South Africa's scores of unemployed youth by inspiring others to follow in his footsteps, turning a scientific idea into a viable business.



SMMes winner: Tshepo Mangoele

South Africa continues to grapple with persistently high levels of unemployment, with the burden of joblessness being carried by women and young people. Unemployment figures for August 2023 have been disclosed by Statistics South Africa. The official unemployment rate in the second quarter of 2023 was 32.6%, a decline of 0.3 of a percentage point from the 32.9% recorded in the first quarter of 2023. The youth are hit hard by the unemployment rate. The current rate is 61% of 15- to 24-year-olds and a staggering 71% if you count those who are no longer trying to find employment.

The bleak outlook on the unemployment rate for students suggests a challenging future. To address this issue, there has been a push to encourage many young individuals to engage in entrepreneurship as a pathway to participating in the economy.

Tshepo Mangoele is the Chief Executive Officer and founder of LignOrganic; and he was a 2023 NSTF-South32 Award Winner in the category for Small, Medium and Microenterprises (SMMEs). Mangoele has a strong passion for the realm of business. During his motivational talk entitled 'Starting a business with a scientific idea', he sparked a fervour for innovation among NSTF Briliants students.

At the online meeting of the students, the perceptive entrepreneur argued, "It's crucial to begin with a problem that people encounter, then devise a solution that addresses it – ensuring there's a user base for the solution."

Emphasising the necessity for sustainable businesses, Mangoele highlighted the significance of profitability. He also underscored the importance of collaboration. He expressed the idea of "learning the importance of not working in isolation and establishing a team in business."

Furthermore, for a business to thrive, essential components include marketing and sales. Mangoele pointed out that the absence of marketing and sales leads to the failure of the business. He advised the students that before initiating a business, there are several crucial considerations. Mangoele emphasised, "In order to reach

commercialisation, various tasks need to be accomplished, such as obtaining market validation."

To youths feeling disheartened about commencing a business because of financial constraints, he offered this advice, "If you lack support from friends and family for investment, another alternative is to explore incubators based on the nature of your project." Mangoele mentioned an alternative, which involves venture capital investing funds into your business in exchange for equity, in the form of shares within your business.

Mangoele received the prestigious 2023 NSTF-South32 Award through his revolutionary biomass conversion technology. The company is helping to replace chemicals derived from fossil fuels with biochemicals such as lignin, which they produce and have successfully formulated and commercialised as a skincare brand.

Article compiled from press materials provided by the National Science and Technology Forum (NSTF) Briliants Programme. The Briliants Programme is a youth outreach project of the NSTF. It recognises at least 18 first-year students who achieved 90% or more in grade 12 physical science and mathematics, and chose to follow a career in the science, medicine or engineering fields. This year a total of 26 Briliants students were identified. The NSTF Briliants Programme is sponsored by the Department of Science and Innovation (DSI) and the South African Council for Natural Scientific Professions (SACNASP).

Yo mongwe wa bafenyi ba Foramo ya Bosetšhaba ya Mahlale le Theknolotši (NSTF) ba Lenaneo la Briliants la 2023 o holofela go thuša masome a bafsa ba Afrika Borwa bao ba sa šomogo ka go hlohleletša ba bangwe go latela dikgatong tša gagwe, go fetoša kgopolo ya mahlale go ba kgwebo ye e šomago.




Translated into Sesotho sa Leboa/Northern Sotho by Tebatso Isaac Makwala

The Centre for Astro-Particle Physics (CAPP) at the University of Johannesburg (UJ)

The Centre for Astro-Particle Physics (CAPP) at the Department of Physics, University of Johannesburg (UJ), is dedicated to research in Gamma-ray Astrophysics, Neutrino Astrophysics, Neutrino Physics, and Gravitational Wave Physics. The Centre is home to scientists and students whose focus is on these research areas. The researchers perform theoretical studies, as well as data analysis and modelling. They are also involved in three experimental facilities, namely the Fermi Gamma-ray Space Telescope; the Cherenkov Telescope Array (CTA), and the KM3NeT Neutrino Telescope, to perform cutting-edge research.

Working at CAPP can provide students and postdoctoral fellows with opportunities to get involved in state-of-the-art science experiments, learn analysis techniques of data collected with various instruments, and interpret with theoretical modelling. Research in Astro-Particle Physics requires a strong background in Physics, Mathematics, and computer programming. Although some theoretical studies are still done on papers with pencils, numerical computations and simulations on computers are the main tools to make theoretical predictions these days. Data analysis and modelling also require significant computer skills and learning specialised software. Students who would like to pursue postgraduate studies in Astroparticle Physics should choose Physics and Mathematics for their BSc degree.

The BSc Honours programme at the Department of Physics offers a wide range of advanced courses, including Astrophysics courses, that can prepare students for future MSc and PhD research in Astro-Particle Physics. Honours students also get a taste of research by doing a project that helps them to prepare for MSc and PhD studies. A limited number of top-up bursaries are available for MSc and PhD students from CAPP.

Contact us:  UJ Faculty of Science  @UJScience  science_uj
www.uj.ac.za/capp



**The Future
Reimagined**



SA scientists using Artificial Intelligence to improve pollen forecasts

Artificial Intelligence (AI) is being used by South African scientists to detect and classify pollen spores in real time, which may improve forecasting of bioaerosols that trigger respiratory illnesses like allergic rhinitis (hay fever) and asthma.

Prof. Jonny Peter, head of the Division of Allergology and Clinical Immunology at Groote Schuur Hospital and the UCT Lung Institute, who also leads the South African Pollen Network (SAPNET), says the monitoring of airborne pollen provides an important source of information for the globally increasing number of hay fever and asthma sufferers.

“The worldwide prevalence of allergic rhinitis and asthma rises dramatically each year, both in developed and developing countries. In South Africa, nearly 30% of people suffer with allergic rhinitis and a recent study from KwaZulu-Natal found that 13.7% of adolescents suffer from asthma – of whom 9% suffer from severe asthma.”

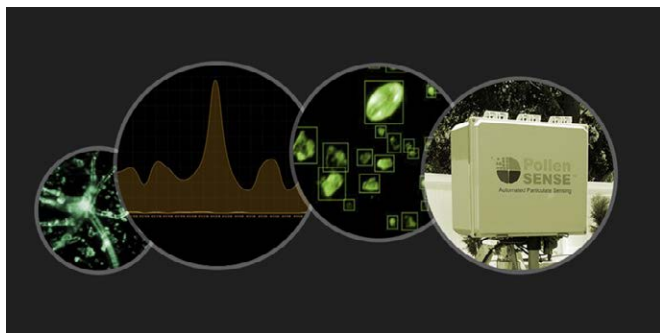
Until now, scientists have manually counted airborne pollen and spore types using volumetric air samplers that suck air from the environment, collecting the particles it traps on adhesive tape, which are then analysed under a microscope by a pollen expert. However, the process

is cumbersome and costly. With the latest developments in image recognition methods and machine learning, automating this process has become feasible.

Peter says by combining cutting-edge technologies, like AI and imaging flow cytometry, which measures the size, count, shape and structure of a cell, they are able to build a system for South Africa that is capable of identifying and categorising pollen more accurately and at much faster rates.

“In addition to AI providing a more comprehensive picture of pollen in the present, it can also help to model historic environmental change.

“Pollen grains from different plant species are unique and identifiable based on their individual features. Analysing which pollen grains are captured in samples from sediment cores in lakes can help scientists get a better grasp on which plants were thriving at any given point



Automated Pollen Sense counters are being set up in key biomes across the country to provide real-time pollen readings.

in history, potentially dating back thousands to millions of years. Its numerous applications are transforming the way scientists conduct research and is enabling new discoveries across fields – accelerating scientific productivity.”

Two AI counters have already been set up in Pretoria Kimberley, and two more in Cape Town and Durban will come online soon. Bloemfontein and Johannesburg will follow in the next few weeks.

“It works similar to the volumetric spore trap that sucks the pollen onto the cellulose membrane, but then it takes a photo of it. From there, AI takes over. The AI is trained using large volumes of images to recognise the individual grains on the sticky tape. The only challenge is that we need to have a period of validation, so for a time, we will put a conventional volumetric trap next to the automatic AI counter to verify the accuracy of the analysis. Once the AI has been sufficiently trained to recognise grains that are indigenous to South Africa, it will be able to classify species very quickly. Main allergens, like grass, plane trees and cypress trees, as well as fungal species, such as *Alternaria*, *Aspergillus* and *Cladosporium*, should be easy for the AI to identify as these are commonly found around the world.”

“Pollen counts are often difficult to predict during spring when counts are highest, and the weather is changing daily. Having access to reliable, real-time pollen readings will significantly improve forecasting and, in turn, help hay fever sufferers to mitigate bothersome symptoms that include a runny or itchy nose, sneezing, itchy and watery eyes, as well as nasal congestion.”

2023 pollen forecast with El Niño thrown into the mix

Peter says this year’s pollen season depends largely on the weather, but that hay fever sufferers can expect higher than normal grass counts. “We are already seeing high tree pollen counts in Cape Town and exceptionally high tree pollen counts in Bloemfontein.”

The El Niño weather phenomenon, which is expected to make its way to South Africa later this spring, could also influence the timing and severity of this year’s allergy season. In SA, it is typically associated with hot and dry conditions, but certain regions could receive increased precipitation, along with higher-than-average temperatures leading to enhanced pollen production.

“The underlying influence of climate change makes the country extremely vulnerable to the effects of El Niño,” remarks Peter. “In Europe, El Niño has caused extreme weather events the last few months, where some countries have reported earlier starts and extended pollen seasons. In the UK, record grass counts were recorded.”

SAPNET partners with SA Weather Service to help allergy sufferers control symptoms

Peter says in addition to the South African Pollen Network providing allergy sufferers with up-to-date pollen counts, its recent partnership with the SA Weather Service (SAWS) will also give the public and healthcare practitioners access to information related to air pollution, including carbon monoxide, sulfur dioxide and ozone – all of which are linked to the worsening of allergic diseases.

“As the SAPNET expands, the aim is to provide communities throughout the country with integrated information in real time of what is in the air – spanning the spectrum of air pollution, as well as pollens, even microplastics and other irritants that might be in the air we breathe. We’ll also be working with different communities to further research that is being done on indoor pollutants, which also play a big role, particularly in asthma and asthma exacerbation in children.”

Seasonal allergies affect an estimated 18 million South Africans, which significantly decreases productivity and the quality of day-to-day living among sufferers.

Thanks to funding from Clicks, Thermo Fisher, Glenmark Pharmaceuticals, Cipla and Dr Reddy’s, SAPNET currently covers ten biomes, which include Cape Town, George, Gqeberha-Port Elizabeth, Durban, Johannesburg, Pretoria, Potchefstroom, Bloemfontein and Kimberley.

For up-to-date pollen counts per region, visit pollencount.co.za. Knowing the daily pollen count will assist hay fever sufferers to better manage their condition throughout the year as grasses, weeds, trees and shrubs pollinate at different times and not just during the peak (spring-summer) pollen period.

Article issued by Meropa Communications on behalf of the UCT Lung Institute. For further information, contact Brigitte Taim from Meropa via brigitte@meropa.co.za.



Citizen science and satellite data shed light on bird diversity in Kruger National Park

In 2022, I wrote a popular article for the South African Environmental Observation Network (SAEON)'s eNews in which I pointed out the debatable importance of Africa's protected areas in conserving bird diversity and preserving threatened birds. In this article, I share some of the processes embarked on and most significant results found when my colleagues and I investigated bird diversity patterns inside and outside the world-renowned Kruger National Park (KNP).

A challenge with answering regional or biogeographical questions (especially those related to the study of the geographic distribution of plants, animals and other forms of life), is that the data required are not commonplace. To assist in answering such questions, citizen science or crowd-sourced Big Data are employed to investigate patterns and/or processes at large spatial and time scales.

One such "proudly South African" project containing this rare data (in the form of millions of species records), is the second Southern African Bird Atlas Project (SABAP2). It continued from its predecessor in 2007 and saw an exponential increase in submissions around 2015 when the popular SA-built BirdLasser smartphone app was launched. The latter enabled birdwatching enthusiasts to log bird species in a simple and intuitive manner and at five-metre accuracy.

Currently, more than two million records are added to the SABAP2 database annually – an invaluable resource for scientists and conservationists but not used as often as one might expect. [Here](#) is a link to the SABAP2 website if you want to read further or become a citizen scientist yourself.

Together with this large database of bird data, some environmental data were required to answer questions about the drivers of bird diversity across the region because I (and undoubtedly other people too) am interested in the causes of certain patterns or behaviours observed in nature. In this case, a typical community ecologist such as myself (when I wear the science hat) posed the following question: How do the bird communities inside the KNP differ from those outside and, if they do differ, what are the causes? This has never been



The Olifants River near the Kruger National Park boundary, October 2015. Rivers like this are essential for maintaining bird diversity across South Africa's Lowveld region.

looked at before at a nearly four-million-hectare scale in this part of the world.

Historical environmental data are nearly as rare as “hen’s teeth” and especially across the larger scales that biogeographical studies (like ours) focus at, but fortunately I found some high-quality data made available (freely) by Copernicus, the European Union’s Earth observation programme. I did, however, employ Google to process the data to my needs.

We subsequently ended up with cover values for the environment such as grass, trees, two types of water (permanent and seasonal) and infrastructure across the region. I could now start walking the path of unforgiving statistical analysis by putting the computer hardware and software to work on a decade’s worth of data that Microsoft could not even read.

Something we realised, and had to deal with early on, was that there is significant variation in effort with citizen science protocols such as SABAP2 (albeit brilliantly simple). This brings about challenges when the scientist wants to compare “apples with apples”.

For example, if a certain area only ever had two surveys (bird checklists) submitted over 10 years, it cannot be compared with an area for which 100 surveys had been submitted over that same period. Why not? Because judged merely on the data, the latter would contain more species when in actual fact, more species would have been recorded for the first area as well, if 100 surveys had been submitted from there. Those species unaccounted for because of little observer effort is something called “dark diversity” (a recent term in community ecology). It refers to

those species not accounted for or absent but that can or should be found in an area.

To counter this, we applied techniques that attempted to account for effort discrepancies. We also decided on a threshold under which grids with too few surveys were discarded from our analyses.

I am not going to bore you with other methodologies, so let’s jump into our findings...

Firstly, about 50% of the bird communities from the mosaic are differently composed to those from KNP. That is to say, the combinations of species in the areas outside the national park, compared with most of the areas inside, were very different. However, since more than 500 bird species were considered, we were not interested in which were found where in each of the areas we looked at, as this was not the aim of our study. We did, however, publish a list of species and where they were found in the publication’s appendix.

Secondly, what was surprising to us is that numbers-wise, neither the mosaic nor the KNP had significantly more species or larger functional diversity than the other. There were species of more diverse evolutionary ages inside KNP, which was to be expected because “old” species (in evolutionary terms) like the Common Ostrich were present there, as well as a range of “younger” species and everything in between. This contributed to elevated phylogenetic diversity values in the park.

The relationships that surfaced between the environment and bird diversity were most interesting...



Camps such as Satara inside the Kruger National Park are host to many different bird species, compared to outside. However, the bird communities found there are not as functionally or phylogenetically (evolutionarily) diverse compared to the more natural areas inside the park.

Seasonal water inside and outside KNP as well as the camps inside KNP (note, not the infrastructure outside) were host to the largest bird communities (containing the most species). However, the added infrastructure inside the park resulted in a cost in diversity. We found a strong negative association between camps and functional and phylogenetic diversity. In other words, these results seem to show that the camps deterred birds of certain functions and evolutionary ages (possibly older birds along the evolutionary tree such as waterbirds, raptors and obviously the Ostrich).

What was surprising is that infrastructure outside the national park did not impact on these components of bird diversity. This may seem unexpected but there are findings that show how urban areas promote bird diversity as there are different processes at work in and along the edges of towns and cities.

Other interesting and expected results were that an increase in tree cover negatively affected phylogenetic bird diversity across the region in that areas with many trees were not host to birds of diverse evolutionary ages. The conservation implications of this may seem less obvious than the effects of infrastructure but it does confirm the negative impacts of bush encroachment has on bird communities (typically outside KNP) and makes one rethink the importance of elephants as ecosystem engineers in keeping the trees at bay.

Article written for the South African Environmental Observation Network (SAEON) eNews by Rion Lerm, Research Infrastructure Technician and PhD Candidate, SAEON Ndlovu Node/Centre for Functional Biodiversity at the University of KwaZulu-Natal. The scientific publication on which this article is based is freely available and can be found [here](#).





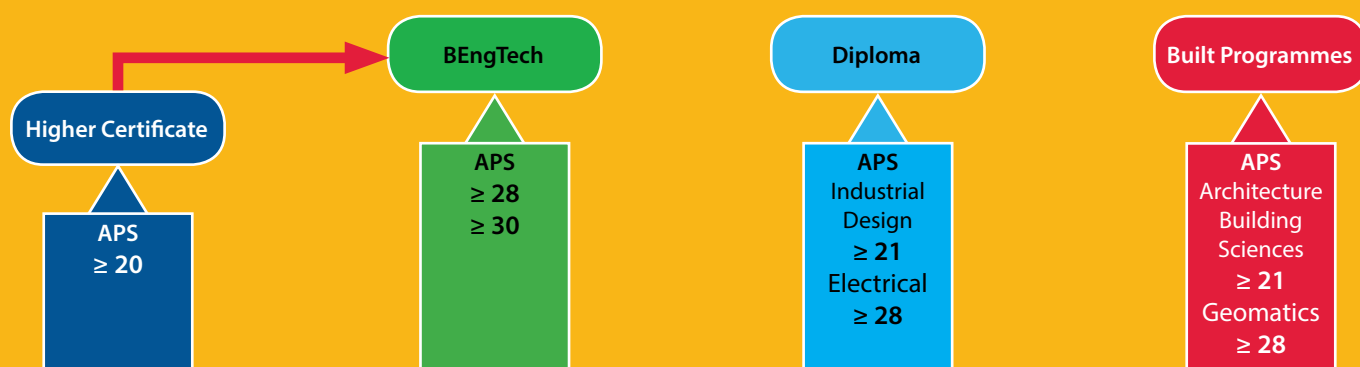
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Photonics and electronics are all around you



Our lives have become much easier thanks to science, innovation and technology. Nowadays we come across a myriad of electronics and photonics devices every day, but most people rarely wonder about whether these devices are utilising photonics, electronics, or both. The aim of this article is to highlight the major role of photonics and electronics in our daily lives, and, since we live in a power crisis, to make people aware of how we can sometimes use light energy instead of electricity.

Developments in the field of electrical engineering known as microelectronics and photonics have been a major driving force behind the enormous advancements in computers, personal electronics, electronic automobile systems, smartphones and lasers. The creation of electronic and photonic devices that produce, detect, transmit, distribute, modulate and magnify electrical energy and information is the focus of this field.

Electronics

When the word electronics is uttered, the first thing that springs to mind is anything to do with little components or circuits of electrical equipment. Typically, computer parts, transition radios or mobile gadgets come to mind. While these are closely connected, electronics can be defined as a discipline of physics and engineering that studies electron behavior, flow, and control under various conditions.

How do electronic systems work?

Understanding how electronic systems work necessitates understanding the origins of energy and how it is delivered to households so that people can utilise it to power their devices. Because it must be manufactured or generated, electrical energy is not freely available in nature for

consumption. Most of the power is produced from fossil fuels such as natural gas, coal and nuclear energy. According to science, energy can only be changed in its form; it cannot be created or destroyed. For instance, a home with solar panels on the roof transforms solar thermal energy into usable energy that can be used to power appliances such as lights and computers.

Types of electronics

Electronics come in a variety of forms that can be grouped based on internal design. Input devices, information processing devices, and output devices are three types



of devices. Among the various types of input devices are keyboards, microphones, and switches. Additionally, information-processing devices include motherboards, sound cards, and video cards, and lastly, printers, projector screens and headphones are examples of output devices.

Photonics

The physical science of light waves is known as photonics. It is associated with the science of production, transmission, emission, processing of signals, detection and sensing of light. Photonics is responsible for many of the inventions that over the past few years have changed the way we live. Examples of photonics include optical fibres, lasers, our phones' cameras and screens, the lights in our houses, and optical tweezers, cars, televisions, and computers.

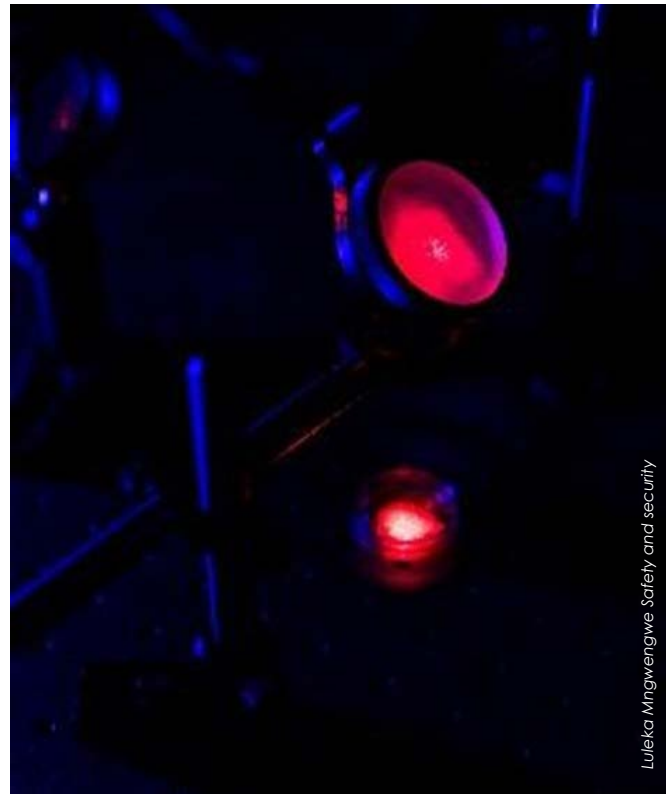
The way we take photos has changed significantly because of photonic-based detectors such as complementary metal oxide semiconductor (CMOS) image sensors (CIS) that are compact, robust and lightweight, and have made it possible for anything from cell phones to cars to now have small, high-quality cameras. Devices for photonics have a very broad variety of applications. Fibre optic networks, which considerably increase the capacity and speed of internet connections all the way down to the home, are primarily reliant on photonic devices for telecommunications. The development of powerful, inexpensive LEDs that reduce power usage while delivering high-quality, flexible lighting options has revolutionised lighting. Solid-state lasers are currently widely used in applications ranging from industrial to medical.

Photonics and daily life

Photonics plays an important role in driving innovation across an increasing number of fields. The use of photonics covers several industries, including manufacturing, life sciences, healthcare, security and safety, as well as optical data transmission, imaging, lighting, and displays. Where current conventional technologies are reaching their speed, capacity, and accuracy limits, photonics provides novel options. Photonics has a profound impact on how we live our daily lives.

Health

Light can quickly, sensitively and accurately detect and measure diseases, and in this sense photonics has the potential to revolutionise healthcare. The study of optical methods in biological systems, including both naturally occurring and bioengineered materials, is known as biophotonics. Imaging and sensing cells and tissue are a crucial component of this kind of science. Injecting fluorescent markers into a biological system is one way to monitor drug delivery and cell dynamics. Biophotonics also includes shining low-energy laser light onto or through biological materials. Depending on the type of material being investigated, the light can be reflected, absorbed, scattered, transmitted, or a combination of these. A clearer



Luleka Mngwengwe Safety and security

Laser light shining on a Petri dish with cells for therapeutic purposes as captured in the biophotonics laboratory.

understanding of how processes operate at the molecular level is made possible by biophotonics, enabling illness prevention and the development of new treatments. In addition, photonic technologies including pacemakers, artificial bones, endoscopes and the tiny cameras used in in-vivo procedures have a significant impact on solving the demands of our aging society.

Photonics enhances the safety and security of people, goods and the environment. Photonics technologies are used in security applications such as biometric and border security systems, video surveillance systems, and tools for the detection of illicit or dangerous items.

Conclusion

Since we are facing a power crisis as a country, using light instead of electricity is a possible solution to the crisis we are facing. Although photonics are common in daily life, photonic devices frequently go unnoticed. For the design and production of tools, platforms, and integrated circuits for use in high-speed data transmission, sophisticated sensing and imaging, photonics represents a significant opportunity. So, take a look around and try to spot all the photonics devices that make your daily life easier or more enjoyable. There are a lot more than you might think.

Article written by Luleka Mngwengwe, Dr. Masixole Lugongolo, and Dr Patience Thenjiwe Mthunzi-Kufa ^{1b}, who are affiliated with the National Laser Centre at the Council of Scientific and Industrial Research (CSIR).

ECO-FRIENDLY shark barrier technology from SOUTH AFRICA installed in the Bahamas

The world's only eco-friendly alternative to shark nets, developed by marine biologists at Stellenbosch University (SU) and their collaborators, and manufactured in the Western Cape, has now been installed at a private island in the Bahamas. It has been designed to remain in the water for at least 20 years with minimal maintenance required.

The innovative, proudly South African [SharkSafe Barrier™](#) combines biomimicry of a kelp forest and magnetic fields to keep humans and sharks apart from one other without harming the sharks or large marine species.

According to Dr Sara Andreotti, marine biologist at SU and co-founder of SharkSafe Barrier™, this nature-inspired technology is currently the only eco-friendly alternative to shark nets, which result in the death of thousands of sharks and other marine life every year.

The installation of a 30-metre-long SharkSafe Barrier™ at the Berry Islands in August this year will further strengthen marine conservation efforts in the [Bahamas](#). In 2011 the Bahamas proclaimed the first shark sanctuary in the Atlantic Ocean, and, in 2018, a Marine Action Partnership (MAP) for Sustainable Fisheries. Shark tourism currently contributes approximately US\$100 million per year to the local economy.

More about the technology

Andreotti says since 2012 the technology has undergone rigorous testing in the turbulent ocean waters along the South African coast, as well as in the tropical waters of

Réunion island and the Bahamas. The results from several of these [case studies](#) have been published in peer reviewed scientific journals.

The thinking behind the development of the SharkSafe Barrier™ concept is a combination of practical experience with sharks and marine biologists' understanding of their behaviour, she explains.

Firstly, fish and other marine animals such as seals have been observed to use kelp forests as a hiding place from predatory sharks. By bio-mimicking a natural kelp forest, created by overlapping rows of plastic pipes anchored to the seabed, the SharkSafe Barrier™ has proved to be an effective deterrent for predatory sharks.

Secondly, marine biologists know that most shark species are sensitive to strong permanent magnetic fields because of the presence of electro-magnetic receptors at the tip of their heads. These small gel-filled pores – called 'Ampullae of Lorenzini' – are connected directly to sharks' brains and allows them to register faint bioelectrical impulses dispersed in the water from their prey.



SharkSafe Barrier™

A conch exploring the limpet-shaped cement blocks anchoring the new SharkSafe Barrier™ installation at an island in the Bahamas. This eco-friendly installation mimics the visual effect of a kelp forest, and generates a strong magnetic field by means of ceramic magnets. This forms a double barrier (both visual and magnetic) that keeps sharks at bay.



Wilda Basson

The SharkSafe Barrier team at KND Fabrications in Maitland, Cape Town, shortly after the parts for the 30-metre-long installation were packed, ready to be shipped to the Bahamas. In the front, from the left, are Laurie Barwell, Errol Bourne, Dr Sara Andreotti, Ronnie Adams, Kezia Bowmaker, and Nina Sirba. At the back are Louie Miggel, Anthony Mederer, Matthew Mtshabe, Lincoln Calbert, Dirk Zimri, Nicolo Farmer, and Ricus du Toit. The factory owner, Rory Bruins, was travelling internationally when the photo was taken.

Using this knowledge, the developers of the SharkSafe Barrier™ created a strong magnetic field by inserting magnets into the kelp-like pipes. But instead of attracting the attention of a shark, the very strong magnetic field over-stimulates the Ampullae of Lorenzini and thus acts as another repellent. In other words, by inserting strong magnets into the kelp-like pipes of the barrier, it further strengthens the ability of the design to repel sharks, Andreotti explains.

Today, the SharkSafe Barrier™ consists of high-density polyethylene pipes manufactured locally by KND Fabrications in Maitland, Cape Town. During installation in

the ocean, the buoyant pipes are anchored on a grid-like structure one metre apart from one another, with large ceramic magnets staggered in the ocean-facing row. The grid is then weighted by limpet-shaped 200-kilogram cement blocks and secured by rock anchors and sand.

Apart from the fact that the SharkSafe Barrier™ combines two proven shark-repellent strategies, it has also been designed to remain in the water for at least 20 years with minimal maintenance required. This offers an opportunity for marine life to settle on the cement blocks that anchor the barriers to the seabed, forming an artificial reef.

Revolutionising the concept of shark management

For Andreotti, the first commercial installation of the SharkSafe Barrier™ is the breakthrough that the team has been working towards for the past 15 years.

“We now have the technology to allow the rightful inhabitants of the oceans to survive and thrive, and for sea-loving humans to enjoy their time in the water safely,” she says.

This is a win-win situation, especially for areas that rely on ocean recreation as a main source of revenue, such as beach towns in South Africa, Brazil, New Caledonia, the Bahamas and Réunion, she concludes.

Article compiled from press materials provided by Stellenbosch University. For more information contact Dr Sara Andreotti at andreottisara@gmail.com.

A voucher specimen that was subsampled for tissue to be stored in the Biobank.

BIODIVERSITY BIOBANKS:



NRF-SAIAB

An insurance policy for the future of nature

In a world where climate change, habitat destruction, overexploitation and pollution are leading to increasing loss of biodiversity that is altering the capacity of the Earth to sustain life, Biodiversity Biobanks are emerging as vital tools for the preservation and exploration of the genetic diversity of Earth's species. These repositories, unlike libraries or banks, store biological samples such as tissue, DNA, seeds and blood, along with valuable information about the organisms they represent. The National Research Foundation's South African Institute for Aquatic Biodiversity (NRF-SAIAB) is at the forefront of this essential work, with its Aquatic Biobank, situated in Makhanda, Eastern Cape, playing a significant role in the conservation and scientific research of aquatic species.

The NRF-SAIAB Aquatic Biobank is nestled within the NRF-SAIAB Collections Facility and currently houses over 45 000 tissue samples of aquatic species, including fish, amphibians and invertebrates. These samples are stored in a solution of 99.9% ethanol in two-millilitre Eppendorf tubes. The biobank facility hosts state-of-the-art equipment, with a total of six minus-80-degree-Celsius freezers. To ensure the safety of these vital samples, the facility employs generators, UPS systems and backup CO₂ cylinders to maintain uninterrupted power to the freezers, with constant monitoring using an online system and temperature sensors. These storage conditions and backup systems ensure that the DNA in tissue samples is not damaged and can be used by researchers to generate DNA sequences that are accurate and reliable.

The six freezers can store a total capacity of 235 224 samples. The biobank serves as a repository for genetic

materials, which are essentially the genetic blueprints of nature, allowing for the long-term storage of invaluable biological samples that can be used for future research and scientific discoveries.

Apart from the Biobank, the NRF-SAIAB Collections Facility also hosts a wet collection of whole specimens known as 'vouchers'. These specimens are stored in 70% ethanol in glass jars, with the collection currently comprising 123 792 lots and over a million specimens. The collection is primarily dominated by the National Fish Collection and is expanding to include amphibians, cephalopods and tunicates. The tissue samples stored in the Biobank are derived from these vouchers, offering researchers the opportunity to study both the genetic makeup and external characteristics of specimens (such as the length, number of scales, fins and gills) for accurate identification.



NRF-SAIAB

A collection of NRF-SAIAB Biobank minus-80-degree-Celsius upright freezers with back-up CO₂ cylinders.

Keeping such vast collections organised is essential, and each sample is stored in uniquely labelled tubes or jars. Information related to the specimen and its linked tissue is stored with software called Specify, allowing researchers to search for and request tissues from specific species they are working on.

The NRF-SAIAB Collections Facility and Biobank are open access platforms, welcoming researchers, both local and international, to request the use of tissue samples and vouchers, thereby promoting open science and shared scientific resources. Data from the facility is accessible through the Global Biodiversity Information Facility (GBIF).

Furthermore, the NRF-SAIAB Biobank is a core biobank of the Biodiversity Biobanks South Africa (BBSA), a research infrastructure project funded by the Department of Science and Innovation (DSI) and hosted by the South African National Biodiversity Institute (SANBI). The BBSA serves as a coordinating and supporting mechanism for numerous biodiversity biobanks in South Africa, with the main aim of increasing the range and quality of samples stored and distributed, and increasing and improving access for research and development.

Interesting facts about the potential of biodiversity biobanks:

Bioprospecting for pharmaceuticals

One of the most promising aspects of biodiversity biobanks is their potential impact on the future of medicine. The genetic diversity of plants and animals held within these biobanks can provide essential resources for the development of novel medicines and advancements in biotechnology research. For instance, marine sponges found in these biobanks have produced intriguing chemicals with antibacterial and antiviral properties, offering potential treatments for various diseases in humans.



NRF-SAIAB

Samples are stored in two-millilitre Eppendorf tubes with a solution of 99.9% ethanol.



NRF-SAIAB Biobank staff preparing a tissue gift request for researchers to conduct DNA analysis.

Uncovering some of nature's most hidden secrets

From identifying new species to understanding the functioning of ecosystems, biodiversity biobanks are helping scientific researchers uncover nature's most hidden secrets. Researchers can study the DNA from the tissues stored in Biobanks, using the sequences of base pairs to gain insights into individual organisms and their species. This knowledge can help predict potential future changes in the environment and the composition of its species.

For those interested in witnessing the importance of these biobanks first-hand, the NRF-SAIAB offers tours

of its facilities. Exploring the diverse aquatic species and the critical work conducted at the facility can inspire individuals to engage in scientific research, contribute to the preservation of species, and even to collect more aquatic samples for the Biobank. In a world where biodiversity preservation is of paramount importance, these biobanks are truly nature's insurance policy for the future.

Article written by Seshnee Reddy , Biobank Coordinator at the National Research Foundation's South African Institute for Aquatic Biodiversity (NRF-SAIAB).



Taskeen

be representing the
Witwatersrand in the



FameLab 2023 winner: Taskeen Hasrod crowned SA's top young science communicator

Wits chemist Taskeen Hasrod, seeking better ways to deal with acid mine drainage, has won a spot in the international FameLab final.

Mining wastewater is a massive problem worldwide, and South Africa is no exception. But the so-called acid mine drainage has a value because of the byproducts it contains. Using machine learning to predict the levels of these byproducts has won Taskeen Hasrod from the University of the Witwatersrand a place on the world stage of science communicators. Taskeen was chosen as FameLab SA 2023 winner during the national leg of the International FameLab science communication competition held on Thursday, 21 September 2023, at the National Research Foundation (NRF) auditorium in Pretoria.

As the national winner, she will represent South Africa in the International FameLab competition hosted by Cheltenham Festivals in the UK.

During the FameLab South Africa Final, ten young scientists showcased research from some of the top academic and research institutes across the country in a way that non-experts can follow and enjoy. The ten finalists each presented a three-minute talk about their research using props and simple language. The talks offered a glimpse into the lives of young researchers in South Africa and the impact they hope to have through their studies and work.

FameLab is the biggest international competition that seeks and supports science communication talent. This year

marked the 11th season of FameLab in South Africa. Taskeen captivated the judges with her storytelling skills and her passion for using artificial intelligence to create a more sustainable future. Her research in environmental analytical chemistry aims to create a circular economy by extracting valuable byproducts from acid mine drainage. The traditional chemistry experiments used to measure byproducts are time-consuming and expensive; however, Taskeen is developing machine learning techniques to short-circuit the process.

Runner-up Caleb Swanepoel from the University of Cape Town is working to improve phage therapy to treat antibiotic-resistant infections. Caleb, who is in the second year of his MSc studies, says the worldwide growth of antibiotic resistance has sparked new interest in phages, which are viruses that target and infect bacteria. Runner-up Ayesha Osman from the University of South Africa is studying for a PhD while lecturing engineering students. Her research aims to use titanium, copper and gold to develop an antibacterial alloy for use in dental applications, and she says it has the potential to benefit millions of people who need dental implants.

In reaction to being named FameLab 2023 champion, Taskeen said: "It's a big win, not just for me, but for my supervisor, my research group, my school, my university,



it means a lot and it shows that when we put our minds to something and we work hard we can achieve it. She paid tribute to her nine fellow finalists, saying they had “become a bit of a family”, and said she was looking forward to representing South Africa and Africa on the world stage.

In pursuit of her scientific goals, Taskeen says discipline, resilience and patience are key.

“Understanding the theory is as important as being able to conduct practical work. Science is an incredibly exciting field that is rapidly growing, expanding and evolving, so having a hunger to learn and being adaptable is vital to becoming a good scientist.”

Taskeen says FameLab taught her how to communicate her research without using scientific jargon.

“That’s incredibly important because the general public deserves to be able to understand our research and learn why it is important. I also learnt how to communicate my research in a really short space of time, which is vital in holding people’s attention.”

The judges for the final – Ina Skosana, Lucky Ditaunyane, Nosipho Mngomezulu and Thabiso Nkone – are all experienced role-players in the South African science communication landscape. Skosana is the news editor at Health-e News Service and was previously the health and medicine editor at *The Conversation Africa*; Ditaunyane is the director of communications and engagements at the Human Sciences Research Council and a member of various advisory boards at institutions of higher learning; social anthropologist Mngomezulu is a lecturer at Wits University and a research fellow in science communication at Stellenbosch University’s journalism department; and Nkone is the NRF corporate communications manager.

The other finalists were:

- **Amos Rakgoale** from the University of Limpopo, who is working towards a postgraduate diploma in science communication. With degrees in aquaculture and biological sciences, Amos entered FameLab after his work at a science centre and as a judge at the Eskom Expo for Young Scientists convinced him South Africans are missing out on the potential of science.
- **Carla Horn** from North-West University, whose MSc in nursing sciences is looking at how the healthcare system can prepare to deliver effective patient care and



The FameLab 2023 finalists.



save lives in the event of disasters. Carla is one of only a handful of disaster-preparedness researchers in South Africa, and says her studies could have an impact on every citizen.

- **Goratileone Oepeng** from the University of Pretoria, whose MSc studies in entomology are looking at how the pheromones honey bees use to communicate affect their reproductive development. "This communication pathway could be used to restore reproductive hegemony of wild honey bee species that pollinate over 60% of flowers worldwide," he says.
- **Jason Pillay** from the University of Pretoria, who is in his final master's year in statistics, specialising in computational and methodological statistics. "My research grows the toolkit needed by many other researchers and professionals focusing on solving real-world problems," he says.
- **Jessica More** from the University of KwaZulu-Natal, who hopes her studies for a master of medicine in laboratory science degree will help to stem tuberculosis, one of the world's biggest killers. Jessica's work at the Africa Health Research Institute is focused on identifying gene expression profiles in TB and could assist in developing targeted treatments that complement existing therapies.
- **Kaylan Reddy** from Stellenbosch University, whose deep connection to plants since childhood has become an academic fixation on an indigenous plant historically known as a mood enhancer. Now studying for a PhD in botany, Kaylan says his research into *sceletium* "seeks to harness its potential for anxiety and depression relief" and forms a bridge between traditional medicine and the global market.

- **Nombali Gumede** from the University of KwaZulu-Natal, who is working on a clinical trial with an antiretroviral therapy (ART) interruption. Many people with HIV struggle to adhere to ART, and Nombali says the opportunity to have an injection periodically, instead of taking a daily pill, will ease the burden of their disease.

The FameLab competition offered all contestants the opportunity to hone their communication and presentation skills to engage the public with their research, starting with training and participating in heats held at various institutions earlier this year. All contestants were encouraged to continue their new roles as ambassadors of their research and to find opportunities to talk about their research outside their academic spaces.

FameLab, an initiative of Cheltenham Festivals in the UK, has been running in South Africa since 2013 through a partnership between the South African Agency for Science and Technology Advancement (NRF-SAASTA) and research communication specialists, Jive Media Africa. Last year's South African FameLab champion, phytochemist Nehemiah Latolla of Nelson Mandela University, went on to win the international FameLab final in the UK.

The FameLab 2024 season is open, and organisations and institutions are invited to make bookings to participate. Jive Media Africa facilitates the FameLab training and heat event. Contact: famelab@jivemedia.co.za.

Article compiled from press materials provided by Shabnaaz Gani from Jive Media Africa for FameLab.



Solve for Tomorrow Schools Competition - winners announced

JOHANNESBURG. – Mbilwi Secondary School in Venda, Limpopo was announced as the winner of the Solve for Tomorrow schools competition at a ceremony at Birchwood Conference Centre in Johannesburg. The competition, which was run by Samsung in partnership with the State Information Technology Agency (SITA), was aimed at giving grade 10 and 11 learners from underserved communities an opportunity to gain invaluable skills while using Science, Technology, Engineering and Maths (STEM), to solve some of the challenges within their communities.

For their efforts, Mbilwi walked away with a prize of R100 000 cash, while in second place, Maphuthaditshaba Secondary from Acornhoek (Mpumalanga) received R50 000 and Umlazi Comprehensive Tech from KwaZulu-Natal got R30 000 for completing the top three places. The cash prizes will go towards STEM equipment for each school, according to their various unique needs. Samsung sweetened the deal by rewarding each of the learners in the top three teams with a Samsung device.

Head of Corporate Affairs at SITA, Tlali Tlali, highlighted that the collaboration with Samsung on this programme happened after finding synergies in the area of corporate social responsibility.

"This is the type of public-private partnership that, when implemented effectively, can bring about extensive, positive and meaningful change in the country. The youth hold the key to the future, and investing in them through such initiatives is a no-brainer. We are proud to partner with a like-minded organisation like Samsung in this effort to empower the youth and help shape the South Africa of tomorrow, while also giving a voice to those who were voiceless before."

The schools had to identify problems in their communities that they could solve using STEM. With Samsung helping them with resources and mentors guiding them, they had to conduct research and develop prototypes for the challenges they had identified.

The winning prototype, as created by the learners from Mbilwi, is an ambitious plan to fix all the potholes in their town's roads using recyclable and sustainable materials that include discarded bottles that they collected.

"This project has been a huge part of our lives in the past year, so winning it means a lot to us," said Igoline Coelho, team member and grade 11 learner. "We have really worked hard as a team as we met every day to put in the work needed to get us not just over the line but victoriously so, therefore winning is awesome. This win will



Deputy Minister in the Presidency, Pinky Kekana.

also encourage other learners in our school to participate in such competitions. We are happy that the competition allowed us to do something good for the environment and hopefully, it will spark even more interest in others to work on making the environment better for all."

The participating teachers also had high praise for the competition. "Winning this competition will help us keep our name on the map," said Tshifhiwa Tshidzumba. "We are one of the top schools in the region and have made a habit of winning, and we are happy to keep it that way. Winning such contests serves to reinforce our status as a great school with a highly competitive edge. We are proud of our learners and their achievement because we don't enter competitions just to add the numbers; we enter to win. When we compete, regardless of the contest or the opponents, we always want to be number one. We are grateful to Samsung and their partners for creating this platform for our learners to expand their STEM horizons."

Speaking at the event, Deputy Minister in the Presidency, Pinky Kekana, said, "In 2018, in line with efforts to improve the education system, the Department of Basic Education highlighted the importance to increase the number of schools that focus on critical learning areas such as science, technology, engineering, mathematics, as well as the arts. The skills acquired by the educators and the learners will benefit them beyond this competition. We

look forward to seeing the inclusion of more schools from the underserved communities in South Africa. We are optimistic that some of the solutions from this competition will eventually be implemented, thus putting South Africa on the map, with accompanying job opportunities for the youth."

Solve for Tomorrow is Samsung's ambitious effort to increase interest and proficiency in STEM, and also help the country contribute to the Fourth Industrial Revolution.

"Samsung is invested not only in contributing to the country's advancement in technology but also its socio-economic growth," said Hlubi Shivanda, Samsung's Director for Business Innovation, Group and Corporate Affairs. "As one of the tools for improving the country, the drive for youth employment is something the company is actively involved in and is pushing through various initiatives. Solve for Tomorrow does this by helping equip the youth with various technological, artisanal and electronic skills. We are proud to see this group of young people applying their minds to learn and help solve some of their communities' problems and hope such programmes spark the revolution for positive and sustainable change within communities."

– Samsung South Africa



Mbilwi Secondary School in Venda, Limpopo was announced as the winner of the Solve for Tomorrow schools competition.

Tshikolo tsha Mbilwi tshino wanala venda kha la Limpopo, tsho divhadzwa sa thikolo tsho dzhiahho vhuimo ha u thoma kha vhutambo uvhu ho bvelelaho ngei Birchwood conference cente ngei jozi. Mutatisano Uyo wo vha wo rangwa phanda nga Sumsung itshi kho shumisana Na tshiimiswa tsha SITA. Tshipikwa huu lambadza vhana vha murele Wa vhu 10 Na 11 ubva vhuoni vhusiku ha vhudi, tshikhala tsha u Wana zwikili vha tshi kho shumisa schince, technology, engineering Na Maths, u tandulula dzinwe dza thaidzo dzine vha kho tangana nadzo hanefho vhuoni havho.

Translated into TshiVenda by Ramukumba Tshauambea



ANCIENT DIAMONDS

shine light on the evolution of Earth

The analysis of ancient, superdeep diamonds dug up from mines in Brazil and Western Africa, has exposed new processes of how continents evolved and moved during the early evolution of complex life on Earth. These diamonds, formed between 650 and 450 million years ago on the base of the supercontinent Gondwana, were analysed by an international team of experts, and have shown how supercontinents such as Gondwana were formed, stabilised, and how they move around the planet.

“Superdeep diamonds are extremely rare and we now know that they can tell us a lot about the whole process of continent formation,” says Dr Karen Smit of the Wits School of Geosciences, who was part of the study. “We wanted to date these diamonds to try and understand how the earliest continents formed.”

Formed millions to billions of years ago, diamonds can shine light into the darkest and oldest parts of the Earth’s mantle. Continents drift across Earth’s surface, creating “supercontinents” and destroying them. Collectively, these migrations are known as the “supercontinent cycle”, and diamonds are one of the few minerals strong enough to survive and record these ancient cycles of creation and destruction.

Supercontinents can focus deep oceanic plate subduction – the driver of plate tectonics – in very specific regions. Such deep geologic processes, especially in the past, have been very difficult to study directly because the oceanic crust is young, and the continental crust only provides a limited view of Earth’s deep workings. Old diamonds offer

a direct window into the deep plate tectonic engine and how it might relate to the supercontinent cycle.

By dating the tiny silicate and sulphide inclusions inside the diamonds, the team led by Dr Suzette Timmerman of the University of Bern, Switzerland, dated the diamonds that formed 300 to 700 km deep under the base of Gondwana. The goal was to trace how material was added to the keel of the supercontinent. While doing this, the team recognised a previously unknown geologic process. The research was published in *Nature* on Wednesday, 18 October.

“The geochemical analyses and dating of inclusions in the diamonds, combined with existing plate tectonic models of continent migration, showed that diamonds formed at great depths beneath Gondwana when the supercontinent covered the South Pole, between 650–450 million years ago,” says Smit.

The host rocks to the diamonds became buoyant during diamond formation, transporting subducted mantle material plus the diamonds. This material was added to the base of the root of Gondwana, in essence ‘growing’ the supercontinent from below.

“Around 120 million years ago, Gondwana started to break apart to form the present oceans such as the Atlantic. At 90 million years ago, the diamonds, carrying trapped tiny inclusions of the host rock, were brought to Earth’s surface in violent volcanic eruptions.”



Dr Karen Smit in the newly developed isotope laboratory in the School of Geosciences at Wits University.

The current locations for these volcanic eruptions are on the continental fragments of Brazil and Western Africa, two of the key components of Gondwana. Thus, the diamonds must have migrated together with different parts of the former supercontinent as it dispersed, “glued” to their base.

“This complex history of the diamonds shows that they are remarkably well-travelled, both vertically and horizontally, within the Earth – tracing both the formation of the supercontinent and the latter stages of its evolution. The accretion of relatively young material to the roots of the continents thickens and welds together these ancient continental fragments indicating a potential new mode of continent growth.”

Smit conducted the isotope analyses of sulphide inclusions at the Carnegie Institution for Science. She is now based



Diamonds with microscopic silicate and sulphide inclusions exposed new processes of how continents were formed and stabilised, allowing for early evolution of life on Earth.

at the University of the Witwatersrand where she is part of a team developing a new isotope lab and methodologies so that diamond inclusion analyses can ultimately be conducted at Wits.

“We have installed the necessary equipment in 2022 and are working towards getting the highly specialised skills and equipment together so we can do this type of diamond work in South Africa, where previously it could only be done overseas,” says Smit.

“We need this type of research to understand how continents evolve and move. Without continents there wouldn't be life. This research gives us insight into how continents form, and it links to how life evolved and what makes our planet, Earth, different from other planets.”

Analysis ya kale, Na musuku ubvaho fhasi fhasi wo gwiwa ngei mugodini Wa ngei Shangoni la Brazil Na vhukovhela ha Africa. Wo bvukulula maitete maswa auri vhashango Ovha a tshi kho itisa hani Na u pfuluwisa hani nga tshifhinga tsha evolution fhano shangoni.

Translated into TshiVenda by Ramukumba Tshauambea



Prof. Thinus Booysen

ON THE BUMPY ROAD TO electric mobility in SA: a second life for combustion engine minibus taxis

A research team from Stellenbosch University joined forces with Rham Equipment to retrofit a minibus taxi with electric propulsion. This is the first electric taxi of its kind in South Africa. Electric vehicle manufacturers in South Africa have a window of opportunity now to open plants in Africa to produce electric vehicles locally. Most of the locally manufactured petrol cars are being exported, but this boon to the economy will end with developed countries transitioning to electric vehicles in the run-up to (or before) 2035. This is according to Prof. Thinus Booysen of the Department of Industrial Engineering at Stellenbosch University (SU).

"Remaining in the slow lane of the electric vehicle transition could put thousands of jobs at risk," says Booysen, who holds the research chair in the Internet of Things. "The automotive industry and our government cannot afford to be asleep at the wheel."

Leading the way in this regard, Booysen and his team at SU joined forces with Rham Equipment to retrofit a minibus with electric propulsion. This means converting a petrol or diesel minibus to an electric vehicle.

This prototype electric taxi, which will be used to prove the concept and for testing, was recently completed and is operational. It is currently being tested for road safety,

after which performance testing will commence. The South African National Energy Development Institute (SANEDI) provided funding for the retrofit, and Transport Services at SU donated one of the minibuses in its fleet.

The project manager at SANEDI, Dr Neville Smith, expressed his excitement about this novel approach to retrofitting normal combustion engines with electric vehicle engines, emphasising that this initiative will contribute extensively to achieving our national climate change objectives and targets.

Booyesen says the first retrofitted minibus is just the beginning.

"More than 70% of the trips in South Africa are by minibus in the informal sector, which is why we are hoping to encourage the retrofitting of some of the 250 000 minibuses in the country with electric propulsion. These will be cheaper and much more environmentally friendly than new electric vehicles. With this venture, we want to help build the skills that will be needed to manufacture electric vehicles locally and also create awareness about how much we could save with electric taxis."

According to the CEO of Rham Equipment, Kevin Reynders, "Groundbreaking innovation and local skills development



are at the core of our company's ethos. Working on this project with Stellenbosch University allowed us to plough back into engineering students' development and to contribute to sustainable mobility in South Africa's dynamic vehicle landscape."

One of Booysen's team members, Stephan Lacock, who is doing his master's degree in electronic engineering at SU and is funded by Golden Arrow Bus Services, helped design the retrofitted minibus with partners at Rham Equipment.

Lacock says they removed the internal combustion engine of the minibus and its associated components such as the petrol tank, manual transmission, gas pipe and radiator. He adds that throughout the development process, the retrofit needed to comply with national road safety regulations, particularly the strict requirement not to make any permanent changes to the minibus chassis (base frame), such as drilling or welding and specific weight requirements.

"Overcoming design challenges, Rham Equipment and our research team have successfully created a reproducible 'kit' that includes the main components of the electric powertrain or system that propels the vehicle forward. These include an electric motor, inverter, charger, electronic control unit, and a single-speed reduction gearbox. The powertrain is skilfully connected to a custom-designed battery pack that meets the specific operational needs of a minibus."

Lacock says one of the standout features of the retrofitted minibus is its advanced regeneration system that harnesses energy generated during deceleration and downhill driving, enhancing the vehicle's energy efficiency and overall range.

"As a result, the minibus is now equipped to travel an estimated range of approximately 120 km, with a maximum speed of 120 km/h. It has an electric motor power of 90 kW and a battery capacity of 53.76 kWh. This ensures that it meets all load and driving requirements comparable to those of traditional internal combustion engine minibuses. Moreover, the electric powertrain brings enhanced agility and an exhilarating driving experience to the minibus."

"Thanks to the inclusion of a 20 kW charger, the minibus can be efficiently charged in just over two hours."

Lacock says it is important to keep in mind that this is just the initial model, and that future iterations and advancements in technology will likely lead to more improvements in charging times, longer ranges by increasing the battery capacity, and overall performance.

Although Booysen is optimistic about the retrofitting of taxis, he is also mindful of the challenges related to powering them in a country where the national grid already operates at half its capacity.

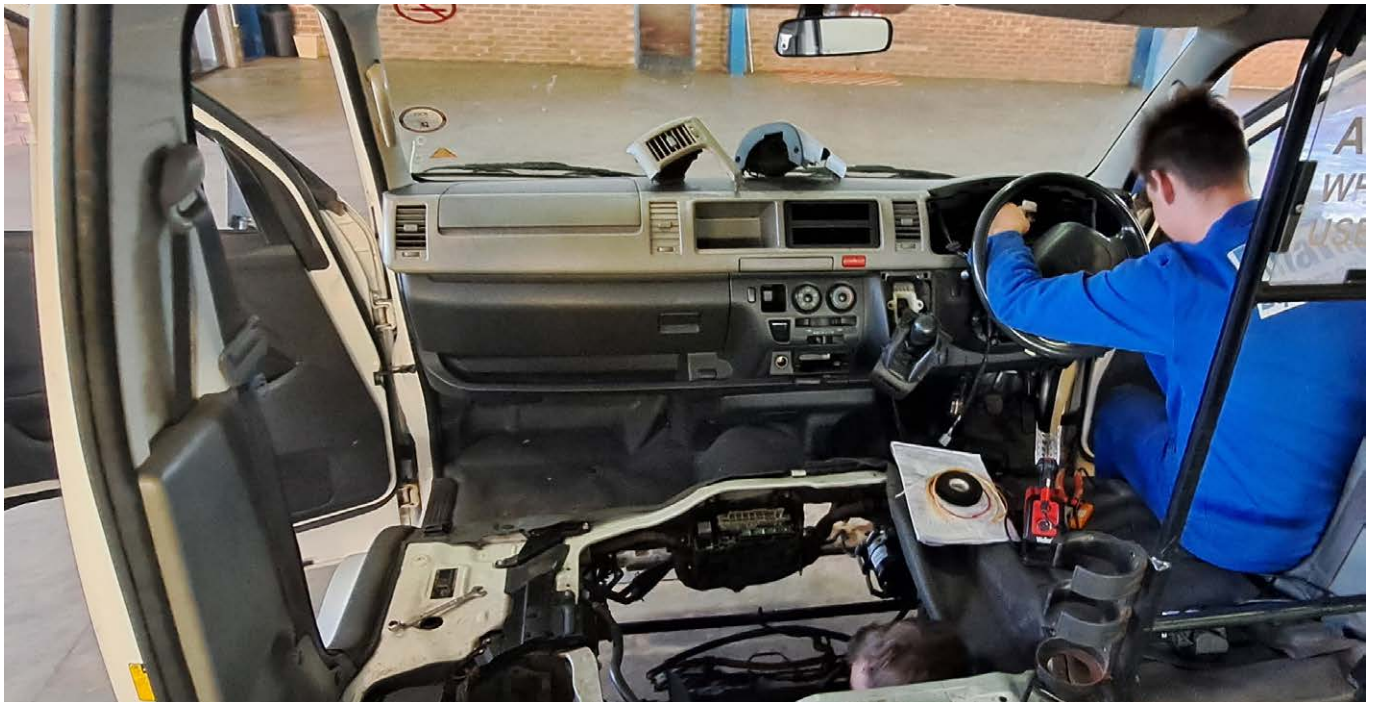
"We need to look at what the impact would be if we add an extra load of electric vehicles to the grid. Given that people who can buy electric vehicles can also afford to install fast chargers, the impact of those vehicles will quickly slay a grid already on its knees."

"With petrol and diesel vehicles, we could drive to the nearest gas station because there was adequate infrastructure, sufficient 'range' on a tank, and the refilling was quick. With electric vehicles, the problem is the 'filling' takes a long time, and the range and energy source are limited."

Echoing Booysen's sentiment, PhD student and team member Johan Giliomee says the expected charging times that result from the way minibus taxis operate is a concern because of the additional load the simultaneous charging will put on the grid.

"Research results show that electrifying all minibus taxis in South Africa could add a load of 5% of what the grid can currently deliver.

"As most taxis have similar operational hours, peaking before and after the workday, their charging opportunity



window also aligns. This will result in a significant peak power draw that needs to be accounted for when planning for the electrification of the minibus taxi sector. In addition, the total energy required for a given operational period also requires in-depth analysis."

Giliomee points out that minibus taxis could be supplied with electricity through the installation of solar panels and battery energy storage systems at taxi ranks. Hydrogen could also be used as an alternative electricity source or for interim energy storage.

Given the current severe electricity constraints, Booysen suggests moving the national discussion from electric

vehicles to a system perspective of electric mobility to include the decentralised provision of electricity.

"We must think anew about how we buy a car; it must be sold as part of a mobility package, that is, the car, solar panels and a large battery as a system, rather than just an electric car that will mess up our grid and will be restricted by our grid."

Booyesen says in the next phase of the project they will collaborate with Rham Equipment and Golden Arrow Bus Service to retrofit one of the company's buses.

- Stellenbosch University

Tshigwada tsha thoduluso iyo ubva ngei gudedzini la Stellenbosch vho tanganya mannda Na tshiimiswa tsha Rham equipment u vusuludza dzangano la dzi thekhisi nga mudagasi. Ndi thekhisi ya uthoma ya mudagasi kha la South Africa.

Translated into TshiVenda by Ramukumba Tshauambea



South African women in science, take a bow!

Burn wounds are increasingly becoming an important cause of death in the Middle East and Africa. In South Africa, burns affect about 3.2% of the population annually, more than 1.8 million people. This places a huge financial burden on the national healthcare system as well as the economy. Many efforts have been made to produce an effective bandage that has the potential to close the wound and accelerate scar healing as the process of wound regeneration is time-consuming and the material for a specific wound type is important for proper healing. This is why the research of Mapula Razwinani, a postdoctoral candidate at the Durban University of Technology, into using plant extracts encapsulated in hydrocolloid bandages, is critically important for the future treatment of burn wounds.

Razwinani is one of seven phenomenal women scientists – three doctoral and four postdoctoral – who were honoured at the 2023 L'Oréal-UNESCO For Women in Science National Awards ceremony (FWIS) on 12 October 2023.

She is joined by fellow Laureates: Saphokazi Timakwe (doctorate: electrochemistry/nanomaterials), Alexandra Howard (doctorate: agricultural sciences), Anna Chrysostomou (doctorate: theoretical physics), Alex Delport (postdoctorate: biological sciences), Gugu Khubeka (postdoctorate: chemistry), and Nireshni Mitchev (postdoctorate: health sciences).

The programme in South Africa is now in its fifth year and provides funding to women scientists in support of the research they are conducting in their respective fields of study. The South African programme forms part of the greater Fondation L'Oréal-UNESCO FWIS programme, which is celebrating empowering women scientists around the world for 25 years in 2023.

Through its 52 regional and national programmes, the initiative has supported 250 talented young women researchers globally at a crucial period in their careers, during their thesis or postdoctoral studies.

While women scientists are leading research across the world, a UNESCO Science Report: Towards 2030 reveals that they represent a mere 33.3% of researchers globally, and their work rarely gains the recognition it deserves.

The report notes that each step up the ladder of the scientific research system sees a drop in female participation until, at the highest echelons of scientific research and decision-making, there are very few women left. In addition, another report by BMJ Global Health found that female health researchers in sub-Saharan Africa face significant challenges in publishing in first- or last-author places in academic journals, with men comprising 61% of first authors and 65% of last authors.

It is challenges like these that make initiatives such as the L'Oréal-UNESCO FWIS programme so important for women scientists globally and a testament to L'Oréal's unwavering commitment to the empowerment and advancement of women in science. To date, the programme has awarded more than 100 laureates, five of whom have gone on to win Nobel Prizes. This is notable, given that less than 4% of Nobel Prizes for science have ever been awarded to women, according to the UNESCO report.

Razwinani is delighted with the award and says the recognition by L'Oréal is a boost to her personal and professional growth, as well as her efforts to be the best version of herself. "The award brings a multitude of career benefits for me, furthering my professional development and allowing me to be an inspiration for other females in STEM."

Fellow recipient Nireshni Mitchev says that she was drawn to the programme because of its specific focus on the contributions of women leading research in their respective fields.

"For me, it acknowledges the fact that women wear multiple hats; we have families and additional roles, and this funding is flexible and caters for many factors to assist female scientists to grow."

"I also look up to the L'Oréal-UNESCO alumni, and am proud to now be associated with this amazing initiative. I am honoured that the importance of my research and the impact it will have for women's health have been

recognised, and this award is a reminder that I am making a difference and motivation to keep persevering."

Serge Sacre, L'Oréal South Africa Country Manager, says recognising women scientists in South Africa is particularly important. "A 2021 Global Gender Report indicates that less than 13% of women choose to study STEM disciplines in South Africa. This can be attributed to many factors such as the perpetuation of gender stereotypes, a flawed education system and a lack of role models, amongst others."

"That said, we at L'Oréal firmly believe that women have a critical role to play in helping solve some of South Africa's, and indeed the world's, most pressing challenges. They need to be represented at every level of the scientific supply chain, from research and implementation, to policy and programming."

Sacre acknowledges there is much to be done to achieve true gender equality in science. "At L'Oréal, we envision a world where girls are encouraged to study science and are enabled to do so, where female students stay the course in pursuing their post graduate studies, and where scientists are judged purely on the merit of their discoveries and the potential of their work to change the world."

"We congratulate the L'Oréal-UNESCO For Women in Science recipients of 2023, and eagerly look forward to their achievements in the future."

– L'Oréal

Vho Mapula Razwiani mutshudeni a kho gudelaho vhudokotela ngei gudedzini la Durban (DUT) u kho shumisa mishonga ine ya vha ya vhutogwa vhukuma kha u fholisa zwilonda. Razwinani ndi munwe Wa vhafumakadzi vho diimisaho. Ndi razwa science, dokotela u wonano tshiphuga nga 2023 Loreal UNESCO zwavhafumakadzi vha shumanaho Na Zwa science. Nga 12 October uno Nwaha.

Translated into TshiVenda by Ramukumba Tshauambea



YouTube reviews

Here are some good YouTube channels and videos that will help to explain the economy, and economic concepts, in simple terms. Happy learning and wealthy investing!

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