SPECIAL EDITION ON AI

UJ INSIGHT

October/November 2025

AI Leaders: Shaping the Future at UJ

New Simulation Centre Redefines Emergency Training in Africa

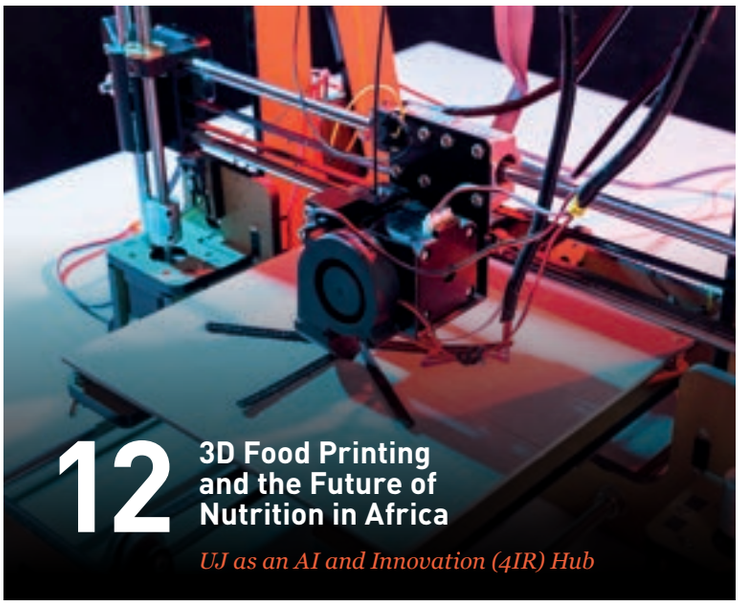
A Blockchain revolution in graduate certification

Shaping Africa's Digital Future

UJ as an AI and Innovation (4IR) Hub

20 YEARS

Our Future. Reimagined.



20 YEARS 2005 2025

UNIVERSITY OF JOHANNESBURG

UJ Insight is published by Strategic Communications, within the Division of University Relations.

Editorial Team

Prof Bongani Ngqulunga;
Dr Phumelela Dhlomo;
Priyal Pillay; Lebogang Seale

Contributors

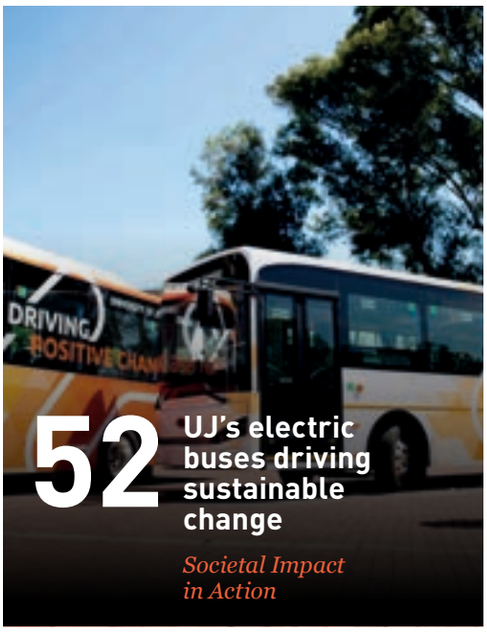
Mpiletso Motumi
Masego Panyane
Herman Esterhuizen

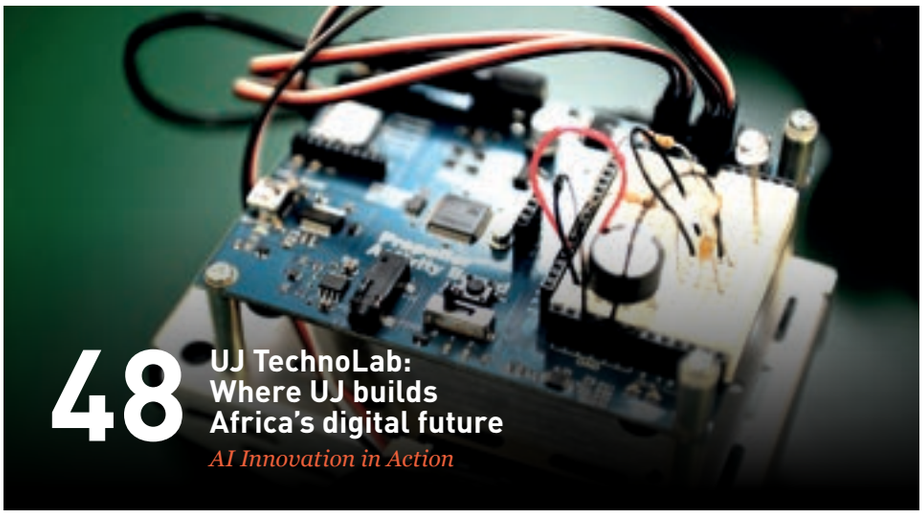
Photography

Nokuthula Mbatha

Design

Purebrown Design





go2uj
university_of_johannesburg
go2uj
ujyoutube
university-of-johannesburg

Table of Contents

Special Edition on AI - Oct/Nov2025

How UJ is shaping Africa's digital future through Research, Innovation, and Societal Impact

At the University of Johannesburg (UJ), the digital future is not an aspiration — it's happening now. Across its campuses and communities, UJ is weaving artificial intelligence, robotics, immersive technologies, and digital learning into its core mission. It is not content merely to prepare students for global change—it seeks to lead it. This edition of UJ Insight delves into the institution's bold trajectory toward becoming Africa's 4IR hub.

Vision 2035: The Future of UJ

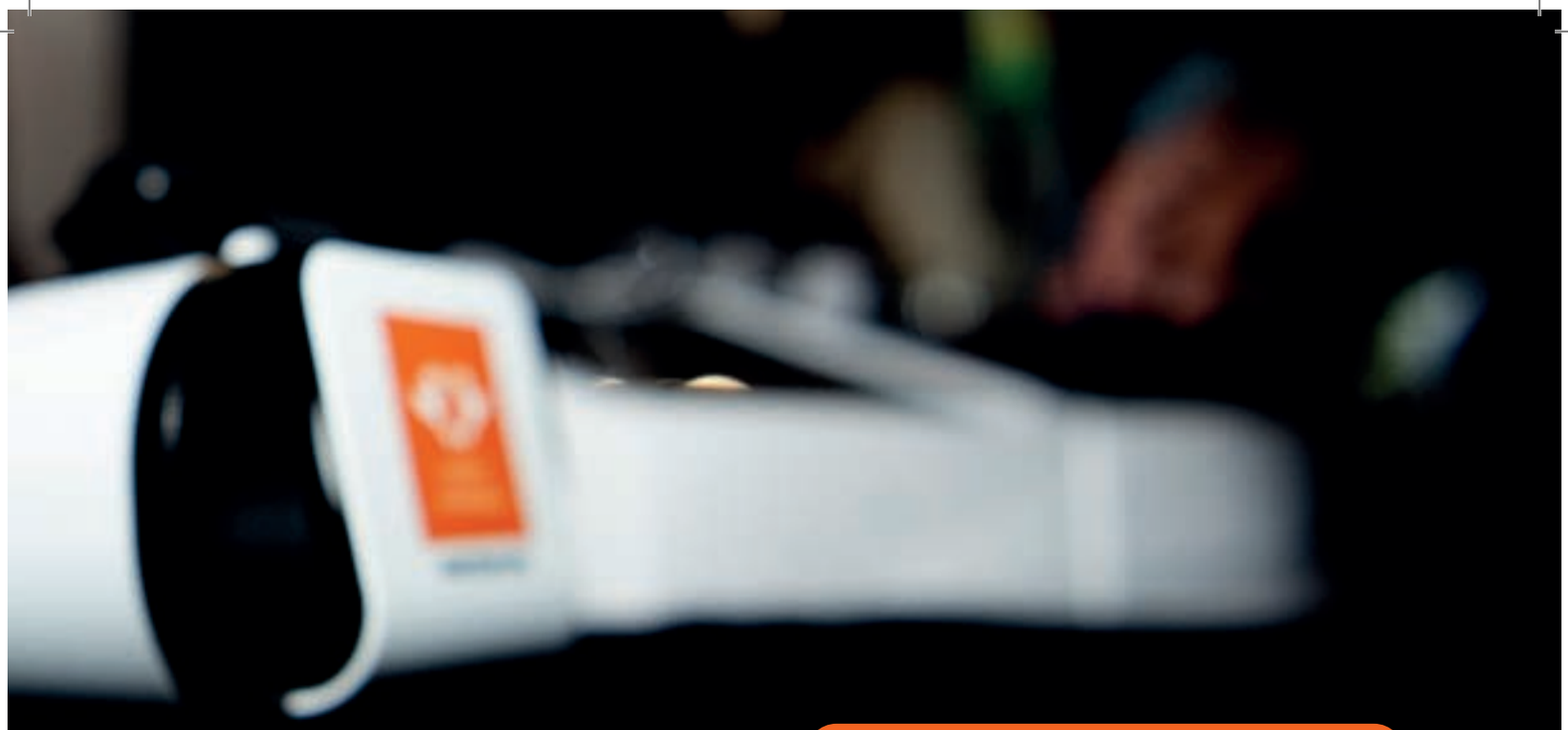
A bold roadmap for innovation, sustainability, and global impact

The University of Johannesburg (UJ) has entered a defining new chapter with the introduction of its Strategic Plan 2035 — a roadmap that reimagines what it means to be a university in a rapidly changing world. Blending innovation with social consciousness, the plan strengthens UJ's role as a driver of transformation, sustainability, and global collaboration.

More than a strategic framework, UJ's 2035 vision captures the institution's belief that higher education must serve humanity — preparing students, communities, and industries for a future shaped by technology, ethics, and inclusivity.

A story of transformation and resilience

Few universities have evolved as rapidly or as boldly as UJ. In just under two decades, it has risen to become one of Africa's most



innovative institutions — a place where ideas meet impact, and where technology and transformation go hand in hand.

"Our story as an institution is a formidable one indeed," says Professor Letlhokwa George Mpedi, UJ's Vice-Chancellor and Principal. "In just under two decades, we have shown our ability to respond to our shifting context and emerge as dynamic and active participants.

We have been at the fore of the fourth industrial revolution (4IR) in Africa, and our commitment to Pan-Africanism, transformation, equity, and access has not wavered. These ideals remain the fabric of our institution."

UJ's Strategic Plan 2035 builds on this foundation, setting out clear priorities that will guide the University over the next decade — deepening its impact in South Africa and beyond.

Three pillars for the next decade

The **Strategic Plan 2035** is anchored in three interconnected pillars that define UJ's pathway to the future:

- **Societal Impact and Sustainability**
  Driving positive change through research and teaching that address inequality, environmental sustainability, and social justice.
- **Global Footprint and Partnerships**
  Deepening collaborations with universities, industries, and governments to advance innovation and knowledge exchange.
- **Technology for the Future**
  Harnessing UJ's leadership in the Fourth Industrial Revolution (4IR) to prepare students for a digital world — always guided by ethics and a people-first approach.

We have been at the fore of the fourth industrial revolution (4IR) in Africa, and our commitment to Pan-Africanism, transformation, equity, and access has not wavered.

Rooted in Africa, shaping the world

We are firmly rooted in Africa, but our influence is global," says Ms Xoliswa Kakana, Chairperson of UJ's Council. "This plan ensures we are prepared to make a difference both locally and internationally."

UJ's global recognition continues to grow. Ranked among the top 400 universities worldwide by the Times Higher Education World University Rankings, the institution stands as one of Africa's most forward-thinking universities — a symbol of excellence, innovation, and transformation.

UJ IN THE RANKINGS

	Latest Edition	Rank in the World / Region	Rank in Africa	Rank in South Africa
Impact and Sustainability Rankings				
Times Higher Education (THE) Impact Rankings	2025	23	1	1
Regional Rankings				
Times Higher Education (THE) Sub-Saharan Africa University Rankings	2024	1	1	1
Young Rankings				
Times Higher Education (THE) Young University Rankings (THE YUR)	2024	60	1	1

Global recognition, local impact

The plan's unveiling follows a series of significant international achievements. In the 2024 Times Higher Education (THE) World University Rankings, UJ was placed among the top 400 universities globally — a milestone that underscores its academic excellence and global competitiveness.

These accolades, coupled with UJ's leadership in innovation and sustainability, highlight the University's growing influence as a Pan-African institution with a global voice.

Since its inception in 2005, UJ has championed academic transformation, technological advancement, and equitable access.
The Strategic Plan 2035 builds on this legacy — charting a bold course towards a sustainable and inclusive future.

Towards 2035 and beyond

"This plan is crucial for the sustainability of UJ and will leave a lasting societal impact," says Dr Phumzile Mlambo-Ngcuka, UJ's Chancellor. "It shows that the University's efforts go beyond the classroom, touching the broader society."
As UJ looks to the next decade, Strategic Plan 2035 serves as both a vision and a call to action — to innovate boldly, educate responsibly, and lead with purpose.

With its foundation rooted in Africa and its gaze fixed firmly on the future, UJ continues to prove that education, when guided by integrity and imagination, can shape not only individuals — but the world.

As UJ looks to the next decade, Strategic Plan 2035 serves as both a vision and a call to action — to innovate boldly, educate responsibly, and lead with purpose.

From the Desk of the Vice-Chancellor

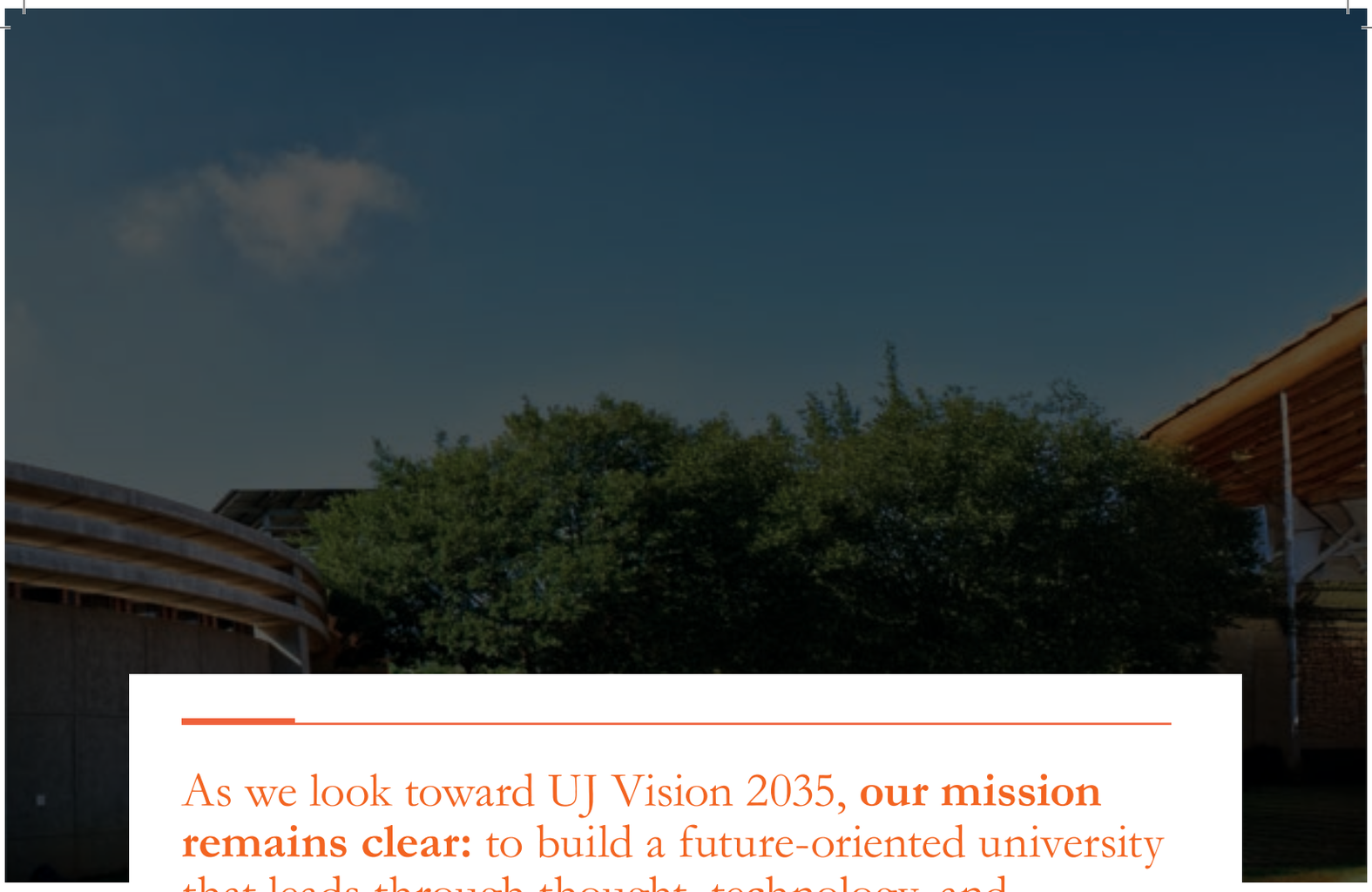
Reflections on UJ's 4IR vision, achievements, and roadmap to 2035

Our researchers continue to push boundaries — using artificial intelligence to improve healthcare, 3D printing to advance food innovation, and data science to inform sustainable policy.

When the University of Johannesburg first embraced the Fourth Industrial Revolution (4IR) as a defining element of its identity, we were not simply responding to a global trend. We were making a deliberate choice — to shape Africa's future through innovation, inclusivity, and purposeful impact.

Today, several years into that journey, it is clear that UJ's commitment to technological advancement has evolved from aspiration to lived reality. Across our campuses, 4IR is no longer a concept confined to laboratories or policy documents; it has become part of how we teach, research, and engage with society. From developing Africa's first university-led electric bus fleet to pioneering community-driven digital projects in rural areas, our initiatives demonstrate how technology can be harnessed to serve humanity.

Our researchers continue to push boundaries — using artificial intelligence to improve healthcare, 3D printing to advance food innovation, and data science to inform sustainable policy. Equally important is the human dimension: UJ's investment in digital



As we look toward UJ Vision 2035, **our mission remains clear:** to build a future-oriented university that leads through thought, technology, and transformation. Innovation, in our view, must always be in service of people — it must reduce inequality, expand opportunity, and empower communities.

literacy, ethics, and critical thinking ensures that our graduates are not just employable, but also responsible global citizens equipped to navigate complexity with integrity and purpose.

As we look toward UJ Vision 2035, our mission remains clear: to build a future-oriented university that leads through thought, technology, and transformation. Innovation, in our view, must always be in service of people — it must reduce inequality, expand opportunity, and empower communities.

UJ's roadmap to 2035 calls for deepened partnerships across sectors, enhanced transdisciplinary research, and the continued integration of 4IR into all spheres of academic and institutional life. It is through this collective effort that we will ensure our university not only keeps pace with change but actively drives it.

In this edition of UJ Insight, we celebrate the remarkable work of our academics, students, and partners who are advancing knowledge and innovation with an unmistakably African perspective. Their achievements remind us that the Fourth Industrial Revolution, when guided by ethics and empathy, holds immense potential to shape a more just and sustainable world.

As we forge ahead, let us remain guided by the spirit of ubuntu — ensuring that every innovation we pursue contributes meaningfully to human progress.

Professor Letlhokwa George Mpedi
Vice-Chancellor and Principal
University of Johannesburg

UJ's Institute for Artificial Intelligent Systems:

Using AI to solve Africa's real-world problems

When Professor Babu Sena Paul reflects on his journey from studying Wireless Communication to leading one of Africa's top innovation hubs in Artificial Intelligence (AI), he describes it as a challenge he couldn't resist. As the Director of the University of Johannesburg's (UJ) Institute for Artificial Intelligent Systems (IAIS) (previously known as the Institute for Intelligent Systems (IIS)), Prof Paul has spent the past several years turning a bold idea into a leading centre for 4IR-driven innovation.

He is driven by the passion for building an institute from the ground up exploring new areas and creating knowledge that changes lives, he says. His curiosity, logical thinking, and commitment to real-world impact define both his leadership and the spirit of the IAIS.

The Institute's mission is clear and ambitious: to become Africa's main hub for solving real problems through research, development, and innovation that supports the UN Sustainable Development Goals. The vision is to "become the partner of choice for governments and industries, offering reliable, value-driven solutions that tackle Africa's unique challenges, while shaping Africa's journey in the Fourth Industrial Revolution, and not just follow it," explains Prof Paul.

That vision is already visible in projects across conservation, healthcare, pharmaceuticals, education, and culture, all guided by the belief that technology should promote inclusion and sustainability.

One of the Institute's projects, led by Prof Terence Van Zyl, uses Machine Learning to support wildlife conservation.

"Smart monitoring can save lives in healthcare institutions with limited workers , as it helps keep patients safe, reduces pressure on staff, and promotes fair access to care".

By analysing ecological data, the team helps rangers and policymakers prevent human-wildlife conflict. This is achieved through "combining real-time data with AI models to track animal movements, monitor risks, and protect both communities and ecosystems," says Paul. This work directly supports SDG 15 (Life on Land) and shows UJ's commitment to research that makes a difference in people's lives.

The Institute is also developing intelligent healthcare systems. Prof Paul co-leads the Intelligent IoT-based Health Monitoring System, which addresses the shortage of medical staff in developing countries. By using wireless sensors and cloud computing, the system continuously tracks patients' vital signs and

detects health risks automatically. He adds that "smart monitoring can save lives in healthcare institutions with limited workers , as it helps keep patients safe, reduces pressure on staff, and promotes fair access to care,"

In the pharmaceuticals field, IAIS researchers such as Prof Uche Kennedy Okonkwo are transforming drug discovery using generative AI models. Their system designs new, synthesizable drug molecules that can target diseases like cancer and hypertension. Some of these AI-designed molecules are created and tested through a collaboration with UJ's Department of Chemical Sciences. He believes that, "this could make drug discovery more affordable, accessible and that it's a step towards personalized medicine for everyone," says Prof Paul.

The Institute is also exploring precision medicine through "physics-informed" neural networks that model how individual patients respond to cancer treatments. By creating a digital version or "pseudo-digital twin" of the P2X7 Receptor Pathway, a systemic understanding of the pathway can help in cancer drug design and treatment. The project aims to develop patient-specific therapies. "This is what we mean by impact, - when computer models lead to better health outcomes, that's success," Paul explains.

Language and culture are other focus areas. IAIS, through Professor Mpho Primus' expertise in Natural Language Processing (NLP), is advancing African language technologies like speech recognition and text-to-speech systems for languages such as Sesotho and Setswana. By studying African rhythms and speech patterns, her team is building AI that truly understands local languages. Prof Paul states, "Language is identity, therefore, if our AI can't speak to our people, it can't serve them".

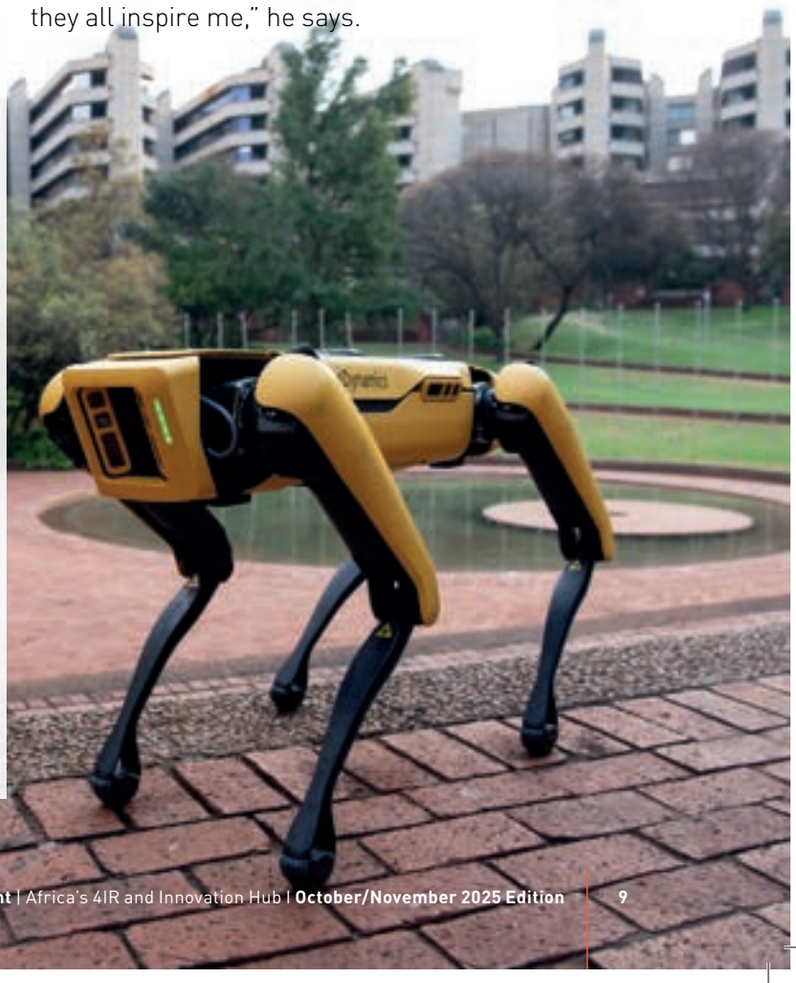
Projects within the IAIS Metaverse Research Unit, led by Dr Herman Myburgh, are also breaking new grounds. The team has created virtual reality platforms that train healthcare workers in managing hypertension, and augmented reality tools for students studying radiography and urban planning. Prof Paul adds that "inclusion means giving every student access to quality learning, and through VR and AR we can bring world-class experiences to anyone, anywhere."

Ethics remains at the core of the Institute's work. Prof Paul is aware of the risks that come with rapid AI growth. He highlights that the biggest danger is misuse, that's why "our Master's students learn not just to build AI systems, but to build them responsibly." Through collaboration with UJ's Faculty of Humanities, the Institute includes ethics and social responsibility in all its programmes and research.

Still, Prof Paul believes that one of the Africa's challenges in advancing 4IR innovation is skilled manpower - the demand is huge, but the supply is small. This is why IAIS is committed to developing people, not just systems."

Under his leadership, the Institute has become a cornerstone of UJ's Strategy 2035 driving Impact through real-world solutions, Innovation through advanced technology, and Inclusivity by ensuring every outcome benefits diverse communities.

When asked what keeps him motivated, Prof Paul shares: "My collaborators, my students, UJ's visionary leadership and the resilience that I see among the present young generation, they all inspire me," he says.



Championing African Natural Language Processing (NLP)

Q&A with Professor Mpho Primus

Professor Mpho Primus is one of the leading voices in African Natural Language Processing (NLP) and the inclusive development of human language technologies. As Co-Director of the Institute for Intelligent Systems (IIS) at the University of Johannesburg, she leads research at the intersection of language and intelligent systems, promoting the equitable representation of African languages in AI.

How did you become interested in working at the intersection of AI and African languages?

My journey into AI and African languages began during my undergraduate studies. One of my Computer Science lecturers encouraged me to combine Computer Science and Linguistics through a new programme introducing Computational Linguistics. I became the first student to pursue this combination, and it immediately ignited a lifelong passion.

Later, while working with the Human Language Technology Group at the Meraka Institute (CSIR), I saw both the promise and inequality in how African languages were represented in technology. Even when tools existed, they often failed to capture the true complexity of our languages — especially tone, one of the most defining features of meaning in African languages.

That realisation shaped my Honours and Master's research, where I developed a tone-labelling algorithm for Sesotho. My goal was to demonstrate that African languages are not anomalies to be adapted to technology, but systems of knowledge deserving the same depth, nuance, and precision as any other language in AI.

What inspired your focus on low-resource languages, particularly Sotho-Tswana?

As a native Sesotho speaker, my research is deeply personal. The Sotho-Tswana languages — rich in tone, code-switching, and discourse — challenge Western-centric language models. They remind us that meaning in African languages is relational, not merely statistical. In that sense, our languages are the perfect teachers for AI.

What were your early works and how did they move the field forward?

I often describe three revolutions in African language research: documentation, linguistic analysis, and now computation. Many African languages have not yet experienced even the first revolution.

My early work developed a linguistically motivated tone-labelling algorithm for Sesotho — a hybrid of phonological theory and computational modelling. This approach showed that when AI systems are designed from within the linguistic logic of African languages, they become far more accurate and faithful. It reinforced a simple truth: if we want equitable AI, we must first understand the internal logic of our own languages.

Why was it important to include audio, text, and visuals in one dataset?

Because communication is inherently multimodal. Music videos, for instance, blend lyrics (text), melody and tone (audio), and gesture or performance (visuals). To create meaningful human–computer interaction, our models must reflect how people actually communicate — through sound, expression, and movement.

How does this dataset contribute to cultural preservation?

It situates language within lived and performed contexts — capturing performances, gestures, and tonal patterns that make communication deeply human. Beyond building better speech or translation tools, it serves as a digital archive of contemporary heritage, preserving not just words but the environments that give them meaning.

What challenges did you face in your multimodal language identification work?

The most complex challenges were around copyright and ownership. Many of the songs and performances we wanted to analyse sit within commercial platforms governed by restrictive intellectual property frameworks, which limit research access and community reuse.

How can your research on language identification and sentiment analysis be applied in society?

By teaching AI to recognise and interpret African languages — often in multilingual contexts — we help technology respond to people in the language they trust most. This builds inclusion in spaces like social media and customer service.

It also helps trace and understand online hate speech, xenophobia, and misinformation, offering insights into how sentiment shifts across communities. The goal is not surveillance, but understanding — building ethical tools that give voice to African speakers online and protect linguistic diversity.

What are the biggest barriers to advancing NLP research for African languages?

Many languages remain under-researched, and ownership of linguistic data often lies with external actors. But the most fundamental barrier is epistemic — we cannot model what we do not understand. There is no NLP without the L. True progress requires investment in both linguistic study and AI development.

What opportunities excite you most about the future?

The rise of African-centred and Ubuntu-driven AI. Hybrid models that merge rule-based linguistics and neural learning can better capture linguistic complexity. Community-driven AI — built through open-source labs and data cooperatives — allows Africans to define, own, and shape the data that represents them.

How do you see these ideas shaping the future of AI and language research in Africa?

The next decade will revolve around three questions: *Who is represented? Where is the system situated? And what kind of future are we coding?*

Our goal must be to move from **AI built for Africa to AI built from Africa** — grounded in our languages, ethics, and personhood.

What guidance would you offer to students and young researchers?

Begin with curiosity and community. Always ask: *Who are we building for, and why?* Design systems that reflect people and languages authentically — because digital inclusion begins with language inclusion. It isn't optional; it's foundational.

Are there personal insights that have shaped your journey?

The ability to stay teachable has been my greatest strength. Working at the intersection of AI and African languages has taught me that innovation begins with discomfort — questioning what exists and imagining what could be.

Progress, for me, comes from humility and curiosity — the twin engines of true innovation.

3D Food Printing and the Future of Nutrition in Africa

Q&A with Prof. Oluwafemi Adebo
Vice Dean: Global Engagement and Director: Centre for Innovative Food Research (CIFR), College of Business and Economics, University of Johannesburg

At the forefront of UJ's mission to pioneer African-led solutions, the Centre for Innovative Food Research (CIFR) is reshaping how technology and tradition intersect in food science. Under the leadership of Prof. Oluwafemi Adebo, CIFR is using cutting-edge 3D food printing to tackle challenges of malnutrition, healthcare, and food sovereignty — transforming innovation into dignity, one meal at a time.

What role does the Centre for Innovative Food Research play in addressing food security and health challenges?

Our Centre serves as a leading innovation hub that transforms laboratory discoveries into real-world solutions and societal impact. At CIFR we focus on developing sustainable, nutritious, and culturally relevant food technologies that tackle food insecurity and improve public health. What sets us apart is our commitment to using indigenous African food sources and knowledge systems. In so doing, we're not just innovating, we're preserving our heritage while solving modern challenges through advanced technologies – in this particular context, 3D food printing.

Why is this research particularly important for South Africa and the broader African context?

This research is particularly crucial for Africa because we face a unique intersection of challenges. With millions of people globally affected by dysphagia — and many in Africa lacking access to specialized care — this technology offers hope. We're addressing our continent's dual burden: malnutrition through customized nutrient-dense foods and our rapidly aging population's healthcare needs. What excites me is that Africa represents a fast-growing digital health space, with over half a billion dollars of investment in the past couple of years. So our research isn't just about innovation — it's about equity, dignity, and using African knowledge systems to solve global health challenges.

What makes 3D food printing superior to traditional texture modification methods?

The difference is transformational. Traditional texture modification methods often result in bland, unappealing, unrecognizable meals that some might even say strip away dignity. 3D food printing changes this completely by offering precise, programmable texture control and visually appealing, recognizable food shapes that enhance appetite and safety for dysphagia patients. It also enables personalized nutrition, fortification, and efficient production, reducing manual labor and providing much better customization compared to traditional methods.

How do you balance maintaining nutritional value while achieving the right texture?

It's a somewhat delicate balance, I must say, and that is where our food science and technology expertise becomes crucial — to retain key nutrients and beneficial constituents during processing. We also then had to

3D food printing changes this completely by offering precise, programmable texture control and visually appealing, recognizable food shapes that enhance appetite and safety for dysphagia patients.

optimize our food ink formulation to ensure the texture is soft enough for swallowing but firm enough to hold shape during and after 3D food printing.

Have you conducted any sensory evaluation or acceptability tests with actual dysphagia patients?

To allude to what Mpho has mentioned, it indeed represents a critical research gap we're addressing in the next phase of this study. The very few available sensory studies in this area are also limited, understandably so. The limited evidence is however promising, and one of the next steps for us is therefore assessing suitability directly with dysphagia patients. Because we don't just want to develop a technology — we are also developing hope for people who've lost the joy of eating.

How does this research contribute to food sovereignty?

Food sovereignty isn't just about nutrition — it's about preserving who we are. Research consistently shows that indigenous communities have better health outcomes when traditional food practices are maintained. Our approach therefore integrates traditional foods with modern nutritional requirements – basically creating a fusion of adequate nutrition and preserving cultural identity, in this context more towards healthcare settings. One can imagine when a patient in a South African hospital can eat a nutritious meal made from locally available mopane worm and orange-fleshed sweet potato — we're not just feeding their body, we're nourishing their soul and honouring their cultural heritage.

What are the main barriers to implementing this technology in hospitals or care facilities?

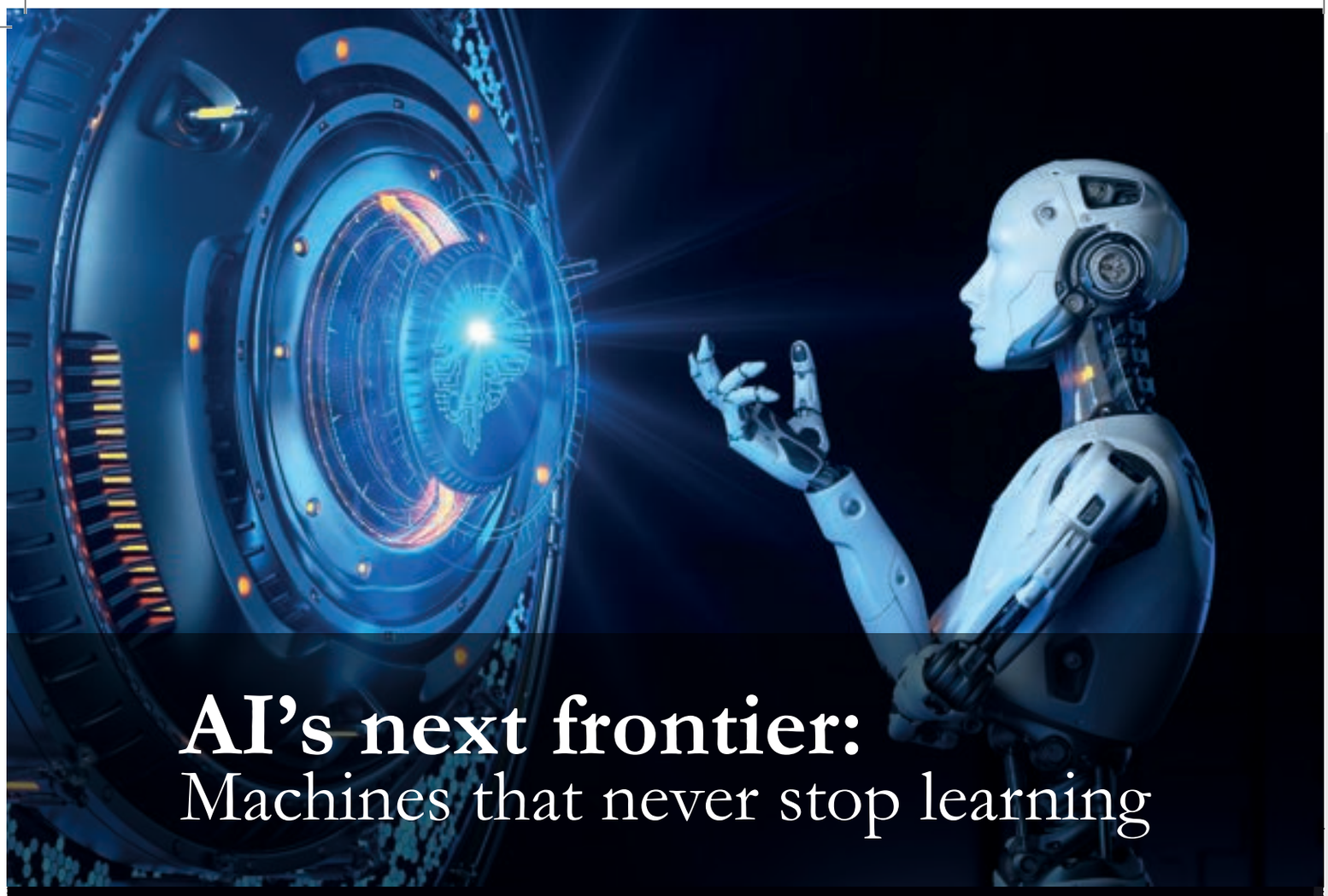
Cost is certainly a challenge in terms of the equipment itself and associated maintenance. Many facilities are still unfamiliar with 3D food printing and most probably do not have the infrastructure for it. Another one is awareness. But what is encouraging is that research within the Centre shows that when South Africans understand the actual benefits of 3D food printing, acceptance dramatically increases. The real barrier is awareness, not rejection. We're however working on scalable models and training programs to bridge these mentioned gaps.

What are the next steps in your research?

Patient validation is our immediate priority over the next couple of months — we cannot move forward without their voices. Subsequent scale-ups and refinements for a ready-to-use system will then follow, which is already underway. I mean, the global 3D food printing market is projected to grow from $398 million to $7.57 billion by 2034 — we're positioning South Africa to lead this transformation in Africa.

When might we see this technology being used in South African healthcare facilities?

I'm optimistic we'll see implementation within 4–7 years or less in specialized facilities. To the best of our knowledge, 3D food printing for dysphagia is not yet used in South African healthcare but shows promise due to positive consumer attitudes and the country's growing 3D food printing ecosystem. At the Centre, we are also going to commence small-scale pilots in this area. Some regulatory hurdles and food neophobia may delay adoption, but aligning with data supporting clinical effectiveness and building on our work in this area and in other parts of the world could accelerate integration. I strongly believe this technology will transform patient dignity, one meal at a time.



AI's next frontier:
Machines that never stop learning

Q&A with Prof Terence van Zyl

Prof Terence van Zyl holds the Nedbank Research and Innovation Chair at the University of Johannesburg's Institute for Intelligent Systems. His work spans spatial-temporal modelling, machine learning, and real-world data science applications.

What's the biggest change you've seen in AI, and how has it shaped your research?

The golden thread in AI progress is clear: improved automation comes almost exclusively through increased machine learning. Why? Because manually engineering AI solutions from scratch is simply too complex. Instead, we let systems learn from vast amounts of data.

The lesson is straightforward—more data is always part of the solution. Web 2.0 and social media unlocked the first data bottleneck, sparking the deep learning revolution. The second bottleneck was our limited capacity to label data. Self-supervised learning has now overcome that barrier.

This breakthrough enabled the foundational models powering DeepSeek, ChatGPT, and DinoV3. The natural next step is making this learning continuous, even after deployment. My current research focuses on self-supervised continual learning—I see this as AI's next major frontier.

During your time at the CSIR, what was your most challenging project turning theory into practice?

Governments and large corporations face a fundamental problem: they're compartmentalised not just organisationally, but digitally. Systems don't communicate, so data remains trapped in silos. Building

effective operational prediction models requires breaking down these barriers and accessing data across the entire organization. Our greatest challenge was consolidating these fragmented data holdings and systems. This work led to several operational systems, including mining subsidence management, acid mine drainage monitoring and prediction, and a high-performance computing platform for analyzing time-series satellite data.

AI is simply the latest example of transformative digital automation, following personal computers, the internet, and cellular networks. Democratizing access to AI will be crucial for Africa's continued growth and will help alleviate many social and economic challenges facing the continent.

How does your background as a System Architect and Team Leader influence your academic leadership?

I'm actively exploring how AI integrates with technologies like IoT to deliver real-world solutions. A prime example is Qulinda, a wildlife and livestock management system operated from Sweden. It's deployed operationally to combat poaching and manage wildlife in Sweden, Kenya, and across South Africa, while also monitoring cattle and livestock across commercial farms in Europe.

The AI models driving these systems were developed here at UJ by our students. Over the next year, we're scaling into Namibia and Zimbabwe. My background in large-scale distributed systems and machine learning gives me unique insight into integrating these components into complete, deployable solutions.

As head of the Nedbank Research and Innovation Chair, what's your primary goal?

The Chair serves as a thought leadership and knowledge transfer bridge between academia and banking. We bring industry challenges and opportunities to the university while leveraging UJ's human capital development and cutting-edge research for the banking sector's benefit.

We co-develop learning pathways centered on hyper-automation through digitisation. Through masterclasses, workshops, and consultative processes, we connect Nedbank's business leaders with UJ's thought leaders across topics ranging from AI ethics and legal frameworks to cybersecurity and AI's future.

What role should AI play in solving Africa's major social and economic challenges?

Digital automation has consistently lowered barriers to entry, creating access to opportunities that improve quality of life. Historically, this has increased job opportunities—a phenomenon known as Jevons Paradox—while boosting work satisfaction through the automation paradox.

AI is simply the latest example of transformative digital automation, following personal computers, the internet, and cellular networks. Democratizing access to AI will be crucial for Africa's continued growth and will help alleviate many social and economic challenges facing the continent.

Why Africa needs critical thinkers, not just AI experts

Q&A with Prof Charis Harley

Prof Harley is a 4IR Professor in the Faculty of Engineering & the Built Environment and leads the Data Science Across Disciplines research group in the Department of Electrical and Electronic Engineering Science at the University of Johannesburg.

You moved from computational mathematics to leading a multidisciplinary data science group. What was the biggest shift?

Computational mathematics isn't pure math—it's applied mathematics. Both fields involve substantial theory. The real transition was in the tools and mindset required.

In computational mathematics, particularly numerical analysis, I focused on a limited set of problems in fluid dynamics and heat transfer. Leading a group that applies data science across diverse fields demands expanded problem-solving skills because the contexts are virtually limitless.

You need to quickly grasp field-specific jargon and concepts, design workflows for varied contexts with different success metrics, adapt data science tools to countless scenarios, and remain highly adaptable and creative. It's exciting, challenging work where you never stop learning.

You've worked both in academia and industry as an analyst and quantitative researcher. How do companies approach data problems differently than university research groups?

I also worked as a machine learning researcher and data scientist in industry. The main difference is what I call a research-oriented or investigative mindset.

We take nothing at face value and assume as little as possible. We assess and investigate all tools—both tried-and-tested methods and state-of-the-art approaches—before designing solutions. We validate and verify every choice, method, and workflow aspect.

We don't treat problems as projects to simply complete. Instead, we see them as opportunities to learn, create, and contribute something new—chances not just to solve problems, but to advance knowledge for society.

As a 4IR Professor, what's your main priority for preparing students for the Fourth Industrial Revolution?

My main goal is developing critical thinkers capable of solving problems with any tools at hand. They must be individuals of character who produce work reflecting their knowledge, skills, and integrity.

What's the most unexpected field where you've seen data science successfully applied?

I've seen these tools applied across countless fields: agriculture, meteorology, finance, healthcare, mining, and much more. Honestly, none surprise me anymore. Data exists everywhere, so the question isn't where we can apply these tools—it's what insights we might gain. That's why we turn to AI and data science.

What's Africa's most critical challenge in ensuring AI adoption benefits the majority rather than widening the digital divide?

We must provide quality education—not just skills development, but character education. Scientists and engineers often preoccupy themselves with whether they can advance AI without asking whether they should. They must question whether adopting certain AI tools produces consequences society actually wants.

Our young generation must lead this field, but to do so responsibly, they need more than technical understanding. They must grasp how to use and create these tools with full awareness of their societal impact.

We shouldn't blindly forge ahead. Instead, we must bring our creativity, skills, and morality to bear when adopting and developing AI.

This way, any digital divide won't be a random consequence of arbitrary advancement, but a thoughtful, strategic result of Africa claiming its place in the international arena.

Even if a digital divide persists superficially, the consequences of AI adoption are far more likely to create advantageous ripple effects for all when we strategically choose where we adopt and advance AI.

We must provide quality education—not just skills development, but character education. Scientists and engineers often preoccupy themselves with whether they can advance AI without asking whether they should. They must question whether adopting certain AI tools produces consequences society actually wants.

How nature holds the key to smarter Cybersecurity

Q&A with Dr Siphesihle Sithungu

Dr. Sithungu is a Senior Lecturer at the Academy of Computer Science and Software Engineering. His research interests are Generative Modelling, Multi-Agent Systems and Nature Inspired Artificial Intelligence.

We must provide quality education—not just skills development, but character education. Scientists and engineers often preoccupy themselves with whether they can advance AI without asking whether they should. They must question whether adopting certain AI tools produces consequences society actually wants.

Your research uses nature-inspired AI, like the human immune system. Why are biological systems the best blueprints for smart, secure technology?

First, as biological beings, it makes sense that our first inspiration for creating intelligent systems would be understanding how biological processes demonstrate intelligence. Since we possess biological brains and consider ourselves intelligent, studying how the brain achieves intelligent behaviour is a natural starting point.

Second, natural systems exhibit remarkable self-organisation, internal coordination, emergent behaviour, and complex coordination. Many AI algorithms draw inspiration from naturally occurring phenomena—ant colonies, schools of fish, flocks of birds. Given the evolving nature of cyber intrusions, computer

systems benefit from being adaptive when detecting threats, and AI provides exactly that adaptiveness.

You created GAAINet, a security model combining Generative Adversarial and Artificial Immune approaches for intrusion detection.

How does this combination outperform older systems?

Artificial immune systems are gradient-free machine learning algorithms, making them better at finding optimal solutions when the problem space can't be modelled using differentiable functions. This makes them more robust than gradient-based approaches like gradient descent, which powers backpropagation in artificial neural networks.

An artificial immune network is a dynamically evolving graph structure that changes shape and connection strengths between nodes in real-time as it learns. Traditional artificial neural networks used for classification and detection don't possess these properties.

GAAINet goes further—it's generative. Beyond detecting intrusions, it generates its own synthetic intrusion examples to address data imbalance in intrusion detection datasets. This imbalance is extremely common in cybersecurity because benign network traffic vastly outnumbers malicious traffic. By generating synthetic samples to train the intrusion detector, GAAINet becomes a holistic solution.

What's the most essential skill you want students to master before entering industry?

The University of Johannesburg currently ranks as South Africa's top computer science university—a testament to the quality of students our department produces. As a Senior Lecturer, I see my role as maintaining that standard alongside my talented colleagues.

My biggest goal is instilling a culture of independent learning. I push students to explore state-of-the-art research and technological advancements and consider how they can contribute to the field. Students deserve to learn how to position themselves as valuable contributors to both industry and academia—not just as employees. There's room for everyone to innovate, and students should know that and have the confidence and opportunities to do so.

Coming from Tsakane, you understand connectivity and resource challenges. What's the most practical way AI can help people in townships and rural areas right now?

Large language models are transforming knowledge accessibility. The availability of low-cost language models creates a unique opportunity for government and the private sector to invest in townships by establishing AI-powered digital libraries where primary and secondary school learners can access the world's knowledge for free.

These digital libraries could transform access to current, relevant, and previously esoteric information for even the most underprivileged learners. The good news? The tools needed already exist, and South Africa has tremendous AI talent to make this reality in the medium term.

How can Africa move from consuming technology to creating and leading AI development that solves uniquely African problems?

We need investment in AI-based research and initiatives. People are already pioneering Afrocentric AI: Deep Learning Indaba—a proudly African machine learning conference—the Data Science for Social Impact Research Group, and Lelapa AI, a startup building large language models specifically for African languages.

> Investment in these initiatives and other smaller projects is exactly what's needed to drive Africa's growth as an AI producer, not just a consumer.

AI and the race to achieve UN Sustainable Development Goals by 2030

By Professor Arthur G.O. Mutambara
Director and Full Professor, Institute for the Future of Knowledge, University of Johannesburg

The United Nations' 17 Sustainable Development Goals, adopted in 2015, address the world's most pressing challenges—from poverty eradication and quality education to climate action and reduced inequalities. These interconnected goals provide a shared blueprint for global cooperation, uniting governments, businesses, and civil society around a common vision for 2030.

A Crisis in Progress

Yet we face an existential crisis. According to the UN's 2024 SDG Report, only 17% of targets are on track for 2030—just five years away. Nearly half show minimal progress, while over a third have stalled or regressed. The COVID-19 pandemic and conflicts in Ukraine, Gaza, and Sudan have disrupted economies and redirected resources away from SDG initiatives. Climate change accelerates, inequality rises, and biodiversity targets lag far behind.

Inadequate funding remains a critical barrier. Achieving the SDGs requires trillions of dollars annually, yet many low-income nations lack resources. Political instability, corruption, and poor governance compound these challenges, while insufficient data capacity makes tracking progress difficult.

The AI Revolution as Catalyst

This is where Artificial Intelligence enters as a transformative—though not singular—solution. AI systems can provide innovative approaches to complex global challenges. In agriculture, AI optimises crop yields by analysing weather patterns, soil quality, and pest activity, reducing resource waste while adapting to climate-induced challenges. AI-powered supply chain management minimizes food loss, ensuring efficient and equitable resource use.

In healthcare, machine learning algorithms detect diseases early, predict outbreaks, and personalize treatment plans. AI medical imaging accurately diagnoses conditions like cancer and cardiovascular diseases. During COVID-19, AI tracked viral progression, supported vaccine development, and optimized healthcare delivery in overburdened systems.

For climate action, AI-powered tools analyse satellite imagery to monitor deforestation, track land-use changes, and measure carbon emissions, helping policymakers design effective adaptation strategies. AI optimizes energy grids, improves storage, and integrates renewable sources like wind and solar, contributing to the transition toward a low-carbon economy.

AI-powered adaptive learning platforms provide personalized education tailored to individual needs, making quality education accessible to marginalized communities. AI supports

gender equality by identifying systemic biases in hiring and enabling women entrepreneurs to access financial services through AI-based credit scoring. Digital payment systems and mobile banking powered by AI advance financial inclusion and economic growth.

Beyond Technology: What Must Change

However, AI alone cannot deliver the SDGs. Success demands enhanced global cooperation, increased funding, improved infrastructure, and economic integration. Countries must align national strategies and budgets with SDG targets through long-term, inclusive policies. Strong governance frameworks ensure resources are allocated efficiently, corruption is minimized, and accountability upheld.

Emerging and least industrialized economies must move up global value chains through beneficiation and value addition—processing raw materials locally to generate higher revenues, create jobs, and ignite sustainable development. International organizations must support capacity-building and financial assistance. Highly industrialised countries must honour commitments to provide aid through mechanisms like the Green Climate Fund, while innovative climate financing models including carbon pricing and green bonds are essential.

The journey requires visionary leadership at all levels—characterized by the ability to articulate a compelling future vision anchored in shared humanity and global interests, not narrow national or hegemonic agendas. Unfortunately, recent shifts toward isolationist, national interest-driven paradigms threaten this collective approach.

Addressing AI's Risks

We must acknowledge AI's potential to widen global inequality. Left unchecked, AI can consolidate power and wealth in affluent nations while exploiting resources in developing countries, entrenching existing inequities and leading to political instability and cultural dominance by a select few. This demands attention to AI safety, regulation, governance, and risk mitigation. We must embrace decoloniality in AI—dismantling colonial-era power dynamics that influence AI systems—and democratize AI by making technologies, tools, and knowledge accessible beyond a privileged few. Emerging economies can leverage AI-enabled leapfrogging to bypass traditional technological stages and adopt cutting-edge solutions directly.

A Strategic Framework Forward

Every continent, regional bloc, country, and organization pursuing SDGs must develop a Strategic Framework for AI Deployment with six components: Vision, Strategy, Policy, Governance, Legislation/Regulations, and Implementation Matrix (including monitoring, evaluation, and feedback). Regional and continental integration plays a vital role in this framework.

The desired 2030 future—a world free from poverty, hunger, and environmental degradation—is not inevitable. It depends on immediate and transformative action. Political and business leaders, policymakers, academics, civil society activists, and citizens must reignite momentum, ensuring 2030 becomes a milestone of achievement rather than regret.

As UN Secretary-General António Guterres warns:

> "We must never allow AI to stand for advancing inequality." Harnessing AI as a transformative force for collective good, benefiting all inhabitants equitably, offers a strategic starting point for the arduous journey ahead.

UJ leads air quality research with TRUE Vehicle Emissions project

The University of Johannesburg's Process, Energy & Environment Technology Station (UJ PEETS) is part of a groundbreaking initiative aimed at improving air quality and promoting sustainable transport solutions.

Motor vehicles are one of the main sources of air pollution in the city of Johannesburg, accounting for over 75% of total NOx (nitrogen oxides) emissions across sectors.

On Monday, 21 July 2025, UJ PEETS in collaboration with the International Council on Clean Transportation (ICCT) hosted the launch of the Comprehensive Real-World Vehicle Emissions Testing and Analysis Project.

An ICCT 2024 study on the health impacts of transportation emissions identified Johannesburg as the South African city bearing the largest burden of these emissions and the associated health impacts.

The Real Urban Emissions (TRUE) Initiative project aims to generate data on the real-world emissions from vehicles in Johannesburg and the Greater Gauteng Region with an innovative remote sensing technology. The goal of this project is to inform the development of policies aimed at reducing the health impacts of vehicle pollution and advancing environmental justice. The project further aims to increase access to high-quality vehicle fleet and emission data and support future monitoring activities by developing local expertise in vehicle emissions measurement techniques. The data will be readily available in a format that can be utilised by policymakers, citizens, and other stakeholders.

The project is managed by the TRUE Initiative, a partnership between the ICCT and FIA Foundation. UJ PEETS and the City of Johannesburg will contribute to the project by leveraging local knowledge and expertise on vehicle fleets and related policies, liaising with relevant local stakeholders, and developing local capacity for future vehicle emissions testing and monitoring activities.

The data will be readily available in a format that can be utilised by policymakers, citizens, and other stakeholders.

City of Johannesburg Head of Air Quality Management, Mr Musa Mahlatji said the City was working on a clean air zone policy.
"The policy will envisage to improve air quality, with the objectives of moving Johannesburg closer to achieving National Ambient Air Quality

Standards (NAAQ) and WHO guidelines or interim targets as well as effectively providing measures or managing emissions in the zone-prioritising vehicle emissions.

"The TRUE initiative drives action towards cleaner urban transport through data collections, analysis and policy recommendations.

Says UJ PEETS Project Leader, Ms Boitemogelo Kwakwa: "UJ PEETS is working in partnership with the ICCT, COJ, and Breathe Cities to roll out a real world emissions testing on vehicles that are driving around in the city. The role of UJ PEETS is to be involved in the onsite deployment and we will also be getting skills development and capacity building by being on the site and being part of the data analysis process with the service provider for the equipment. Thereafter all the data will be given back to the partners. We are hoping to be involved in a process of policy engagement and alignment for better and cleaner air in Johannesburg."

Nokuthula Dubazane, Breathe Cities Portfolio Manager, said the initiative was rolling out in 14 cities across the world.

"The whole ambition is to cut air pollution and climate emission in cities. The data will be essential for this. The work we are doing here is generating data that can be used to inform policy. In South Africa we are working on Johannesburg, but we want the outputs to influence the regional policy interventions." She added that the data collection had already started and will be wrapped up by mid-August. The remote sensing technology analysis will go on until the end of the year and by June next year, the outcomes of this project will be made available.

The launch of the TRUE Initiative in Johannesburg marks a major milestone in UJ's commitment to societal impact and sustainability.

"UJ PEETS is working in partnership with the ICCT, COJ, and Breathe Cities to roll out a real world emissions testing on vehicles that are driving around in the city.

The Metaverse Research Unit:

Exploring immersive technologies for education, business, and society

When Dr. Herman Myburgh jokes that his "attention span is too short to stay in one academic field," he means it. His career has moved from astrophysics to microbiology, to human nutrition, and now to the fast-changing world of Extended Reality (XR) and Fourth Industrial Revolution (4IR) technologies. But through all these changes, one thing has stayed the same, his desire to use innovation to make a real difference in people's lives.

Dr. Myburgh is a Senior Lecturer at the University of Johannesburg's Institute for Artificial Intelligent Systems and the Department of Environmental Health. He also heads the UJ Metaverse Research Unit (MRU), where he works at the intersection of health, technology, and education. His projects focus on how immersive technology can solve real problems in Africa.

His unusual academic journey began with a moment of reflection. "I asked my professor whether Pluto was still a planet. His response, 'Why does it matter?' made me rethink everything," he says. "That's when I decided I wanted to do work that makes a real impact on Earth." This led him from astrophysics to physiology and microbiology, and later to a PhD in human nutrition focused on nutrigenetics. But his career took a major turn one night during his master's degree.

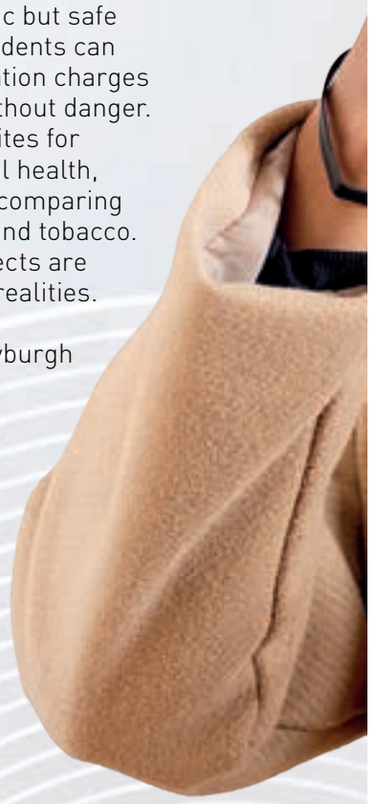
While waiting on an 18-hour lab experiment, he came across YouTube videos showing robots doing microbiology tasks. "That's when it clicked, I needed to prepare for the future," he says. "With the world's knowledge online, nothing stops us from being academic explorers."

After completing his PhD, Myburgh joined NWU's African Unit for Transdisciplinary Health Research (AUTHeR). There, a challenge from his supervisor changed his career again. "Prof Petra Bester asked me to present our work in a creative way, with zero budget. So, I taught myself virtual reality using YouTube," he laughs. "That presentation's success convinced me that XR could change how we learn and work, especially in solving South African health problems."

This belief now drives his work at the UJ Metaverse Research Unit, an Africa-first initiative creating XR solutions for social good. "Our goal is simple," he explains. "We want African answers for African challenges. The biggest opportunities come from understanding our own context."

The MRU's work shows this clearly. One project is a translation app for radiographers that helps professionals from different language backgrounds correctly position patients. Another explores virtual reality for nursing education, tailored to South African nurses because, as Herman says, "authenticity matters." The team is also creating virtual training for law students to handle sensitive conversations, such as helping victims of gender-based violence, in realistic but safe settings. In mining education, students can use VR to practice placing detonation charges and learn from their mistakes without danger. The team is also capturing real sites for virtual field trips in environmental health, and supervising global research comparing Google search trends on vaping and tobacco. Across UJ, more than 14 XR projects are running each adapted to African realities.

Despite his excitement for XR, Myburgh stays grounded. "I'm not blinded by the hype," he says. "Many tech trends forget the most important thing: the people who use them. Every MRU project starts with one question: Does this help society?"



He believes the biggest strength of VR is safe, hands-on learning. Whether it's mining students avoiding real danger or law students practicing difficult conversations, XR allows mistakes without real-world harm something especially valuable where resources are limited.

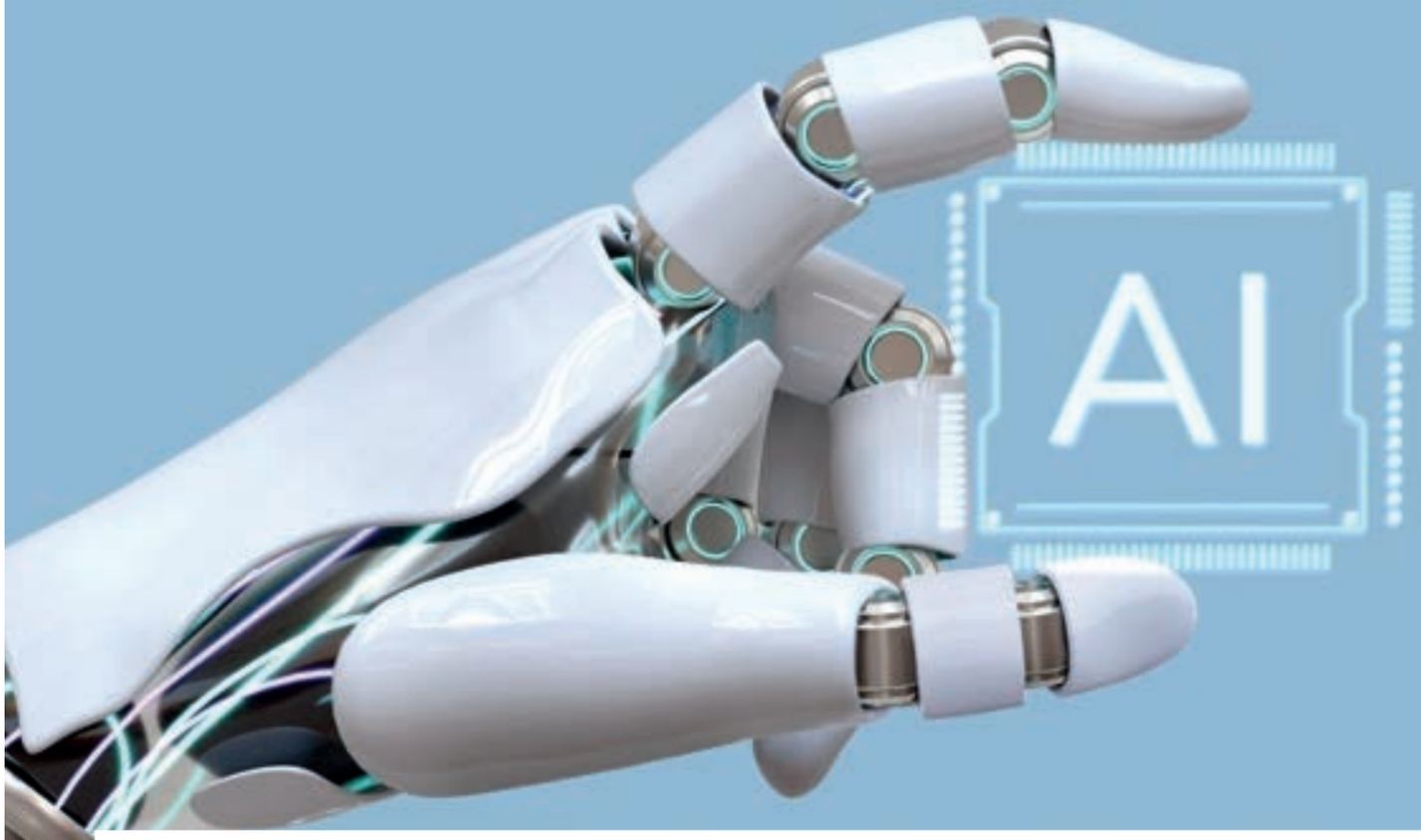
Still, he is honest about the challenges. "Africa is a mobile-first continent," he says. "We can't design for expensive headsets few can afford. Data costs are high, so we build apps that can work offline. The best VR means nothing if people can't access it."

This practical approach comes from personal experience. He believes that connecting the right people and resources makes anything possible. He recalls mentoring Dr. Lucia Olifant, who became pregnant in high school but went on to earn her PhD, posthumously. "She didn't wait for opportunities she created them. Her story reminds me that determination makes anything possible."

His nine years with the African Nutrition Leadership Programme (ANLP) also shaped his outlook. "Their motto 'Lead from where you stand' changed how I view leadership," he says. "I've seen ministers rise from that programme, but I've also seen leadership in a car guard who knows every customer's name. You don't wait for perfect conditions; you start where you are."

That idea defines both Herman and the Metaverse Research Unit: optimistic but realistic. Their mission isn't about fancy headsets or copying Silicon Valley, it's about creating technology that fits Africa's people, challenges, and creativity.

"Their motto 'Lead from where you stand' changed how I view leadership,"



AI Leaders: Shaping the Future at UJ

At the University of Johannesburg, a dynamic community of scholars, innovators, and thought leaders is ensuring that South Africa plays a leading role in the global AI revolution. From ethical algorithms and smart systems to blockchain economies and intelligent language technologies, these researchers are redefining how humanity and machines learn, decide, and create — together.

Prof. Abejide Ade-Ibijola:
AI & Applications Pioneer

Professor of Artificial Intelligence and Applications at Johannesburg Business School. He holds a PhD in AI and leads the Research Group on Data, AI and Innovations for Digital Transformation. Prof Ade-Ibijola has authored 90+ publications, pioneered projects like "Grit Lab Africa" which mentors young technopreneurs and has won multiple awards for innovation and teaching.

Prof. Daniel Mashao:
Engineering & AI for Society

Executive Dean of the Faculty of Engineering & the Built Environment (FEBE). His research interests include implementing 4IR technologies in communities, especially in human language technologies and their societal impact. Under his leadership, FEBE has been involved in outreach, and innovation such as 3D printed housing projects were planned.

Prof. Letlhokwa George Mpedi:
AI, Law & Education Integration

Prof. Letlhokwa George Mpedi is the Vice-Chancellor and Principal of the University of Johannesburg (UJ). A distinguished scholar of Labour and Social Security Law, he has increasingly championed the integration of Artificial Intelligence and Fourth Industrial Revolution (4IR) thinking into higher education. Under his leadership, UJ has introduced pioneering initiatives designed to equip students, legal professionals, and policymakers with the skills and ethical grounding needed to navigate a rapidly evolving digital world.

"Artificial Intelligence holds transformative potential for Africa's development — not merely as a technological tool, but as a catalyst for inclusive growth, ethical governance, and knowledge creation. At UJ, we are embedding AI literacy across disciplines to cultivate leaders who can harness innovation responsibly and shape an equitable digital future for the continent."

Prof. Nnamdi Nwulu:
Blockchain, AI & Sustainable Systems

Prof Nnamdi Nwulu holds the South Africa/Switzerland Bilateral Research Chair in Blockchain Technology and directs the Centre for Cyber-Physical Food, Energy & Water Systems (CCP-FEWS). His research integrates blockchain with AI and IoT to build cyber-physical decision support systems addressing food, energy and water security challenges. He has supervised numerous PhD students to completion, filed multiple patents, won several research excellence awards and secured substantial research funding in these fields.

"By 2030, Africa will face a 'perfect storm' of resource shortages. Solutions won't come from imported frameworks but from African researchers solving African problems. At UJ, we're using AI and blockchain to build decision support systems that help communities, industries and governments navigate this storm. These aren't theoretical models, but solutions designed for real African challenges.'

Prof. Charis Harley
Data Science Across Disciplines

Prof Harley is a 4IR Professor in the Faculty of Engineering & the Built Environment and leads the Data Science Across Disciplines research group in the Department of Electrical and Electronic Engineering Science. Her expertise lies in computational mathematics, data analytics, data science, and interdisciplinary applications of AI. Over her career, she has published extensively and led multiple grant-driven research projects.

Dr. Siphesihle Sithungu:
Generative AI, Immunological Computation & Industrial IoT

Dr. Sithungu is a Senior Lecturer at the Academy of Computer Science and Software Engineering. His research interests are Generative Modelling, Multi-Agent Systems and Nature Inspired Artificial Intelligence. Dr. Sithungu is a professional member of BCS – The Chartered Institute for IT as well as a committee member of IFIP (International Federation for Information Processing). He has generated over 20 publications in his field. In addition to his research, Dr. Sithungu teaches an honours module on Advanced Artificial Intelligence, where students are taught how to create Generative AI systems.

"There is no doubt that AI will continue to influence various parts of our lives. The question we should be asking ourselves as Africans is "How will AI feature in Africa's story? Will AI supplement the digital divide or will it be the reason more Africans compete at the global stage?" I sincerely hope that the answer we come up with as leaders will result in AI working for us as Africans."

Prof. Terence L. van Zyl:
Machine Learning & Spatial Analytics

Prof Terence van Zyl is well known in UJ's AI & robotics circles (Institute for Intelligent Systems). He works extensively on spatial-temporal modelling, machine learning, and data science applications.

Prof. Mpho Primus:
African NLP (Natural Language Processing)

Prof. Mpho Primus is one of the leading voices in African Natural Language Processing (NLP) and the inclusive development of human language technologies. As Co-Director of the Institute for Intelligent Systems (IIS) at the University of Johannesburg, she leads research at the intersection of language and intelligent systems, promoting the equitable representation of African languages in AI.

Her work focuses on low-resource NLP, computational phonology, and inclusive AI design. From building multimodal datasets to engaging with philosophical questions of context-aware AI rooted in African realities, Prof. Primus champions an approach to technology that is both scientifically rigorous and socially grounded.

"Artificial intelligence has become a mirror of power, reflecting whose ways of life count and whose voices are amplified or ignored. For Africa, the question is not only about technological capability but about agency, presence, and ownership in the digital sphere. Our languages carry memories, worldviews, and philosophies that must inform how we design and govern AI. When technology learns to listen in our mother tongues, it does more than translate, it transforms. At UJ, we are advancing AI that is rooted in African realities, inclusive in its design, and transformative in how it reimagines what representation, ownership and agency mean on our continent."

Prof. Arthur G.O. Mutambara:
Decentralised AI & Systems

Director & Full Professor, Institute for the Future of Knowledge (IFK), UJ. He leads the Decentralised Artificial Intelligence & Control Systems Research Group at IFK, exploring decentralised AI, control systems, and transdisciplinary integration of AI in engineering.

In addition to research, Prof Mutambara teaches control systems in both mechanical and electrical/electronic engineering faculties.

Prof Daniel Mashao reflects on the past, present and future of AI

When Professor Daniel Mashao began his doctoral studies in Artificial Intelligence (AI) at Brown University in the late 1980s, few could imagine what machine learning would become. At a time when computers filled entire rooms and programs took hours to run, he was already envisioning machines that could recognise and interpret the human voice.

"AI wasn't fashionable then," he recalls with a smile. "But I knew it would define how we live, work, and understand intelligence itself."

Now Executive Dean of the Faculty of Engineering and the Built Environment at the University of Johannesburg (UJ), Prof Mashao stands among South Africa's early AI pioneers — laying intellectual foundations long before the term "4IR" was coined.

A journey sparked by curiosity

Prof Mashao's fascination with computers began in Atteridgeville, where his mathematical ability earned him the nickname "computer."

"I was in Grade 6 and kept correcting my teacher's maths," he laughs. "My teacher said, 'You're a computer,' and that changed my life. I wanted to know what a computer really was — I thought it might be some kind of TV."

Promoted a grade early in high school and known in his community for his aptitude, he studied Electrical Engineering at the University of Cape Town, graduating cum laude in 1986. His first professional placement, at GEC and stationed at the then Rand Afrikaans University (RAU) (now UJ), exposed him to research and problem-solving.

"I realised I was happiest designing and testing new ideas. That year changed my life," he says. "After working for six months, I applied for a master's at UCT."

From Cape Town to the Ivy League

During the height of apartheid sanctions, several Ivy League universities opened opportunities for South African students. Prof Mashao was among the first to take part, joining Brown University for research and later pursuing a PhD in Computer and Electrical Engineering. He went on to become the first black South African to earn a PhD in Engineering.

"My thesis focused on recognising speech sounds like p, t, k and digit recognition using Hidden Markov Models and Artificial Neural Networks — the foundations of today's AI and large language models."

He recalls the era's challenges: "Our programmes would run overnight — you'd start today and get results tomorrow. One classmate's car number plate read BAM52K, meaning if your programme exceeded 52 megabytes, it would crash. Today's models are almost a billion times larger."

AI Then and Now

In those early years, computing was limited by slow processors and scarce memory. Neural networks were promising but inefficient, and the field endured what became known as an "AI winter."

"We knew neural networks could mimic human decision-making, but they were painfully slow and memory hungry. Then came Moore's Law — computing power doubling every 18 months — and everything changed."

He explains that modern advances like the "Attention Mechanism," popularised in All You Need Is Attention, revolutionised AI. "In my day, Markov models could track three states. Now models retain context across thousands. That's what makes systems like ChatGPT possible. It's extraordinary to see theories we once dreamed about come alive at this scale."

The human side of the machine

For Prof Mashao, AI's evolution has always raised profound questions about consciousness and meaning.

"Artificial neural networks were inspired by neurons in the human brain, but even with billions of parameters, they don't have consciousness," he says. "AI can predict the next word or image, but it cannot feel or understand in the way humans do. It's intelligent, yes — but not human."

He believes the next frontier lies not in making AI more human, but in understanding what it means to be human in an intelligent world.

Reflections on progress and purpose

From mainframes to generative models, Prof Mashao has witnessed AI's transformation firsthand. Under his leadership, UJ's Faculty of Engineering and the Built Environment has become a living laboratory for innovation — leading projects in 3D-printed housing, renewable energy systems, AI and language technologies, and digital infrastructure for rural development.

The AI of today is not the AI I studied," he says. "But the goal remains the same — to build systems that make life better. Technology must serve humanity, not the other way around."

He notes that this vision aligns closely with UJ's Vision 2035, which emphasises Societal Impact, Global Partnerships, and Technology for the Future.

"UJ's strategy isn't about chasing trends. It's about using 4IR to solve real African problems — inequality, sustainability, and access."

Advice to the next generation

"Know that what we know is still tiny in this vast world," he says. "Stay curious. AI may change jobs and systems, but creativity and critical thought will always matter."

He predicts that AI will soon reshape education — not by replacing teachers, but by transforming how humans learn. "We may need to rethink our four-year degrees. The focus will shift to understanding and controlling generative AI, not competing with it."

"When I started, we asked whether machines could think," he reflects. "Now, the question is whether humanity can think ethically about machines."

It's a fitting summary of a career grounded in scientific excellence and human values — and a reminder that Africa's technological future depends not on consuming innovation, but on creating it.

AI in Africa: Is the Continent Being Left Behind?

Q&A with Professor Abejide Ade-Ibijola

Professor Abejide Ade-Ibijola is Professor of Artificial Intelligence and Applications at the Johannesburg Business School (JBS), University of Johannesburg, where he leads pioneering work at the intersection of AI, education, and innovation for societal transformation.

Africa is often seen as lagging behind in AI. What are the implications of this?

Africa has strong theoretical knowledge but often lacks the ability to turn that knowledge into practical, market-ready solutions. Much of our expertise remains confined to theory, creating a gap between what is taught and what is applied. Many graduates, particularly in STEM fields, lack the hands-on technical skills needed to drive innovation. Bridging this divide between intellectual understanding and technological execution is crucial if Africa is to catch up in AI readiness.

How can AI support infrastructure development, and what are the most critical needs for this to happen?

AI cannot build roads or power stations, but it can help us plan, manage, and maintain them more effectively. With the right tools, AI can guide engineers and policymakers in designing smarter, more resilient systems. For instance, it can analyse sensor data to detect cracks in bridges, forecast electricity or water demand, and improve resource efficiency. Combined with drones and satellite imagery, AI can also track projects in real time and enhance transparency.

For AI to thrive, Africa needs the basics in place—reliable electricity, strong internet connectivity, robust data systems, and modern data centres. We also need skilled people, ethical governance, and digital public infrastructure such as secure IDs and e-payment systems. Ultimately, AI will only succeed if supported by people and institutions that can manage it responsibly.

How can technology hubs and data centres accelerate AI innovation while ensuring local ownership?

Technology hubs and local data centres create spaces where African innovators can build and test AI solutions using home-grown data. Keeping data on the continent ensures ownership and control over both information and intellectual property. These hubs also foster collaboration between universities, start-ups, and governments—moving ideas from research to real-world solutions that address local challenges.

How can Africa's education systems prepare people for AI-driven jobs?

We must equip schools, universities, and TVETs with practical, project-based AI curricula taught through real datasets. Teachers should be retrained at scale, and universities should partner with industry for internships, labs, and short courses. Access to devices, connectivity, and local-language content is essential, as is teaching AI ethics alongside coding. This will produce graduates who are job-ready, adaptable, and entrepreneurial.

Can African universities fulfil this role, and what needs to change?

Many universities, especially in poorer countries, struggle with outdated infrastructure, limited funding, and overworked staff. Few have the resources for modern labs or practical training. In addition, much African research remains invisible globally due to publication in low-impact journals. To move forward, universities need investment in

facilities, lecturer training, and closer industry ties. More importantly, the focus should shift from publishing papers for promotion to producing solutions that improve lives.

Are we training people for the right AI jobs, and how should we adapt as automation grows?

Currently, Africa is not training enough people with the right AI skills. Most graduates still leave with theory-heavy knowledge and limited practical exposure. As AI automates routine work, many will be at risk of job loss. Governments will need new social support mechanisms and policies to manage this transition, especially as global AI systems enter African markets. Investment in retraining, innovation, and fair regulation will be vital to protect people while embracing AI's opportunities.

What are the socio-economic impacts of AI across sectors, and how can we mitigate risks?

AI is transforming health, agriculture, and finance—improving diagnosis, crop yields, and access to banking. But it also brings risks such as job displacement, inequality, and data privacy issues. Clear policies, strong data governance, and ongoing skills development are needed to ensure people work alongside AI rather than be replaced by it.

How can Africa's AI strategies create sustainable value while reflecting local values?

Public and private sectors must build AI strategies rooted in Africa's priorities—health, agriculture, and education—rather than copying Western models. Governments should enforce fairness and data protection, while businesses invest in ethical AI and local talent. Collaboration is key to ensuring AI creates jobs, supports small enterprises, and uplifts communities. Africa's AI journey must be people-centred and purpose-driven, led by Africans who understand local contexts.

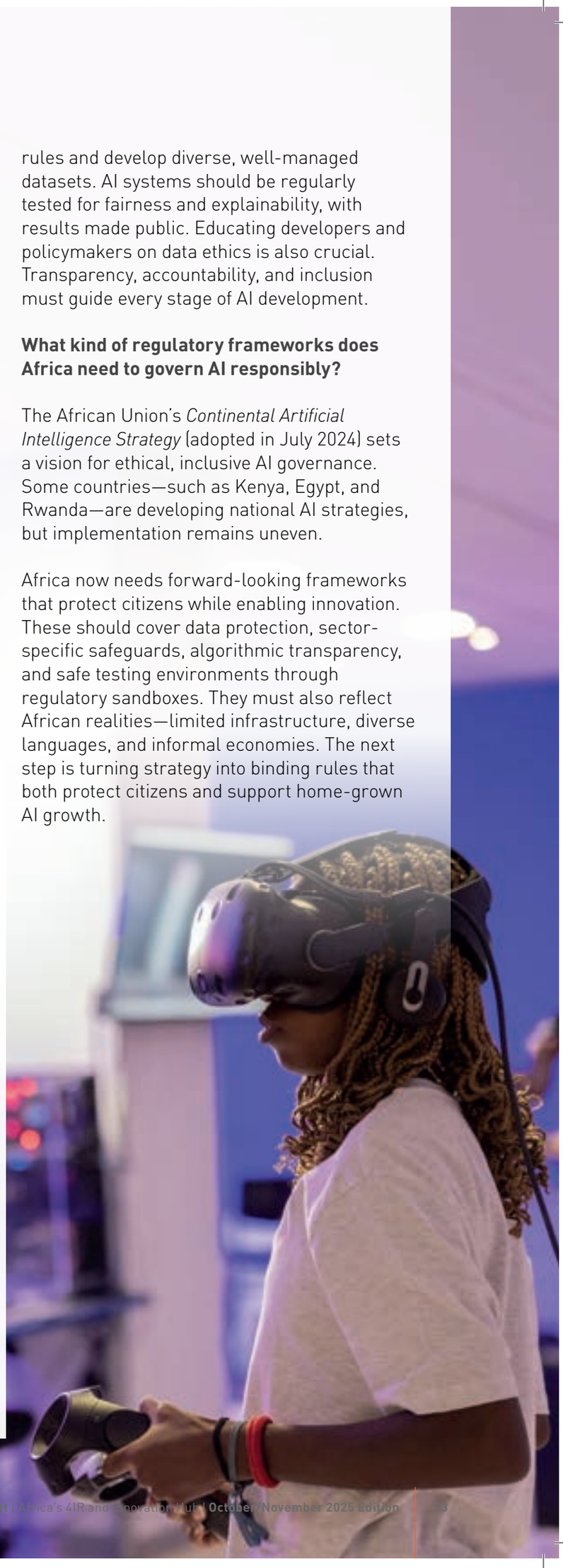
How can we ensure data transparency and avoid biased algorithms?

Bias often stems from poor or unbalanced data. Africa must establish clear data governance rules and develop diverse, well-managed datasets. AI systems should be regularly tested for fairness and explainability, with results made public. Educating developers and policymakers on data ethics is also crucial. Transparency, accountability, and inclusion must guide every stage of AI development.

What kind of regulatory frameworks does Africa need to govern AI responsibly?

The African Union's *Continental Artificial Intelligence Strategy* (adopted in July 2024) sets a vision for ethical, inclusive AI governance. Some countries—such as Kenya, Egypt, and Rwanda—are developing national AI strategies, but implementation remains uneven.

Africa now needs forward-looking frameworks that protect citizens while enabling innovation. These should cover data protection, sector-specific safeguards, algorithmic transparency, and safe testing environments through regulatory sandboxes. They must also reflect African realities—limited infrastructure, diverse languages, and informal economies. The next step is turning strategy into binding rules that both protect citizens and support home-grown AI growth.



Teaching AI at UJ: Charting a path for all students

A rtificial Intelligence (AI) isn't just a specialised discipline at the University of Johannesburg (UJ) — it's becoming part of the foundation of what it means to study, think, and lead in the modern world. Through an inclusive, multi-layered approach, UJ is embedding AI across its teaching and learning eco-system, ensuring that every student — from first years to postgraduates — is equipped for an AI-driven future.

AI for Everyone: The First-Year requirement

One of UJ's most forward-thinking initiatives is the compulsory short-learning programme *Artificial Intelligence in the Fourth Industrial Revolution (4IR)* for all first-year undergraduate students.

Delivered fully online via the UJ Digital and uLink platforms, the course introduces every student — regardless of discipline — to the fundamental concepts, ethics, and implications of AI. Rather than focusing on coding or technical programming, it encourages critical thinking about how AI is transforming societies, economies, and the world of work.

Upon completion, students receive a digital certificate, and the achievement is recorded on their academic transcript. This early exposure ensures that AI literacy becomes a universal part of the UJ student experience — a shared language of the future.

Mastering AI: Advanced study & specialisation

For students who want to go deeper, UJ offers a professional Master of Artificial Intelligence through the Institute for Intelligent Systems (IIS), housed in the Faculty of Engineering and the Built Environment.

- The programme is both full-time (1 year) and part-time (2 years), allowing flexibility.
- It includes taught modules such as Programming for AI, Machine Learning, Mathematics & Statistics for AI, Psychology and AI, Ethics of Artificial Intelligence, plus a research project.
- Admission requires an Honours degree (or NQF level 8) in a relevant field (Engineering, Commerce, Mathematical/ Natural/Computer Sciences), or equivalent with research/work experience, plus the minimum mathematics requirement.

This MSc programme gives students the theoretical knowledge, hands-on skills, and ethical grounding needed to contribute to AI research, development, or industry in South Africa and beyond.

Free AI Education for wider community

UJ's commitment to democratizing AI knowledge extends beyond its enrolled students. The university has made the Artificial Intelligence in the 4IR short course freely available to the public as a Massive Open Online Course (MOOC).

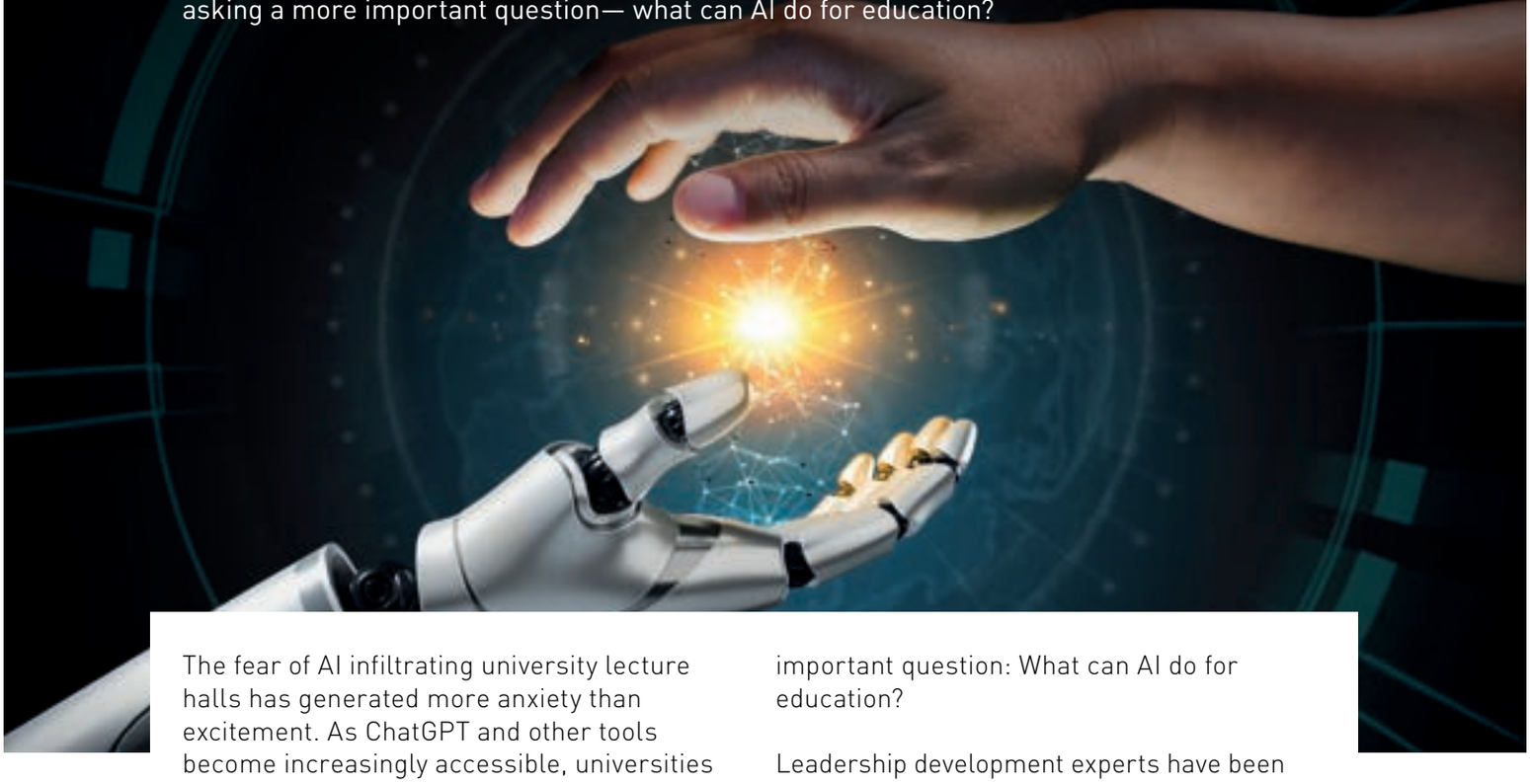
The course is open access, requires no prior qualification, and consists of eight interactive units assessed through multiple-choice tests. Successful participants earn a shareable digital certificate — expanding AI literacy to thousands of learners globally.
This move reinforces UJ's commitment to inclusivity, public learning, and ensuring that AI literacy is not limited by field of study or socioeconomic status.

By embedding AI in its curriculum at multiple levels, UJ is not just preparing specialists— it's building a culture of AI awareness, responsibility, and innovation across the university and the broader society.

AI won't replace leaders, but will redefine future leadership development

By Professor Kat Yassim (Associate Professor in the University of Johannesburg, Faculty of Education, Department of Education Leadership and Management)

While much of the conversation is focused on what AI is doing to education, we should be asking a more important question— what can AI do for education?



The fear of AI infiltrating university lecture halls has generated more anxiety than excitement. As ChatGPT and other tools become increasingly accessible, universities report a sharp rise in students using AI to complete assignments – often without disclosure and without understanding the implications.

Lecturers and university academic centres now find themselves having to scramble to revise assessments, rewrite policies and rebuild trust in academic integrity.
There is fear of AI as it challenges how universities evaluate learning; what they consider original work, and proof of skills and competencies. While much of the conversation is focused on what AI is doing to education, we should be asking a more important question: What can AI do for education?

Leadership development experts have been asking this question over the past few years while carrying out experiments on how AI can be used for mentorship, coaching and as a simulation tool by school principals.
These experiments show that a technology that is feared can be leveraged to transform leadership at schools. However, this can only happen when AI is employed intentionally and when lecturers work with students to develop critical skills that support their learning, growth and development as leaders.
For instance, when most people hear "AI in leadership", the first thing they imagine is automation of scheduling tools, email generators or data dashboards.

AI won't replace leaders. But leaders who learn to work with AI will undoubtedly replace those who do not. AI is not a force coming to disrupt leadership development, it's already here, and we should be working towards building future-ready leaders who leverage AI as a tool that supports leading education into a sustainable future.

These days, however, the introduction of Autonomous AI (also called Agentic AI, like Microsoft Pilot) runs independently to design, execute, and optimise workflows with little human intervention. Such AI functions are useful since they free school leaders from an exceedingly high administrative workload, which helps them structure their time more strategically.

Other AI benefits

These are helpful developments, and so, preparing school principals at present requires the exploration of a different frontier – one that explores the use of AI to provoke self-reflection, model coaching conversations and deepen emotional awareness, while also offering ideas for innovation and change. Through structured prompts, dialogue simulations and reflection tools, AI can take on the role of a trusted partner and non-judgmental sounding board.

It can walk a leader through a difficult decision, surface ethical blind spots, and offer tailored feedback on communication, tone and policy congruence as needed. As most school principals work in isolation or within a small network, they are often under pressure to make the correct decisions and to engage fairly and ethically with several different stakeholders, making this kind of immediate, on-demand coaching revolutionary.

The benefits of AI are many and various. Research shows that school leaders want support that is timely, intelligent and available 24 hours a day, seven days a week. This is impossible for a human coach, but possible for an AI tool.

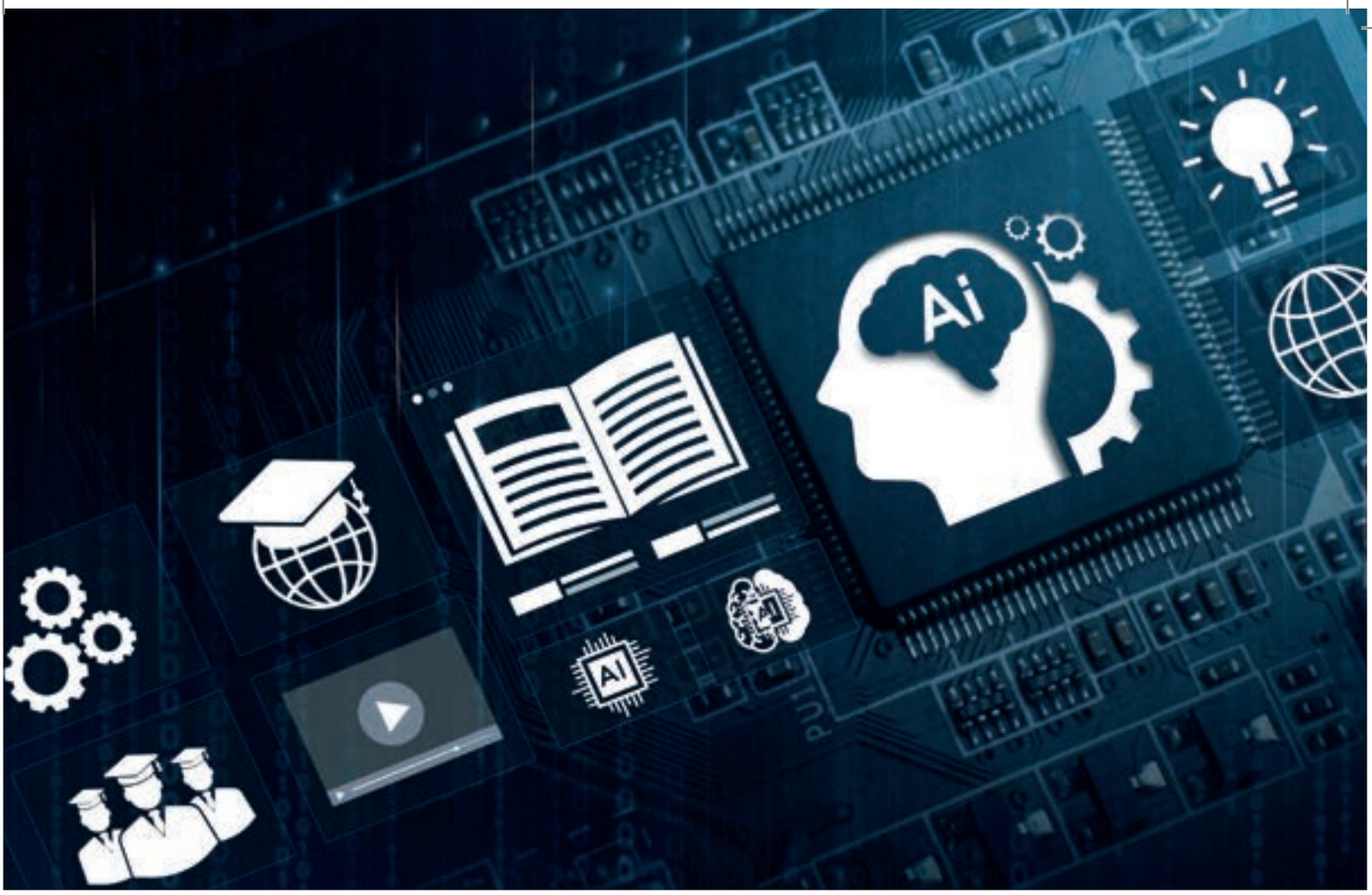
This does not mean replacing human mentors, but it does mean extending our reach, scaling the wisdom that exists and supplementing human relationships with intelligent tools that can help leaders stay grounded in their values, even during chaos or a crisis.

South African school principals do not have an easy job, as they are expected to be instructional leaders, crisis managers, community builders, policy interpreters, strategists, counsellors and support services. The demands of this job make it difficult for them to make time to access human mentors, and most do not have safe spaces to reflect. For example, one principal described the journey as "hit and miss… where you learn as you lead".

Another principal lamented that "your job consumes you because it's not only about the classroom, but also about the community… the child who needs a champion". Therefore, school principals require support in real time and AI can make this possible. AI tools sharpen their thinking and strengthen their leadership identity. While it does not always offer perfect answers, it does often ask better questions.

Outdated assessments

So, here is the problem. Universities and leadership development programmes are still assessing leadership development and potential in outdated ways, with reliance on theoretical essays, written exams, case studies and checkbox competency frameworks. This says very little about how someone actually leads in the real world. In the age of AI-generated texts, these outdated assessment types are not valuable any more. While one can ask AI to write an essay, AI cannot handle clashes with staff, make decisions based on empathy and accountability or adapt when things change instantaneously.



So, in university classrooms, lecturers must develop authentic assessments so that leaders are developed in action. These are dynamic, context-rich tasks that reveal a leader's thought processes, ethical reasoning and decision-making under pressure.
School leaders should engage in the real work of leadership where they lead using AI-simulated dilemmas, live reflection journals and role-play scenarios. These mirror the reality and messiness of leadership. When leadership skills are assessed authentically, what matters is a leader's capacity to navigate tension, hold uncertainty and act with integrity. Leaders who are being developed today will, in turn, manage teams, schools and systems where AI is everywhere. So, the future of leadership is not only in leaders working with people, but in collaborating with algorithms, interfacing with data-driven systems and making decisions in environments where AI is an invisible, but powerful force.

AI literacy a core leadership skill

This means that AI literacy is not optional in university settings, it must be embedded as a core leadership skill. This is where principals learn not only how to use AI as a self-development tool, but also how to model its responsible use for their staff and students. Future-ready leaders do not have to choose between human insight and machine intelligence, as they will know how to harness both.

In this sense, AI is used to expand leadership thinking and not replace it. This is where technology becomes a tool in service of humankind, and when used in this way, it becomes the catalyst for ethical, courageous and future-ready leaders.

It is therefore time for the design of leadership development programmes that invest in using AI as a coach, mentor and personal development trainer.

AI won't replace leaders. But leaders who learn to work with AI will undoubtedly replace those who do not. AI is not a force coming to disrupt leadership development, it's already here, and we should be working towards building future-ready leaders who leverage AI as a tool that supports leading education into a sustainable future.

UJ leads EU-Funded project to advance AI-driven Digital Education

Artificial Intelligence (AI) is transforming the way people teach, learn, and communicate. Tools such as ChatGPT and other digital platforms are showing immense promise in South Africa — expanding access to information, improving student support, and even bridging socioeconomic divides. But as these technologies reshape education, they also raise new challenges around academic integrity, critical thinking, and digital literacy.

Responding to these emerging demands, the University of Johannesburg (UJ) has secured a €400,000 (approximately R8.1 million) grant from the European Union's Erasmus+ Programme to lead a landmark digital transformation initiative across South African Technical and Vocational Education and Training (TVET) colleges. The project — Pro-TELDE (Promotion of Technology-Enhanced Learning and Digital Education) — underscores UJ's commitment to advancing innovation, societal impact, and inclusive digital education.

Empowering Educators for the Digital Era

"In today's digital age, the landscape of education is rapidly evolving, requiring institutions to adapt to the changing demands of the workforce," says Professor Tankiso Moloi, Executive Dean of the College of Business and Economics (CBE) at UJ.

"Project Pro-TELDE reflects UJ's commitment to advancing digital education and empowering educators for success in the digital era."
— Professor Tankiso Moloi, Executive Dean: College of Business and Economics, UJ.

"In today's digital age, the landscape of education is rapidly evolving, requiring institutions to adapt to the changing demands of the workforce"

Prof Moloi explains that one of the greatest challenges for educators today is the rise of AI-generated content being presented as students' original work. Through Project Pro-TELDE, UJ aims to empower TVET lecturers in business and economics to harness open digital resources and technology-enhanced learning (TEL) methods effectively.

At the heart of the project is an online repository of validated TEL and digital teaching materials, developed and hosted by UJ, specifically designed for South African educators in business and economics. The repository is available at **digitalskills.uj.ac.za.**

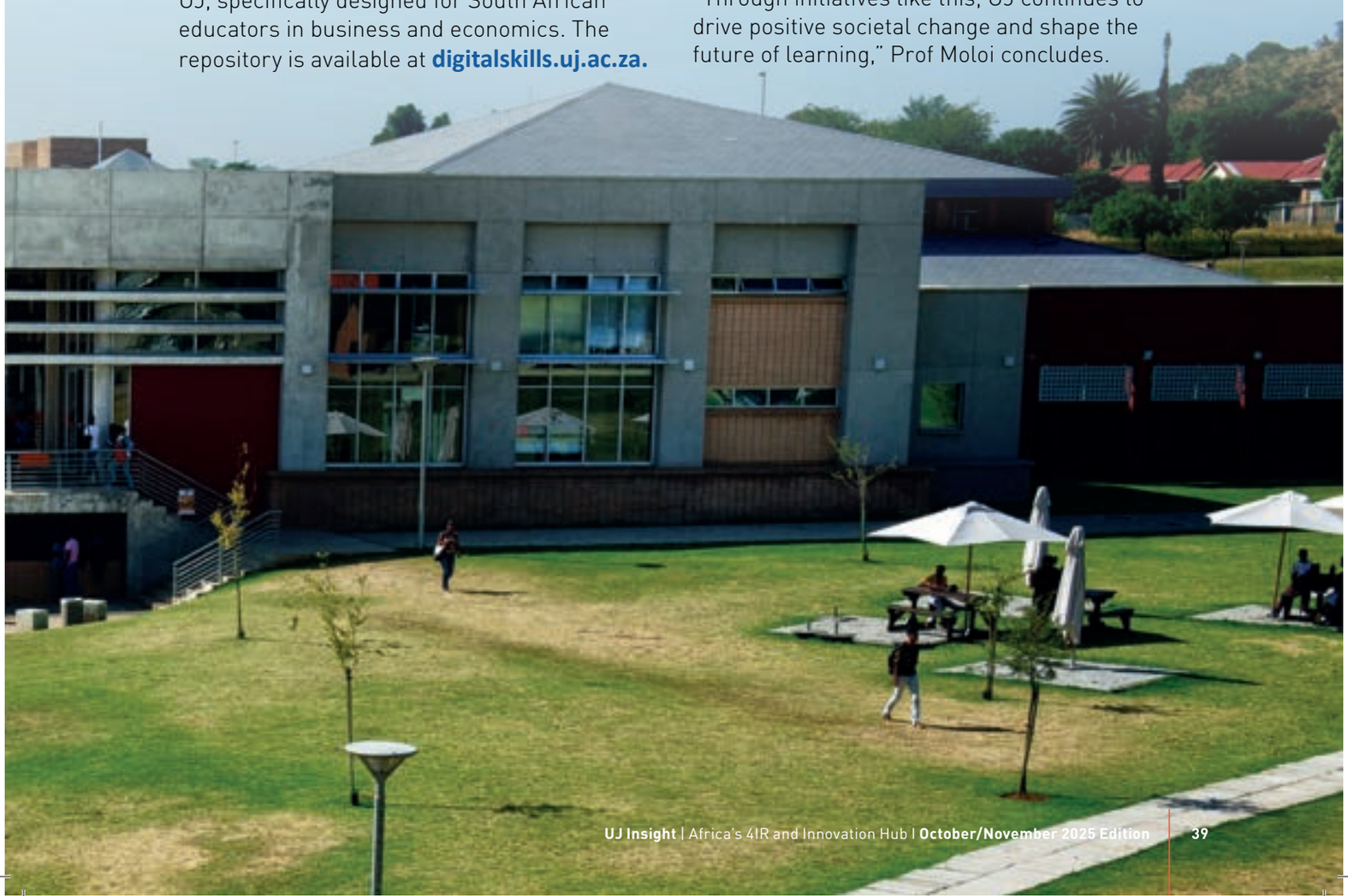
Collaborating Across Borders

Prof Moloi emphasises that partnerships are essential to the project's success. "We are excited to lead this initiative alongside both local and international partners," he says. Project Pro-TELDE brings together a consortium of leading institutions, including Central Johannesburg TVET College, Majuba TVET College, Vhembe TVET College, PIXEL (Italy), Università degli Studi di Roma La Sapienza (Italy), and the University of Peloponnese (Greece). Together, they are creating a framework for digital learning that is adaptable, scalable, and responsive to the needs of both educators and students.

Expanding the Impact

Building on the success of Pro-TELDE, the UJ team has secured a follow-on EU-supported project focused on entrepreneurship education. This new phase continues to work with several TVET partners, this time including Mangosuthu University of Technology (MuT), to strengthen digital and entrepreneurial skills in the South African education system.

"Through initiatives like this, UJ continues to drive positive societal change and shape the future of learning," Prof Moloi concludes.

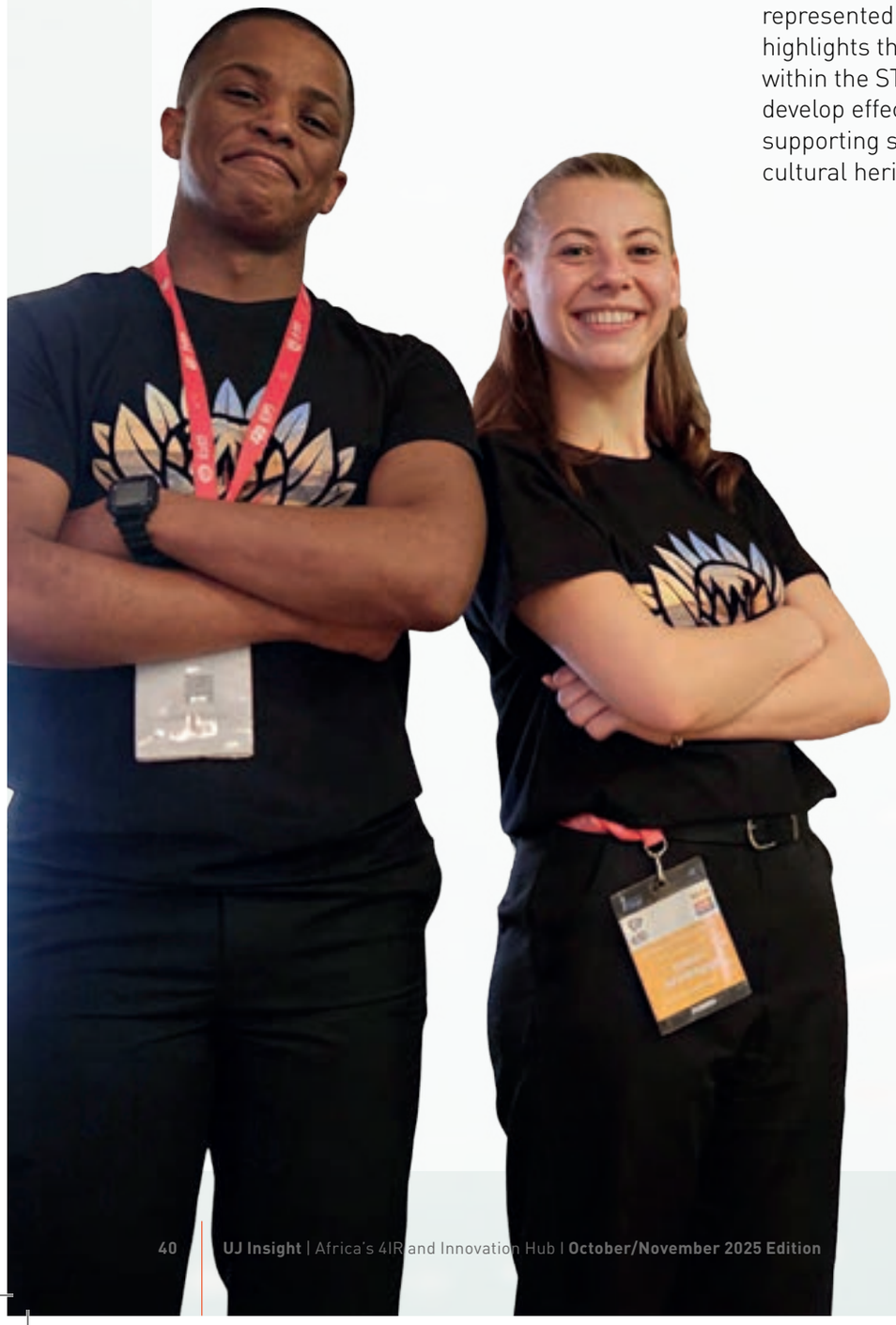


UJ students take top spots at G20 Tourism Hackathon

The University of Johannesburg (UJ) has cemented its status as a leader in applied innovation, with students from the School of Tourism and Hospitality (STH) clinching both first and second place at the highly competitive G20 Tourism Hackathon.

Third-year Bachelor of Tourism Management and Development students, Teagon Spykerman and Inganathi Zimela, were part of the winning teams at the event, which was focused on generating cutting-edge AI solutions to drive job creation and sustainable growth across the global tourism sector. The hackathon brought together 46 youth representing 21 institutions of higher learning.

UJ stood out as the only university with students represented in the top two teams, a feat that highlights the quality of innovative thinking within the STH. The students were mentored to develop effective prototypes and applications supporting smart tourism, rural inclusion, and cultural heritage innovation.



Dr. Tracy Daniels, Academic Head for Hospitality, expressed immense pride: "What an incredible job. The University of Johannesburg is the only university with students in the top two teams. An amazing, amazing achievement."

First Place: The Hologram Hub

Teagon Spykerman was a key member of The Catalysts team, which secured the first-place prize of R175,000. Their winning concept, Hologram Hub, offers a sophisticated digital platform designed to empower rural communities. The solution enables these communities to profile and preserve their unique cultural heritage by telling their own stories, thereby attracting tourists directly to their locations. Spykerman shared that participating in the competition has given her that all important confidence boost: "Being part of the G20 Hackathon has been a truly eye-opening and incredible experience. This opportunity has taught me how to work better in teams, but more importantly, it has opened my eyes and made me believe in myself more, and I'll forever be grateful for that," she said.

> "Being part of the G20 Hackathon has been a truly eye-opening and incredible experience. This opportunity has taught me how to work better in teams, but more importantly, it has opened my eyes and made me believe in myself more, and I'll forever be grateful for that." Teagon Spykerman

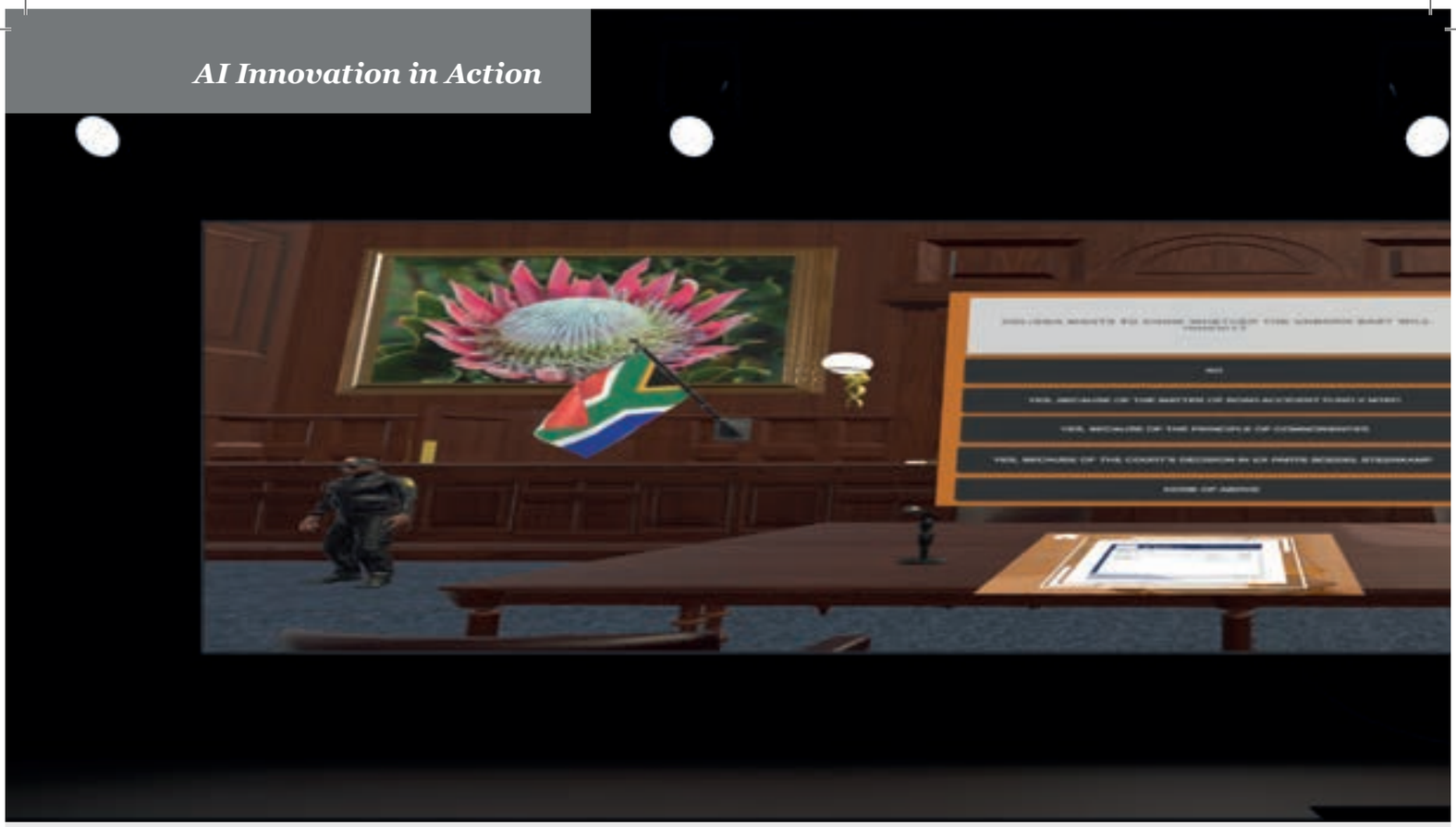
Inganathi Zimela's team, Map My Biz, secured a strong second place with a prize of R140,000.

Their ingenious solution directly addresses the challenge of visibility for local entrepreneurs. Map My Biz combines offline accredited learning with AI-driven support and a global smart map, ensuring that rural entrepreneurs become visible, trusted, and adequately supported by international and domestic tourists. Zimela said as a tourism student, the competition allowed him to grow a mindset leaning towards innovation when it comes to issues of global tourism.

> "After everything I walked away with new knowledge, stronger problem-solving skills, a winning concept, new friends and the confidence that young future leaders can truly shape the future of tourism." Inganathi Zimela

"Being part of the first ever G20 Tourism Hackathon South Africa was an inspiring and eye-opening experience for me. It challenged me to think with an innovative mindset about global tourism issues that need to be solved urgently, I got the privilege to collaborate with diverse brilliant minds and embrace innovation as a tool for real sustainable global impact. After everything I walked away with new knowledge, stronger problem-solving skills, a winning concept, new friends and the confidence that young future leaders can truly shape the future of tourism," he said.
Following their success, both teams earned the extraordinary opportunity to present their solutions at the G20 Ministerial Summit, showcasing their UJ-developed innovations directly to Tourism Ministers from G20 countries.

Professor Diane Abrahams, Director of the STH, congratulated the students and their mentor, stating, "Well done to Akhona Melani for the guidance to the students and congratulations to Teagon and Inganathi, we are super proud of you."



Africa's first **Virtual Reality Courtroom**

Africa's first Virtual Reality Courtroom The University of Johannesburg (UJ) is breaking new ground in legal education with its trailblazing Virtual Reality (VR) Courtroom Game, which was launched on Friday, July 19, 2024. This cutting-edge initiative not only marks a first for South Africa but is also a groundbreaking development for the entire African continent. By harnessing the power of virtual reality, UJ is set to transform traditional teaching methods, offering students a dynamic and immersive learning experience that blends theoretical knowledge with hands-on practice.

Transforming traditional methods

In South Africa, legal education has traditionally followed a structured approach, categorising law into distinct disciplines rooted in Roman tradition. However, this method often overlooks the interconnectedness of legal issues within the country's complex constitutional democracy. The VR Courtroom Game, created by UJ's Faculty of Law in partnership with the Johannesburg Business School (JBS) Innovation Lab, tackles this issue head-on by plunging students into realistic legal scenarios that mirror actual cases.

Innovative educational approach

Professor Michele van Eck, the project's lead, emphasises that the team was acutely aware of the contemporary challenges in legal education, particularly the need to connect legal content with its impact on everyday life in a nation shaped by apartheid's legacy.

"We aimed to craft an innovative and inclusive approach to legal education. The VR Courtroom Game is a game-changer, offering students complex legal scenarios across various disciplines. It immerses them

"We aimed to craft an innovative and inclusive approach to legal education. The VR Courtroom Game is a game-changer, offering students complex legal scenarios across various disciplines. It immerses them in real-life situations, helping them grasp the intersection of legal principles and preparing them for practical legal work."

in real-life situations, helping them grasp the intersection of legal principles and preparing them for practical legal work. This involved extensive development to ensure that the scenarios are authentic and accessible for students at all levels of legal understanding," says Prof van Eck.

Technical lead developer Professor Abejide Ade-Ibijola adds that the VR Courtroom Game is designed to make legal education not just informative but exciting. By incorporating virtual reality and artificial intelligence (AI) within a game-based learning framework, the game bridges the gap between theory and practice. "This approach enhances students' analytical skills and provides a deeper, more engaging understanding of legal principles.

It's not just about learning law; it's about experiencing it in a way that prepares them for real-world practice," notes Prof Ade-Ibijola.Prof van Eck and Prof Ade-Ibijole recognise the invaluable contribution of the project team from the Faculty of Law and the undergraduate students at the JBS Innovation Lab, without which this project would not have been possible.

Collaborative success

The VR Courtroom Project is directed by Professor Michele van Eck, with Professor Abejide Ade-Ibijola serving as the Lead VR Game Developer. The team included experts from the UJ's Faculty of Law, such as Professor Puseletso Letete, Ms. Natasha Naidoo, Mr. Elton Hart, Ms Felicia Zuba, Mr. Louis Koen, Dr Werner Nel, Dr Yvette Joubert, and Dr Whitney Rosenberg, who developed the storyline, content, and scenarios for the game. These experts also tested and validated the game to ensure its accuracy and effectiveness.

Empowering South Africa's youth through XR Coding: A vision for future

By: Prof Umesh Ramnarain (Professor in Science Education and the Director of the CALTSTEAM Research Centre in the Department of Science and Technology Education at the University of Johannesburg.)

In a world rapidly shaped by emerging technologies, the ability to code is no longer a niche skill but a gateway to opportunity. At the University of Johannesburg, the Centre for Advanced Learning Technologies in Science, Technology, Engineering, Arts and Mathematics (CALTSTEAM) is pioneering an innovative initiative: the XR Online Coding Club. This programme directly aligns with ACEEU's standards of Third Mission Activities and Internal Support Structures, providing transformative learning experiences for youth from underserved communities while cultivating a pipeline of entrepreneurial thinkers prepared for the Fourth Industrial Revolution. This initiative is especially vital in South Africa, where youth unemployment is one of the country's most pressing socio-economic challenges.

According to Statistics South Africa (2024), the youth unemployment rate remains above 60% for those aged 15–24, with many young people lacking access to opportunities to build future-oriented skills. CALTSTEAM recognises that bridging this gap requires more than academic instruction, but demands a comprehensive, inclusive approach to empowerment through digital innovation.

Creating Access to Future-Ready Skills

The XR Online Coding Club is pioneered by Prof Umesh Ramnarain and his colleagues at the CALTSTEAM, and recognises the need to empower youth in coding to build XR applications. To date, there are 300 school learners and university students who are enrolled. The XR Online Coding Club offers free, self-paced online courses that address critical digital competencies. These include Introduction to Python, Game Design with Unity, 3D Modelling with Blender, and Augmented and Virtual Reality Development. Learners from high schools and universities engage with these open-access modules via a dedicated learning platform, building competency in the creation of applications in ICT. Importantly, this initiative addresses a key equity challenge of the digital skills divide in historically disadvantaged communities in South Africa. Schools in such communities lack the digital infrastructure and teacher capacity to deliver meaningful technology education. By providing expert mentorship, the club promotes inclusive participation in the digital economy and empowers learners to become producers not just consumers of technology.

> The XR Online Coding Club empowers youth to build XR applications, bridging the digital skills divide through free, inclusive learning.

From Digital Literacy to Digital Entrepreneurship

CALTSTEAM's approach is not just about skills development but it is about nurturing entrepreneurial mindsets. Each course culminates in hands-on projects, such as designing XR content with real-world applications in STEM education. These projects provide learners with opportunities to prototype, test, and refine digital solutions, laying the groundwork for tech-based entrepreneurial ventures.

By fostering collaboration, critical thinking, and problem-solving through technology, the XR Online Coding Club aligns with the broader goals of South Africa's National Development Plan 2030 to create employment and promote innovation (National Planning Commission, 2012).

This entrepreneurial thrust positions learners to imagine new futures for themselves as start-up founders, app developers, or digital content creators. Students undertaking studies at the CALTSTEAM centre have developed applications such as an Augmented Reality (AR) translanguaging learning application for chemistry. With demand increasing, CALTSTEAM is poised to expand the XR online coding club to countries across the African continent.

Building a Sustainable Ecosystem for Innovation

Central to the success of this initiative is the strong institutional commitment to entrepreneurship from the University of Johannesburg. By mobilising internal support structures, forming partnerships with local schools, and anchoring the programme in social justice and community engagement, the XR Online Coding Club exemplifies how universities can play a catalytic role in regional innovation ecosystems. As an entrepreneurial university initiative, it reflects an authentic commitment to societal impact, fulfilling both educational and economic mandates. In doing so, it creates ripple effects that empower entire communities, not just individual learners.

Conclusion

The XR Online Coding Club is more than a training programme. It is a bold step toward reimagining entrepreneurship education in Africa. By equipping youth with immersive technology skills and a mindset for innovation, CALTSTEAM is laying the foundation for a new generation of digital entrepreneurs.

Importantly, this initiative embodies the standards of the Accreditation Council for Entrepreneurial and Engaged Universities (ACEEU) by advancing Third Mission Activities, fostering entrepreneurial teaching and learning, and leveraging internal support structures to create long-term societal impact. It demonstrates how universities can act as engines of transformation by addressing pressing socio-economic challenges, bridging digital divides, and empowering disadvantaged communities through inclusive innovation.

In doing so, the University of Johannesburg positions itself as a continental leader in entrepreneurial and engaged education, fully aligned with ACEEU's vision of higher education institutions as catalysts for regional development, social justice, and economic empowerment.

Inside UJ's Green Technology Powerhouse, **PEETS**

The Process, Energy & Environmental Technology Station (PEETS) at the University of Johannesburg, works to turn research into real, helpful solutions for South Africa. Its main goal is to support a "green circular economy," helping industry, government and communities by sharing knowledge, helping small businesses, and developing technologies that are sustainable.

PEETS was staarted in 2010 with funding from government agencies because many smaller firms and remote areas don't have easy access to high-end infrastructure or technical skills. PEETS bridges that gap by making technology, engineering skills, and environmental know-how available where they are most needed.

One of the big projects PEETS is working on is the Eastern Cape Water Provision Project with SOURCE Global. In this project, PEETS installed hydropanels in remote villages, plus two schools. These panels make drinking water from air and sunlight. Villages chosen were ones without regular water supply or electricity. Besides setting up the hydropanels, PEETS trained people in the community how to use them, how to keep them clean, and how to store the water safely. This is helping more than a thousand people get clean water every day.

Another current project is the TRUE Vehicle Emissions Study in Johannesburg, which measures real pollution coming out of cars and other vehicles using roadside sensors. PEETS is working with local government, the International Council on Clean Transportation and other partners. The aim is to track emissions from over 100,000 vehicles in Gauteng, gather reliable data, train people to use the monitoring technology, and feed information into policies to clean up the air.

> “A vital bridge connecting research, innovation, and real-world environmental and community needs.”

PEETS also offers many services to businesses, especially small and medium-sized enterprises (SMEs). It helps with audits of energy use and waste, engineering advice, product and process development, testing prototypes, and training. It works in areas like renewable energy, energy efficiency, water quality, waste optimization, air quality management, clean transport, and 4IR-related engineering.

The station helps communities in rural and remote areas by finding solutions that don’t depend on large infrastructure. For example, in villages without electricity or water pipes, hydropanels are off-grid solutions. PEETS also works to reduce waste, improve water systems, and assist local firms to be more efficient so they use less energy and produce less pollution.

Challenges remain. Many communities PEETS works with are far from services, have little infrastructure, or lack strong internet and electricity. Also, there are not always enough people with the technical skills to maintain systems or use data. PEETS often has to include training and education as part of their projects.

In terms of impact, PEETS has supported over 1,000 green economy projects since it began. It has helped municipalities, industry and small businesses to use clean energy, to manage waste better, to save water, and to develop renewable energy and efficient systems.

PEETS plays a role in policy too: data collected through projects like the vehicle emissions study are supposed to help local and national government make better rules about air quality, transport emissions, and environmental standards. The station is also part of many government and industrial partnerships, which means its work has a chance to be scaled or used elsewhere.

In short, PEETS is more than a research unit. It is a bridge between research and real needs. It works to ensure that environmental and energy technologies are accessible, affordable, and effective in South African settings especially remote or under-resourced areas. Its success will show in cleaner air, safer water, better waste handling, and in local communities gaining the tools and knowledge to solve their own challenges.

UJ TechnoLab:

Where UJ builds Africa's digital future

Walking into the University of Johannesburg's TechnoLab, you're met with the satisfying hum of machines and the excited chatter of learners testing ideas. From soldering benches and coding stations to robotics kits and 3D printers, the Lab is a hands-on hub where Africa's digital future is being imagined and built.

The station is part of the Faculty of Engineering and the Built Environment based at the Auckland Park Kingsway Campus and is dedicated to raising technology knowledge and literacy among students of all ages.

Delivering high-quality technology workshops, the TechnoLab was founded in 1995 and has since given technology workshops to over 60,000 pupils. Technolab's technology workshops provide a variety of courses with a focus on Technological Processes (systems), Electronics & Microcontrollers, Coding and Robotics, 3D Printing, and VR/AR Technologies, which involves the development of higher cognitive capabilities, creative thinking skills, and problem-solving abilities.

A Vision That's Practical and Inclusive

"UJ TechnoLab is more than just a space for innovation, it's where we shape the leaders, thinkers, and creators of Africa's digital future," says the Lab's manager, Mr Herman Sekoele. That sentence captures the Lab's mission: to democratise access to emerging technologies so that students, teachers, researchers, and community members can all participate in 4IR.

UJ TechnoLab serves a broad audience, UJ students and faculty, school learners and teachers, external partners and small entrepreneurs — and specialises across several technological domains: robotics, coding and programming, artificial intelligence (AI), Internet of Things (IoT), data innovation and analysis, and 3D printing. These areas are taught and tested in project-based ways so learners don't just consume knowledge, they apply it.

How UJ TechnoLab positions UJ at the heart of 4IR

UJ TechnoLab gives learners practical fluency in digital tools and creative problem solving. By engaging in robotics competitions, AI and 3D-printing workshops, and IoT prototyping, students create tangible projects and portfolios that showcase the skills today's employers and funders are looking for. UJ TechnoLab's approach, hands-on prototyping, constant iteration, and real-world application, transforms classroom learning into entrepreneurial opportunity. To stay ahead, the team constantly scans global and local trends, pilots new tools (for example, integrating 3D printing into product-design modules), and adapts those tools for local needs. The result is a learning environment that's experimental, relevant, and future-facing.

> "UJ TechnoLab is more than just a space for innovation, it's where we shape the leaders, thinkers, and creators of Africa's digital future."
> **Mr Herman Sekoele.**

The Big 4IR Issue — and the Opportunity

South Africa's biggest 4IR challenge is twofold: a digital divide that locks out many learners from meaningful tech access, and a skills mismatch where education doesn't always align with industry needs. But these twin challenges are also opportunities. UJ TechnoLab uses hands-on training, teacher upskilling, and community outreach to bridge access gaps, and it emphasises practical projects that make learners employable and entrepreneurial. Importantly, technologies like 3D printing offer a powerful local opportunity: low-cost prototyping and localised manufacture can spur small-scale entrepreneurship, repairs, and assistive device production, directly supporting local economies.

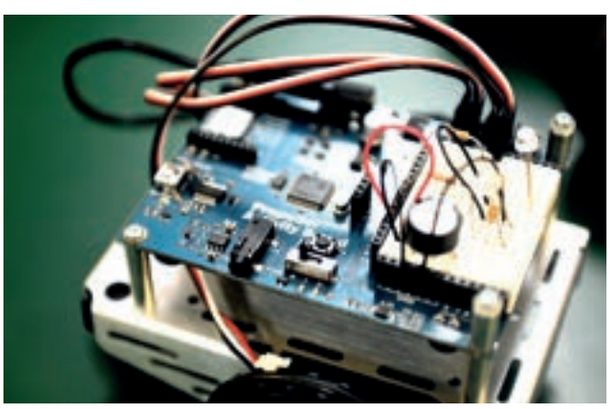
Impact Beyond the Building

UJ TechnoLab measures success both quantitatively and qualitatively. Quantitative indicators include the number of learners and teachers trained, schools reached, workshops and camps run, prototypes produced, and partnerships formed. Qualitative measures come from follow-up surveys, case studies, learner and teacher testimonials, and tracking of pathways (for instance, how many participants pursue further STEM study or start small tech ventures). The Lab also documents research outputs, competition results, and community stories to show long-term change. When a teacher trained by UJ TechnoLab goes back to a rural school and runs a yearlong robotics elective, that multiplier effect becomes a key impact metric, beyond raw attendance numbers, it's evidence of sustainable change.

2025 Highlights

In 2025, UJ TechnoLab strengthened its role in the community through a range of impactful initiatives.

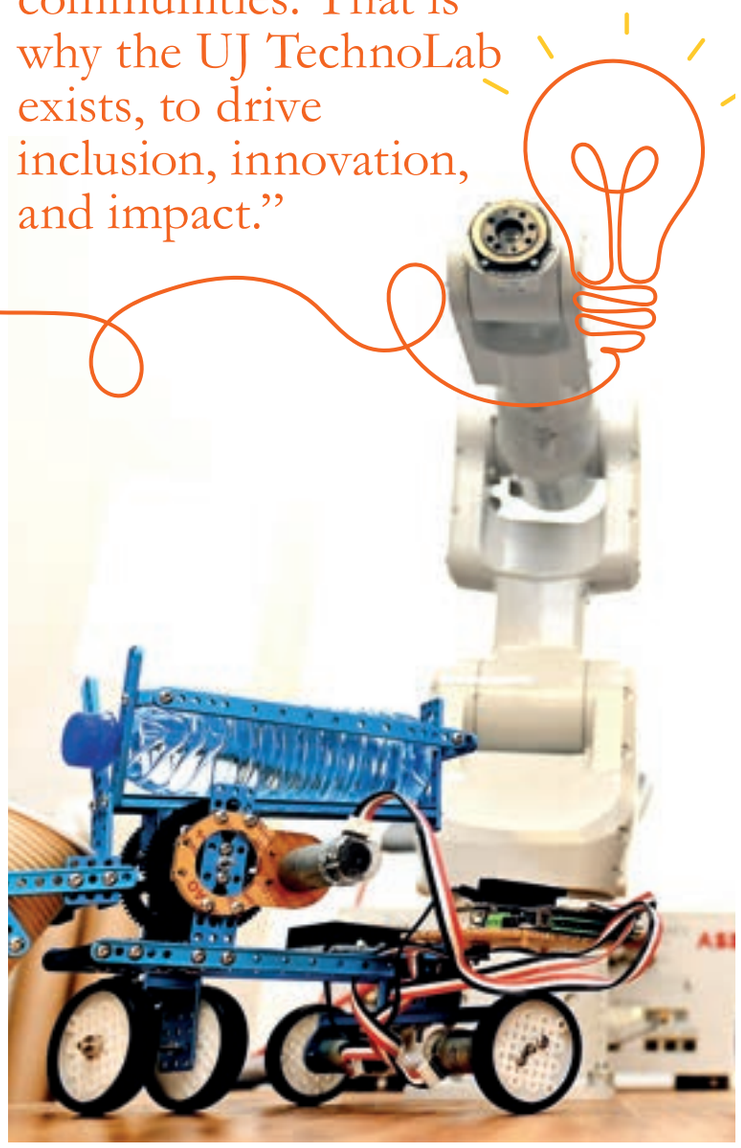
- The annual Holiday Club, hosted three times a year during Easter, Winter, and Spring holidays introduced children (mainly of UJ staff) to coding and robotics, preparing them for the World Robotics Olympiad in October.
- The annual Winter Camp, a week-long programme running from Monday to Friday, combined robotics, coding, 3D-printing demonstrations, and industry site visits (including with NECSA, UJ Mock Mine, UJfm, etc.) to give learners immersive STEM experiences. The camp concluded on Mandela Day, and in partnership with UJ Library, TechnoLab hosted a special event for the Winter Camp learners that celebrated skills development, reflection, and community impact.
- The Lab delivered teacher-training sessions at St John's College in Mthatha, Eastern Cape, aligned with the national curriculum.
- 3D-printing workshops were integrated into prototyping tracks, enabling learners to quickly transform ideas into physical models.
- In collaboration with Tomorrow Trust, the Lab welcomed 115 learners from disadvantaged areas/backgrounds for a one-day hands-on session in coding and robotics.
- The Lab also hosted high-school final-year learners from Eswatini, offering them a guided tour and an introduction to UJ TechnoLab's programmes and vision.



What's next for 2026

Plans include introducing an official Coding and Robotics Short Learning Programme, expanding the interschool coding and robotics competition, scaling maker-space access (more 3D printers and low-cost materials), deepening industry partnerships for internships and project mentorship, and strengthening 4IR Hub activity in the Eastern Cape to broaden regional impact.

"At UJ, we believe technology must not only advance knowledge but also uplift communities. That is why the UJ TechnoLab exists, to drive inclusion, innovation, and impact."



UJ's electric buses driving sustainable change

When UJ rolled out its first electric buses in 2023, it made history — becoming the first South African university to deploy electric vehicles (EVs) for inter-campus transport. What started as an ambitious pilot has since grown into a bold commitment to sustainable mobility: by 2028, UJ plans to replace its entire diesel fleet with 17 electric buses.

A quiet revolution on wheels

On 16 May 2025, the university unveiled two additional electric buses, bringing the fleet to five. These buses do more than reduce emissions — they reinvent campus transit. Passengers riding the EVs have noted their near silence; the hum of the air-conditioning is often the loudest element.

The buses carry up to 76 people (57 seated, 19 standing) and are outfitted with modern features: USB ports, CCTV cameras, and internal stop buttons. Their range is robust — up to 400 km on a single charge — making them suitable for long inter-campus routes.

One of the most striking differences is operating cost. The electric buses cost roughly R1 per kilometre, compared to diesel buses which cost over R12 per kilometre. The lower maintenance burden further strengthens the financial case for electrification.

Scaling for 2028 and beyond

The expansion plan is ambitious but methodical: UJ intends to buy four electric buses annually through 2028 to phase out the diesel fleet entirely. The institution expects that battery supply will be the major constraint, since 60 % of bus components can be sourced locally but battery modules are imported. To power this transformation, UJ is scaling its solar capacity and exploring on-campus charging infrastructure, mitigating reliance on Eskom during load-shedding.

Why It Matters

The electric bus initiative is about more than just better transport. It touches on multiple strategic aims:

- Sustainability & carbon reduction: Transport contributes a measurable share of campus emissions, and electrification shrinks that footprint.
- Health & comfort: Quiet, smooth rides reduce noise and air pollution exposure.
- Institutional credibility: UJ's commitment signals that the university is not just educating in the era of 4IR — it's acting within it.
- Operational savings: Lower fuel and maintenance costs free up resources for further innovation.

As a student rider put it: "The ride is so smooth … I'm used to buses being loud."

Challenges & Considerations

The path isn't without obstacles. Load-shedding remains a serious risk to charging schedules. UJ addresses this by planning solar back-up and redundant charging times. The global battery supply chain is another vulnerability; UJ seeks to offset this through local manufacturing strategy and smart procurement.

Another consideration: the source of electricity. If buses are charged using coal-heavy grid power, the emissions reductions are less dramatic. That is why solar expansion and grid cleaning are integral parts of UJ's long-term sustainability strategy.

Driving Forward

UJ's electric bus programme is a powerful example of technology in service of mission. It demonstrates that institutional structures — logistics, funding, infrastructure — can be reimagined to align with the vision of a greener, smarter university.

As UJ accelerates toward 2028 and beyond, the electric bus fleet will become a living symbol of how innovation isn't just in the labs or classrooms — it's on the roads, ferrying students, reducing emissions, and transforming the daily rhythms of campus life.

"The ride is so smooth … I'm used to buses being loud."

UJ's community-driven 4IR projects in rural Limpopo and beyond

In the Limpopo Province of South Africa, between the towns of Thohoyandou and Musina in the Vhembe district, lies a tiny village called Gwakwani (loosely translated armpit in English). Tucked away in South Africa's north-eastern corner, not far away from the borders of Zimbabwe and Mozambique, the village can only be accessed via one dirt road. For many years, water and electricity were short in supply. Basic healthcare was infrequent, if not non-existent. Internet connectivity was a distant dream. Bread was a luxury – only available in far-off places.

Today, however, all of that has changed for the better – not only for Gwakwani but for some neighbouring villages too. This is all thanks to the University of Johannesburg (UJ)'s Innovation for Societal Impact and Sustainability project. Through this project, launched on 4 October 2024, the University leverages technology to address critical infrastructure needs for residents in under-resourced areas, bringing sustainable solutions in energy, water, connectivity, and education.

> "The University leverages technology to address critical infrastructure needs for residents in under-resourced areas"

The project, which dates to 2014, was developed in collaboration with Through partnerships with Schneider Electric. It directly supports the United Nations Sustainable Development Goals (SDGs), including access to clean water, affordable energy, quality education and healthcare as well as technological advancement. A solar-powered off-grid bakery, supported by a cold storage to enhance the operation, ensures that residents can savour fresh bread. The bakery has generated jobs and income.

Solar powered boreholes and reservoir tanks now dot the villages of Gwakwani, Matatani and Mbodi– replacing the diesel boreholes which used to break down regularly. This has ensured that residents can enjoy access to clean running water. In turn, the water supply reduces malaria risks and enables residents to practice farming for income.

Two brightly orange painted structures at Matatane village – one serving as a containerised crèche and another as a clinic. The crèche is equipped with the village's first TV, providing early childhood education. This is a welcome intervention for children who used to wait for a mobile truck that used to serve as a creche once a week. The clinic has brought the much-needed relief to residents who used to travel up to 20 kilometres to access healthcare.

Cellphone connectivity – something residents of Gwakwani could only dream of a few years ago – is now a reality. No longer do they have to climb the nearby mountain for a signal. To top it all, they now enjoy free Wi-Fi – a luxury they could only have dreamt of. And when darkness falls, residents now do not have to live in fear of criminals – their homes are now lit with solar lights.

The project has also been expanded to Hanyani Secondary School, and it now boasts solar panels and a state-of-the-art learning facility, known as the Tshumisano Learning Centre. Developed in partnership with the South African Jewish Board, the learning centre is equipped with computers, books and updated learning materials. Additionally, solar-powered lamps have replaced paraffin lamps. This enhanced safety while allowing learners to study in the evening. The impact has been instantaneous. The school's matric results improved from a paltry 45% percent to 93% percent this year. Recently, UJ, in partnership with Absa bank and Qhubeka (an NGO) distributed 131 bicycles to Grade 11 learners to ease their pain of walking long distances top the school.

UJ Vice-Chancellor and Principal, Professor Letlhokwa George Mpedi, has singled out the project as an example that UJ is living up to its vision to be an International University of Choice, anchored in Africa, Dynamically Shaping the Future. "Through its interventions, this project directly addresses issues of inequality by improving access to basic services in marginalised rural communities. It promotes sustainable practices, especially in energy and water conservation, addressing immediate needs while ensuring long-term viability. By involving the community in the decision-making and implementation process, UJ fosters a sense of ownership and self-reliance among the residents."

Dr Phumzile Mlambo-Ngcuka, UJ's Chancellor, lauded the University for its continued leadership in societal transformation and sustainable development.

"This project once again demonstrates the value that a university can bring to communities, especially through collaborations with the private sector. UJ's recognition as the number one institution in South Africa and on the African continent — and 23rd globally in the 2025 Times Higher Education Impact Rankings — reflects the real-world impact of its work. The benefits of these initiatives will be felt for generations to come."

Project Highlights

- Renewable Energy: Solar-powered boreholes, streetlights, and home lighting now provide reliable and sustainable energy.
- Water Access: Solar borehole pumps and a new water network ensure access to clean water in the villages.
- Digital Connectivity: Has ensured access to information and enhanced learning and educational opportunities.
- Economic Empowerment: A solar-powered bakery and agricultural irrigation systems have created jobs and improved food security.
- •ducational Enhancement: Hanyani Secondary School equipped with an ICT centre, equipped with science labs, updated learning materials. An Early Learning Centre has also been developed at Matatani village.
- Social Justice and Crime Prevention Centre: Helps residents with access to services such home affairs, social security and crime prevention activities.
- Cassava production initiated in Gwakwani

4IR Water projects in the Eastern Cape

A groundbreaking partnership is transforming lives in rural South Africa, one hydropanel at a time

In the remote villages of the OR Tambo District, where water scarcity has long been a daily struggle, an innovative solution is quite literally pulling clean drinking water from thin air.

Through a pioneering collaboration between the University of Johannesburg's Process, Energy & Environmental Technology Station (UJ PEETS), SOURCE Global, and UJ's Water and Health Research Centre, over 1,000 community members now have access to their own renewable source of clean water—thanks to revolutionary solar-powered hydropanels that harvest atmospheric vapour.

Technology Meets Community Need

The Eastern Cape Water Provision Project, launched in March 2023, has installed 400 hydropanels across four villages: Lujazu, Luphoko, and two schools in Mthambalala and Cutwini. These remarkable devices harness solar energy to extract water from the air, providing a sustainable solution where traditional infrastructure seemed impossible.

"Through community engagement, we identified remote and isolated villages which did not have reticulated water or any likely future water supply," explains Dr Kousar Hoorzook, who leads the project from UJ PEETS. "We looked at criteria like access to water, plans for future infrastructure investment, climate and scarcity—to ensure we are responding to the needs of society and working with the community to take the work forward."

The selection process was deliberate and thoughtful, prioritising communities most in need and least likely to receive conventional water infrastructure in the foreseeable future.

Empowering the Most Vulnerable

The project's impact extends far beyond mere access to water. Its dual objectives address both immediate needs and long-term community development.

First, it improves access to quality water for those most affected by scarcity: women,

children, elderly residents, and people with disabilities. Second, it dramatically reduces the time and physical effort required for water collection—a task that traditionally falls disproportionately on women and children—thereby enhancing the socio-economic potential of entire communities.

"Recognising the challenges faced by these communities in accessing clean drinking water, the project addresses this pressing issue by implementing cost-effective methods," Dr Hoorzook notes. "The initiative harnesses atmospheric vapour to provide a renewable and sustainable solution, empowering families to overcome the scarcity of clean water."

Building Capacity, Not Just Infrastructure

Technology alone isn't enough. Understanding this, the project has invested heavily in training and community education.

In 2022, village principals received comprehensive training on the revolutionary SOURCE Hydropanels and their operation. The following year, UJ PEETS partnered with the Water and Health Research Centre to expand these initiatives, addressing practical concerns like vandalism prevention and maintaining water quality during collection.

Community members learned proper hygiene practices, from correct hand-washing techniques to using appropriate containers for water collection. Training emphasised the importance of clean water and strategies for equitable distribution throughout the villages, ensuring everyone benefits from this technological breakthrough.

A Philanthropic Circle

The project received funding from the Chan Soon-Shiong Family Foundation, based in the United States. Its namesake, Dr Patrick Soon-Shiong—a medical scientist, entrepreneur, and philanthropist—grew up in Gqeberha (formerly Port Elizabeth) and studied medicine at the University of the Witwatersrand before emigrating to America in 1977, where he built a distinguished medical career.

His foundation's investment represents a meaningful return to his South African roots, supporting innovation that addresses one of the continent's most pressing challenges.

Looking Forward

"UJ PEETS would like to strengthen these communities and provide them access to a dependable, long-lasting source of clean drinking water," Dr Hoorzook emphasises.

> "This sustainable initiative exemplifies the power of innovative solutions in addressing critical challenges such as access to clean drinking water."

The collaboration stands as a testament to what's possible when academic institutions, technology companies, and philanthropic organisations unite around a common goal: transforming lives through sustainable development and innovative thinking.
In villages where collecting water once meant walking kilometres each day, families now have a reliable source mere steps from their homes. It's not just water from air—it's hope made tangible, one hydropanel at a time.

Leading the way with innovative registration processes

The future of education isn't just about what we teach but more fundamentally about how we engage, empower, and enable every learner. At the University of Johannesburg (UJ), under the leadership of Registrar Professor Bettine van Vuuren, this future is being built today, brick by digital brick, with a relentless focus on the Fourth Industrial Revolution (4IR) and social impact. Crucially, this journey begins not in the lecture hall, but the moment a student steps onto their academic path. In 2024, UJ didn't just talk about 4IR leadership but redefined it, setting a bold new benchmark for South African higher education and creating an inclusive, tech-driven ecosystem where women in STEM and every student can thrive.

While many South African universities still grapple with the logistical labyrinth of registration, relying on easily forged ID copies, manual verification, and queues that test patience, UJ decisively broke ground. The University became the first in South Africa to implement facial recognition technology for student registration. This wasn't merely a tech upgrade but a strategic declaration of intent.

"For us, embracing 4IR isn't confined to our curricula. It is integrated into the entire student lifecycle, from that first interaction during application and registration right through to graduation where we issue each graduate with a block-chain enabled digital certificate and secure badge to share on LinkedIn," says Prof van Vuuren. "This revolutionary step with facial recognition is far more than just preventing fraud, and it is a testament to our commitment to providing a secure, efficient, and profoundly progressive learning environment. It reflects our dedication to staying at the forefront of technological advancement."

Gone are the days of vulnerable ID submissions. New UJ students received a simple SMS prompting them to confirm their identity via a quick, non-intrusive facial scan. This technology analyses unique facial features, creating a virtually impenetrable barrier against identity fraud. "This advanced level of authentication ensures the person registering is indeed who they claim to be," explains Dr Tinus van Zyl, UJ's Senior Director of Central Academic Administration. The result is an enhanced security level for the entire University community and a registration process stripped of unnecessary friction, setting a powerful tone for a student's 4IR journey from day one.

UJ's 4IR registration revolution

Steps:

1. **SMS trigger:** New students receive the link.

2. **5-seconds to scan:** AI matches facial biometrics.

3. **Instant verification:** Identity confirmed.

4. **Facial Scan:** 5-second verification.

Impact

70% faster than manual ID checks.

Zero identity fraud cases in the 2024 pilot.

Fully virtual and accessible nationwide.

MoUJi, the 24/7 Smart Digital Assistant that is supporting applicants and students

UJ's 4IR commitment extends far beyond secure access to the University. Recognising the immense stress of transitioning to university, amplified by the staggering ratio of nearly 695,000 first-time applications for less than 11,000 spaces, UJ proactively sought a smarter solution. The answer arrived in the form of MoUJi, our AI-powered digital assistant.

Born from a need to handle all the application inquiries efficiently and reduce the peak-period cost of temporary staffing during registrations, MoUJi embodies UJ's "walk the talk" approach to 4IR. Launched in 2020 and continuously evolving, MoUJi leverages AI and natural language processing to simulate human conversation, providing instant, 24/7 answers on everything from applications and registrations to financial statements, timetables, and student portal password resets.

"MoUJi was conceived to alleviate pressure on our invaluable Central Academic Administration (CAA) team, to ensure students get basic information without delays, and crucially, present a low barrier to entry," explains Prof van Vuuren. Its success has been remarkable.

Accessible via the UJ website, Facebook Messenger, and crucially, WhatsApp, MoUJi meets students where they are, providing personalised support where and when they need it. This multi-channel approach, built on the latest technology, is key to UJ's demographic agility.

"By deploying on WhatsApp, we've broadened our reach significantly," stresses Prof van Vuuren. "It allows us to engage students across diverse socio-economic backgrounds and locations, ensuring that access to critical information isn't dictated by proximity to a campus or ownership of a high-end device." The results speak volumes and has shown a reduction from 120 to 60 temporary call centre agents during registrations over the last few year, saving over half a million rand annually, increasing student engagement and ensuring complex queries get to the human supported agents.

A Blockchain revolution in graduate certification

The University of Johannesburg (UJ) is redefining how South African universities protect and validate qualifications — using blockchain technology to secure every graduate certificate and uphold the credibility of higher education in the digital era.

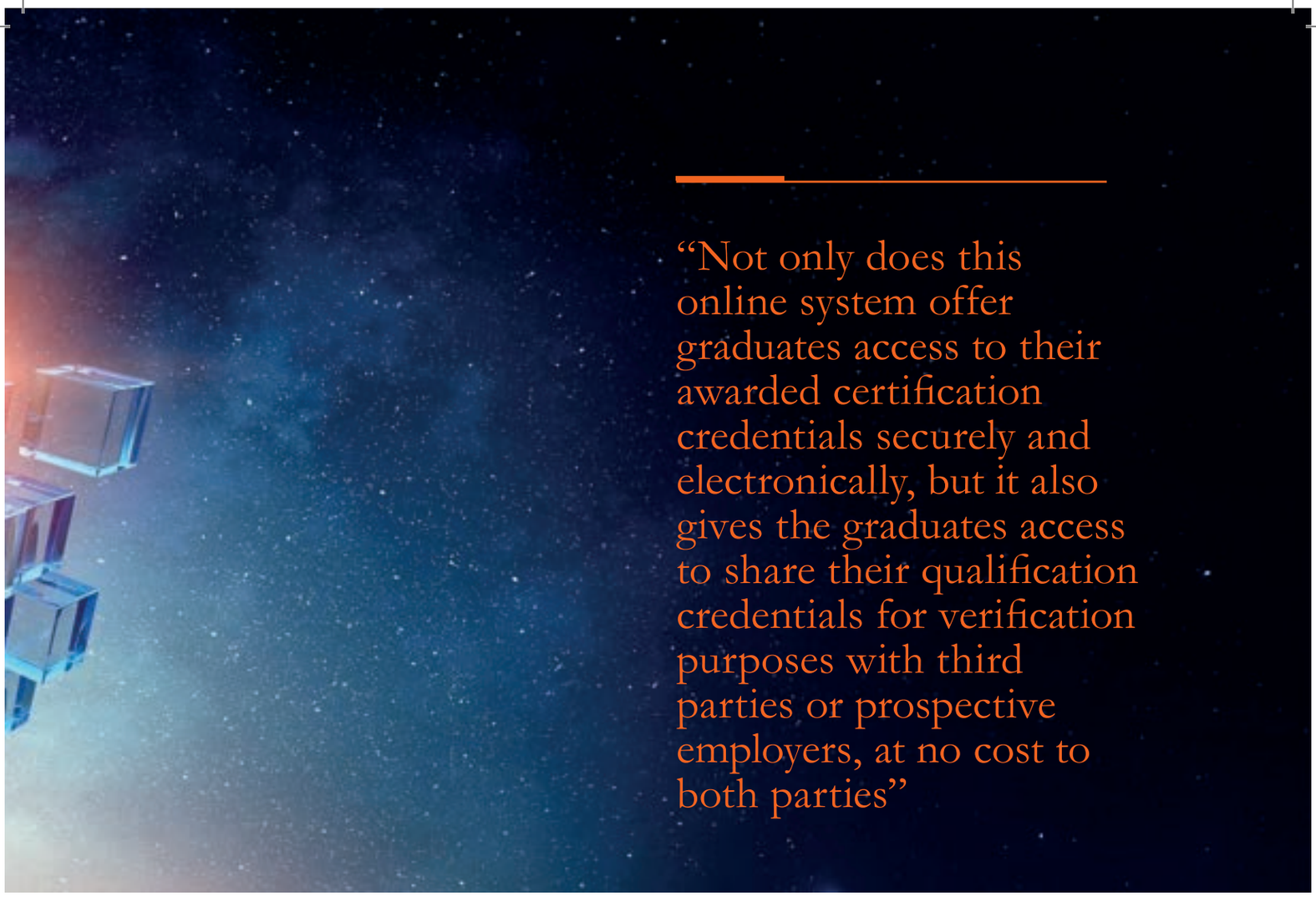
When it comes to academic integrity, trust is everything. As fraud and counterfeit certificates become more sophisticated, the University of Johannesburg (UJ) has taken a bold, future-focused step to safeguard the authenticity of its qualifications.

As the first South African university to introduce blockchain-based certificates, UJ continues to push the boundaries of digital transformation in higher education. The initiative builds on the success of its earlier Digital Certificate System, which already allowed graduates to access and share verified digital copies of their qualifications.

"The Digital Certificate system, which was introduced a while back for our graduates, gave graduates access to their certificates digitally and assisted in securely sharing these certificates with third parties or prospective employers, at no cost. The new blockchain-based certificate features will enhance the security of certificates even more. Certificates issued from this year on will have QR codes printed on them, which anybody can scan with a smartphone to verify whether the information on the certificate is correct and has been issued legitimately by UJ. The public is now able to validate the awarded qualifications for UJ graduates without having to contact the University or having to go through a verification agency, just by scanning the QR code on the certificate — and best of all, at no cost," says Dr Tinus van Zyl, Senior Director: Central Academic Administration at UJ.

How it works

Each UJ certificate issued since 2023 carries a QR code linked to blockchain validation. Anyone — from employers to professional bodies — can scan the code using a smartphone to verify the legitimacy of a qualification. The system removes the need for manual verification through the University or external agencies, saving time while enhancing trust.



> "Not only does this online system offer graduates access to their awarded certification credentials securely and electronically, but it also gives the graduates access to share their qualification credentials for verification purposes with third parties or prospective employers, at no cost to both parties"

Graduates retain full control over who can access their academic records.

The Digital Certificate system gives our alumni access to and put them in control of who can verify their qualifications. Key features incorporated into the new system are designed around international security standards and are compliant with legislation in terms of the protection to personal information.

"Once a third party or a prospective employer request to verify an awarded qualification, the certificate holder must authorise the access. UJ is constantly reviewing and implementing secure technologies to bring our clients the latest, cutting-edge systems and certification security features," adds Dr van Zyl.

Empowering graduates, protecting integrity

Beyond verification, the platform allows alumni to order replacement certificates, request transcripts, make secure payments online, and select courier options — locally or internationally — ensuring that graduates around the world can access their official records quickly and securely.

"Not only does this online system offer graduates access to their awarded certification credentials securely and electronically, but it also gives the graduates access to share their qualification credentials for verification purposes with third parties or prospective employers, at no cost to both parties," notes Dr van Zyl.

Leading Africa's digital transformation

UJ's blockchain-based certification system is more than a technological upgrade — it's part of the University's Fourth Industrial Revolution (4IR) vision to strengthen digital trust, transparency, and service excellence. It underscores how technology can advance institutional legitimacy while empowering students and alumni.

In a world increasingly defined by data and digital identity, UJ's leadership sends a powerful message: trust and technology can — and must — coexist.

UJ launches pioneering AI and the Law Institute

Prof Mpedi leads a bold new chapter in Africa's legal and technological future

The University of Johannesburg (UJ) has marked another defining milestone in its 20th anniversary year with the launch of the AI and the Law Institute — a pioneering initiative that places the University at the forefront of Africa's ethical, legal, and technological transformation.

Unveiled at a prestigious ceremony at the UJ Arts Centre on 17 October 2025, the Institute reflects UJ's unwavering commitment to advancing responsible innovation and shaping the legal frameworks that will govern Artificial Intelligence (AI) in the years ahead.

For UJ's Vice-Chancellor and Principal, Professor Letlhokwa George Mpedi, the Institute represents a deeply personal and purposeful project.

"Our Faculty of Law is launching the AI and the Law Institute, a project close to my heart," said Prof Mpedi. "I have long been passionate about the intersection of artificial intelligence and the law, having written extensively on the subject. Recently, I had the privilege of collaborating with Prof Tshilidzi Marwala, Rector of the United Nations University, on the book Artificial Intelligence and the Law (Springer, 2024). We are also finalising another publication, Artificial Intelligence and Employment Law."

Prof Mpedi added that the establishment of the Institute "marks another pivotal moment for UJ, as it seeks to advance responsible and ethical innovation — where technology, justice, and human dignity converge."

Shaping the future of AI governance in Africa

The AI and the Law Institute will address global challenges emerging from rapid technological change by developing robust legal, regulatory, and ethical frameworks for Artificial Intelligence and related technologies. Through this interdisciplinary hub, UJ aims to:

- Lead continental discourse on AI regulation within constitutional and human rights frameworks.
- Promote the ethical and transparent deployment of algorithms in legal and governance systems.
- Drive legal education reform, ensuring future lawyers are fluent in the language and logic of AI.

- Develop policies and research that ensure technology serves justice and social good.

The launch drew leading academics, judges, policymakers, and industry experts — including Deputy Chief Justice Dunstan Mlambo, who delivered a keynote address on the evolving interpretation of law in the age of AI and how the Institute will enrich Africa’s legal innovation landscape.

A vision grounded in scholarship and global collaboration

A distinguished legal scholar and NRF-rated researcher, Prof Mpedi has built his career on exploring how law evolves alongside social and technological change. His qualifications in Labour and Mercantile Law, combined with global leadership training at Oxford’s Saïd Business School and Harvard Kennedy School, position him uniquely to lead Africa’s legal response to the digital era.

His collaboration with former UJ Vice-Chancellor Prof Tshilidzi Marwala, now Rector of the United Nations University, underscores UJ’s contribution to international thought leadership. Their co-authored works — Artificial Intelligence and the Law and the forthcoming Artificial Intelligence and Employment Law — are already shaping global legal scholarship.

A catalyst for ethical and inclusive innovation

The Institute will promote interdisciplinary research bridging law, ethics, and technology, while developing innovative academic programmes that prepare students and professionals to navigate AI’s legal frontiers. It will also partner with governments, private sector stakeholders, and civic organisations to influence equitable AI policies and foster public dialogue on fairness, transparency, and accountability in digital systems.

This landmark initiative builds on UJ’s broader Fourth Industrial Revolution (4IR) strategy, which integrates digital transformation across all disciplines — from engineering and health sciences to humanities and law — ensuring that innovation remains guided by ethical reflection and social responsibility.

Rescue ready: New Simulation Centre redefines emergency training in Africa

University of Johannesburg (UJ) has unveiled a first-of-its-kind Rescue Simulation Centre — a landmark facility that positions South Africa and the continent at the forefront of rescue education, simulation and research.

The four-storey, 3,000m² facility, designed and commissioned by the Department of Emergency Medical Care (EMC) in UJ's Faculty of Health Sciences, represents an innovative trajectory in emergency response education and research, firmly positioning the University at the forefront of rescue training, simulation, and innovation.

Speaking ahead of the launch, UJ's Vice-Chancellor and Principal, Professor Letlhokwa George Mpedi, highlighted the Centre's strategic role in enhancing national preparedness and advancing professional rescue capabilities. "With this state-of-the-art Rescue Simulation Centre, we are redefining how emergency response training is delivered on the continent. There is no longer a need to travel abroad for world-class rescue training. It is right here at UJ. This facility serves not only our students but the nation. As we celebrate UJ's 20th anniversary, this milestone reflects our steadfast commitment to innovation, excellence, and nation-building. By investing in safety and skills, we save lives and strengthen our country's readiness for the challenges that lie ahead," said Prof Mpedi.

He added that the Centre provides a diverse range of cost-effective, accessible, and comprehensive learning experiences all in one facility. "This project is about accessibility, quality, and national impact," said Prof Mpedi. "We are creating opportunities for students, professionals, and industries to gain world-class training locally, while building the capacity South Africa and the broader continent to respond effectively to future emergencies."

UJ Rescue Simulation Centre represents a significant leap forward in how rescue professionals are trained to respond to the increasingly complex demands of modern disasters. Supported by the Department of Higher Education and Training, the facility provides realistic, high-fidelity simulated environments that can identify and close critical gaps in rescue preparedness, coordination, and related technical skill.

According to Connor Hartnady, a lecturer in the Department of Emergency Medical Care, UJ and one of South Africa's experienced emergency response specialists, the Centre bridges a critical gap between theory and real-world application. "This facility equips teams with the resources and practical experience they need to respond effectively, save lives, and manage risk," Hartnady said. "Natural hazards are increasing, urbanisation is evolving rapidly, and emergencies are becoming more complex.

This Centre prepares responders not only for South African conditions but for challenges across the continent."

Government, civil society, and industry partners attended the launch of the Rescue Centre, extending messages of support to the University. Among them, Deputy Minister of Employment and Labour, Judith Nemadzinga-Tshabalala, echoed the Prof Mpedi's sentiment, adding that the launch represents more than an institutional milestone. "UJ's Rescue Centre responds to the urgent need for environmental protection, emergency preparedness, and sustainable economic development. Through education, training, and research, it will expand South Africa's emergency response capacity, strengthen collaboration between institutions, and enhance regional leadership in rescue operations. The establishment of this Centre is, therefore, not merely an institutional achievement, but a national pledge to safety, dignity, and resilience in the face of increasing global and environmental challenges."

Prof Mpedi concluded: "With the launch of this world-class facility, UJ continues to reaffirm its commitment to advancing the Fourth Industrial Revolution (4IR) in education, while addressing the urgent societal need for safety, innovation, and sustainability. UJ Rescue Simulation Centre stands as a symbol of hope, resilience, and progress, one that will shape a new generation of African rescue professionals equipped to confront the challenges of tomorrow."

INSIDE THE RESCUE SIMULATION CENTRE

- 4-storey, 3 000m² facility
- 5m survival pool for HUET training
- 15m helicopter hoist operations zone
- Urban search and rescue tunnels
- 30-seater aircraft fuselage for casualty simulations
- Trench rescue simulator
- Environmental systems: rain, wind, waves, darkness

"With this state-of-the-art Rescue Simulation Centre, we are redefining how emergency response training is delivered on the continent."


UNIVERSITY
OF
JOHANNESBURG