

The GIBS Emerging to Converging Technologies Conference: The Future World



Conference
Speaker
Summary

**Gordon Institute
of Business Science**
University of Pretoria

**Georgia
Tech** 

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of Business
Science

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Introduction

The Emerging to Converging Technology: The Future World conference covered the gambit in terms of ground-breaking innovations, the human implications of technology uptake, regulation, applications, value-chain disruption, existing applications and future-focused potential. From blockchain to the likes of machine learning, data analysis, artificial intelligence (AI), the Internet of Things (IoT), robotics, gene manipulation and synthetic neurobiology, the conference cast a wide net by focusing on the vast array of technologies available globally then narrowing the discussion down to the African and emerging market context.

The international flavour of the event was supported by the participation of leading academics from MIT and Georgia Tech in the United States. One of the top research universities in the world (ranked 72nd globally by the QS World University Rankings 2020), Georgia Tech's Dr Pascal Van Hentenryck and Dr Soumen Ghosh were in attendance, alongside Massachusetts Institute of Technology

MIT political science professor, Dr Kenneth Oye. MIT was recently ranked (for the eighth consecutive year) as the world's best university according to the QS rankings 2020.

Opening the event, GIBS Dean Nicola Kleyn observed: "If we look at the advancements in tech, and the amount of sense making we, as business, have to do to try to incorporate this and adapt our business models, it requires phenomenal shifts. This is not always easy because there is geographic distance for us, in the continent, from the hubs where these technologies are emanating. And we have a local context. So we cannot take plug-and-play models that worked in other countries and assume they are going to work here."

The event, born out of a discussion between Kleyn and a colleague at IMD business school in Lausanne, Switzerland three years previously, was designed to draw siloes and pockets of insights together and encourage collaboration between academic institutions around the world.



"We have silos and pockets where we are having conversations about tech, often accompanied by pictures of robots and amazing things we all gasp at, but I am not sure we have really provided the space that gives permission to be somewhat naïve, and permission to not know everything," said Kleyn. **"My intention for all of us is to free ourselves up from our industries, to ask questions and share. Let's see this as an opportunity to bridge the significant divide that exists not only in this country, but this continent."**

Conference host, GIBS international faculty and Georgia Tech lecturer Lew Roberts, kept Africa firmly at the forefront of discussions over the two-day event, observing that many technologies are already finding a home in the African context.

“We don’t have flying cars, yet, although we do have drones and automated skateboards,” said Roberts. “But we also see a plethora of technology coming through... this whole area of emerging technology continues to emerge. It’s a continuous wave and nobody knows what’s coming yet.”



In case you missed it, or would like a recap of what was shared at the conference, we have compiled a summary of the key insights from all the speakers on the day.

Speaker Day 1

Keynote address: **Emerging technologies and our future world**

DR KENNETH OYE

Professor Political Science
and Data Systems

Massachusetts Institute of Technology

*“Moore’s Law looks slow then you look at what is going on in DNA sequencing and synthesis.” - **Dr Kenneth Oye***



The great convergence current underway in the world of technology and innovation is, said Dr Kenneth Oye, directly related to the merging of information technology and biological technology. Biotech is changing rapidly, overlapping siloes and dissolving previous barriers. In the process it is asking serious ethical, environmental, social and security questions which must be considered in the quest to balance the risk of new technology with the rewards and opportunities.

To highlight his point, Oye outlined a number of innovations taking place currently in fields such as agriculture, healthcare, disease prevention, mining, transportation and manufacturing. All of these examples are stretching both human imagination and ingenuity as well as challenging regulations and ethics codes of conduct.

The recent case of the Chinese CRISPR-babies, where the brains of twins Lulu and Nana were genetically edited before birth to give them immunity to infection by HIV, was also discussed. Chinese scientist He Jiankui has since been suspended and the consequences have been severe, explained Oye, pointing out that “the reactions in China have been worse than in the West”.

Oye stressed that there should be a code of conduct for researchers and suggested widening the scope for engagement to include critics of new technologies, civil society, business, regulators and researchers. It was also necessary, he said, to accept that applications like gene-based technology could have implications and effects which the creators do not foresee. Hence the need to balance potential benefits with risks.

How technology is being stretched

<p>Sustainable salmon - AquaBounty, a United States biotechnology firm, lays claim to creating the world's most sustainable salmon. By modifying salmon genes, the company is able to grow the fish bigger and faster, but they received pushback when the product came to market.</p>	<p>Synthetic vanilla - Swiss synthetic biology company Evolva's synthetic vanilla-bean replacement vanillin is brewed from yeast. When, in 2015, Nestlé committed to only using natural vanilla, demand for the natural product soared, sparking interest in vanillin. But the product has been the subject of consumer concerns.</p>	<p>Gene-editing</p> <p>Eradicating diseases: In the American state of Florida, British biotechnology firm Oxitec engaged with the community on releasing lab-grown mosquitos to combat infectious diseases. They abandoned the project due to resistance. But, gene-based technology can be used to try and eradicate diseases like dengue fever.</p>
<p>Opiate production – Producing opiates in yeast, instead of via poppy plants, creates analgesics which are less addictive.</p>	<p>Tackling African swine fever – Using in-embryo gene-editing to create livestock that is resistant to this highly contagious viral disease.</p>	<p>Agricultural applications: Modifying plants to improve their tolerance for salt and even turning plants into desalination facilities.</p>
<p>Self-fertilizing crops - Voigt Lab is working on creating Nitrogen-fixating legumes that can make their own fertilizer.</p>	<p>Xenotransplantation – Transplanting organs from an edited pig genome into humans.</p>	<p>Livestock applications: Chinese researchers have altered one gene in cashmere goats to create longer hair.</p>

“We don’t know what the end story will be. Myopia is very evident and the cool stuff that often takes off is usually the unimagined technologies,” he said. Sometimes new technologies require other technology to be develop first, so it can build on those capabilities. Therefore, it is increasingly important to look at the full picture with reference to both legal standards and ethical norms.

“You need to be doing more than mere compliance. And those duties and responsibilities are both good ethics and good business,” said Oye.

Speaker Topic: **Machine learning and artificial intelligence**

DR PASCAL VAN HENTENRYCK

A. Russell Chandler III Chair and
Professor in the H. Milton Stewart
School of Industrial and Systems
Engineering

Georgia Institute of Technology

*"I'm going to give you a set of magic tricks,
by telling you what we can do these days."* -

Dr Pascal Van Hentenryck



You can hardly tune into social media, the mainstream press, TV or radio without being inundated with the hype around AI and machine learning, and the issues these new technologies are raising. The reality, though, is that machines have been part of our lives for decades and while their application is deepening, this is not a new debate.

Dr Pascal Van Hentenryck began his presentation by remembering the chess battle between Garry Kasparov and IBM's Deep Blue computer in 1997, which the grand master lost. While this was a tremendous achievement, more recently the ancient strategy game AlphaGo has attracted the attention of AI. "This is a more complicated game and the predication was that computers wouldn't be able to challenge the best players for 20 years," said Van Hentenryck. But, in 2016, AlphaGo beat 18-time world champion Lee Sedol in a five-game challenge.

In short, computers and digital technology are evolving at fast pace and have the advantage of being able to process large quantities of data and search for commonalities. Tasks previously regarded as being either too challenging for computers to tackle – yet - are coming on stream, such as speech recognition (think Apple's Siri and Amazon Alexa), facial recognition (just ask Facebook about the privacy challenges around this technology), translation ("Google Translate is improving every year") and digit recognition ("for a computer this is incredibly difficult", said Van Hentenryck, but in the past five years the progress being made is impressive).

Some computers that can now detect cancer by looking at sequences of videos, and applications are being rolled out in hurricane predictions and sentiment analysis. Interest in the field is blooming

<p>7 745</p> <p>The number of submissions made to the 33rd AAAI Conference on Artificial Intelligence (AAAI-19), held in January 2019.</p>	<p>S2 419</p> <p>The number of papers submitted by China (382 were accepted)</p> <p>1 280</p> <p>The number of papers submitted by the United States (264 were accepted)</p>	<p>16.2%</p> <p>The conference's paper acceptance rate, a new record.</p>
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To make sense of this surge in interest and application, Van Hentenryck took delegates through the basics of machine learning, highlighting that this was linear regression in its simplest form, and that most of the work being done was around minimising the 'loss function'. At the moment a great deal of attention is being paid to deep learning and "CNN (convolutional neural nets) have revolutionised the field of computer vision" albeit that training these machines is not always easy. Long Short-Term Memory has also been highlighted as the most significant advance in AI in recent years.

The advantage of machine learning, said Lelo Mdhlahla, is that it is democratic.

“Machine learning is problem agnostic, so you can apply these to any problem and a problem is always local. It doesn't mean the problems in Africa are the same as those in the United States, or Asia. They don't have to be the same problems we have in other parts of the world.”

Right now there are limitations, “and we don't understand all the things we are doing”, he admitted. It is easy, for example, to fool these systems and this brittleness still needs to be

understood. However, machine learning systems can be better than humans if they are allowed to work on specific data sets. “They will outperform humans in certain situations, but if you apply this to other situations then less so. They need to be trained for those systems,” said Van Hentenryck.

When it came to the human interface with machines, and the potential for overtaking human abilities, Van Hentenryck was clear that when using these tools would spark societal change - such as the impact of self-driving cars on jobs - that regulation was critical.

Other concerns on the horizon currently also include bias and privacy. Quoting his Georgia Tech colleague Peter Swire, an expert in privacy law, Van Hentenryck stressed that systems are data greedy but much of the information they need to form a complete picture is private. That represents a challenge. Bias, of course, has the potential to skew data and is a “severe issue”.

Ultimately, however, machine learning is here to stay and will continue to grow. The field is much bigger than we have yet explored, said Van Hentenryck. It's not just predicative analysis but also descriptive analysis and prescriptive analysis, all areas of focus for the future.

Speaker Topic:

Using artificial intelligence and data analysis to solve healthcare issues in Africa

DR ELTON DORKIN

Dr EP Dorkin & Associates

Part-time GIBS faculty member

*“AI is making an impact in high-income countries, one analysis shows US\$150 billion saving by 2026.” - **Dr Elton Dorkin***



Opening a multi-pronged session focusing on African healthcare, Lew Roberts observed: “One of the benefits of big data is to gain insight.” He highlighted the potential to pool data from thousands of doctors around the world who are treating cancer, in an effort to share data and share insights.

When it comes to Africa, however, Dr Elton Dorkin of DR EP Dorkin & Associates, and a part-time GIBS faculty member, stressed the importance of taking a step back and recognising that while you might be receiving world-class treatment at a clinic in Sandton, that just 10km down the road most settings are resource poor. This, he said, demanded a different use of technology to meet more basic healthcare needs.

The real problems facing many African countries is less about gene editing, but rather about clients who don't have the staff to look after the patients. “Only 10% of health is contributed to by healthcare, 90% of health is clean running water, a job. If this can make health better it will do more for people's health than just focusing on healthcare,” he said.

For Dorkin, this human impact underlines his interest in technology. “I am interested in AI like I am in a blood pressure machine: I don't know how a blood pressure machine works but I know what to do with the information and I know what its limitations are. I'm not a deep subject expert but I'm also not a fool. I am a sceptic but I am an optimist at the same time.”

There is no universally accepted sub-field of AI in healthcare but it does include the likes of expert systems, machine learning, natural language processing, automated planning and scheduling, and image and signal processing. All of these require base technologies to be in place, such as cloud technologies, electronic medical records and health informatics. Fortunately, Africa generally has good penetration of these technologies, said Dorkin, and “there is a large AI-for-development community. A major lesson from them is building intelligence into existing systems and institutions rather than starting from scratch or hoping to replace existing systems, however broken.”

Innovation do exist, said Dorkin, but most require skills to manage and understand them. “Whether you are in the West or Africa, it requires expertise. You need to sift through information for what is useful and what is not, and you need to ensure accuracy of tracking and trust. Then you can consider how you integrate the various AI systems.”

African healthcare applications

Natural Language Processing	AI planning and scheduling	Signal and image processing
<p>By scouring online sources and social media, it is possible to pick up key words to help map and detect outbreaks, health disparities and adverse drug reactions, and the like.</p>	<p>Using technology to plan for immunisation schedules, supply chain management and scheduling visits for community health workers.</p>	<p>Expert systems can be used to highlight the likelihood of diagnoses like birth asphyxia, based on a risk score. But the challenge in Africa is still the expert skill needed to act on this, said Dorkin.</p>
<p>Machine learning</p> <ul style="list-style-type: none"> • Predicting epidemics like dengue fever and where the hot spots are for transmission. • Using technology to guide cancer treatment. 		<p>This sub-section includes wearables, radiology and dermatology – all of which can be handled by technology rather than people.</p>

There are, of course, challenges around this uptake of technology in Africa, not least of which is the quality of data sets. “A lot of medical information doesn’t sit on the system. Some people pay for doctor visits independently and if we don’t have information then that’s a problem,” said Dorkin. He also highlighted bias, the need to standardise medical terminology as well as issues around skills and privacy as considerations that must be addressed.

Quoting from Eric Topol’s book *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again*, Dorkin stressed: “AI is quickly evolving and is already being used to support and improve health services in many high-income countries. It also holds great promise for improving the delivery of health services in resource-poor settings; although further research and investments are needed to accelerate its deployment in such settings.”

Speaker Topic:

Telemedicine and analysis: revolutionising healthcare in Africa

DR EVANGELOS APOSTOLERIS

Specialist urologist

Olivedale Netcare Hospital, Life Fourways Hospital, Cure Day Clinics Fourways

“We need to change from bricks to bytes and use smartphones above hospital visits.” - Dr Evangelos Apostoleris

“Education is important in healthcare, so with Apps people can take charge of their health. And if patients are aware of the data, it helps,” Dr Evangelos Apostoleris noted in his presentation,

in which he also called on clinicians to reflect on their own data sets, rather than relying largely on external insights.

Telemedicine and data are the next steps towards personalisation in healthcare, and this will rely heavily on data gathering and the analysis thereof. It is increasingly obviously that the world is moving towards a value-based approach to healthcare in which access is important, healthcare outcomes are important, cost and satisfaction and your health-care practitioner are significant. But is South Africa ready for this new world?



Based on information from the Future Health Index 2019 by Philips, which shows how countries around the world are shaping up in using technology to improve the healthcare experience for both healthcare professionals and patients, South Africa is lagging. “With technology comes infrastructure and in South Africa it’s important to look at internet penetration, servers per capita and mobile speed, along with regulation,” said Apostoleris.

With less to spend on healthcare than more developed nations, it is important for South Africa to be careful in how it allocates funds.

	South Africa	England
GDP per capita:	US\$6 151.08	US\$39 720.40
Healthcare exp/capita	US\$470.80	US\$4 355.81
Av. Life expectancy	63.6	81.4
Infant mortality rate (/1000)	28.8	3.7
Top cause of death	HIV/Aids	Coronary artery disease
Input (HC/GDP)	8.2	9.9
Overall outcome score	37.1	85.8
Efficiency ratio	4.5	8.7

Source: Future Health Index 2019

Despite the savings and efficiencies that can be gained by driving a telemedicine approach, South Africa continues to lag 16 country peers in adopting telehealth and remote monitoring. Yes, there are innovations coming out of the Department of Health, such as MomConnect and NurseConnect – which aim to support maternal healthcare using cellphone-based technologies – but subsequent to the Presidential Health Summit in October 2018, and considering the mHealth Strategy SA 2015-2019, South Africa not sharing information widely and is not recognising the importance of healthcare organisations becoming ‘data organisations’.

In Australia, meanwhile, the country is rolling out a digital ‘My Health Record’ which every citizen is entitled to and which they can delete if they want it. “This is health information accessible whenever and wherever which is high quality and which is secure,” explained Apostoleris. Similarly, in Finland, that country’s Kanta Services are a digital health and social care treasure chest. Patients agree to share healthcare data and information is easily and quickly accessible, flowing between

healthcare professionals and ensuring better treatment. Both systems rely heavily on trust, something which may be lacking in the South African context.

Of course, noted Apostoleris with regard to regulation, all telemedicine innovations must ensure patient privacy and compliance with personal information legislation is important, “but if the regulatory framework is used, it has potential”.

There are benefits and cost savings along the healthcare chain if technology is adopted in the manner it has been in Finland and Australia, said Apostoleris. It makes simple tasks easier and allows more time and focus to be placed on much-needed and under pressure human skills and abilities.

Ultimately, concluded Apostoleris: **“The patient should be at the centre of healthcare.” And this is where telemedicine has huge applications. “Together with good leadership we need to work together to create an ecosystem.”**

Key take outs from a facilitated discussion: **Audience Q&A session**

DR ELTON DORKIN

Dr EP Dorkin & Associates

Part-time GIBS faculty member

DR EVANGELOS APOSTOLERIS

Specialist urologist

Olivedale Netcare Hospital, Life Fourways

Hospital, Cure Day Clinics Fourways

LEW ROBERTS (Moderator)

GIBS international faculty

Georgia Tech lecturer



Following presentations by Dr Elton Dorkin and Dr Evangelos Apostoleris, Lew Roberts moderated a Q&A discussion that touched on issues from privacy and trust, to the African context, how to best use these digital tools and the importance of data sets. Key sound bites from the discussion included:

“There is an agreement between sharing information in Nairobi ... and one of the principles was that if information is paid for by the public then the public should have access to it. So the information within government-created systems should be able to be put to use for the good of society, with an opt-out option.”
– **Dr Elton Dorkin**

“Finland is the most advanced country in the world because of trust. In the United States we are terrified that disability insurers will have access to information.”
– **Dr Kenneth Oye**

“[There are examples of] reverse innovation, which takes place in less developed countries and diffuses back to more advanced countries. Like the hand-held ultrasound, but it’s not a trend. You don’t see this happening often. It’s often the reverse, but we might not be able to use this technology due to the infrastructure. But there are opportunities to leapfrog.”
– **Dr Elton Dorkin**

“Sometimes something as simple as running water could be the most important health-care intervention in a community, or building a road so an ambulance can get through. Your money is best spent on that. Sometimes importing a technology which depends on 5G isn’t the option. We need to be careful with our resources and we need to play, and we can only plan if we work together as a team.”
– **Dr Evangelos Apostoleris**

“It’s the engineers who come with the tools and make it easier and easier to use and more and more applicable to the problem at hand.”
– **Dr Elton Dorkin**

“Leadership from across the spectrum needs to stand up and take significant strides in the right direction. Let’s say technology can create savings in Johannesburg, for arguments sake. Then, if we are efficient, we can use those savings to build up infrastructure. We can constantly distribute our limited resources correctly.”
– **Dr Evangelos Apostoleris**

“When you have data you understand which hospitals are busy. So you might have 50 clinicians at one hospital when you actually only need 12. This is what the data shows you, and that other 38 you can send to the peripheral areas.”
– **Dr Evangelos Apostoleris**

“There is no health benefit of FitBit, but that technology can still help. We just need to understand and apply.”
– **Dr Elton Dorkin**

“The data has to mean something; not just ‘I did 10 000 steps’. The efficiencies you gain from good data is important.”
– **Dr Evangelos Apostoleris**

“Everyone must take care of their own health. We can’t be unhealthy and expect an insurance provider or the government to pay. We also need that element of responsibility that I look after my health, it’s the biggest gift I have in life.”
– **Dr Evangelos Apostoleris**

Speaker Topic: **Big data and the internet of things**

MANOJ CHIBA

Lecturer and data analyst specialist

GIBS

*“Without big data analytics, companies are blind and deaf.” - **Manoj Chiba***

Data is driving innovation, so any discussion about the potential for big data and data analytics must start with a discussion around where and how data is harvested. Trust is a critical component in these discussions, said Manoj Chiba, highlighting the harm done to the Facebook brand following the data sharing scandal involving British political-consulting firm Cambridge Analytica.

“We are quick to adopt but we are also quick to worry about our privacy. We must be pragmatic about many of the things coming through,” said Chiba, stressing that data is a bridge which enables something. Data is, therefore, essential. But it also requires that data is harvested from a variety of sources. Of course, the more digital doors you open the more chance you have of a breach.



“Big data is not about size, it’s about the ability to search, aggregate and cross-reference data sets,” said Chiba. Only then can the value of the data be truly appreciated. “For AI and all these things to work nicely, you can’t take a single data source. People are multi-dimensional, so big data is about different types of data.”

Failure to cast the net wide in sourcing data can lead to issues of bias, he warned, highlighting the danger of treating all people the same.

While many companies are currently struggling to understand the role of data in their businesses, Chiba was quick to stress that a data strategy should feed into a company strategy and not be elevated to something more. “Successful companies embed data analytics across the organisation, not in a single unit,” he noted.

Analytics is fundamentally a tool which should be used to navigate the change impacting society and economies at such an exponential rate. “Data allows us to move from uncertainty to usable probably. There’s a 60% change of something happening, rather than ‘I don’t know,’” said Chiba, noting that the bigger issue facing companies is how to make sense of this wealth of data to better serve consumers, to innovate and to address basic needs.

Technologies like AI, IoT and increased device usage are driving a change in the human condition, and with each new platform or device another avenue is opened for data collection. But what are we doing with this data, this intelligence?

IoT applications in the real world

EOH IoT	Air France/KLM	Smart cities
Using the IoT to sense and switch off geysers if they are going to blow. Saving R3 billion in replacement costs.	The PROGNOS system uses big data gathered each day from aircraft to apply predictive maintenance, thereby reducing costs and risks.	Impacting urban angst such as traffic flow, citizen security and tracking areas of infrastructure and resource strain by harvesting data.

While getting caught up in the convenience of connected devices like the Amazon Alexa, Chiba noted that a massive portion of the global population still has no access to the IoT. “We keep forgetting about a large portion of the African population that lives below the poverty line,” he said.

Chiba also highlighted the importance of combining innovations like machine learning with human talents. “Machine learning, for me, really comes into play in strategic decision-making,” he said. “It’s about feeding data and information in the form of observations and real-world interactions to help us make decisions. It’s still a human who must make a decision

based on the context in which they are operating.”

In other words: If your heart rate goes up and this is picked up by your Apple Watch, the device will direct you to a doctor. But it doesn’t replace the doctor.

Speaker Topic:

Sensors and big data for precision farming

BRIAN BOSIRE

Co-founder and CEO

UjuziKilimo

*“We are at a point where climate change is a big issue, which will affect emerging farmers. AI and machine learning are a means to an end to helping farmers address these issues.” - **Brian Bosire***

Kenyan innovator, Brian Bosire turned the spotlight firmly on African technology applications as he outlined how UjuziKilimo uses a simple sensor device to monitor and collect soil sample data which is analysis via a real-time interactive platform. This data collection phase is then supported by providing insights around crop management directly to farmers via SMS. These interventions are intended to help local farmers improve farming methods and yields.

The company, which means ‘knowledge farming’ in Swahili, was created to tackle a fundamental lack of knowledge about fertilizing, how the markets operate and how to maximise yield. In Kenya, Bosire explained, not only do farmers lack knowledge, but they also lack help, with one agricultural extension officer allocated to support 1 200 farmers. The poor application of fertilizer alone means that Africa has lost 37kg of macronutrients a year over the past 30 years, he said. With the



continent’s population forecast to rise to more than two billion people by 2050, this is a critical concern for food security.

Using the UjuziKilimo device, farmers can determine the pH of their soil, as well as salinity, moisture, type, macronutrients, organic carbon and GPS data – all this is measured in just five minutes for US\$6, which can be paid via mobile money. The farmer receives actionable data about the best crops to plant and what to do and has access to a personal profile containing historical data.

Bosire shared that 11 000 Kenyan farmers have signed up to UjuziKilimo in 2019 alone and 30 million datasets have been collected. The platform also increases the prominence of agro dealers and their products, as well as increasing the visibility of the sector as a whole.


33 million

Smallholder farms in Africa



>80%

The amount of food consumed in Africa which comes from smallholder farmers




<2 ha

Average farm size




US\$1 000

Average annual budget for agriculture inputs per farmer



1.8

Average tons of cereal produced per hectare



80%

Household income derived from agriculture across Africa



200 million

The size of the African farmers market by 2021

UjuziKilimo has partnered with World Bank and Google to scale up the offering. Although, during the Q&A session which followed the presentation, issues around cross-border data sharing and privacy were highlighted as a potential challenge to achieving scale. Other considerations raised included the need for a voice option, to cater for illiterate farmers, and for a multi-language approach (currently only Swahili and English are used). How to monetise the innovation and diversify the offering to include the likes of disease predication and pest control were also discussed.

Speaker Topic: **Emerging energy technologies**

DR PASCAL VAN HENTENRYCK

A. Russell Chandler III Chair and Professor in the H. Milton Stewart School of Industrial and Systems Engineering

Georgia Institute of Technology

"I think there are incredible opportunities in energy across the entire African continent." - Dr Pascal Van Hentenryck



Micro-grids (interconnected energy resources that act as single entities on a grid) came in for discussion during an energy-focused presentation which highlighted the optimisation of existing energy grids, the challenges being created by climate change and the potential impact of technologies like solar and wind.

Each time you flick on a light there is a huge machine operating behind the scenes to ensure generation can meet consumption. This power must be transmitted from where it is generated to where it is consumed and the balance between output and usage must be in place at all times. This is one of the reasons why renewable energy hasn't been able to scale up on demand, because it lacks the reliability of nuclear or coal.

"But we need a paradigm shift," said Van Hentenryck.

Using storage to deal with this problem is increasingly challenging the system, since it straddles the traditional production and distribution model. Already there are plants around the world challenging the status quo:

- Virtual power plants, like those in Queensland, Australia, combine battery storage with solar. And, with four hours of battery life, they can meet demand even during peak times.
- Concentrated solar plants, such as Ouarzazate in Morocco, combines solar with a storage plant which can be run all day, for 10 days. The plant has 7.5 hours of energy storage.
- Kathu Solar Park in the Northern Cape "is also an impressive solar park with storage of 4.5 hours", said Van Hentenryck. As is Bokpoort, also in the Northern Cape, which can generate solar on demand.

But nobody has yet figured out how to invest in transmission, said Van Hentenryck. This is where micro-grids step up. They can be sized for communities, they simplify the distribution channel and they don't have to be operated centrally.

“Africa is going to double to 2.4 million people by 2050 and will consume more electricity, and many of these isolated communities are a good fit for micro-grids. If you combine this with concentrated solar parks, then you have a good innovation,” said Van Hentenryck.

While it is harder to switch established economies like the United States and those in Europe from the old energy system, Africa has the potential to leapfrog old ways and make use of new systems, like micro-grids. “Even the vertically integrated players have to invest in micro-grids, as this is the future,” said Van Hentenryck. “There will be a major disruption, but this disruption is easier to do in Africa than anywhere else. There are entire business opportunities here.”

Africa can lead the way in dispatchable renewable energy, harnessing the optimising power of AI and machine learning, said Van Hentenryck. “Solar energy could power the entire continent and ensure we don't go into an ecological disaster.”

Speaker Topic: **Energy solutions for rural communities in Africa**

LELO MDHLADHLA

Chief Marketing Officer

POWERX

*“We have an energy Innovation pipeline
which can propel Africa to the forefront
of the global economy” -*

Lelo Mdhladhla

The energy solution is different for different markets. In advanced economies it's about improving on existing infrastructure to create better efficiencies, said Lelo Mdhladhla, whereas in markets like Chile they are faced with improving infrastructure and generation.

“In Africa it's about access to lighting, heat, and cooking and sanitation.”



650 million people out of 1.4 billion
don't have access to electricity in Africa.

Sub-Saharan Africa's **rate of electrification**
is 44% (the global average is 89%)

Sources: World Economic Forum, Thomson Reuters Foundation

Challenges facing the African continent include access to energy, security of supply, environmental issues and the very real impact of climate change and the costs associated with natural disasters. Some countries also lack the necessary infrastructure. This is why small-scale innovations such as Kenya's M-KOPA Solar and AzuriTV are worth noting, because they bring household power solutions to the people, while cutting out the traditional distributors and power generation firms.

- M-KOPA Solar allows you to own a system on a pay-as-you-go basis. After 12 months you own the system. It's quick to install and it's yours for life. The 600 000 households provided with this form of solar power will save US\$450 million over four years compared with using kerosene fuel.
- AzuriTV has linked a solar offering to its entertainment offering of 60 channels of local and international radio and content. Equipment is paid off in instalments and, when the product is owned outright, the energy generated is free. The product comes with four LED lights, a rechargeable radio and torch and mobile phone charging.

Bio gas is another option, said Mdhlahla, which can be used to power electronic devices using livestock waste. The World Bank has been working with rural women in Tanzania to highlight the value of homemade biogas fuel as an alternative to expensive and polluting cooking fuels.

There are profound opportunities for energy access in rural Africa, said Mdhlahla. **"It's about being quick and nimble and looking for solutions that are suited to the community and not necessarily the investor. For example, in Mauritius, because they don't have huge land mass, they are looking at floating solar parks."**

Mdhlahla warned that countries lacking South Africa's sophisticated power grid and infrastructure are actually in a position to leapfrog South Africa in the future as they will not be weighed down by the same sort of legacy capital infrastructure. "So Kenya, Uganda and Malawi will be on the forefront of energy solutions in the future," he predicted.

Key take outs from a facilitated discussion:

Emergent to converging technologies

BRIAN BOSIRE

Co-founder and CEO
UjuziKilimo

LELO MDHLADHLA

Chief Marketing Officer
POWERX

DR PASCAL VAN HENTENRYCK

A. Russell Chandler III Chair and Professor in the H. Milton Stewart School of Industrial and Systems Engineering
Georgia Institute of Technology

DR EVANGELOS APOSTOLERIS

Specialist urologist
Olivedale Netcare Hospital, Life Fourways Hospital, Cure Day Clinics Fourways

MANOJ CHIBA

Lecturer and data analyst specialist
GIBS

LEW ROBERTS (Moderator)

GIBS international faculty
Georgia Tech lecturer

Wrapping up the first day of the conference, the panellists applauded the insights shared on renewable resources, farming and healthcare and stressed that technology – particularly in the African context – had the potential to solve for real problems.

But challenges facing the continent in terms of technology uptake and business opportunities highlighted significant issues such as:

- The need for governments to create an enabling environment.
- A call for governments to lower barriers to entry.
- The challenges around the cost of doing business.
- How to start by focusing on solving single problems, and worrying about scaling and business cases down the line.

- The challenges around regulation failing to keep pace with technological change.
- A need to encourage failure and allow innovators to learn through failure.

Particular focus was placed on using technology to solve for Africa's problems, and whether a meaningful discussion could even be expected to take place between the developed and emerging worlds when the issues facing these two worlds are so diverse.

“Are we in ivory towers?” asked Dr Pascal Van Hentenryck. “Even in the United States we have people who don't have a home, but they might have a job. Inequality is widening. This is not just an issue of Africa. How do you find solutions to these communities, since the problems are different to those of the other communities. You need to think of this holistically.”



In response to a question from the floor, it was roundly agreed that solving complex issues such as inequality required a transdisciplinary approach that would bring communities, academic institutions, governments and business to the table. **“There is a real role for research and development and we need to have the conversation about what the role is of research,”** said Lew Roberts.

This same, collaborative and partnership approach would have to be applied in the future to address complex future issues such as the impact of AI and technology on the world’s human workforce and skills requirements.

Observed Manoj Chiba: “Because of AI and tech there is going to be a net gain of jobs available [the World Economic Forum says while 75 million jobs around the world could be displaced by 2022 due to robots, some 133 million new jobs will

be created]. Things we can’t imagine will need to be done. It’s going to be difficult to understand what is going to happen in the next five years, and what those jobs are.... [but] nothing will create critical thinking and innovative creative thinking.”

Chiba concluded: **“The road to that [a net gain of jobs] is going to be bumpy, but panicking is not going to solve the problem. We need to reskill ourselves. We have access to free online courses, why are we not using those?”**





Speaker Day 2

Speaker Topic: **Blockchain Technology**

DR BITANGE NDEMO

Associate Professor of
Entrepreneurship

University of Nairobi

“Only six countries are ready to exploit 4IR. There are still too many countries shutting down internet when they do not like what news is being spread.”

- Dr Bitange Ndemo

Africa has experienced three major waves of innovation with the advent of digital technology:

- The Internet in the form of Google and Yahoo!
- Mobile connectivity including Facebook, Twitter, Alibaba and WeChat.
- And now blockchain, which is most evident in technologies like Uber and Airbnb.



What is blockchain?

“Blockchain is an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually anything of value.”

Source: Don Tapscott, author of Blockchain Revolution.

Blockchain is disrupting business processes and enabling new ones, both globally and locally. It is making new systems more efficient, affordable and secure, and, said Dr Bitange Ndemo, this technology is going to have a major impact on African governance in the future.

An example he gave is the running of the Kenyan national elections. Blockchain technology will allow for the better control of data. This means that candidates will no longer be able to fabricate degrees, criminal records or other pertinent records. Ultimately, Ndemo said during his presentation, blockchain will make the electoral process more transparent.

In addition to improved transparency in Africa's democracies, blockchain is also influencing the way the African private sector is doing business. In the future blockchain will become invaluable to companies across the value chain. Logistics companies will be able to better track their assets throughout their journey. Proof and the transfer of assets will be immutable, as there will be a single 'source of truth'. Companies will be able to use smart contracts across a range of business endeavours, and there will be collaborative development of assets through their lifecycles, from design to maintenance.

Consumers will be able to ensure that they are getting the products they want through improved traceability and provenance of products, right from their source. And, finally, a better understanding of the value chain will emerge, enabling business and financiers to better understand the risks associated with various players along the chain.

Ultimately, Ndemo explained, blockchain will result in greater ease of doing business, a greater understanding of the risks involved with doing business on the continent, more transparency for consumers, and also improved data privacy.

But the uptake of this technology is a slow process and Ndemo believes that this is due to a combination of not fully understanding the technology and a lack of government policies and legislative frameworks. He listed the major issues as:

- Resistance to change
- Lack of capacity building
- Lack of enabling infrastructure
- Lack of enabling legal frameworks
- Lack data protection laws
- Uniting Africa into one economic block
- Regulatory challenges.

In order to facilitate the adoption of any new technology (not just blockchain) African countries must be smart when they look at policy and regulatory issues. **“We need to recognise our weaknesses,” said Ndemo. He added: “We need to change our laws, we need to enable the development of our capacity, and that requires external help.”**

Ndemo then called for the African Union and Africa as a whole to collaborate and share data. He called for greater leadership in this arena and said that Africa must be careful not to allow data to be mismanaged or deleted by governments who do not approve of its content. He also urged African countries to consider standardising legislation for the continent.

Finally, he said, that while people don't need to understand the technology available, they do need to see the benefits of it. Already, said Ndemo, the private sector is benefitting from game-changing developments like blockchain.

Speaker Topic: **How blockchain technology can serve emerging markets**

TUNDE ELIJA KELANI

Product Manager

Crowdforce

“We are trying to encourage the adoption of blockchain technology, driving leadership from the bottom up to try and get the technology adopted.”

- Tunde Elija Kelani



One of the companies that has successfully adopted the use of blockchain technology is Nigerian firm Crowdforce. They are applying this technology to the collection of data and to the provision of digital financial services. “We are using a network of field agents, the largest agent network in Africa, to collect to better enable financial inclusion services in the country,” explained Tunde Elija Kelani.

He added: **“Data is the new oil. People want to get data and organisations need data to make decisions, even government policies require better data.”**

Kelani explained that collecting data in Nigeria is challenging. The communities in which Crowdforce operates are often hostile and resistant to sharing information. In addition, there are areas with poor mobile networks (which are vital for their work) and organisations such as Boko Haram are further hampering data collection and mobile penetration in some provinces. As such Crowdforce has had to innovate in terms of how they tackle these issues.

The company’s biggest and most valuable resource is its more than 100 000-strong network of data collectors across Nigeria. These people are often trusted members of the communities in which they operate, making communities more comfortable to share information.

Crowdforce's initial product offering was that of data collection for its clients. They started off by using their field agents to collect data through the use of mobile forms. Kelani explained that Crowdforce had specifically trained and incentivised these agents to collect meaningful data. The value of the way they work is that it affords real-time data for their clients. An invaluable resource in a market like Nigeria.

Through their data collection work, the company then saw a massive opportunity to help those who have traditionally been excluded from traditional financial services to access to digital financial services. This saw the launch of Payforce, the company's digital financial solution.

“We are looking to move people into the digital economy,” said Kelani. He explained that, globally, 94% of all transactions are still cash based, two billion people are unbanked and there is still a massive lack of transparency when it comes to the financial services industry.

With the goal of moving Nigerian, and African, people into the digital economy, Payforce has set itself a monumental task. Their ambition is to get one million merchants and agents to reach one billion consumers across Africa. “We empower micro businesses with the tools that drive mass adoption to digital,” explained Kelani. Payforce, through using cryptocurrencies

and digital financial services, is helping people move towards a cashless economy. However, if they do need cash, they are able to ‘withdraw’ funds from the microbusinesses (which transact in cash) within the network.

In this way, said Kelani, **“we are reaching communities that banks are unable to reach”**.

Their model is to incentivise local and trusted retail outlets in each community to render financial services via Payforce Terminals. This enables the company to convert people to digital banking, which is critical for financial inclusion, explained Kelani, who noted that some of the biggest markets in Nigeria are still unbanked.

So, where to next? The company is looking to attract and keep track of is the US\$61 billion in remittances flowing into Nigeria from the country's large diaspora. And they are now seeking to help government ensure that the more than two million people who are collecting pensions are actually still alive through the use of biometric scanners.

But two key issues facing the company going forward, concluded Kelani, will be the issue of privacy and data protection.

Speaker Topic: **Internet and digital technologies**

DR SOUMEN GHOSH

Professor of Operations and Supply Chain Management

Scheller College of Business at Georgia Institute of Technology

*“Digital disruption is a change in behaviour.” – **Dr Soumen Ghosh***



The first thing Dr Soumen Ghosh noted during his address was that the adoption rates of new technologies have increased exponentially:

To get to 50 million users it took:

- Radio - 38 years
- TV - 13 years
- The internet - 4 years
- Facebook - 2 to 3 years
- Instagram - 6 months
- Angry Birds - 35 days
- Pokémon Go - just a few hours.

Technologies have changed the way we consume various media. Take listening to music for example, which went from vinyl LPs to tapes, then to CDs before the iPod came along, and now people are streaming their music through platforms like Spotify. The same goes for movies and television, the likes of Netflix and Showmax have all but obliterating traditional TV and cinema, while Facebook, BuzzFeed and their social media counterparts are slowly eating away at more traditional media sources like newspapers and news channels.

Even the way we shop is starting to move away from brick and mortar to online shopping with big names such as Amazon, Alibaba and eBay starting to dominate the global retail space; while banks are being disrupted by mobile money and cryptocurrencies. The adoption of technology is happening so fast, that Ghosh noted that beggars in China have turned to wearing QR codes to make it easier for China's urban and largely cashless society to make a donation.

Ghosh then said that businesses had to wake up to the fact that the disruption to any supply chain is being driven by the end consumer. If you move along the chain from raw materials, to suppliers, manufacturers, distribution, retail/customers and consumers, the disruption is taking place between retailers and consumers. And the people ultimately driving the change are Generation Z, those born between the mid-90s to the mid-2000s. They are the keenest adopters of technology, he said, noting that on a global scale it is worth noting that the Chinese market has overtaken the United States when it comes to e-commerce.

Ghosh noted that there were four major changes taking place when it comes to meeting the demands of consumers.

These are:

1. Increased product variety. Consumers are demanding more choice.
2. Increased product personalisation. Consumers are willing to pay a premium to have products custom-made for them. Many global organisations are piloting schemes to allow this, from 3D printing pasta shapes, to mix-and-match beverage six-packs.

3. Frictionless commerce. An innovation which allows consumers to walk into a shop or restaurant, choose their products and walk out without having to go through the usual payment channels. Using facial recognition and scanners, commercial outlets simply debit their accounts as they exit the store. We are seeing this in the Amazon Go concept and Alibaba's Tao Cafés.
4. Direct to consumer proliferation. This is taking hold as consumers demand that products are delivered straight to their front doors. Shopping is being aided by augmented reality which allows people to make decisions on clothing and makeup on their computers.

Big tech giants such as Amazon and Alibaba are leading the way in this technology and Ghosh warned that local organisations who are not changing, adapting and keeping up, will fail. This, he said, is already a reality.

But as consumers become more demanding, the rest of the value chain is going to have to catch up. The 'phy-gital' (physical and digital) supply chain will have to adapt, while the physical delivery of goods will have to match the digital revolution impacting consumer behaviour.

Speaker Topic:

Digital technologies and innovation in Africa

NJIDEKA HARRY

Founder and CEO

Youth for Technology Foundation

“How can young people compete with 21st century opportunities and how can we match talent with potential?”

- Njideka Harry



Africa has a massive youth population which can either be a dividend or a disaster for the continent, said Njideka Harry. She noted that as many as 40% of jobs available in the market today do not go to young people, and this is a problem. For Harry, education is a key factor in the success of young people on the continent.

However, Harry warned that current education systems are obsolete and that Africa's youth who are moving through the current education system will not be able to secure employment when they are done. She lamented that many were not even leaving university with employable skills.

Harry told delegates that education needs to be about teaching young people the ability to learn. She said that it is not only about equipping the youth with skills for the future.

“They need a flexible learning model to be able to adapt to the tech coming out - 65% of the youth will end up in jobs that do not exist yet,” she explained.

Harry said that the importance of what she was saying is highlighted by the fact that the market is predicting 1.5 million new digital jobs by 2020. How, she asked, does Africa hope to compete in such a world? The answer, she stressed, lay in reskilling the youth.

And reskilling the youth is the task Harry set herself when she formed her foundation. As technology has evolved, so has the offering that Harry's foundation created. In 2001 the focus was on basic computer literacy but now, nearly two decades on, and Harry is committed to helping Africa's youth to become more

What does Africa need to understand about technology?

It accelerates quickly!	It has broad applicability and can transform multiple industries and impact people.
It has a large economic impact and creates economic value.	It has a transformative impact and moves surpluses from producers to consumers.

adaptable and able to invent, create and design a world they want for themselves. Her foundation now offers programmes encouraging the youth to use technology to find solutions to problems within their communities, from security to social projects.

As a community, Africa readily adopts technologies, especially as the costs fall. Some of the examples of the African adoption of technology included the continent's uptake of mobile technology which has resulted in the fact that some 12% of Africans use mobile money (well above the global average of 2%). But to get African even more on board this digital revolution, she urged that businesses and the private sector would have to get involved and help formulate the continent's digital strategy.

Some of the disruptive technology that Harry believes Africa should be keeping its eye on are advanced robotics, energy storage including advanced battery systems, technologies that address local issues and 3D printing, which can offer a massive boost for the creation of jobs in the gig economy. The latter, she says, will also democratise manufacturing.

Harry urged African leaders who are serious about competing in a 4IR world, to start focusing on three key areas:

- Education - to get more players in the space.
- Infrastructure - specifically electricity and access to digital technology.
- Policies - that are capable of formulating an environment where ideas can be shared and can grow. An enabling environment that encourages innovation.

Her final word on the matter of preparing Africa to compete in a digital world, was that women need to be included in Africa's digital revolution. **“Women should not be left behind, 4IR should not increase inequality,”** she stressed.

Speaker Topic: **Robotics and field applications**

DR PETER CORKE Professor of Robotic Vision

*Queensland University of
Technology*

“We want robots to help us in our daily lives. We want robots who can help us at home, where they are human friendly.” -

Dr Peter Corke



Dr Peter Corke began his presentation by observing that we often think of robotics in terms of the dazzling humanoid machines depicted in Hollywood movies. The reality, however, is that robots are rather more pedestrian in real life than these glamour bots would lead us to believe.

In part this is due to the fact that designing and building robots is an extremely complex endeavour, especially as vision and hand-eye coordination form a very big part of what we require of automatons. He explained that when it comes to ‘seeing’, the understanding and decoding of images is incredibly complex for machines and requires bigger and better algorithms that enable computers to process pictures quickly and make rapid, accurate decisions about what they are perceiving. The most obvious example of this is the self-driving car.

Then, when it comes to movement, this requires further, often tricky, design requirements. Corke explained that that developers of robots are working now with the idea of reinforced learning, rather than writing equations to get the parts of a robot to move. **“With reinforced learning we reward a robot for doing what it is meant to be doing like walking for example,”** he explained. The robot is taught through simulations and learns through trial and error. “Moving robots require massive inputs, like where to put is feet on uneven ground,” he explained.

The future of robotics is bright and is making the time, cost and effort around their design worthwhile. First generation robots, those used in factories like automotive manufacturers, are still the most dominant use of robotics around the globe. They are fast, strong and locked away, as they can

unintentionally cause injury to people. But now robots are being designed to interact with human beings on a day-to-day basis and to enhance human productivity. These can take the form of vacuum cleaners moving through our homes, to delivery robots, medical robots, self-driving cars, port logistics, demolition robots, undersea robots, forestry robots, robots used for bomb-disposal, robots used in mining, the list goes on and on.

But what all this technology will have in common is that robots are now being asked to sense, think and act, and ultimately become autonomous.

Ultimately, though, what will drive the adoption of robotic technology, according to Corke, is that people have made the distinction between work and labour. He said, by their nature, humans do not like labour, so this is what robots will be employed to do.

Corke predicted that massive business opportunities will arise when it comes to the production of robots, particularly as the demand for robots soars. "Robotics for service delivery is a growing trend," he noted and said things like food delivery robots and robotic trucks are all innovations that are on the horizon. When it comes to self-driving cars, Corke said that AI cars can probably drive better than human beings and will result in far fewer deaths on the road.

But there is a resistance to the technology, and he said people need to get over the inherent bias they feel towards robotic technology. People, said Corke, still believe it is better to have 1.2 million people killed globally by human drivers, than 100 000 people killed by autonomous cars. "This is the big robotic dilemma," he said.

Another challenge to the adoption of robots, and especially a technology like self-driving cars, is that for it to be optimally functional, the quality of infrastructure needs to be enhanced, and this will require a massive amount of investment.

Ethical issues will also come into play when it comes to robotics and AI. A good example is this is robotic armies, and whether robots will ultimately be sanctioned to make decisions to kill people. In fact, the debate around allowing lethal autonomous robotic weapons is currently raging across the world.

Another ethical question being raised, is the issue of privacy. 'Seeing' robots all have cameras - a Tesla self-driving car for instance has six cameras - which means countries can essentially be creating armies of surveillance machines, and the concern is what happens to all that data.

Philosophers are also discussing whether AI robots will need to be given rights. And when will you be allowed to turn them on and turn them off?

Although robots are going to undeniably transform society, Corke's closing thought for the audience, was that no matter how the future unfolds, good regulation of robotics and AI technology is going to be key to ensuring that this technology is never abused.

Speaker Topic:

Building sensing and thinking machines with synthetic neurobiology

DR F. KENNEDY McDANIEL

Chief of Staff

Koniku

“We need to think of the globe’s circular economy. We need to stop thinking about stuff linearly.” - Dr F. Kennedy McDaniel



Dr F. Kennedy McDaniel’s presentation kickstarted with a call for businesses, especially tech firms, to stop thinking about the products they produce in a linear manner. Recycling and reusing are becoming increasingly important on a planet with limited resources. “We need to be reusing our stuff or the system will collapse... our e-waste is ridiculous,” she said.

While McDaniel noted that **“tech has always been around to make our lives easier and to help us support seven billion people, not sustainably, but to support them”**, the time has now come to think differently. And here, she said, the solution lay in looking to biology. Biology is constantly recyclable, she noted. “Biology can solve things that we cannot.”

Technology using living organisms means the devices can be reused when the cells die, she explained, adding: “When the biochip ends its lifecycle, we can recycle the degradable products.”

In addition to creating more sustainable technology through the use of biology, McDaniel said that biology has capabilities that digital technology does not. She said engineers and scientists are succeeding in getting technology to ‘see’, ‘hear’ and move, but she said a sense like smell will be virtually impossible to develop digitally, because smell is a more complex sense than vision or hearing.

She explained that humans have 400 scent sensors, dogs 1 000 and elephants 2 000. There are three trillion smells and we have 80 000 words to describe them. There is a massive opportunity here, and McDaniel asked how can commercial companies can develop technology to make use of this incredibly complex sense, especially given that vision and sound account for a US\$3 trillion industry across the globe?

One technology that McDaniel shared with the audience was how Koniku has used its knowhow to create biotech that can detect a specific explosive substance commonly used by terrorist bombers. The company took cellular organisms that could detect this substance, and then successfully infused them with a fluorescent gene from a jellyfish.

Now when those cells come into contact with the explosive, they light up, proving the presence of the substance. The benefit of this technology over, for example, sniffer dogs is that sniffer dogs can smell a substance, but they cannot tell their handler what they are smelling. Although these cells only detect a single substance, when they light up, they are telling scientists exactly what substance is present. “This technology is more objective and clearer,” said McDaniel.

This technology can now be used to check that products like beer are produced to the same standards, with the same taste and smell. McDaniel has also met with the brains trust at the Kruger National Park to look at using the technology to trace rhino horn, in an effort to try and curb poaching. The technology could link samples of rhino horn to a specific rhino. McDaniel also said they were using the cells to pick up the scent of a beetle pest decimating vast areas of the Kruger National Park. The technology can also be used to pick up diseases such as bird flu, swine flu and foot and mouth disease, which cost agricultural industries billions in blanket culling of potentially infected animals.

When asked about unintended consequences of using genetically modified organisms, McDaniel confirmed that their cells cannot transfer genetic information, can’t grow outside the computer chips, and die when exposed to open air. In other words, they can only complete their lifecycle within the computer.

To conclude her presentation, McDaniel assured the audience that the environment and any potential unintended negative consequences from their technologies are always front of mind for Koniku.

Key take outs from plenary session: **The future world: the impact of emerging and converging technologies on society and business**



DR KENNETH OYE

Professor Political Science and Data Systems
Massachusetts Institute of Technology

NJIDEKA HARRY

Founder and CEO
Youth for Technology Foundation

DR SOUMEN GHOSH

Professor of Operations and Supply Chain
Management
*Scheller College of Business at Georgia
Institute of Technology*

TONY CHRISTODOULOU

CIO: Africa for America Tower Corporation
Adjunct faculty: GIBS

DR PETER CORKE

Professor of Robotic Vision
Queensland University of Technology

ABDULLAH VERACHIA (Moderator)

Senior Faculty
GIBS

The conference drew to a close with a plenary session that touched on the key issues to come out of the two-day conference, and which asked questions of how the future world would continue to evolve; and what this would mean for business, society, governments and the academic institutions that attempt to make sense of these radical changes.

Of particular interest was the ethical considerations around technology adoption in unequal societies and how

Highlights from the discussion included:

Looking into the crystal ball

“Some technologies do change the world, but it is difficult to determine what the impact of a technology will be in situ. When you take a tech into the world of finance or governance there is an uncertainty about how things will develop. Some technologies are here and now, some are blue sky, like biological computing. Sticking to the stuff we know already makes things easier, but more boring.”

– **Dr Kenneth Oye**

“I’d like to focus not on the blue sky, 25-years-out stuff, but we should focus on the things that are tangible and almost here and ask how they’d fit in the context of South Africa and Africa more broadly. We should be thinking about disturbance and consequence effects.”

– **Dr Kenneth Oye**

“Visibility is poor if we look too far out. But one of the key challenges will be the interactions between humans and technology. But, when AI gets better and better, then what is the role for humans?”

– **Dr Soumen Ghosh**

“Science fiction is becoming science fact. One of the challenges is our ability to adopt and execute technology. How effective are organisations at adapting to technology? Is technology really the focus or is the human sociology changing?”

– **Tony Christodoulou**

“You are surprised when you see a robot. We need to get more systems out there and get learning and experience on which applications work well, and which don’t. We know they are good in manufacturing and mining, but other industries don’t have those economics and those numbers and we are still scratching around to see which applications make sense.”

– **Dr Peter Corke**

“We are at the cusp of this revolution. We haven’t figured out anything yet; it’s just conceptual. But ultimately technology, should we be able to leverage it, will improve the quality of life.”

– **Dr Soumen Ghosh**

“It’s important to understand which aspects of the 4IR affect your business. It all boils down to actual empathy, putting yourself in the product you are trying to design or process you are trying to implement and if this technology is applicable. But sometimes technology does not solve a problem, and you should be comfortable and confident to walk away.”

– **Njideka Harry**

“Anything that can’t be digitized will be so much more valuable.”

– **Abdullah Verachia**

“Whenever someone says ‘it’s obvious’, then it’s time to run.”

– **Dr Kenneth Oye**

Applications for Africa

“In biotech one area of application in Africa and South Africa, specifically, is biomining. To mitigate waste problems and more efficiently extract precious metals from waste. This might take the industry and put it onto a more solvent footing. Secondly, the development of saline tolerant plants. I know groups working on this exact problem but both examples require collaboration with all stakeholders. And, a thirdly, we talk gene drives and the control of vector-borne diseases; I would like to have a stakeholder engagement exercise to focus on the credibility of those measures. But I want it to take place in an area where there is genuine engagement and concern.”

– **Dr Kenneth Oye**

“When I wear my Africa hat the opportunities are drones and energy. We must not wear a first world hat but make it viable to our objectives. Cost won't hold us back, and because innovation is compounding innovation. Also sometimes having a person do it is better. We don't need to plug tech all the time.”

– **Tony Christodoulou**

“We are seeing some fascinating examples in India... data has become ubiquitous in India and I think we'll see a lot of that transcending into other markets, which is exciting.”

– **Abdullah Verachia**



Human skills for the future

“If we are pumping out people in our education system for jobs that won't be there, then we have a problem. There could be a focus on technology and the skills we need in the future. There are things happening in pockets, like #welovecode but we can't put blinkers on and think there will be no impact. Self-service tech will have an impact, and it's here.”

– **Tony Christodoulou**

“There is a thing called white-collar conceit, because they went to university. These are not the professions we should be encouraging, some jobs that trade people do are harder to automate (like electricians) and they'll have a longer work lifespan.”

– **Dr Peter Corke**

“Empathy is an attribute which we believe machines will struggle to do in the long term, so creativity and empathy are two areas where machines won't do as well as humans. But empathy will come.”

– **Dr Peter Corke**

“We will see personalised medicine where the cellphone serves as a nursing multiplier. How does that bear on emotion? Can you programme the emotions to create enough empathy as the clinicians we currently deal with? I don't think that's as big a reach.”

– **Dr Kenneth Oye**





The social impact

“I’m peddling a tech that makes no sense for a country that has [close to] 30% unemployment. In Australia we have a very different labour market. If you have jobs that people can do, and people who want to do them, that’s difficult. You might make more profit if you put robots in there, then you’ll have huge social disruption and it would be hard to keep a country stable.”

– **Dr Peter Corke**

“Are we leaving people further behind when it comes to equity, education and access to entrepreneurial opportunities? For us it takes working with multiple stakeholders to ensure we are bringing the best of what we have in quality education and access to resources, so young people in developing resources can keep up with their digital peers.”

– **Njideka Harry**

“People talk a lot about robots working with people to increase productivity. The addition of robots means your enterprise will achieve more. This is probably the most enlightened way to use this technology. In Singapore if you introduce robots that will displace people you have to keep them in the firm and reskill them. If machines are going to come in, then you have to do something with those people. That social consideration has to trump everything else.”

– **Dr Peter Corke**



How tech can transform Africa by 2030?

“Effective tech that is most significant will be those that have an impact on the political economies (eg patronage systems and corruption). But how do the information technologies affect the ability of governments to engage with what causes state failure. It’s a question that needs to be studied more deeply.”

– **Dr Kenneth Oye**

“How have we enabled the country to be better because of technology? Imaging hydroponic centres or smart things around sustainable farming to Africa, that could be huge. Hopefully in 11 years’ time leadership has really stepped up to focus on people.”

– **Tony Christodoulou**

I’m struck by some challenges and opportunities you have here: energy is clearly an issue that underpins everything. Also issues around corruption, crime and identities – like a lack of documentation in Nigeria. We take this for granted in the West, and I think you’ll have to try and get that in place. Technology might help, but I’m not sure it’s a technology issue. And education is really challenging, especially in rural areas.”

– **Dr Peter Corke**



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