NEXT EINSTEIN FORUM

An AIMS initiative

AFRICA, THE NEXT AI BATTLEFIELD

An opinion paper

The transformative power of digital technologies continues to grow with nations at the cusp of massive disruptions as the Fourth Industrial Revolution (4IR) takes shape, altering the way society operates and interacts. In these COVID-19 times, the disruption will have long lasting impacts that have yet to be understood, particularly for Africa.

One of the key characteristics of the 4IR is that it is largely driven by digital technology, and is cross cutting among various economic sectors, thus making it indispensable for Africa's economic growth. Already, African economies have benefitted immensely from mobile technologies with the mobile economy contributing *8.6% to Africa's GDP (US$144 billion)* in 2018 and *US$14 billion* in tax revenue in 2017, giving a glimpse of what the 4IR can avail on the continent if adopted fully.

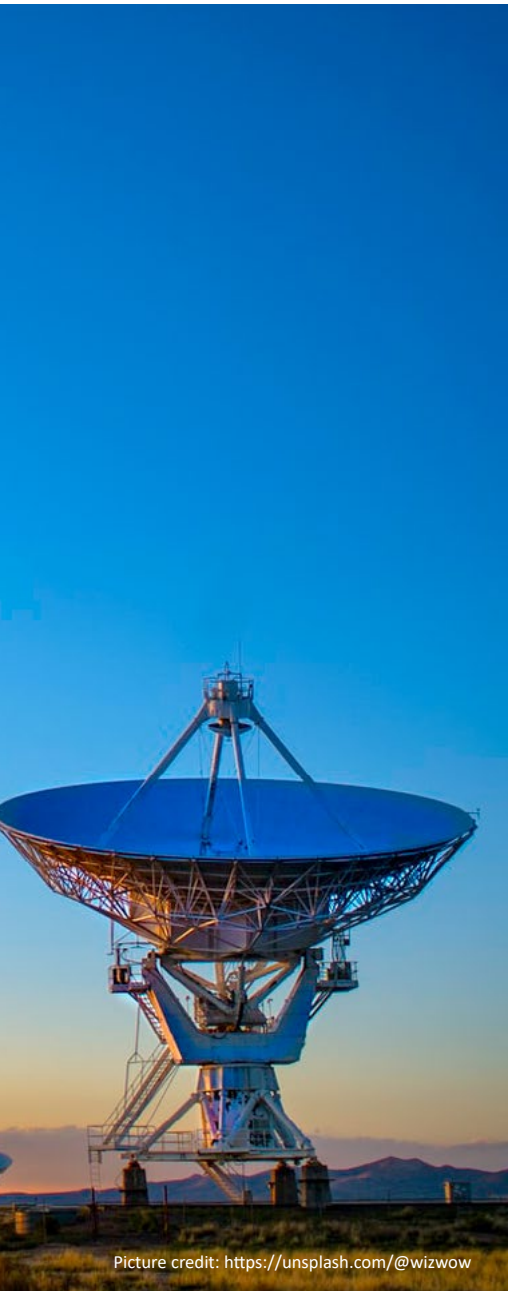
In turn, science and technology based entrepreneurial activities are on the rise in different sectors. Examples of successful start-ups using Artificial Intelligence (AI)technologies to create value for their customers include Ghana's Hello Tractor, an advanced agricultural analytics and decision making tool that cuts across the mechanization ecosystem.

Zipline, a medical drone delivery company exhibiting great potential to become a billion dollar company, started its operations in Rwanda and has now expanded into Ghana and the U.S., a rare example of reverse innovation.

Despite all these new opportunities on the continent, there are still a number of risks associated with the new technologies. Emerging technologies, such as AI which underpin the 4IR, rely on data-based algorithms that are susceptible to embedded biases. As a result, scholars and activists have begun to probe the technologies and relationships that form the basis for this rapid digitization, looking not only at the sharing of benefits and risks derived from these relationships, but also, the processes, values and motivations behind digital expansion. The debate on power has already taken root in the majority world with countries, individuals and organizations challenging the advent of cyber colonialism.

Cyber-colonialism is, however, a very confrontational topic. Others have suggested that the framing of the discourse in less provocative language would be helpful to advance the debate while others emphasize that these uncomfortable conversations must take place. So, what does cyber colonialism mean for Africa and what makes Africa the next battlefield for cyber colonisation?

The Battlefield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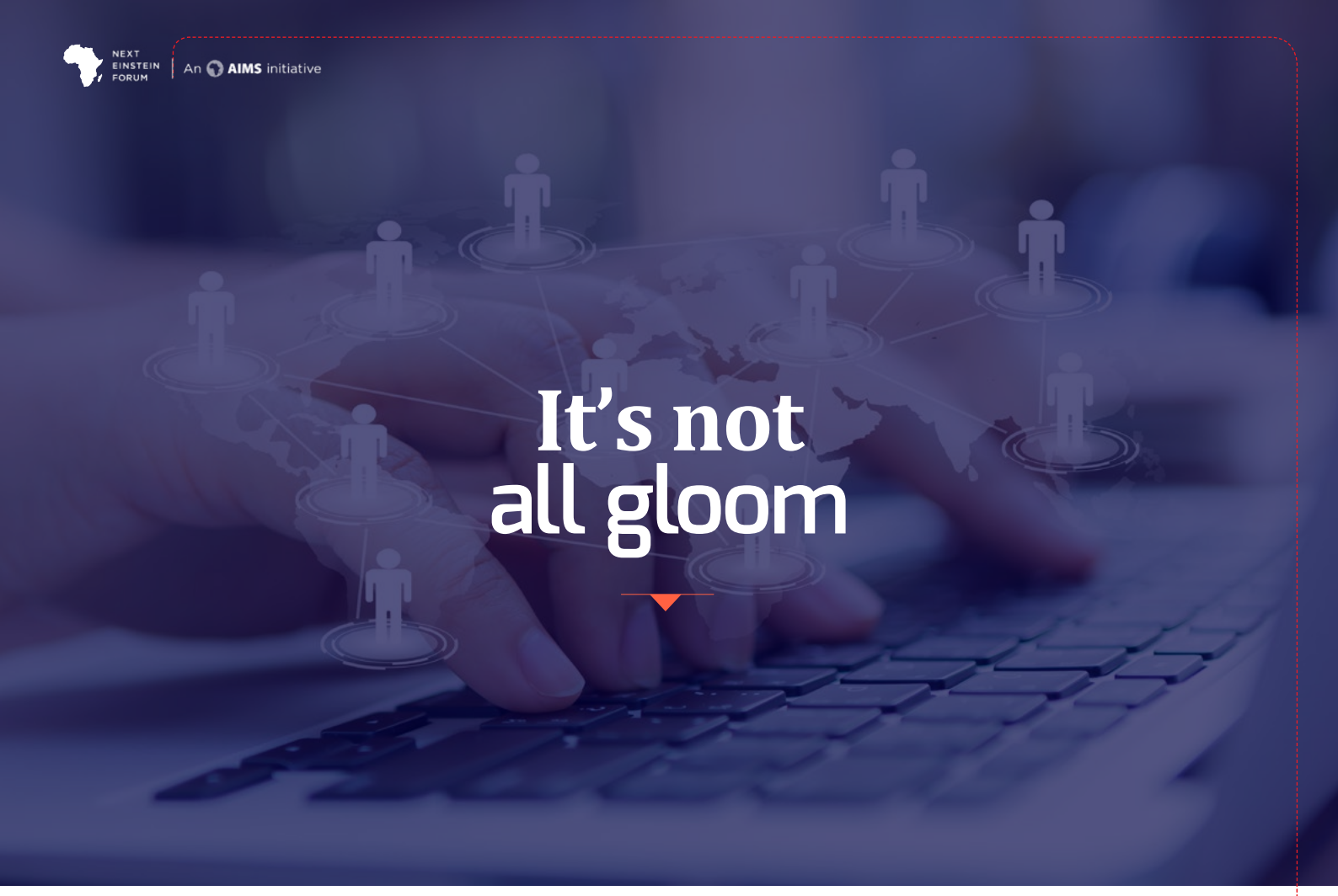
The AI race is dominated by mainly the US and China. In Africa, the US dominates at the architecture level of the digital ecosystem while China leads on the infrastructure front by availing cheap mobile phones through Chinese companies such as Huawei and ZTE. In Sub-Saharan Africa, an estimated *483 million subscribers* are expected to access mobile internet services by 2025, and the access is enabled largely by the availability of relatively affordable smartphones from China.

On the technology side, North America (mainly the US) and China are the major contenders with the former leading on *patent activity* and the latter taking the lead on research activity. To put this into perspective, China and the United States alone make up for *90%* of the market capitalisation value of the world's 70 largest digital platforms. In 2018, *95%* of worldwide AI enterprises were hosted in only 20 countries, and none of these in Africa. The AI ecosystem in Africa is in its nascent stages and is still too small to make significant inroads on the global stage, with start-ups like *InstaDeep* and *ICog Labs* showing great promise.

China continues to strengthen its relations with Africa by increasing investments in infrastructure, for example, through the *Digital Silk Road*. Furthermore, China-Africa trade was estimated to be *US$148 billion in 2017* alone. Apart from infrastructure investments, China has, notably, increased investments in other sectors as well, targeting African small and medium enterprises (SMEs) and start-ups. *Lori Systems*, a logistics firm based out of Kenya, received more than *US$20 million* from Chinese venture capital firms in a recent funding round. ILate 2019, Ethiopia recently joined Rwanda in *signed an agreement with Alibaba*, an e-commerce firm from China, on the electronic world trade platform (eWTP) which opens up international markets for SMEs. As well, young African entrepreneurs stand to benefit from a *US$10 million* pledge from the Founder of Alibaba, Jack Ma, to be distributed over a ten year period. China's footprint on the digital landscape in Africa, undoubtedly, will continue to grow.



It's not all gloom

While there are risks of exploitation for Africa, AI has an important role to play in Africa's technological and therefore economic transformation. In the field of agriculture, digital technology presents considerable opportunities to improve the welfare of Africans by playing a central role in the sustainable development of the sector. For instance, *Zenvus*, a Nigerian precision farming start-up, is helping farmers conduct optimal irrigation operations, by measuring and analyzing soil data like temperature, nutrients, and vegetative health. Furthermore, *Abdoulaye Baniré Diallo*, Next Einstein Forum Fellow and co-founder and chief scientific officer of the AI start-up *MIMS*, is working with advanced algorithms and machine learning methods to leverage genomic precision in livestock production models, which if scaled up would potentially mitigate the challenge associated with livestock farming in some parts of Africa with harsh climatic conditions.

The health sector is another area with huge potential for digital transformation. A majority of African countries are characterized by underfunded and inadequate health systems, a predicament further accentuated by sizable infrastructural gaps. Cutting edge technology seems to be one of the key solutions to these challenges, and a few countries are already demonstrating its transformative potential. In Guinea, Moutaga Keita has set up *Tulip Industry*, a company that manufactures disruptive and sustainable technologies and precision medical diagnostics equipment customised to fit context.

Supply chains and logistics sectors exhibit great potential for impact especially in reaching out to disenfranchised communities. *Twiga*, based out of Kenya and with a database of more than 17,000 farmers and 8,000 vendors,, is focused on enabling Africa's supply chains to formalize and develop into market leaders both in innovation and financial capability by linking farmers, vendors and markets.

AI and the gig economy

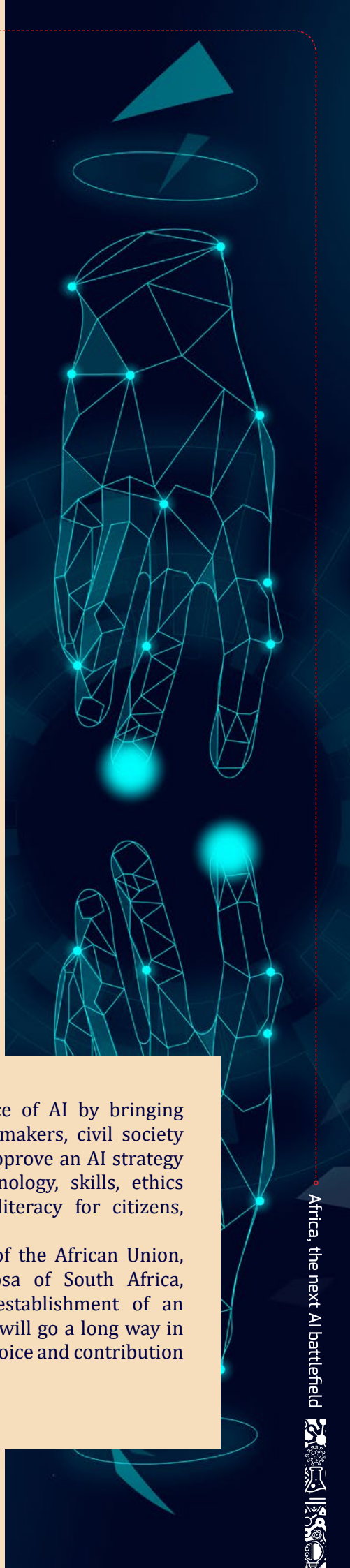
Proliferation of digital technologies has given rise to new economies such as the gig economy. The gig economy has become synonymous with major American companies like Uber and Airbnb whose impact has spread to various other countries worldwide. In Kenya, the gig economy is valued at *US$109 million and employs about 36,573* workers. Globally, it churned out *US$204 billion in gross volume* and is expected to grow to approximately *US$455 billion by 2023.*

Regardless of the type of gig work, gig workers in Africa like everywhere else, are prone to exploitation and lack representation through, for example, workers' unions. Their appraisal is based on algorithmic-based rating which indirectly forces them to work for very long hours to improve their ratings and gain higher income exposing them to health risks. Although the technology driven gig economy is touted as *opening up employment opportunities* to a continent grappling with *very high levels of youth unemployment*, t, the quality of the work matters, therefore, the risks and benefits must be weighed. For example, gig work affects women differently. *A study* conducted on gig workers in South Africa and Kenya, highlighted the plight of women in balancing paid work and unpaid care roles and the security risks they face in the discharge of their duties. On the other hand, the gig economy disrupts local economies, e.g. the *2017 violent clashes* between taxi and Uber drivers in Johannesburg. Policy interventions should, thus, probe further on the nature of work, roles played, access to resources and putting in place systems that ensure that this information is sex -disaggregated to protect workers and for states to derive some form of benefit.

The pervasive nature of AI makes it difficult for governments to put in place measures to derive tax gains from these digital platforms to reinvest in areas such as local infrastructure, health and education. There are ongoing debates and tussles between the US and various countries on the issue of digital taxes. Kenya has implemented tax on income from foreign online marketplaces and Zimbabwe is charging *5% tax on foreign e-commerce companies* for transactions done locally. Uganda enacted a social media tax in 2018 courting much controversy due to the motive and likelihood of adversely affecting internet services in that country. On the other hand, the OECD has come up with *digital tax proposals* under a unified approach, but, *countries in Europe* and Asia are still deciding on or already in the process of enacting unilateral digital levies on US tech companies for revenue generated from within their countries. Africa is silent.

Picture credit: https://unsplash.com/@markusspiske

Let's build our own AI



Most AI technologies are developed in wealthier markets due to prohibitive costs and specialized skills required to build them, even where they are meant to be used in developing countries. In as much as the geo-political discourse of cyber colonisation is mainly focused on the race between the United States and China, which drowns out the voices of the consumers, especially African consumers, Africa must not just be an end-user.

We believe African countries are at critical crossroads where decisions and investments today will determine whether Africa becomes cyber colonised or leverages AI to accelerate its development. Three things must happen in the next ten years:

Create and implement an AI strategy for Africa

Scientists and activists have raised concerns on the exclusionary nature of conferences convened to deliberate on emerging technology issues, particularly, AI. The conferences charge *exorbitant attendance fees* and come up with resolutions with global implications wwithout the requisite wide consultations. For example, the *Global Partnership on AI* is currently being spearheaded by France and Canada and the *Partnership on AI* has no notable representation from Africa nor Latin America. It is high time Africa contributes to the global discourse on the ethics and governance of AI by bringing together scientists, policymakers, civil society and business leaders to approve an AI strategy that would look at technology, skills, ethics and governance, digital literacy for citizens, investments etc.

The current Chairman of the African Union, President Cyril Ramaphosa of South Africa, recently called for the establishment of an *African Forum on AI*. This will go a long way in consolidating the African voice and contribution to these global matters.

Build critical AI technical capacity

AI applications tend to reinforce social biases typically related to gender and race because as it stands, AI is a male dominated field with only *22% of AI professionals* globally being female. We don't know the number for Africa, yet. But, initiatives to bridge this gap are already underway, *Black in AI* is working towards increasing the presence of black people in AI and *Alliance4AI* is a community of AI practitioners in Africa coming together to stimulate Africa's adoption of emerging technologies working closely with organisations such as *Zindi* and *Data Science for Africa.*

The lack of critical mass on the continent extends to the majority of citizens who lack digital and legal literacy and, therefore, struggle to comprehend the nature and risks associated with AI as well as legal clauses on terms and conditions for data extraction.

As the threat to personal privacy increases, governments and individuals alike should be vigilant to protect their data online. Here in Africa, only *28 countries* have so far enacted legislation on data and privacy protection. The European Union's G*eneral Data Protection Regulation* (GDPR) is a good template for comprehensive regulation that gives individuals more control on their personal data. However, legislation alone is not adequate, but should be accompanied by support on efforts to train more people on personal data protection and online privacy issues.

As well, poor human capital development opens up the continent to near monopoly of software, hardware, as well as network connectivity by western corporations. Digital supremacy by American and Chinese tech companies has centralized the ownership and control of the digital ecosystem. In terms of software, companies such as *Microsoft and Google* are able to maintain a high level of control on software, because it is often proprietary, which is basically software that users cannot read, modify, or share the source code.

This is not to say that nothing is happening. African universities are creating AI related degrees and training programs to bring their computer science programs up to date. In 2018, the African Institute for Mathematical Sciences (AIMS) launched a novel one-year *African Master's in Mathematical Sciences* (AMMI) which takes budding mathematical scientists and exposes them to top AI researchers at Google and Facebook and other top programs globally, preparing them to build the algorithms that will affect business and life. African governments and their development partners need to accelerate initiatives like these systematically.

Africa accounts for only 2% of the world's research output due to a plethora of challenges that African researchers face including infrastructure, access to data, funding etc. According to the *Elsevier AI Report Worldwide map* on publications in AI, only 11 African countries have published research on AI. The number of AI publications range from 71 in Senegal to 3,215 in Egypt against China's *127,123*. Scholars usually pursue research according to the agendas of their funders leaving the majority of African governments without the evidence necessary for the development of good and relevant policies. This needs to change. It is not enough to point out global inequalities. Africans must be enabled to do AI research as an economic and national security imperative.

Focus investments on a framework

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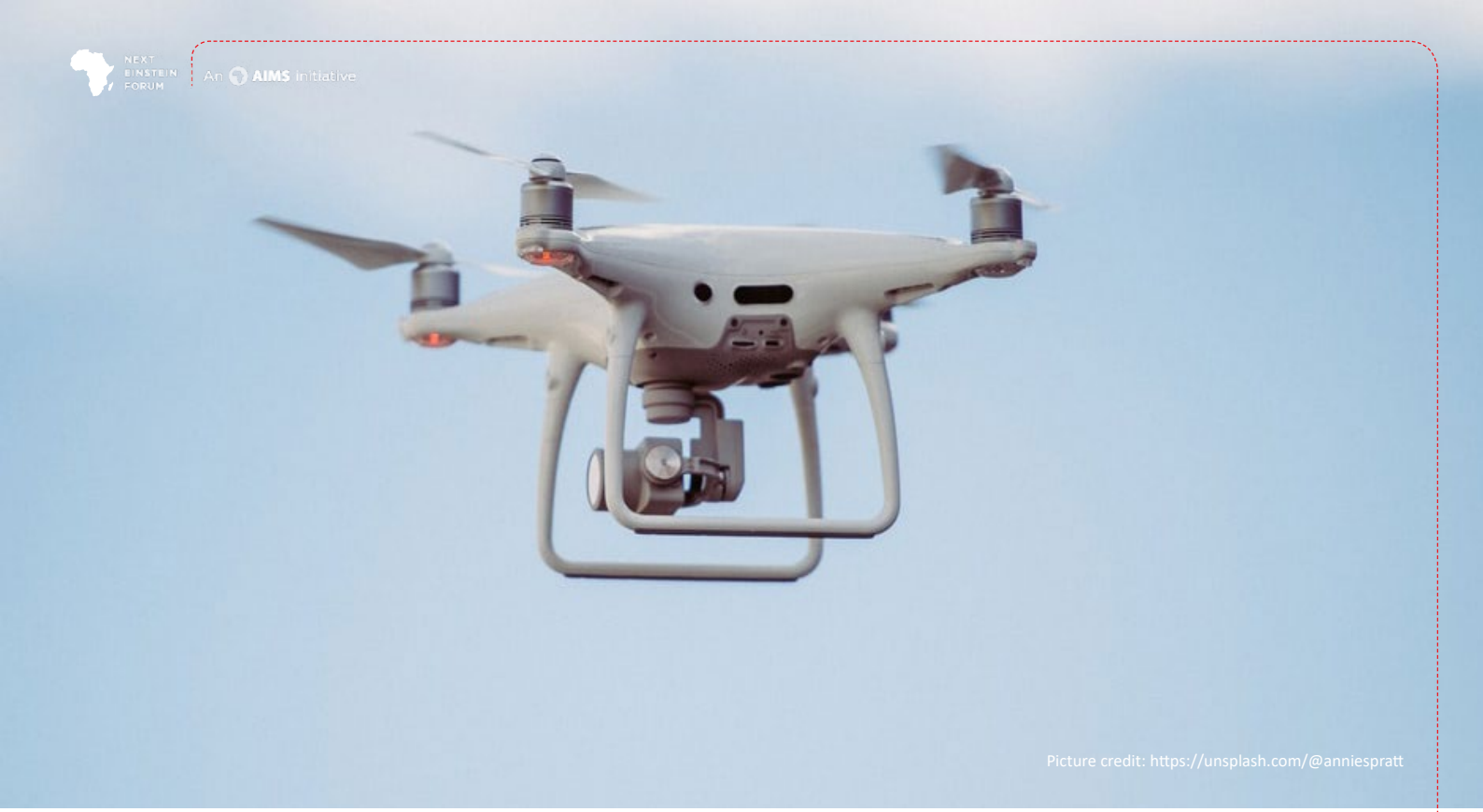

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that includes infrastructure

Research suggests that low- and middle-income countries may be more vulnerable to the negative social impacts of AI and less *likely to benefit from the attendant gains*. Multiple factors make Africa vulnerable to cyber-colonisation. First, poor infrastructure on the continent gives technology companies the opportunity to intervene through the provision of critical digital infrastructure to connect the unconnected, but at the cost of personal data and privacy for proprietary gain. The nature of these initiatives offers new forms of exploitation and subjection. Building digital infrastructure at par with international standards is capital intensive, and consequently a majority of African countries are relying on foreign investment to develop their local digital ecosystems. Companies such as Google, Facebook, Microsoft, IBM, and Uber are increasingly ramping up investments on the continent. For instance, Google has opened an *AI lab* in Accra Ghana. Facebook's *"FreeBasic"* program, which has beenaccused of exerting control over Internet experiences on mobile phones, remains highly influential in Kenya and Ghana. Africa will need to invest more than $1.2 trillion per year to set up economy-specific infrastructure covering a broad range of areas.

When African governments go digital relying on infrastructure and systems that they do not have total control on, they expose themselves to cyber hacking.

The vulnerability is worsened by the fact that African governments are slow to respond to the ever-changing dynamics on the digital front through, for example, relevant policies, such as, cyber security and data protection policies and/or legislation. So far, the African Union (AU) Convention on Cyber Security and Personal Data Protection adopted in 2014 has been ratified by only 5 countries. The solution here lies in developing in-house information technology architecture that is less dependent on outside support and making investments in green energy to ensure that basic infrastructure, such as water and electricity, is in adequate and continuous supply.

Efforts are being made at both the national and regional level. As it stands, Mauritius is ranked first in Africa on the Global *Cybersecurity Index*, followed by Rwanda. Some of the initiatives that make Mauritius stand out include the country's Botnet Tracking and Detection project which empowers the Computer Emergency Response Team of Mauritius (CERT-MU) to respond proactively to any threats on their systems.

They also conduct awareness sessions for their civil servants through the IT Security Unit. On the regional front, the African Union has set up a *Cybersecurity Expert Group* with a mandate to ensure that Africans have "access to a secure and trusted cyberspace" and believes that Africa should articulate its own ethos, ethics and strategies for Cyberspace, Cybersecurity and AI.

Slightly above fifty percent of African countries, including *Kenya* and *South Africa*, have passed data protection laws for security and privacy concerns. To meet regulatory stipulations for locally generated data to be stored locally (data localisation) and data storage demands, *carrier neutral data centres* are sprouting in some African cities, from Cape Town, Johannesburg and Harare, to Kigali and Nairobi. International technology companies are also coming in with *Microsoft establishing its first cloud data centre* on the continent in Johannesburg last year and Amazon Web Services set to follow suit in Cape Town in the coming months.

The continent needs to leverage its economic regions and other mechanisms to create regional technology hubs that include the full ecosystem (incubation hubs and accelerators, venture capital and other funding instruments, policy facilitation etc.) to fully leverage AI and the nine other technologies we have identified that will accelerate the continent's development, as

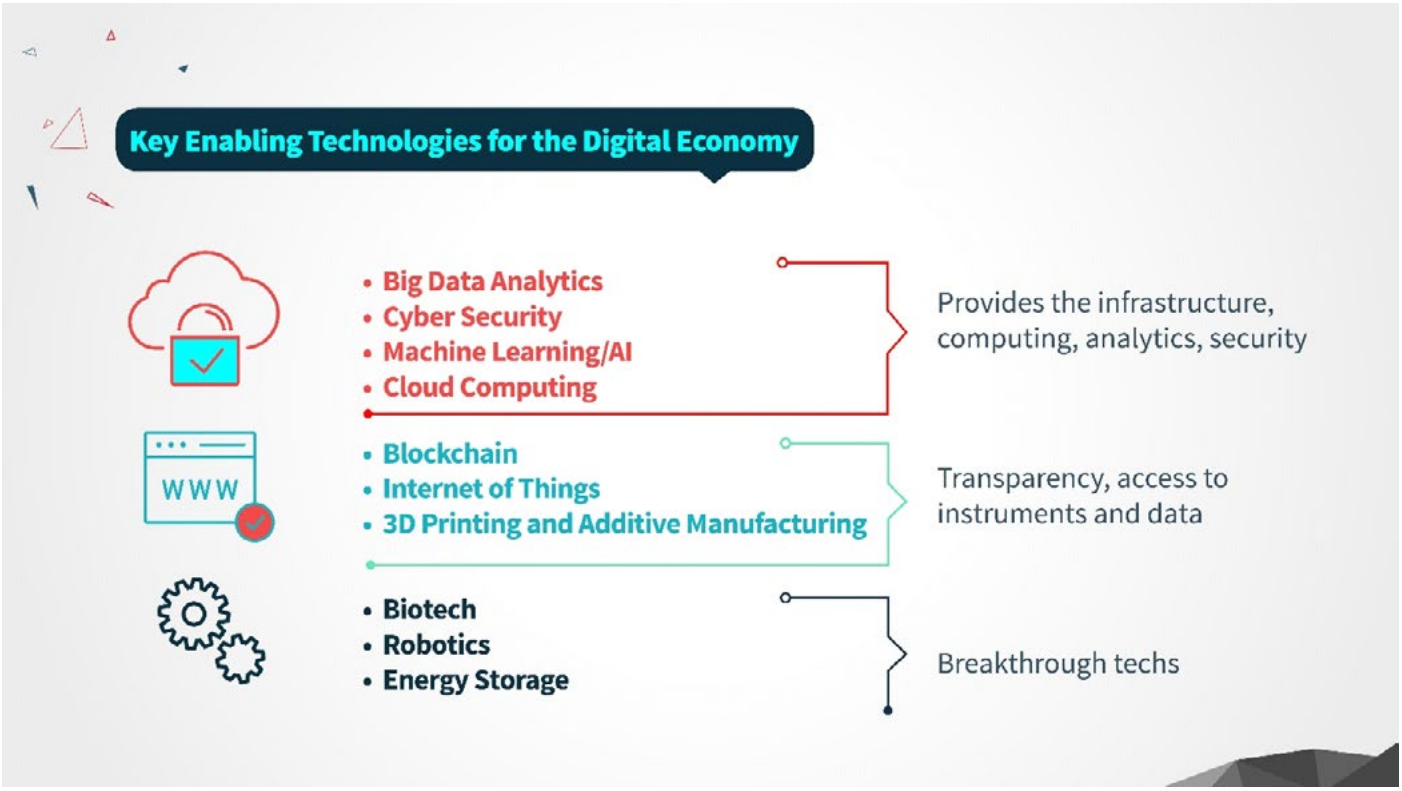

Fig 1. The Key Enabling Technologies for the Digital Economy
Source: Roadmapping Africa's Digital Economy- Next Einstein Forum

Towards Africa's cyber independence

If Africa is to mitigate cyber colonization, substantial investments should be made to ensure internet decentralization, and advocate for free and open software created by Africans. Furthermore, as sociologist Michael Kwet rightly points out, if Africa is ever to achieve any form of digital independence, we ought to teach our children how "Google" and the internet works, what is behind it, rather than binding them to its products.

The key areas of contestation in Africa are the extraction of personal data, the entire digital architecture, unconnected populations and more broadly international trade laws that favour western states and China. Cyber-colonisation threats exist at state, societal and individual levels and include threats to the sovereignty of nations and personal freedoms and privacy.

On the regulatory side, states must be proactive in coming up with legislation that protects the basic rights of its citizens whilst at the same time promoting innovation, research and development. Unfettered access to populations and political discourses (mostly through social media platforms) opens room to political meddling for geo-political gains by external parties through psychological profiling enabled by big data and AI. *The Cambridge Analytica scandal* and the *use of Africa* as a testing ground for political interference is an indication of how vulnerable developing countries are, without the requisite infrastructure and knowledge to block such intrusions.

This digital sovereignty can only be achieved by acknowledging the interdisciplinary nature of AI technologies and coming up with interventions on the socio-economic, political and technological front. Basic and economic specific infrastructure is a prerequisite, anchored on a robust policy and regulatory environment, establishing new forms of partnerships and providing adequate funding for research and development and each of these interventions to be implemented successfully. Human capital development is a key intervention towards empowering young African minds to build solutions that serve their communities and the global markets – made by them for them.

Africa's economic and demographic resources ultimately place it at the epicentre of future cyber wars between the world's digital superpowers. The continent is not helpless. Through strategic and concerted effort, building capacity across infrastructure, policy and skills, borrowing from best practices from other emerging markets, Africa can be an AI powerhouse ■

[1]Point de Situation Pandemie de COVID 19 au 28/04/2020 (ISAO,2020)

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