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A STUDY ON THE AI LANDSCAPE OF UNIVERSITIES IN AFRICA

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Artificial Intelligence Institute of South Africa

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2. Executive Summary

According to McKinsey & Company, capabilities in Artificial Intelligence (AI) that include Machine Learning, Computer Vision, and Natural Language Processing are enabling companies globally in all industries to derive better insights in the automation of processes, the addition or augmentation of capabilities, and the ability to make better decisions[1]. It has been estimated by McKinsey that the potential economic value at stake from applied AI is between $17 trillion to $26 trillion, and the share of companies pursuing that value is increasing. According to the annual McKinsey Global Survey on the state of AI, it is shown that the proportion of responding organizations adopting AI more than doubled from 20 percent in 2017 to 50 percent in 2022. The survey also indicated that adopting AI can have significant financial benefits[1].

Lital Marom, Founder & CEO of Unfold in an article in Forbes states that "Artificial intelligence stands on the brink of becoming the next revolutionary catalyst." She further goes on to state that AI can be a defining technology of this era and has the potential to fundamentally transform how we live and work. She goes on to further state that AI could fundamentally alter our lifestyles and how we conduct business[2].

According to Forbes[3], the market size of artificial intelligence globally was projected to be valued at $136.55 billion in 2022. This figure is expected to grow exponentially which is being backed by an ever-increasing investment in Artificial Intelligence-based technologies, digital disruption, and the competitive advantage of rapidly growing global economy. The compound annual growth rate (CAGR) of the global artificial intelligence market size is projected to expand at a rate of 37.3% between 2023 to 2030 and is projected to reach $1,811.8 billion by 2030[3].

As highlighted in [4], the development of AI in Africa is also attracting huge amounts of resources and funds. An example of this has been with Tunisian AI start-up InstaDeep that received $100m during 2022[4].

To evaluate the potential for growth in the AI sector in Africa, in collaboration with Intel, the TUT Hub of the Artificial Intelligence Institute of South Africa (AI-ISA) undertook a study to evaluate the AI landscape in Universities in Africa. The main objective of the study is to gain a deeper understanding of the landscape of AI across Universities in Africa which can provide some indicators and the readiness of the continent in equipping its workforce in AI.

The study provided a better understanding of the AI landscape across Higher Education institutions (HEIs) across the African Continent by considering various indicators. From the study on the AI programmes offered at various HEIs across the continent, it was found that there is a general uptake in AI programmes offered across the continent. The study further highlighted the various Research Institutes that are undertaking research and development project across Africa that is contributing to the development of human capacity in AI. The study also shows the wide adoption of AI that is taking place in the continent and the various stakeholders involved with the research institutes that are making the engagements in AI possible.

Considerable activities in AI are taking place in various HEIs across the African continent that could provide the opportunity to support potential startups and spinoffs from within the Universities which could contribute to building effective ecosystems in Africa and contributing to the DeepTech ecosystem. The study also provided a snapshot of the various Global Industries that are collaborating with various African Universities on AI research and development programmes across the continent as well as the Global AI use cases that could be used to apply the use of AI to solve grand challenges faced in Africa.

A critical area in the adoption of AI across the continent is with regard to AI Strategy and Policy. The study provided an overview of the status of AI Strategy and Policy across the selected African Countries. Various countries across the continent continue to drive the adoption of AI strategies and policies. One of the challenges identified was regarding investment in AI infrastructure with many countries in Africa having limited access to sufficient platforms for training in AI and reliable power in most countries.

1. Technology Trends Outlook 2023, available online: https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-top-trends-in-tech#new-and-notable
2. Lital Marom, Embracing The AI Revolution: A Guide For Industry Leaders, available online: https://www.forbes.com/sites/forbescoachescouncil/2023/08/10/embracing-the-ai-revolution-a-guide-for-industry-leaders/?sh=6008de556a9a
3. Top AI Statistics and Trends In 2023, Forbes, available online at: https://www.forbes.com/advisor/in/business/ai-statistics/
4. Groundbreaking Report Highlights Artificial Intelligence in Africa, AI for Good blog, available at: https://aiforgood.itu.int/groundbreaking-report-highlights-artificial-intelligence-in-africa/

3. Introduction

According to Forbes [3], the market size of artificial intelligence globally was projected to be valued at $136.55 billion in 2022. The growth is being backed by an ever-increasing investment in Artificial Intelligence-based technologies, digital disruption, and the competitive advantage of rapidly growing global economy. The compound annual growth rate (CAGR) of the global artificial intelligence market size is projected to expand at a rate of 37.3% between 2023 to 2030 and is projected to reach $1,811.8 billion by 2030 [3].

As stated in [5], Africa is at a massive turning point considering the impact of AI across the continent. Providing support for AI in the continent makes the region ripe with opportunity for a better future. The report highlight how South Africa, Nigeria, Egypt, and Kenya dominate this sector with AI impacting at least 120+ separate market segments across Africa [5]. As stated by an Intel Report [6], DeepTech is fundamental to digital transformation and development and represents the latest wave of innovations that are expected to fuel the next industrial revolution across the African continent.

3.1 AI Landscape Study in Universities in Africa

Higher Education institutions across Africa are not an exception to how quickly AI is making an impact and changing several industries across the globe. Most Higher Education Institutions are being forced to consider how AI is making an impact on the Education Environment in terms of how students are taught, how research and innovation is conducted, the ways in which students are interacted with to ensure that Higher Education institutions continue to be relevant and competitive as the world continues to experience various forms of Digital Transformation across society.

To enable a better understanding of the AI landscape in Universities across the African Continent, this study seeks to provide a better understanding of the following:

i. Provide a clear understanding of the value of AI and the role it can play in Universities in Africa with suitable indicators.

ii. Provide a better view and understanding of areas of research and development inclusive of applications and use cases of AI in African Universities.

iii. Linked to the above, provide an impact analysis of how AI contribute to the African University landscape.

iv. Provide an overview of how Global Industries are engaging with African Universities on AI research and development programmes.

3.2 Scope of the Study

Considering the current trend across Africa and the development of AI strategies in the continent, a sample set of Universities across countries in Africa is considered. The following table provides a summary of the countries that were considered for the study:

Table 1 – *Sample Countries considered in the study.*

No.	Country	Region
1.	South Africa	Southern Africa
2.	Mauritius	Southern Africa
3.	Kenya	East Africa
4.	Rwanda	East Africa
5.	Nigeria	West Africa

5. State of AI in Africa, AI Media, available at: https://aiexpoafrica.com/state-of-ai-in-africa-report/
6. Evaluating the African Deep Tech Spin-off Ecosystem - From the Lab to Market, Intel Report, available online at: https://community.intel.com/t5/Blogs/Intel/Policy-Intel/Evaluating-the-African-Deep-Tech-Spin-off-Ecosystem-From-the-Lab/post/1438921?attachment-id=88395

No.	Country	Region
6.	Ghana	West Africa
7.	Senegal	West Africa
8.	Cote d'Ivoire	West Africa
9.	Egypt	North Africa
10.	Tunisia	North Africa
11.	Morrocco	North Africa

3.3 Study Deliverables

The study of the AI landscape of Universities in Africa seeks to provide the following deliverables:

i. Provide a report on the value of AI in universities of the African continent.

ii. Highlight Higher Education (HE) institutions that provide AI courses.

iii. Provide a better view and understanding of areas of research and development of AI in African Universities

iv. Provide a summary of the Prospects and challenges of AI for higher education in Africa.

v. Provide indicators that could be used to determine HE Universities that poised to be leaders in AI in Africa.

vi. Identify training programmes in AI that can enhance HE and learning in African universities.

vii. Provide a summary of the types of Artificial Intelligence that African universities can contribute to or can invest in i.e., Robotic platforms, Chatbots, Computer Vision, Edge AI, AI Algorithms etc.

viii. Highlight how startups/spinoffs can be assisted using AI in African universities.

ix. Summarise how Global Industrial Partners are engaging with African Universities on AI research, capacity development etc.

x. Provide suggestions/recommendations for African universities, AI startups, policy makers and private sector by examining AI use cases in global universities and how there are leveraging AI.

3.4 Study Methodology

The main source of data sampling that was used to collect data for the study was based on freely available data on the internet. Institution websites were considered for the study. During the study, it was generally found that the availability of data varied from country to country which is highlighted as one of the challenges in providing a clearer picture of the state of AI in Higher Education institutions across the continent. This is flagged as one of the areas that greater development needs to be considered to provide a better indication of the state of AI in Higher Education across the continent.

4. Overview of AI Programmes at Higher Education Institutions in Africa

4.1 Introduction

To better understand the impact of AI across the Higher Education landscape in Africa, higher education institutions across the sample countries selected in each region were studied to determine the types of programmes offered in each country.

4.2 Summary of AI Programmes offered in Africa

As highlighted above, a sample set of Universities across countries in Africa were considered in this study to evaluate the extent of AI programmes offered in Universities across Africa. From the study conducted, the data suggests that the North African countries (Egypt, Tunisa, and Morocco) rank highest in their maturity in the offering of structured programmes oriented towards training in AI as opposed to other regions. This is followed by the Southern African countries (South Africa and Mauritius). The countries reviewed in the East African countries (Kenya and Rwanda) do demonstrate that programmes in AI do exist, though mainly integrated in Computer Science programmes. Finally, West African countries seem to provide less structured programmes in Artificial Intelligence. However, various programmes in Computer Science do exist. While this may not be a true reflection of the actual status of the programmes offered, the information provided in the public domain and in institutional websites seems to be lacking.

The figures below depict the levels of the taught programmes in AI that were found in the study and a general overview of the domains of AI that the taught programmes are oriented to.

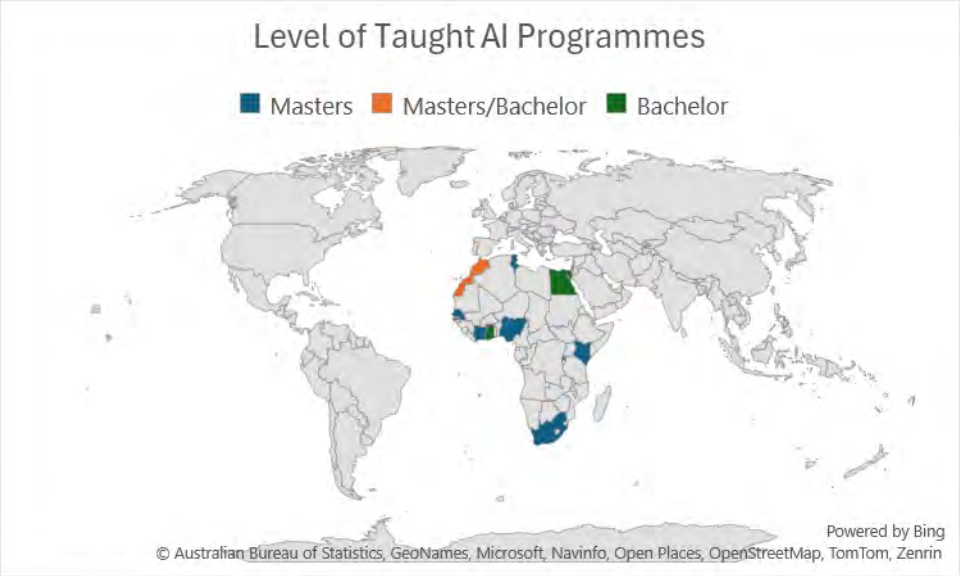

Figure 1 – *Level of Taught Programmes in AI in Africa in the study conducted.*

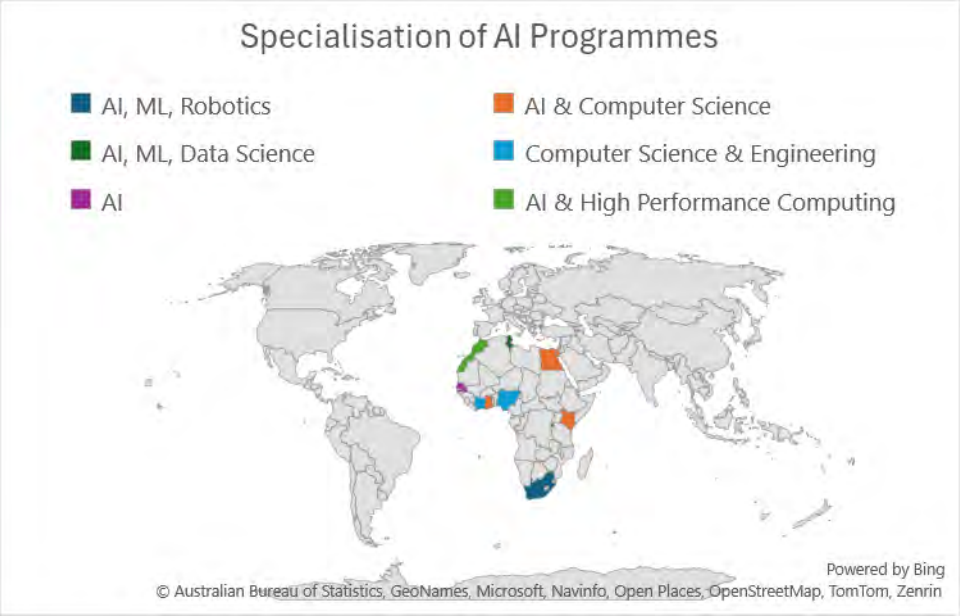

Figure 2 – *General Specialisation fields of Programmes in AI in Africa in the study conducted.*

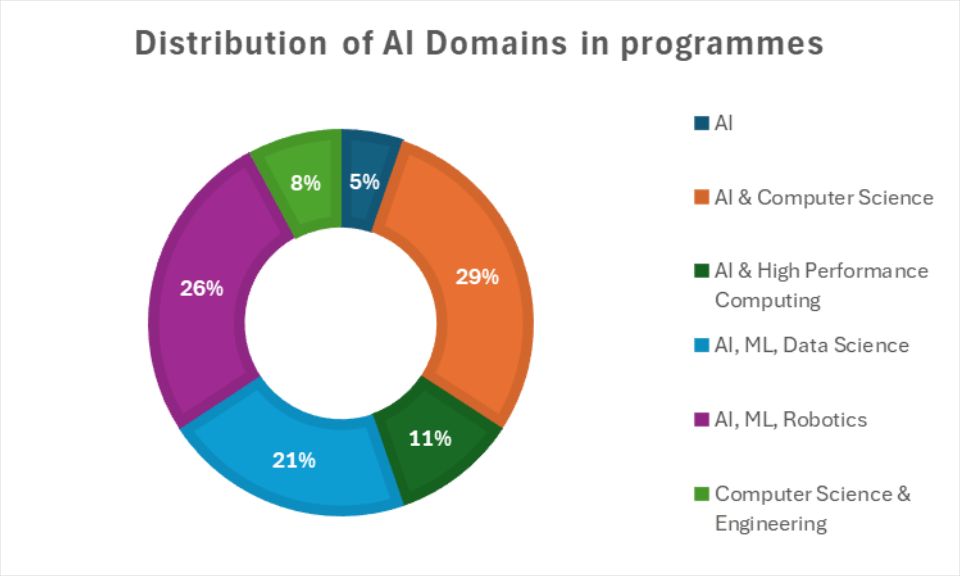

Figure 3 – *Distribution of Programmes in AI in Africa in the study conducted.*

The sub-sections below provide a high-level summary of the Universities providing dedicated programmes in the 11 shortlisted countries, with detailed descriptions of the courses summarized in Table 3 to Table 11 in Annexure 1.

4.2.1 AI Programmes offered in South Africa

Based on the study conducted, the following universities and research institution were found to provide dedicated AI programmes in South Africa: University of Johannesburg, University of Cape Town, University of Witwatersrand, University of Stellenbosch, The African Institute for Mathematical Sciences (AIMS). A more detailed overview is provided in Table 3 in Annexure 1.

4.2.2 AI Programmes offered in Mauritius

Based on the study conducted, the following universities were found to provide dedicated AI programmes in Mauritius: University of Technology, Université des Mascareignes, University of Mauritius, Open University of Mauritius. A more detailed overview is provided in Table 4 in Annexure 1.

4.2.3 AI Programmes offered in Kenya

Finding clear information on study programmes in AI offered in Universities in Kenya was a challenge. Universities that offer dedicated programmes in AI were also a challenge to find. Many Universities however offer programmes in Computer Science which have some specialisations in AI. In the study, the University of Nairobi, Jomo Kenyatta University, Strathmore University, Kenyatta University, Dedan Kimathi University of Technology, and Maseno University – School of Computing and Informatics were found to offer programmes that provide orientation towards AI. A more detailed overview is provided in Table 5 in Annexure 1.

4.2.4 AI Programmes offered in Rwanda

From the study conducted, the Carnegie Mellon University Africa based in Rwanda, the AIMS institute Rwanda, and the University of Kigali / African Centre of Excellence in Data Science (ACE-DS) were found to provide dedicated AI programmes or related in Rwanda. A more detailed overview is provided in Table 6 in Annexure 1.

4.2.5 AI Programmes offered in Nigeria

As highlighted above, finding clear information on study programmes in AI offered in Universities in Nigeria was also a challenge. Many Universities in Nigeria do offer programmes in Computer Science which have some specialisations in AI. From the study conducted, University of Lagos (UNILAG), Obafemi Awolowo University (OAU), The Federal University of Technology, Akure, Covenant University (CU), University of Nigeria, Nsukka (UNN), Ahmadu Bello University (ABU) were found to provide related programmes in AI in Nigeria. A more detailed overview is provided in Table 7 in Annexure 1.

4.2.6 AI Programmes offered in Ghana

Based on the study conducted, the Academic City University College and Kumasi Technical University were found to provide dedicated AI programmes or related in Ghana. A more detailed overview is provided in Table 8 in Annexure 1.

In general, it was found that various Universities in Ghana offer programmes in Computer Science at Undergraduate and Postgraduate Level. These include the following Universities: University of Ghana, University of Cape Coast, Kwame Nkrumah University of Science and Technology, Ashesi University.

4.2.7 AI Programmes offered in Côte d'Ivoire

In general, very limited information was found regarding universities that offer AI programmes or related in Côte d'Ivoire. A number of Universities offer programmes in Computer Science. Based on the study conducted, the Université Félix Houphouët-Boigny and the Nangui Abrogoua University School of Engineering and Technology (ENSIT) were found to provide dedicated AI programmes or related in Côte d'Ivoire. A more detailed overview is provided in Table 9 in Annexure 1.

4.2.8 AI Programmes offered in Senegal

As in the above cases, in general, very limited information was found regarding universities that offer AI programmes or related in Senegal. A number of Universities offer programmes in Computer Science. Based on the study conducted, the African Institute of Mathematical Sciences Senegal (AIMS) and the Dakar Institute of Technology were found to provide dedicated AI programmes or related in Senegal. A more detailed overview is provided in Table 10 in Annexure 1.

4.2.9 AI Programmes offered in Morocco

Based on the study conducted, the Mohammed VI Polytechnic University / AI Movement, Al Akhawayn University in Ifrane (AUI) and Mohammed VI Polytechnic University (UM6P), Mohammed V University of Rabat, and the Euromed University of FES / The School of Digital Engineering and Artificial Intelligence (EIDIA) were found to provide dedicated AI programmes or related in Morocco. A more detailed overview is provided in Table 11 in Annexure 1.

4.2.10 AI Programmes offered in Tunisa

Based on the study conducted, the Pristini School of AI that focuses on various Master's programmes related to AI, and the Mediterranean Institute of Technology (MedTech) in collaboration with the Mediterranean School of Business (MSB), and Université Centrale Tunisia; were found to provide dedicated AI programmes or related in Tunisa. A more detailed overview is provided in Table 12 in Annexure 1.

4.2.11 AI Programmes offered in Egypt

Based on the study conducted, the Nile University, the Egyptian Russian University (ERU), the Arab Academy for Science, Technology & Maritime Transport (AASTM), Pharos University of Alexandria, the Egypt University of Informatics (EUI), and the Kafr El Sheikh University were found to provide dedicated AI programmes or related in Egypt. A more detailed overview is provided in Table 13 in Annexure 1.

4.3 Summary of AI Programmes offered in Higher Education Institutions in Africa

From the study conducted and from the sample set of Universities considered, it was found that in general, most regions provided training in a broad spectrum of AI Related topics which may be summarised as follows:

i. Southern Africa – From the analysis conducted, Universities in South Africa and Mauritius provide well-structured programmes and offer training in AI in the areas of Machine Learning, Computer Vision, Data Analytics, Big Data, Robotics, Natural Language Processing, and the Internet of Things.

ii. East Africa – The Universities reviewed in Kenya and Rwanda provide training in AI in the areas of Machine Learning, Data Analytics, Big Data, and the Internet of Things.

iii. West Africa – As highlighted above, the availability of information from higher education institutions in West Africa is not readily available. In Senegal, however, it was found that training in AI is provided in the areas of Machine Learning, the Internet of Things, Robotics, and National Language Processing.

iv. North Africa – From the Universities reviewed in Morocco, Tunisa, and Egypt, it was also found that many higher education institutions offer structured programmes in AI. The following areas of AI were found at the higher education institutions in the countries: Machine Learning, Computer Vision, Natural Language Processing, Cloud Computing, Data Analytics, and Big Data.

5. Overview of Research Insititutes at Higher Education Institutions in Africa

5.1 Introduction

As a further analysis of the capacity in AI being developed across the continent, a review of the Research Institutes in each region was conducted. The type of AI research being conducted was also analysed. This section provides a summary of the analysis.

5.2 Summary of AI Research Institutes in Africa.

From the study conducted, as with the Universities offering programmes in AI, the data suggests that the North African countries (Egypt, Tunisa, and Morocco) and the Southern African countries (South Africa and Mauritius) rank highest in their maturity in the establishment of AI Research Institutes as opposed to other regions. This is followed by the countries in the East African countries (Kenya and Rwanda). Finally, West African countries have also demonstrated the establishment of some Research Institutes in AI. It is seen that the established AI Research Institutes have support from Industrial Partners (Ex. Intel in Kenya, Ericsson in Egypt, etc), Government Departments (Ex. Department of Science and Innovation, Department of Communications and Digital Technologies in South Africa etc), and International Governments Support (Swedish Development Agency, German Development Agency etc in West Africa). A high-level summary of the AI domains researched on at the Research Institutes across Africa based on the study conducted is provided in the following figure.

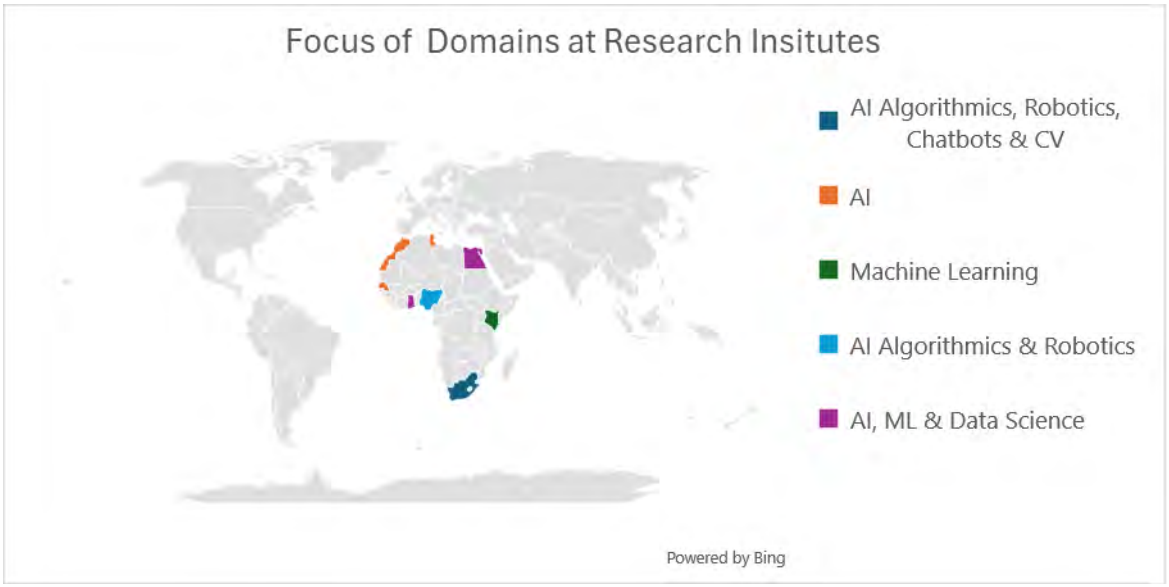

Figure 4 – *Summary of Research Domains at AI Research Institutes in Africa*.

5.2.1 AI Research Institutes in South Africa

Based on the study conducted, the following universities / research institutes were found in South Africa: The Centre for Artificial Intelligence Research (CAIR), The Artificial Institute of South Africa (AI-ISA) – TUT & University of Johannesburg, Centre for 4IR South Africa (C4IR) – CSIR. In the review of South African Universities / Research Institutes, most research institutes are driven by various government initiatives such as the Department of Science and Innovation (DSI) and the Department of Communications and Digital Technologies (DCDT). A more detailed overview is provided in Table 14 in Annexure 2.

5.2.2 AI Research Institutes in Mauritius

Based on the study conducted, the main research institute found in Mauritius is the Mauritius Research and Innovation Council. A more detailed overview of the council is provided in Table 15 in Annexure 2.

5.2.3 AI Research Institutes in Kenya

Based on the study conducted, the University of Nairobi currently hosts a Computing for Development Laboratory. A more detailed overview of the laboratory is provided in Table 16 in Annexure 2.

5.2.4 AI Research Institutes in Rwanda

Based on the study conducted, the main centre that conducts research in AI in Rwanda is the Digital Transformation Center Rwanda. A more detailed overview of the centre is provided in Table 17 in Annexure 2.

5.2.5 AI Research Institutes in Nigeria

Based on the study conducted, two centres were found in Nigeria that conduct research in AI: the National Center for Artificial Intelligence and Robotics and the Robotics and Artificial Intelligence Nigeria institute. A more detailed overview of the centres is provided in Table 18 in Annexure 2.

5.2.6 AI Research Institutes in Ghana

Based on the study conducted, the RAIL laboratory at the Kwame Nkrumah University of Science and Technology conducts research in various topics related to AI for development. A more detailed overview of the laboratory is provided in Table 19 in Annexure 2.

5.2.7 AI Research Institutes in Côte d'Ivoire

Based on the study conducted, dedicated research institutes in AI were not found in Côte d'Ivoire.

5.2.8 AI Research Institutes in Senegal

Based on the study conducted, the Université Cheikh Anta Diop which hosts the International Development Research Centre and the African Centre for Technology Studies (ACTS) currently conduct research in AI in Senegal. A more detailed overview of the centres is provided in Table 20 in Annexure 2.

5.2.9 AI Research Institutes in Morocco

Based on the study conducted, three research institutes that conduct research in AI were found in Morocco: MoroccoAI, the Moroccan International Center for Artificial Intelligence, and Cadi Ayyad University of Marrakech. A more detailed overview of the institutes is provided in Table 21 in Annexure 2.

5.2.10 AI Research Institutes in Tunisia

Based on the study conducted, the Tunisian AI Society (TAIS) was found to conduct research in AI in Tunisia. A more detailed overview of the institute is provided in Table 22 in Annexure 2.

5.2.11 AI Research Institutes in Egypt

Based on the study conducted, the following centres conduct research in AI in Egypt: the Ericsson Data Science & Cloud Software R&D Hub and the National Council for Artificial Intelligence. A more detailed overview of the centres is provided in Table 23 in Annexure 2.

5.3 Summary of Research Institutes at Higher Education Institutions in Africa.

From the study conducted and from the sample set of Universities considered, a number of research institutes are operating in the regions considered. As highlighted above, many of the institutes are driven by Government initiatives while others are driven by International Development Agencies. A number of global industrial partners are also supporting various centres across the African continent.

i. Southern Africa – From the analysis conducted, the research centres in this region mainly focus on the areas of AI Algorithmics, Robotics, Computer Vision, Chatbots, and the Internet of Things.

ii. East Africa – In the East African region, the main focus of AI centres is in AI Algorithmics, Natural Language Processing, Chatbots, and the Internet of Things.

iii. West Africa – Considering the West African region, the focus of the AI centres is in the area of Machine Learning, Robotics, Augmented and Extended Reality, and the Internet of Things.

iv. North Africa – In North Africa, the main focus of research at the AI Centers considered include a focus on development of AI-Enabled solutions and the focus on AI solutions in the Telecommunications sector in Egypt.

6. Overview of the Status of National AI Policy in Africa

6.1 Introduction

As stated in [7], the world has witnessed an increased awareness of the societal implications of AI with various political bodies taking action on the impact of AI on society. However, while [7] reported that Sub-Saharan Africa showed serious challenges to AI adoption by governments, the analysis conducted in this study demonstrated that there has been growth during 2023 with a total of **4 countries** in Africa having published national AI strategies.

The following section provides a summary of the analysis of the status of National AI policies for the countries under study.

6.2 Status of National AI Policy

The following table provides a summary of the AI Policy status across the continent.

Table 2: *Status of National AI Policy across the African Continent*

No.	Country	AI Policy Status
1.	South Africa	Presently, there is no specific legislation in South Africa regarding AI, though a framework is currently under development.
2.	Mauritius	Mauritius launched its AI Strategy in 2018. The AI Strategy provides recommendations from working groups that have conducted research into how AI can be integrated into the national priorities of the country and how it can be embedded within the business ecosystem of the country. The country has further established the Mauritius AI Council.
3.	Kenya	Kenya does not have a stand-alone national AI strategy or regulatory framework. Kenya relies on several existing laws to address issues related to AI and digital technologies. These laws include the Data Protection Act (DPA) of 2019, which confers a framework for data protection in Kenya.
4.	Rwanda	On April 20th, 2023, Rwanda became one of the few countries in Africa to develop a national AI policy. The policy, called the "National AI Policy for Responsible AI Adoption," outlines a roadmap for Rwanda to harness the power of AI for sustainable development.
5.	Nigeria	Nigeria currently does not have an AI Strategy. However, In August 2023, the Federal Government has issued an invite to Nigerian and non-Nigerian top researchers across the globe to help the country design its National Artificial Intelligence (AI) Strategy[8].
6.	Ghana	There is no known legal or regulatory framework around AI in Ghana. However, there are some regulations that cover aspects of the scope of AI.
7.	Côte d'Ivoire	Côte d'Ivoire currently does not have an AI Strategy.
8.	Senegal	On September 14, 2023, the Senegalese government, launched the national strategy on artificial intelligence (AI)
9.	Morocco	In 2021, the Moroccan Government started building a strategy for developing an AI ecosystem through the Agency for Digital Development (ADD)

7. Government AI Readiness Index 2023, Oxford Insights, December 2023, available online: https://oxfordinsights.com/ai-readiness/ai-readiness-index/2023-government-ai-readiness-index-2-2/

10.	Tunisa	Presently, there is no specific legislation in Tunisa regarding AI, though a framework is currently under development.
11.	Egypt	The government of Egypt launched its national AI Strategy in 2019. The strategy has two pillars: building human capacity and supporting scientific research and innovation. Egypt has also created a National AI Council which is responsible for supervising the implementation of the strategy.

6.3 Summary of Status of National AI Policy

As stated in [7], the announcement of AI strategies and policies in developing countries across the world during 2023 provides an indication of the potential boost amongst countries that were lagging in the formalisation of AI policies and strategies. As further stated in [7], it is seen that AI is becoming a pivotal element in the development agendas across most countries around the world and seeing the support of various international development agencies supporting the development of AI strategies across the world [7].

7. How Startups/Spinoffs can be assisted using AI In African Universities

7.1 Introduction

While the space of Deep Technologies (DeepTech) in Africa is considered relatively small in comparison to advanced nations across the world, Africa has been witnessing growth over the past years which can be attributed to the development of new applications and the integration with existing products[9]. As further stated, the growth in this domain can be attributed to the widespread adoption of Artificial Intelligence-based solutions across the continent[8].

However, various factors continue to contribute to the slow growth in innovation across the sectors. These can be attributed to the lack of adequate support systems for DeepTech, the high cost associated with research and development and associated costs required to drive high level innovations, and the general lack of effective fund mechanism for startups in the industry.

7.2 Report on how startups/spinoffs can be assisted using AI in African Universities

While specific programmes that are oriented towards assisting startups/spinoffs using AI in African Universities were not found in the analysis conducted, a large number of research institutes were reported on in Section 5 of this report. It is expected that these research institutes could play an important role in the DeepTech ecosystem across the African continent.

For example, in South Africa, the strategic implementation framework for the establishment of the National AI institute of South Africa (AI-ISA) and it related Hubs refers to the following objectives as part of its policy framework:

1. Collaboration and alliance with the African continent.
2. Industry and small, medium, micro enterprise (SMME) development.
3. Research and development.
4. Governance, regulatory and ethical approaches.
5. Training and development.

Thus, the various research institutes reported on in Section 5 could contribute to supporting DeepTech in Africa in AI through the various programmes that they offer.

8. Co-creating a National Artificial Intelligence Strategy in Nigeria, available online: https://twitter.com/bosuntijani/status/1696113557354549599?ref_src=twsrc%5Etfw%7Ctwcamp%5Etweetembed%7Ctwterm%5E1696113557354549599%7Ctwgr%5E637e081e75e32ab4469063c1f934b59d38418f56%7Ctwcon%5Es1_&ref_url=https%3A%2F%2Fwww.vanguardngr.com%2F2023%2F08%2Fcommunications-minister-invites-top-researchers-to-develop-national-ai-strategy%2F

9. B Agbokponto Soglo, K Hatch, S Beckmann, Evaluating the African Deep-Tech Startup Ecosystem, October 2022, available online: https://community.intel.com/t5/Blogs/Intel/Policy-Intel/Evaluating-the-African-deep-tech-startup-ecosystem/post/1424924?attachment-id=87195

8. How Global Industrial Partners are Engaging with African Universities on AI Research, Capacity Development etc.

8.1 Introduction

Global partners have a considerable potential to contribute to the growth of the AI ecosystem in Africa. This is evident from the various interventions that are currently taking place across many countries in Africa. The study found several interventions by Global Industrial Partners which is reported on below.

8.2 Summary on Report on Global Industrial Partners engagement with African Universities / Programmes on AI research, capacity development etc

From the study conducted, it was difficult to extract sufficient information regarding Global Industrial Partner engagements with African Universities on AI research, Capacity Development in general. While some information was found regarding involvement in many countries at Universities across Africa, the amount of information was in general insufficient. However, the Global Industrial Partners that are partnering with African Universities / National programmes is having an impact on the extent of research being conducted in AI as well as on capacity development initiatives.

8.2.1 Global Industrial Partner's engagement with African Universities / Programmes on AI research, capacity development in South Africa

Based on the study conducted, a number of Universities in South Africa partner with various Global Industrial Partners as part of their activities in conducting research in AI as well as with capacity development initiatives. These include Intel, Google, Microsoft, AWS, IBM, etc.

Furthermore, in partnership with the TUT Hub of the Artificial Intelligence Institute of South Africa (AI-ISA), Intel has partnered with TUT in developing an Intel Career Tech centre based at the Pretoria West campus of TUT. The centre will focus on adopting the AI for Future Workforce[10] training as well as the OneAPI programme[11] as part of a Honours level programme in Electrical Engineering focusing on Computational Intelligence.

A more detailed overview of the Universities and Global Industrial partners is provided in Table 24 in Annexure 3.

8.2.2 Global Industrial Partner's engagement with African Universities / Programmes on AI research, capacity development in Mauritius, Nigeria, Cote d'Ivoire, Morrocco, and Tunisia

Based on the study conducted, information could not be extracted regarding Global Industrial Partners engaging with African Universities in Mauritius, Nigeria, Cote d'Ivoire, Morrocco, and Tunisia.

8.2.3 Global Industrial Partner's engagement with African Universities / Programmes on AI research, capacity development in Kenya

In the context of Kenya, based on the study conducted, two Industrial partners are currently collaborating with Universities in Kenya. A summary is provided in Table 25 in Annexure 3.

10. AI for Future Workforce, available online: https://www.intel.com/content/www/us/en/corporate/artificial-intelligence/digital-readiness-ai-for-future-workforce.html

11. oneAPI Academia and Community Programs, available online: https://www.intel.com/content/www/us/en/developer/tools/oneapi/training/academic-program.html#gs.5p53l1

8.2.4 Global Industrial Partner's engagement with African Universities / Programmes on AI research, capacity development in Rwanda

Two Global Industrial Partners are currently collaborating with the AIMS institute in Rwanda. A summary of the partners is provided in Table 26 in Annexure 3.

8.2.5 Global Industrial Partner's engagement with African Universities / Programmes on AI research, capacity development in Ghana

Based on the study, three Global Industrial Partners are currently partnering with institutions in Ghana. A summary of the partners is provided in Table 27 in Annexure 3.

8.2.6 Global Industrial Partner's engagement with African Universities / Programmes on AI research, capacity development in Senegal

Based on the study conducted, a number of Global Industrial Partners are currently collaborating with Universities/ research institutes in Senegal. They also include International Development Agencies. A summary of the partners is provided in Table 28 in Annexure 3.

8.2.7 Global Industrial Partner's engagement with African Universities / Programmes on AI research, capacity development in Egypt

Based on the study, two Global Industrial Partners are currently collaborating with research centres in Egypt. A summary of the partners is provided in Table 29 in Annexure 3.

9. Suggestions/Recommendations on How African Universities, AI Startups, Policy Makers, and Private Industries Could Take Advantage of AI Use Cases in Global Universities and how there are Leveraging AI

9.1 Introduction

As highlighted in [12], over 1 billion jobs are set to be transformed by AI technology in the next 10 years. To be able to respond to this shift, Higher education institutions need to prepare students for this revolution. However, as discussed in [13] , a global survey prepared for the Ministerial Roundtable on Generative AI and Education, organized by UNESCO of over 450 schools and universities found that fewer than 10% have developed institutional policies and/or formal guidance concerning the use of generative AI applications. The survey demonstrates the urgency in the need for Higher Education institutions to continue providing guidance and direction with regard to capacity building in AI.

As stated in [9], higher education has been turned to for people that seek to acquire knowledge and skills to prepare them for the world of work. However, the model is being challenged today as a result of the impact that AI is placing on society. The traditional models of education have to thus evolve to meet the demands being placed as a result of the AI revolution taking place.

9.2 Some Key recommendations on how Higher Education institutions need to prepare for the AI revolution

The article in [9] highlights 3 key reforms that need to take place at Higher Education institutions which could be considered with African Universities as well.

1. New Curriculum for AI – to meet the growing demands for capacity development in AI, there is a need to build new curricula oriented towards AI and various potential use-cases for AI that are focused on challenges faced in Africa in areas such as Education, Healthcare, Manufacturing, Telecommunications, Agriculture, Transport, Climate Change, Sustainability etc. that could be solved using AI solutions.

2. Experimental Programmes for the Workspace – As highlighted in [9], designing programmes that expose students to the rapidly changing AI landscape would benefit in adapting to the changing world. By connecting the abstract knowledge, they attain at university and linking it with real-world problems in the workplace would contribute to ensuring greater impact in building and preparing an AI-ready workforce.

3. Preparing Universities for Lifelong Learning – As highlighted in [9], the world cannot avoid the fact that AI is reinventing the workplace. This creates the need to have Universities respond to develop programmes that aim to upskill and reskill to address the changing professional needs. For example, offering executive courses for a period of few weeks to few months.

12. Here are 3 ways higher education can prepare for the generative AI revolution, available online: https://www.weforum.org/agenda/2023/05/3-ways-higher-education-can-prepare-for-generative-ai-revolution/
13. UNESCO survey: Less than 10% of schools and universities have formal guidance on AI, available online at: https://www.unesco.org/en/articles/unesco-survey-less-10-schools-and-universities-have-formal-guidance-ai

10. Indicators That Could be used to Determine Higher Education Universities that are Poised to be Leaders in AI in Africa

10.1 Introduction

As highlighted in [14], various factors can be attributed to the drivers of AI across the world. For example, big tech companies could be attributed to the drive of AI in North America while Government Policy in general can be seen to be driving AI in Europe. However, in Africa, the challenges are vast. As highlighted in [13], many sub-Saharan African universities lack sufficient computing curricula as part of their academic offerings and have to deal with unreliable and expensive infrastructure, challenges with internet connectivity and electricity.

However, in spite of the various challenges faced across the continent, there are various positives that can be demonstrated as highlighted by the data collected in this study which is illustrative of the growing extent of capacity development across the continent. As highlighted in [15], Africa is considered to have the youngest population globally. It is considered that 70% of the sub-Saharan Africa's population is under the age of 30 provides tremendous opportunity for the continent's growth [14].

10.2 Recommendations for the definition of Indicators

In the determination of indicators that could be used to determine Higher Education Universities in Africa that are poised to become leaders in AI in Africa, various approaches could be used. For example, in the determination of world rankings of Higher Education Universities globally, the Time Higher Education[15] makes use of 18 performance indicators to provide a comprehensive and balanced comparison between universities. The performance indicators [16] are grouped into five categories that include: 1) Teaching (the learning environment); 2) Research environment (volume, income, and reputation); 3) Research quality (citation impact, research strength, research excellence and research influence); 4) International outlook (staff, students, and research); and 5) Industry (income and patents).

Based on the above, a similar set of indicators can be used to determine Universities in Africa that are poised to become leaders in AI.

1. Universities that have developed Academic Programmes in AI in the Programme Qualification Mixes (PQM) across the different levels (Undergraduate, Postgraduate level).

2. The extent of Research and Innovation in AI that is taking place within the university.

3. The R&I outputs in AI being generated at the university.

4. Impact of AI Training Programmes being offered to the community (non-formal training programmes linked to skilling, re-skilling…)

5. Extent of Collaborations/Partners with various stakeholders in AI (Government, Industry, NGOs, International Collaborators).

6. Extent of support for Startups, Spinoffs, and the DeepTech ecosystem.

7. Extent of AI Infrastructure being invested at the Universities.

14. Susan D'Agostino, Technology Students in Africa, Bolstered by 'Grassroots AI, available online: https://www.insidehighered.com/news/tech-innovation/artificial-intelligence/2024/01/04/african-technology-students-bolstered
15. Young People's Potential, the Key to Africa's Sustainable Development, available online: https://www.un.org/ohrlls/news/young-people%E2%80%99s-potential-key-africa%E2%80%99s-sustainable-development#:~:text=Africa%20has%20the%20youngest%20population,-to%20realise%20their%20best%20potential.
16. World University Rankings 2024: methodology, Times Higher Education, available online at: https://www.timeshighereducation.com/world-university-rankings/world-university-rankings-2024-methodology

11. Summary of the Prospects and Challenges of AI For Higher Education in Africa

11.1 Introduction

As highlighted in [17], Africa will be home to the world's largest working-age population by 2040. It is projected that the African population will nearly double to 2.5 billion over the next quarter-century[18]. It is predicted that this rapid growth in the young population in Africa has the potential to contribute to the smart deployment of its labour force in highly productive jobs and which in turn will contribute to the spurring of economic growth in the continent. It is further predicted that on the current growth trajectory across the African continent, the services sector will create at least 85 million net new jobs across the continent by 2030[19].

As highlighted in [20], AI is projected to contribute $15.7 Trillion to global GDP. Furthermore, a study conducted by Access partnership and Google, projected that AI applications could support up to USD 136 billion worth of economic benefits for four sub-Saharan countries (Ghana, Kenya, Nigeria, and South Africa) by 2030[21]. AI thus has the potential to drastically shift how businesses operate, stimulate innovation across the continent, and contribute to uplifting the lives of its people through job-creation. To achieve this, however, a crucial element is the development of adequate skills to support the growth in the AI sector across the continent.

11.2 Summary of the Prospects and Challenges

As highlighted above, the growth in the AI sector across Africa has the opportunity to contribute to economic growth across the continent. A number of key prospects as well as potential barriers in Higher Education can be identified which are summarised below.

11.3 Prospects of AI for Higher Education in Africa

i. Development of dedicated AI Programmes (Undergraduate & Postgraduate programmes) – An opportunity lies in the development of dedicated programmes oriented to building AI skills at the Undergraduate level as well as the Postgraduate level oriented to various use cases of AI.

ii. Development of a Skills-base in AI oriented to various use cases of AI – Through the skills development that is taking place in AI, the development of a skills-base in AI oriented to specific use cases of AI will provide the required human capacity to drive the AI growth in the continent.

iii. Contribution to Startups, Spin-offs, and the DeepTech ecosystem – through the development of skills in AI across the continent, the opportunities lie for the youth across the continent to contribute to economic growth across the continent.

iv. Contribution to Economic Growth – with the various challenges being faced across the continent such as economic challenges and unemployment rates, the development of skills and the DeepTech ecosystem could greatly stimulate the economies across the continent.

v. Stimulation of Investments from various stakeholders – through the capacity development in AI that is taking place, the opportunity for various stakeholders getting involved with Higher Education activities in AI could in-

17. M Kuyoro, A Leke, O White, L Woetzel, K Jayaram, and K Hicks, Reimagining economic growth in Africa: Turning diversity into opportunity, Mckinsey Global Institute, available online: https://www.mckinsey.com/mgi/our-research/reimagining-economic-growth-in-africa-turning-diversity-into-opportunity
18. How the Youth Boom in Africa Will Change the World, New York Times, available online: https://www.nytimes.com/interactive/2023/10/28/world/africa/africa-youth-population.html
19. Reimagining economic growth in Africa: Turning diversity into opportunity, McKinsey Global Institute, available online: https://www.mckinsey.com/mgi/our-research/reimagining-economic-growth-in-africa-turning-diversity-into-opportunity
20. AI is here to stay: How AI can contribute to the economic growth in Africa, UN University, available online: https://inra.unu.edu/publications/articles/ai-is-here-to-stay-how-artificial-intelligence-can-contribute-to-economic-growth-in-africa.html
21. AI in Africa: Unlocking Potential, Igniting Progress, available online: https://accesspartnership.com/ai-in-africa-unlocking-potential-igniting-progress/

crease. To make a greater impact, a triple helix model that promotes the interaction between academia, government, and industry would become more feasible.

vi. Driving Government Strategies and Policy – through the development of greater skills in AI that can contribute to economic growth in countries, the motivation for Government to drive AI strategies and policies will be further accelerated.

11.4 Challenges for AI for Higher Education in Africa

i. Access to Higher Education continues to be a challenge across the continent. As highlighted in [22], Higher Education Institutions (HEIs) in South Africa grapple with a range of complex issues that affects access to quality education. Furthermore, considering the 60 million people in the country, just over 1.1 million students were registered across the countries with 208 299 first-time entering enrolments projected[23]. This highlights the challenges faced in access to Higher Education in South Africa.

ii. Access to High-speed Internet and Electricity – Most countries across the continent still grapple with poor internet access and reliable power networks. The availability of these infrastructure will contribute to the effective growth in the AI sector and various potential uses-cases for AI that can be rolled out.

iii. Cost of Investment in AI Infrastructure

- A challenge faced by many universities across Africa is the cost of AI-based infrastructure. If one considers the cost of required infrastructure for supporting Computer Vision, Edge AI, Cloud Computing infrastructure, the cost implications can make the access to effective AI training beyond the capacity of most educational institutions in Africa.

- In December 2023, Intel introduced the AI PC. The PC provides for a dedicated AI engine that offers power-efficient AI acceleration and local inference on the PC. The AI PC consists of a CPU, a GPU, and a Neural Processing Unit (NPU) with each providing for specific AI acceleration capabilities. The benefit of the NPU is that it handles AI and ML tasks on the PC instead of sending data to be processed in the cloud[24]. This provides tremendous benefits from the perspective of required infrastructure investments making AI training more affordable.

iv. Incentives to retain AI Experts in Africa – due to the lack of adequate incentives for AI experts across Africa, the tendency is for many academics to seek better opportunities in the Global North.

22. Higher Education Leaders Survey 2023: Disruption and opportunities in education, available online: https://www.pwc.co.za/en/publications/higher-education-leaders-survey.html
23. Over one million enrolments expected in public universities, available online: https://www.sanews.gov.za/south-africa/over-one-million-enrolments-expected-public-universities
24. What is an AI PC?, Intel Newsroom, available at: https://www.intel.com/content/www/us/en/newsroom/news/what-is-an-ai-pc.html#gs.6bjvbp

12. Summary of the Types of Artificial Intelligence that African Universities can Contribute to or Can Invest in & The Future of AI in African Universities

12.1 Introduction

As highlighted in [25], Higher Education Universities across the African continent are investing in developing talent and skills to ensure that it contributes to the future of AI, research and innovation in AI, and in developing strong partnerships for AI development. Several examples of initiatives being undertaken at various Universities across Africa have been highlighted in this study. These include the activities in AI being conducted at Research Institutes associated with Universities in Africa.

12.2 Types of Artificial Intelligence that African Universities can Contribute to or can Invest in

To conduct an analysis of the types of AI that African Universities can contribute to or can invest in, an overview of the types of AI initiatives being conducted at Universities through the various research Centres in Africa is presented. As highlighted previously, the publicly available information from University websites was a challenge which contributed to a limited indication of the type of AI activities taking place in some countries under study. One of the key findings from this study is that AI Algorithms and Machine Learning is a common area where African Universities can contribute to and can invest in across all the 11 African countries.

Country	Summary of AI Types
South Africa	AI Algorithmics & ML Chatbots Natural Language Processing (NLP) Computer Vision VR/AR Drones & Robotics IoT Online Learning Platforms
Mauritius	AI Algorithmics & ML IoT Chatbots NLP Online Learning Platforms
Kenya	AI Algorithmics & ML IoT Chatbots NLP
Rwanda	AI Algorithmics & ML
Nigeria	Machine/Deep Learning Internet of Things (IoT) Blockchain Intelligent Robotics Extended Reality (XR) - VR/AR/MR

25. Artificial Intelligence in African Higher Education, Association of African Union Universities Blog, available online: https://blog.aau.org/wp-content/uploads/2023/10/ENGLISH_-CONCEPT-NOTE-AU-DAY-2023.pdf

Country	Summary of AI Types
Ghana	AI Algorithmics & ML
Côte d'Ivoire	n/a
Senegal	AI Algorithmics & ML
Morocco	AI Algorithmics & ML Robotics & Autonomous systems Big Data Analytics Cyber Security
Tunisa	AI Algorithmics & ML Big Data Analytics Cyber Security
Egypt	AI Algorithmics & ML NLP Speech Recognition Computer Vision Cloud Computing Robotics

12.3 Future of AI in African Universities

The article in [22] highlighted that during 2023, Higher Education Institutions (HEIs) in South Africa had to deal with a wide range of continuing complex issues which include the wide disparities in socio-economic distributions, the lack of adequate funding within the higher education sector, and the historical structural inequality that affects access to quality education in South Africa. These challenges can be extended across the African continent which also experience the above challenges, and in some cases, and to a greater extent. These challenges have been further coupled with the pressure on HEIs to leverage and integrate various emerging AI tools such as ChatGPT and Bard (Gemini) into the HEI educational fabric [22].

As highlighted in Section 10.2.1 that focused on the prospects of AI for Higher Education in Africa, the opportunities that lie within African Universities making a marked impact on the growth of AI in the continent is positive. African Universities are making marked strides in developing AI capacity across the Universities that are being fuelled by the different activities taking place at the different HEIs presented in this study.

13. Recommendations to African AI Ecosystem Stakeholders Based on the Key Findings of the Research Conducted.

13.1 Introduction

As stated in the introduction, the objective of this study was to evaluate the potential for growth in the AI sector in Africa. The main objective of the study was to gain a deeper understanding of the landscape of AI across Universities in Africa and to use the study as a mechanism to provide some indicators regarding the readiness of the continent in equipping its workforce in AI.

13.2 Key Findings & Recommendations of the Study

As a result of this study, the following has been established through the data that was collected:

i. The study was able to provide a better understanding of the AI landscape across Universities across the African Continent providing an overview of the **type of academic programmes** HEIs are providing. While there was large variation in the type of programmes offered, the study was able to show that programmes oriented to AI are slowly developing across the continent. While some regions are more advanced than others (For example, the Northern African countries were found to be more advanced in their adoption of AI-based programmes compared to other regions), there is still opportunity for countries in Africa to react to the need to develop more programmes that are purely AI-based.

ii. An overview of the **Research Institutes** focused on AI in Africa was provided. The overview provided an indication of the Research and Innovation activities in AI that is taking place in Africa. The use cases highlighted demonstrate the wide adoption of AI that is taking place in the continent. Furthermore, the various stakeholders involved with the research institutes was highlighted which include Government Agencies, Industrial Partners, and International Funding agencies. It is clear that to achieve greater impact in AI across the African continent, it is crucial that collaborations in the form of a Triple Helix model continues to be promoted.

iii. The study was able to provide an overview of the status of **AI Strategy and Policy** across the selected African Countries. Again, some of the countries studied are quite advanced in their adoption of AI strategies and policy. This is an area where there is considerable opportunity to drive the adoption of AI strategies and policy making with contributions to the initiatives currently being driven by Governments (For example, the Strategy and Policy initiatives being driven by the South African Government and in Nigeria).

iv. As highlighted in the study, considerable activities in AI are taking place in various HEIs across the African continent. This provides the opportunity to **support potential Startups and Spinoffs** from within the Universities in partnership with Key stakeholders across the continent. This could further benefit the ongoing initiatives in building effective ecosystems in Africa and contributing to the DeepTech ecosystem.

v. The study was able to provide a snapshot of the various **Global Industries** that are collaborating with various African Universities on AI research and development programmes across the continent. As highlighted above, the collaborations provide an effective mechanism to ensuring stronger development of the AI ecosystem in Africa through the provisioning of suitable AI platforms, access to AI training programmes, support for the AI startups and spinoffs generated from within African Universities.

vi. While **Global AI use cases** were identified through the study, the opportunity that lies in the African context is to apply the use of AI to solve grand challenges faced in Africa. These include the challenges associated with Climate, the need to develop more efficient Farming and Food Production approaches, contributing to the Healthcare sector, contributing to the Energy production sector, supporting the Manufacturing sector for production efficiencies etc.

vii. An area that was identified that needs support in the development of AI adoption across the continent is regarding investment in **AI infrastructure**. The biggest challenge faced in many African countries is regarding the accessibility to sufficient platforms for training in AI. The diverse need spreads from suitable compute power, computer vision platforms, Edge AI platforms, platforms for Robotics and Autonomous systems etc. The other

challenge faced across the African continent is the access to stable power supply which many countries across the continent are still battling with, making the application of AI-based solutions an opportunity to address this challenge.

14. CONCLUSION

This study which was initiated by Intel in collaboration with the TUT Hub of the Artificial Intelligence Institute of South Africa (AI-ISA) was conducted to evaluate the potential for growth in the AI sector in Africa. The study aimed to provide a better understanding of the AI landscape across Higher Education institutions (HEIs) on the African Continent by considering various indicators. From the study on the AI programmes offered at various HEIs across the continent, it was found that there is a general uptake in AI programmes offered across the continent. The study further highlighted the various Research Institutes that are undertaking research and development project across Africa that is contributing to the development of human capacity in AI. In addition, the study also shows the wide adoption of AI that is taking place in the continent and the various stakeholders involved with the research institutes that are making the engagements in AI possible.

Furthermore, considerable activities in AI are taking place in various HEIs across the African continent that could provide the opportunity to support potential startups and spinoffs from within the Universities which in turn could contribute to building effective ecosystems in Africa and contributing to the DeepTech ecosystem. The study also provided a snapshot of the various Global Industries that are collaborating with various African Universities on AI research and development programmes across the continent as well as the Global AI use cases that could be used to apply the use of AI to solve grand challenges faced in Africa.

A critical area in the adoption of AI across the continent is with regard to AI Strategy and Policy. The study provided an overview of the status of AI Strategy and Policy across the selected African Countries. Various countries across the continent continue to drive the adoption of AI strategies and policies. One of the challenges identified was regarding investment in AI infrastructure with many countries in Africa having limited access to sufficient platforms for training in AI and reliable power in most countries.

As highlighted in [26], Africa is considered to be young, innovative, and resource rich. It is thus poised to contribute to the reimagining of its economic opportunity, a great need across the continent that could benefit the continent and the world at large. As further highlighted in the article, 25% of the world's population by 2050 will originate from the African continent with the population set to rise to 2.5 billion people. This provides a clear opportunity to tap into an ever-growing youth population across Africa and nurturing them to become potential contributors to the AI workforce across the continent. This cannot be achieved in isolation, but through effective partnerships among all the stakeholders involved in the development and growth of the African AI ecosystem.

26. M Kuyoro, A Leke, The path to greater productivity and prosperity in Africa, McKinsey & Company, available online: https://www.mckinsey.com/industries/public-sector/our-insights/the-path-to-greater-productivity-and-prosperity-in-africa#/

ANNEXURE 1: List of AI Programmes Offered in Selected Countries in Africa

Table 3: *AI Programmes offered in South Africa*

Name of University	Programme Offered	Description
University of Johannesburg	Master's of Artificial Intelligence	The purpose of the Artificial Intelligence (CW) program at University of Johannesburg is to develop skilled graduates able to work at a high level of competence with cutting edge Artificial Intelligence applications and concepts across a range of fields
University of Cape Town	MSc/Mphil in Artificial Intelligence	The Artificial Intelligence programme at the University of Cape Town involves two years of full-time study.
University of Witwatersrand	MSc Robotics	The programme is tailored to understanding how robots perceive the world, build models and plans, and take actions to manipulate their environment. This is done by focusing on machine learning, control, computer vision and artificial intelligence.
University of Stellenbosch	MSc in ML & AI	The MSc in Machine Learning and Artificial Intelligence is a one-year structured master's programme at Stellenbosch University that seeks to equip students with the fundamentals of ML and AI, plus a suite of sophisticated techniques and concepts at the research forefront of these fields.
University of Witwatersrand	MSc in AI	The coursework component of the MSc by Coursework and Research Report in the field of Artificial Intelligence covers topics ranging from computational intelligence, machine learning, multi-agent systems through to computer vision and natural language processing.
The African Institute for Mathematical Sciences (AIMS)	Master's in AI for Science	AI for Science is a new stream in AIMS South Africa's Master's degree in Mathematical Science, made possible through a partnership with Google DeepMind

Table 4: *AI Programmes offered in Mauritius*

Name of University	Programme Offered	Description
University of Technology, Mauritius	MSc Artificial Intelligence with Machine Learning	The MSc Artificial Intelligence with Machine Learning programme aims at enhancing the skills of the students by focusing on applied aspects of Machine Learning and Artificial Intelligence.
Université des Mascareignes	Master Artificial Intelligence and Robotics	The main objective of the AIR Master is to create a culture of interdisciplinarity in order to promote research and innovation using AI and Robotics to serve the society of tomorrow. Possible fields of application are: Health, Education, Energy, Environment, Maritime / road surveillance etc.
University of Mauritius	MSc Artificial Intelligence	This MSc Artificial Intelligence programme has been carefully designed to allow graduates to develop core data analysis skills and explore both traditional and state-of-the-art aspects of AI and machine learning. The objectives of the programme are to: Provide a solid awareness of the key concepts of AI; Encourage graduates to explore the latest tools and techniques in this field; Provide graduates with the fundamental knowledge and practical skills needed to design, build, and apply AI systems for real-life applications through group and individual projects.
Open University of Mauritius	BSc (Hons) Data Science and Artificial Intelligence	This programme combines two key areas of computing, namely data science and artificial intelligence, in a synergistic manner. Data science and Artificial Intelligence are two complementary areas of Intelligent Systems, with Data science focusing on statistical techniques and Artificial Intelligence on algorithmic techniques.

Table 5: *AI Programmes offered in Kenya*

Name of University	Programme Offered	Description
University of Nairobi	Master of Science in Computer Science	The philosophy of the Master of Science in Computer Science is to inspire learners to utilize the requisite knowledge, skills and attitudes acquired through quality teaching, research and innovation, in order to design and implement the next generation of computing/ICT solutions and infrastructure to stimulate Kenya's digital economy by embracing innovation and utilizing state of the art technologies such as Artificial Intelligence (AI), Internet of Things (IoT), cloud computing and block chain.
Jomo Kenyatta University	Master of Science Artificial Intelligence	This Two-year MSc programme is a specialist course that focuses on Artificial Intelligence and Knowledge Engineering, as well as the development of computational and engineering models of complex cognitive and social behaviours.
Strathmore University	Master of Science in Data Science and Analytics (MSc DSA)	The Two-year programme provides students with a route to high-quality careers in Big Data, Machine Learning, Artificial Intelligence, Data Analytics and Data Science. The programme will supply industry and government entities with a stream of highly trained data experts.
Kenyatta University	Master of Science in Computer Science	The Two-year programme aims to train students on theoretical principles of computer science in order to equip them with graduate level knowledge and skills in the field of distributed systems, software engineering, data sciences and artificial intelligence required in job market, research, and development.
Dedan Kimathi University of Technology	Master of Science in Computers Science	A two-year programme that seeks to upgrade students with expertise in computer science and elevate their careers.
Maseno University – School of Computing and Informatics	Master of Science in Computer Science with a Focus on AI	The MSc in Computer Science programme seeks to produce highly qualified personnel capable of developing complex computer system solutions consisting of hardware and/or software, using these methods, tools, and techniques.

Table 6: *AI Programmes offered in Rwanda*

Name of University	Programme Offered	Description
Carnegie Mellon University Africa	Master of Science in Engineering Artificial Intelligence (MS EAI)	MS EAI is a 16–20-month programme that opens the door to advanced skills that enable engineers to design powerful solutions to today's challenges. The MS EAI degree intersects with specific engineering disciplines but more importantly cuts across important problems in areas such as transportation, building systems, manufacturing, energy, agriculture, security, health, and climate. Students learn to combine a foundation in artificial intelligence, machine learning, and data science with their engineering, information technology, and software skills through theoretical and practical hands-on study of real-world applications.
AIMS institute Rwanda	African Master in Machine Intelligence	The African Masters of Machine Intelligence (AMMI) seeks to prepare well-rounded Machine Intelligence (MI) researchers by focusing on basic research in MI as well as the development of a vast array of applications that respond to both present and future needs of Africa and the world. Community at large, achieving crucial breakthroughs for the global good.
University of Kigali / African Centre of Excellence in Data Science (ACE-DS)	MS in Data Mining	The Master's degree with specialization in Data Mining equips graduates with solid knowledge and hands-on experience in techniques for managing, analysing and extracting hidden knowledge from structured and unstructured big data ensembles and in building adaptive analytic systems.

Table 7: *AI Programmes offered in Nigeria*

Name of University	Programme Offered	Description
University of Lagos (UNILAG)	MSc in Computer Science	The University of Lagos is one of the top universities in Nigeria, offering various courses in science, engineering, and technology. The university offers a degree program in Computer Science with a specialization in Artificial Intelligence.
The Federal University of Technology, Akure)	MSc in Computer Science	The Federal University of Technology, Akure is a top-rated university in Nigeria that offers various programs in science, engineering, and technology. The university offers a degree program in Computer Science with a specialization in Artificial Intelligence.
Covenant University (CU)	MSc in Computer Science	Covenant University is a private university in Nigeria that offers various programs in science, engineering, and technology. The university offers a degree program in Computer Science with a specialization in Artificial Intelligence.
University of Nigeria, Nsukka (UNN)	MSc in Computer Science	The University of Nigeria, Nsukka is a leading institution of higher learning in Nigeria that offers various courses in science, engineering, and technology. The university offers a degree program in Computer Science with a specialization in Artificial Intelligence.
Ahmadu Bello University (ABU)	MSc in Computer Science	Ahmadu Bello University is one of the oldest and largest universities in Nigeria, offering various programs in science, engineering, and technology. The university offers a degree program in Computer Science with a specialization in Artificial Intelligence.

Table 8: *AI Programmes offered in Ghana*

Name of University	Programme Offered	Description
Academic City University College	BSc Artificial Intelligence	The aim of the BSc in Artificial Intelligence (AI) is to equip our graduates with knowledge in emerging advances in computational, decision-making sciences and technologies that allow computers and machines to function in an intelligent manner both in accurate prediction of events and outcomes.
Kumasi Technical University	Bachelor of Science in Artificial Intelligence	The concentration in Data and Computational Science is one of two concentrations in the Bachelor of Science in Artificial Intelligence. This concentration incorporates artificial intelligence, machine learning, and the software and data analytics applications of these technologies.

Table 9: *AI Programmes offered in Côte d'Ivoire*

Name of University	Programme Offered	Description
Université Félix Houphouët-Boigny	Master's in Computer Science	Upon completion of the degree in Computer Science, students will be able to demonstrate mastery of computer science in the following knowledge areas: - Algorithms, data structures, and complexity; programming languages and compilers; software engineering and development; computer hardware and architecture - Be able to apply problem-solving skills and the knowledge of computer science to solve real problem
Nangui Abrogoua University	Master's in Computer Engineering	The objective of the Master in Computer Engineering is to offer students training as a general computer engineer capable of mastering in IT systems and infrastructures (architecture, distributed systems, networks, etc.), information and knowledge technologies (databases, knowledge bases, Web, artificial learning, etc.), interaction and visualization techniques and methods (human-machine interface, interaction, visualization, etc.), software development concepts and technologies (software engineering, verification, program proof, software testing, security, etc.), information systems of businesses and organizations
School of Engineering and Technology (ENSIT)	Engineering cycle as part of Master (M1/M2)	ENSIT is an engineering school dedicated to teaching and research in digital sciences and technologies. The majors in the engineering cycle include: Artificial intelligence, Automation, Linux administration, IT, connected objects and security, Analog signal processing, Databases

Table 10: *AI Programmes offered in Senegal*

Name of University	Programme Offered	Description
African Institute of Mathematical Sciences Senegal (AIMS)	African Master's in Machine Intelligence (AMMI)	AMMI is a novel fully funded one-year intensive graduate program that provides brilliant young Africans with state-of-the-art training in machine learning and its applications. The AMMI program prepares well rounded machine intelligence researchers who respond to both present and future needs of Africa and the world.
Dakar Institute of Technology	Master's Degree in AI	The Artificial Intelligence Master's degree is aimed at students and professionals who want to become specialists in so-called Artificial Intelligence techniques

Table 11: *AI Programmes offered in Morocco.*

Name of University	Programme Offered	Description
Mohammed VI Polytechnic University / AI Movement	AI Governance & Practice	The 'AI Governance & Applications' executive program offers participants an in-depth knowledge of the latest developments in artificial intelligence, including its impact on organizational governance models and the ethics of designing and deploying AI solutions.
Al Akhawayn University in Ifrane (AUI) and Mohammed VI Polytechnic University (UM6P)	Master's in High Performance Computing	Master in High Performance Computing dedicated to Artificial Intelligence
Mohammed V University of Rabat	Master's programme in AI	The programme is a aims to develop student's AI skills.
Euromed University of FES / The School of Digital Engineering and Artificial Intelligence (EIDIA)	Undergraduate & Master's	EIDIA offers cutting-edge engineering training in the fields of artificial intelligence, big data sciences, robotics, cyber-security and web and mobile technologies.

Table 12: *AI Programmes offered in Tunisa*

Name of University	Programme Offered	Description
Pristini School of AI	Master in Machine Learning for Business	This Master's programme aims to provide the necessary skills (probabilistic modelling, deep learning, unstructured data processing, data visualisation, neural networks, etc.) for the implementation of machine learning solutions, strategic decision making in organisations and the improvement of business processes.
Pristini School of AI	Master's in Data Science, AI & HealthTech	This Master's degree aims to provide a comprehensive training in artificial intelligence in health diagnosis and decision making. It provides you with an in-depth knowledge of the uses and applications of Artificial Intelligence for Health and offers you an understanding of the foundations of machine learning.
Pristini School of AI	Master in Data Science, AI & Industry 4.0	This course addresses a strong need in Industry 4.0 for Big Data project management while focusing on the key knowledge needed to solve business challenges and gain competitive advantage through the application of artificial intelligence technologies. It provides the theoretical and practical knowledge to work in all sectors and implement AI where necessary.

Name of University	Programme Offered	Description
Mediterranean Institute of Technology (MedTech) in collaboration with the Mediterranean School of Business (MSB).	Master in Blockchain and Artificial Intelligence in Business Computing	The Master aims at specialized training mainly in the following topics: Blockchain, Artificial Intelligence, Financial and Analytics Technology, Digital Business, and IT & General management.
Université Centrale Tunisia	Master's degree in Artificial Intelligence	The Master's degree in "Artificial Intelligence Engineering" aims to train experts in Artificial Intelligence with the aim of meeting the growing needs for designers and developers in the fields of robotics, the interconnection of objects and the processing of massive data.

Table 13: *AI Programmes offered in Egypt*

Name of University	Programme Offered	Description
Nile University	Artificial Intelligence (Undergraduate)	The artificial Intelligence program aims to prepare generations of distinguished specialists in the field of artificial intelligence and its subfields such as Machine Learning and its applications in computer vision and pattern recognition and intelligent information systems in health and transportation as well as natural language processing systems, recommendation systems and smart cities.
Egyptian Russian University (ERU)	Bachelor's degree in Artificial Intelligence	The Faculty of Artificial Intelligence at the Egyptian Russian University is looking forward to excellence in the field of education and scientific research, to achieve a prominent position locally and internationally, and to develop the information society while adhering to professional ethics.
Arab Academy for Science, Technology & Maritime Transport (AASTM)	Bachelor's degree in Artificial Intelligence	College of Artificial Intelligence, El Alamein mission is to contribute to the social and economic development of the Arab countries by preparing young generations capable of deploying high level knowledge of concepts in Artificial Intelligence and Data Analysis to the real-world applications. This can be achieved by providing competitive, intellectual, and society driven academic programs, research studies and community services, while strictly commit to the highest levels of quality.

Name of University	Programme Offered	Description
Pharos University of Alexandria	Bachelor Programme in Artificial intelligence and Machine Learning	The College of Computer Science and Artificial Intelligence seeks to achieve scientific distinction in the fields of computer science, Information, and Artificial Intelligence in a way that makes the college contribute effectively to the state's drive to drive technology, Information and Communication, and it enables the college and University to occupy a distinguished position at the local, regional, and international level.
Egypt University of Informatics (EUI)	Bachelor Programme in Computer Science with track in Artificial Intelligence	EUI aims to be a leading international, regional, and local hub in communication and information technology and their affected fields, in terms of the quality of education and learning, basic and applied scientific research, community service, and environmental development.
Kafr El Sheikh University	Bachelor of Science in Artificial Intelligence (Biological Artificial Intelligence specialization)	The programme aims to prepare professional graduates that are qualified with the latest concepts of bio-artificial intelligence that enables them to contribute to the development of biosystems at the local and global level through the provision of professional-level bio-artificial intelligence services and the active participation in scientific research through research centres and universities to serve the community.

ANNEXURE 2: List of AI Research Institutes in Selected Countries in Africa

Table 14: *AI Research Institutes in South Africa*

Name of University/ Organization	Name of Unit	Description	Funder/ Stakeholder	Types of AI
University of Johannesburg	The Artificial Institute of South Africa (AI-ISA)	The Artificial Intelligence Institute of South Africa is the brainchild of the Department of Communications and Digital Technologies (DDT), the University of Johannesburg and the Tshwane University of Technology. Founded upon the vision set out by the Presidential Commission on the Fourth Industrial Revolution (PC4IR), the institute positions itself as an adjacent innovation engine for public and private sectors. It will generate knowledge and applications that will position South Africa as a competitive player in the global artificial intelligence (AI) space.	DCDT	AI Algorithmics Chatbots Robotics
TUT	The Artificial Institute of South Africa (AI-ISA)	As above	DCDT Intel Augmented Startups	AI Algorithmics Robotics Computer Vision Chatbots
The Council for Science and Industrial Research (CSIR)	Centre for 4IR South Africa (C4IR)	The Centre for the Fourth Industrial Revolution South Africa (C4IR South Africa) is a multi-stakeholder hub that works with Business Partners to develop internal tools and governance frameworks for their innovations and influence regulatory policy; and with Government and its entities to develop policy frameworks and governance protocols to create an environment that opens the doors to new economic opportunities and accelerates the development and adoption of disruptive technologies.	DSI WEF Deloitte DSBD (Small Business) SAICA AIDC (Eastern Cape) British High Commission NAAMSA...	AI Algorithmics

Table 15: *AI Research Institutes in Mauritius*

Name of University/Organization	Name of Unit	Description
Mauritius Research and Innovation Council	MRIC	The Mauritius Research and Innovation Council (MRIC) is a corporate body set up on the 1st of September 2019 through the proclamation of the Mauritius Research and Innovation Council Act 2019. The Council acts as the apex body which advises the Government on matters concerning applied research, innovation and research and development issues. The new Act empowers the Council in the promotion of high-quality research and in fostering innovation.

Table 16: *AI Research Institutes in Kenya*

Name of University/ Organization	Name of Unit	Description	Funder(s)/ Stakeholders
University of Nairobi	The Innovation hub – Computing for Development Lab (c4DLab)	A multi-disciplinary technology hub and incubates technology-driven start-ups from inception through to growth. The project is conceived under the custodian program of Africa Technology and Innovation Accelerator (AfTIA) and targets to admit startups founded by students, faculties, and alumni of the University of Nairobi as well as the general public.	Intel

Table 17: *AI Research Institutes in Rwanda*

Name of University/ Organization	Name of Unit	Description	Funder(s)/ Stakeholders
Digital Transformation Center Rwanda	AI Hub of Rwanda	The AI Hub provides a wide range of tailored services, spaces, and opportunities to co-create a vibrant and inclusive AI ecosystem in Rwanda.	GIZ

Table 18: *AI Research Institutes in Nigeria*

Name of University/ Organization	Name of Unit	Description	Funder(s)/ Stakeholders
National Center for Artificial Intelligence and Robotics	NCAIR	The National Centre for Artificial Intelligence and Robotics (NCAIR) is one of NITDA's special purpose vehicles created to promote research and development on emerging technologies and their practical application in areas of Nigerian national interest. The centre, a state-of-the-art facility, along with its modern digital fabrication laboratory (FabLab)	National Information Technology Development Agency (NITDA), created in April 2001 to implement the Nigerian Information Technology Policy and co-ordinate general IT development in the country.
Robotics and Artificial Intelligence Nigeria	RAIN	RAIN is a world-class technology hub and research centre with head office in the vibrant and culturally diverse city of Ibadan	

Table 19: *AI Research Institutes in Ghana*

Name of University/ Organization	Name of Unit	Description	Funder(s)/ Stakeholders
Kwame Nkrumah University of Science and Technology	Responsible Artificial Intelligence Lab (RAIL)	The Responsible Artificial Intelligence Lab (RAIL) is under the Artificial Intelligence for Development in Africa (AI4D) Multidisciplinary Labs project initiated by International Development Research Centre (IDRC). RAIL has been envisioned as a Maker Space that would develop talent in Data Science and Machine Learning to help bridge the widening skills gap needed to champion the Digital Economic Transformation agenda of Ghana and the Subregion.	AI for Development Africa International Research Development Centre, Canda (IRDC) Swedish International Development Cooperation Agency (SIDA) GIZ (German Cooperation agency) FAIR Forward

Table 20: *AI Research Institutes in Senegal*

Name of University/ Organization	Name of Unit	Description	Funder(s)/ Stakeholders
Université Cheikh Anta Diop / International Development Research Centre	Using AI to combat COVID-19 in Senegal and Mali.	This research proposes COVID-19 epidemiological modelling based on the socio-anthropological context in Senegal and Mali. It also addresses the question of the adaptability and social acceptability of AI technologies and health control measures while respecting ethics and human rights. This multidisciplinary research, proposed by a consortium led by Université Cheikh Anta Diop in Senegal	International Research Development Centre, Canda (IRDC) Swedish International Development Cooperation Agency
African Centre for Technology Studies (ACTS)	Artificial Intelligence for Development (AI4D) Africa Scholarship Programme	The African Centre for Technology Studies (ACTS) is implementing the Artificial Intelligence for Development Africa (AI4D) Scholarship Project to foster and nurture talent in responsible Artificial Intelligence (AI) and Machine Learning (ML) in African public universities.	International Research Development Centre, Canda (IRDC) Swedish International Development Cooperation Agency

Table 21: *AI Research Institutes in Morrocco*

Name of University/ Organization	Name of Unit	Description
MorroccoAI	n/a	MoroccoAI is an initiative led by AI experts in Morocco and abroad to promote AI growth in Morocco across the spectrum
Moroccan International Center for Artificial Intelligence	AI movement	AI Movement is a center of excellence in Artificial Intelligence that aims to foster the emergence of Moroccan expertise in Artificial Intelligence and Data Sciences
Cadi Ayyad University of Marrakech	AI research center	The center aims to develop AI skills among Moroccan researchers and encourage collaboration with AI industry players.

Table 22: *AI Research Institutes in Tunisia*

Name of University/ Organization	Name of Unit	Description	Funder(s)/ Stakeholders
Tunisian AI Society (TAIS)	n/a	TAIS envisions in building a Tunisian AI Community that brings together these talents. TAIS include Tunisian academics in Tunisia and in international universities (e.g., Canada, USA, France, Netherlands), AI practitioners in various sectors (tech companies such as Google, Amazon and Meta, financial companies such as Envestnet, Santander and National Bank of Canada, and health system such as Microsoft Health division), and researchers in leading labs and research centers (such as Knowledge Discovery & Web Mining Lab and Efrei Research Lab)	Various collaborators including academics and professions from various industry (locally and internationally)

Table 23: *AI Research Institutes in Egypt*

Name of University/ Organization	Name of Unit	Description	Funder(s)/ Stakeholders
Ericsson Data Science & Cloud Software R&D Hub	n/a	AI & Analytics Hub, we use leading-edge tools and methodologies to develop innovative data analytics solutions. You will be instrumental in developing the global AI & Cloud portfolio in Ericsson, to deliver on the promise of a digitally connected society. The R&D Hub aims to be at the cutting edge working at the forefront of AI/ ML technology. It aims drive change and push the boundaries of what is possible. The team consists of like-minded innovators, all driven to go beyond the status quo to build what comes next. Collaborating globally, the R&D Hub aims to fortify Ericsson's position as a leader in the field.	Ericsson
National Council for Artificial Intelligence	n/a	In November 2019, the Egyptian government formed the National Council for Artificial Intelligence as a partnership between governmental institutions, prominent academics, and practitioners from leading businesses in the field of AI.	Ministry of Communications & Information Technology

ANNEXURE 3: List of Global Industrial Partners Engagement with African Universities

Table 24: *Global Industrial Partners engagement with African Universities (South Africa)*

Name of University / Programme	Global Partners
University of Johannesburg	Google Microsoft AWS
University of Cape Town	AWS
University of Witwatersrand	IBM
University of Stellenbosch	BMW IT Hub
University of Pretoria	Google
The African Institute for Mathematical Sciences (AIMS)	ATOS
Tshwane University of Technology	Intel AWS
Central University of Technology	Microsoft Samsung
Grand Challenges South Africa	Bill & Melinda Gates Foundation

Table 25: *Global Industrial Partners engagement with African Universities (Kenya)*

Name of University / Programme	Global Partners
University of Nairobi	Intel
Strathmore University	IBM

Table 26: *Global Industrial Partners engagement with African Universities (Rwanda)*

University / Organisation	Global Partner
The African Institute for Mathematical Sciences (AIMS)	Google Facebook

Table 27: *Global Industrial Partners engagement with African Universities (Ghana)*

University / Organisation	Global Partner
The African Institute for Mathematical Sciences (AIMS)	Google Facebook
Academic City University College	Arm

Table 28: *Global Industrial Partners engagement with African Universities (Senegal)*

University / Programme	Partner
The African Institute for Mathematical Sciences (AIMS)	Google Facebook
Université Cheikh Anta Diop	IRDC Swedish International Development Cooperation Agency
African Centre for Technology Studies (ACTS)	IRDC Swedish International Development Cooperation Agency
Grand Challenges Senegal	Bill & Melinda Gates Foundation

Table 29: *Global Industrial Partners engagement with African Universities (Egypt)*

University / Organisation	Global Partner
Ericsson Data Science & Cloud Software R&D Hub	Ericsson
Information Technology Institute (ITI)	Amazon Web Services (AWS) Academy