FINAL TECHNICAL REPORT / RAPPORT TECHNIQUE FINAL

BUILDING A NETWORK OF EXCELLENCE IN ARTIFICIAL INTELLIGENCE IN SUB-SAHARAN AFRICA - FINAL TECHNICAL REPORT

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IDRC Grant / Subvention du CRDI: 108914-001-Building a network of excellence in artificial intelligence in Sub-Saharan Africa

Building a Network of Excellence in Artificial Intelligence in Sub-Saharan Africa

Final Technical Report

IDRC Project Number-Component Number: 108914-001
By: Davor Orlic
Report Type: Final Technical Report
Period covered by the report: 1 January 2019 to 31 December 2020
Date: December 30 2020
Country/Region: United Kingdom
Full Name of Research Institution: Knowledge 4 All Foundation
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Executive Summary

This project's overall objective is to establish a *Network of Excellence* in AI in sub-Saharan Africa (SSA) that contributes to sustainable development through the responsible and inclusive design and deployment of AI. Specifically, the projects highlights are:

- **AI4D programme established** (Artificial Intelligence 4 Development) in Africa and running:
- **150 researchers and practitioners** in the field of AI connected in a broad network;
- **4 research reports** to assess and deepen our understanding of AI capacity and use in SSA;
- **10 innovation projects** focused on ethical, inclusive, participatory and gender-responsive approaches/applications in development challenges, with consideration for SDG targets;
- **5 data competitions** a series launched with the mission of obtaining the best possible results using machine learning methods to solve challenges across African languages
- **6 relevant events** supported including workshops in AI across sub-Saharan Africa

The research developed a deep understanding of the landscape of Artificial Intelligence in Sub-Saharan Africa from recommendations via reports, to action via hands-on mini-projects with AI/ML researchers. The project had a diversified portfolio of actions including mini-projects on AI, dataset creation, reports on different AI topics, and support of events across Africa. It focused on developing a network of institutions and individuals working on and researching AI from across sub-Saharan Africa[1]. It assesses in details what does the AI landscape in Sub-Saharan Africa look like and the measures stakeholders in the region are taking to ensure that they are AI-ready across three key groups involved in AI capacity building in SSA, namely, Centres of Higher Education and Training[2], Governments[3], and the broader AI community in the region. It further provides feedback on a general level[4] with one initial specialized report on AI and Agriculture. With all the research delivered, this project acknowledges the potential and the growing importance of funding Networks and domain specific research relevant to African researchers and practitioners with a focus on ethical, legal and social aspects of AI research. One of the major results is helping create the foundations for cracking the language barrier for a multilingual Africa[5].

The report provides a summary of project activities, including outcomes and outputs. The project drew from the Global South ecosystem mapping[6] and facilitated a bottom-up network/community of researchers who investigated and gave recommendations on how future AI4D networks research agenda and actions should be shaped. Additionally, the project considered effective capacity building approaches based on identified policy and educational frameworks within the target countries.

1. Research problem

The project's main approach and methodology have not changed from the initially proposed ones. The basic rationale and general objective of the project was to understand the AI divide in Africa, assess the current capacity in AI on the continent and based on the findings, design a roadmap or call to action for activating and delivering the potential of AI across Africa, and to make informed decisions within the broader AI4D funding programme. The contribution to knowledge that this project represents from a scientific, developmental and policy perspective

[1] AI4D networks https://africa.ai4d.ai/

[2] Artificial Intelligence Capacity in Sub-Saharan Africa - Compendium Report https://africa.ai4d.ai/wp-content/uploads/2021/03/AI4D-Report%E2%80%94AI-in-SSA.pdf

[3] Artificial intelligence needs assessment survey in Africa https://unesdoc.unesco.org/ark:/48223/pf0000375322

[4] Responsible Artificial Intelligence in Sub-Saharan Africa: Landscape and General State of Play https://africa.ai4d.ai/wp-content/uploads/2021/03/AI4D-Report%E2%80%94Responsible-AI-in-SSA.pdf

[5] Cracking the Language Barrier for a Multilingual Africa https://www.k4all.org/project/language-dataset-fellowship/

[6] List of AI players in Africa http://www.k4all.org/ai-ecosystem/

are described in details Section 4, the research problems and general reflections are described below.

Problem 1: Development priorities

At the beginning of the project our hypothesis was that the key challenges that could deepen inequalities leading to a so-called AI divide in respect to the global South, and in particular Africa were:

1. Sub-Saharan Africa is barely represented among the AI expertise pool
2. Expertise remains unseen by Northern technology hubs
3. General skills shortage for the development and deployment of AI applications
4. Lack of diversity among those who have the skills,
5. Disparities between men and women remain considerable
6. Financial resources for development of AI applications are becoming available in Africa with corporate and venture capital investors increasingly coming from the continent.

Our research process has reinforced these observations, but has also led to a revised view of some aspects, for example in launching the micro-projects we setup a network of mainly Africa based mentors who showed great expertise and helped out the African researchers with their projects.

Problem 2: Scientific importance of AI in Africa

We understand more research is needed to explore the potential benefits and risks surrounding AI spreading rapidly across sectors and around the globe, particularly in Africa. Here we identified the following challenges:

1. The need for a coordinated plan to encourage AI education[7]
2. Support research laboratories across the continent
3. Incentivize research-based entrepreneurship in the AI sector
4. Facilitate collaboration between AI researchers and experts in other domains.

Our reflections on this problem remain have been reinforced, our surveys and reports show evidence that more needs to be invested in AI education and capacity building and that Networks of Excellence can be used as a mechanism to incentivize scientific discovery. The researchers' understanding of the idea of a need for a pan-African research strategy is still relevant and needed[8] but hard to achieve unless a number of stakeholders from Governments, academia, civil society and research communities, with international donors agree in a political and transparent way to such a roadmap.

Problem 3: Key issues and potential solutions

There is a consensus that AI is changing our world, that it is here to stay and that it offers a vital commercial opportunity in every sector.[9] However, the future of AI is uncertain, especially in Africa. Here we defined the following challenges;

1. AI automation technologies could create workforce problems
2. Growing fear about nefarious uses of AI

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[7] The role of education in AI (and vice versa) https://www.mckinsey.com/featured-insights/artificial-intelligence/the-role-of-education-in-ai-and-vice-versa

[8] Look to Africa to advance artificial intelligence https://www.nature.com/articles/d41586-018-07104-7

[9] PwC's Global Artificial Intelligence Study: Exploiting the AI Revolution https://www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html

3. AI might reinforce structural inequalities and bias, perpetuate gender imbalances, and introduce other unknown risks and unintended consequences in Africa.

Consequently, we remain certain that the roll-out of future AI applications across Africa requires a healthy critical perspective and an ongoing public dialogue. Our research supports the notion that there is untapped potential in supporting researchers, policymakers and the private sector to collaborate and inform African governments to create legal frameworks and a set of values that will help to ensure that AI in Africa serves the good of humanity.

2. Progress towards milestones

All project milestones as specified in the Grant Agreement for the entire reporting period have been achieved. However, we briefly list here each main project milestone:

Milestone	Achievement evidence
Milestone 1: Project workshop	This workshop has been organized in Nairobi (link)
Milestone 2: Roadmap or Call to Action	The team has generated the following reports: 1. ***Artificial Intelligence Needs Assessment in Africa*** (link), with 32 countries involved, released as IDRC/K4A/UNESCO report in Jan 2021 2. ***Artificial Intelligence in Sub-Saharan Africa - an AI capacity building agenda via a survey of universities; HEIs, and communities of practice*** (link), released as an K4A/IDRC report in April 2021; 3. ***Artificial Intelligence in Africa: A general state of play and landscape***, released as an K4A/IDRC white paper in April 2021 (link) 4. ***Roadmap for Research on Responsible Artificial Intelligence for Development (AI4D) in Africa - A focus on Agriculture***, to be released as an IDRC white paper in 2022;
Milestone 3: Project website	The AI4D public website (link) was established during the first weeks of the project, aiming to act as one of the primary tools for communicating the project's concept, news and achievements. In this sense, references to the website have been included in the majority of the project-related announcements (progress announcements, press releases, etc.) as a way to prompt users for more information on the project. The public website was constantly updated during the past two years presenting the main progress performed and also the results and achievements of the project results. It is worth noting that the entire content of the website is being republished to fit the concept of the new AI4D programme with the new Networks.

Milestone 4: Research instruments	We have designed three research instruments – a Government Survey, a Centres of Higher Education and Training Survey, and an AI Community Survey. The latter two surveys were sent out on June 25th 2019 with weekly reminders to the recipients via SurveyMonkey (four reminders in total). All three of the surveys have been translated into French and Portuguese. The only deviation from the timeline is the Governmental survey which was delivered with UNESCO and was announced to all African member states at the Information for All Programme (IFAP) meeting in May 2019.
Milestone 5: Call for proposals for applications	The call for proposals has resulted in 32 responses with applications ranging from the following fields: Healthcare (10), Inclusion and Gender (6), Agriculture (5), Governance (4), Education (4), Algorithmic Governance (1), Energy (1), Future of Work (1), Wildlife Conservation (1). We have selected 10 projects that fitted the selection criteria, delivered via a ranking system in Easychair and assessed by independent reviewers for each field. The projects kicked-off on September 15th 2019 and finished on December 31 2021.

3. Synthesis of research results and development outcomes

This project's overall objective is to establish a Network of Excellence in AI in sub-Saharan Africa that contributes to sustainable development through the responsible and inclusive design and deployment of AI. Specifically, the projects current findings and results in the period 1 January 2020 to 31 December 2021 are complementary and connected to another IDRC grant number 109187-002) and has achieved the following outreach via its interconnected activities:

Reach of Artificial Intelligence 4 Development programme across Africa

In total 42 countries reached

Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Chad, Comoros, Congo, Democratic Republic of Congo, Egypt, Eswatini, Ethiopia, Gambia, Ghana, Guinea, Ivory Coast, Kenya, Lesotho, Madagascar, Malawi, Marocco, Mauritania, Mauritius, Mozambique, Namibia, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Sudan, Tanzania, Tunisia, Togo, Uganda, Zambia, Zimbabwe

Main achievements

Supported 6 workshops
Commissioned 4 reports
Run 3 COVID-19 data challenges
Run 5 African Language data challenges
Funded 21 mini-projects
Launched a Fellowship for Low Resource African Languages
Developed 10 African language datasets
Built a text-to-speech platform for African Languages
Created a registry of AI hot spots in Africa
Engaged with ~ 150 researchers, ~ 30 institutions
Researched policy across 39 countries

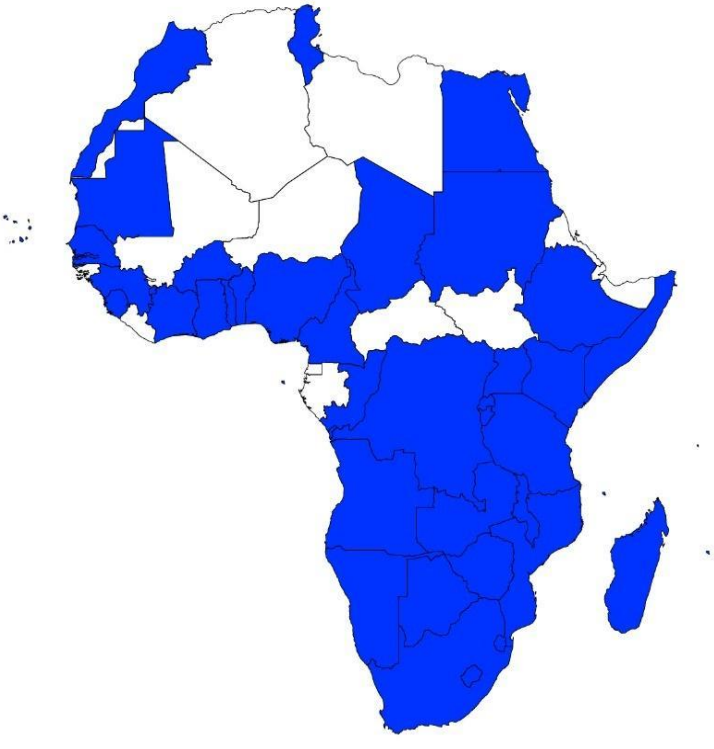

Figure 1: AI4D Network activities outreach across Africa

Milestone	Achievement evidence	Hard evidence
Network kickoff workshop	This workshop was delivered on 3-5 April 2019 Nairobi, Kenya[10] and hosted 82 participants form all African regions and AI and development experts. The complete workshop was filmed, however only interviews with participants were openly licensed and released to the public. The videos were transcribed into English.	Access workshop here and videos here

Milestone	Achievement evidence	Hard evidence
Reports		
Report 1: Findings of the Artificial Intelligence Needs Assessment Survey in Africa	This report and survey were released in partnership with UNESCO, Knowledge for All Foundation (K4A) and Neil Butcher Associates (NBA) for supporting this survey as part of the ongoing collaboration with the AI4D Network in Africa.	Access report here
Report 2: Artificial Intelligence in Sub-Saharan Africa Compendium Report	The report presents findings from all data sources, synthesising them into findings, key takeaways and recommendations for each of the stakeholder groups. A detailed outline of the methodology is provided in Appendix I.	Access report here
Report 3: Artificial Intelligence in Africa: A general state of play and landscape	The report presents findings showing that despite African countries unique peculiarities, Africa would benefit from adopting a collective approach to rulemaking around emerging technology such as the collective policy response of European countries, which have similar cultural disparities.	Access report here
Report 4: Roadmap for Research on Responsible Artificial Intelligence for Development (AI4D) in Africa - A focus on Agriculture	The report presents findings showing that, to diffuse successfully, AI can utilize and leverage the current convergence of biology, agronomy, plant and animal science, digitization and robotics which is transforming	Report still under review

[10] Network kick-off meeting revisited https://www.k4all.org/2019/07/revisiting-the-nairobi-meeting-of-the-african-network-in-artificial-intelligence/

	the global agri-food value chain, sometimes spilling over from other sectors. Sub-Saharan Africa needs to build the capacity and necessary policies for its farmers to leapfrog the earlier stages of innovation in which they did not participate or benefit from.	

Milestone	Achievement evidence	Hard evidence
Machine Learning Challenges		
GIZ AI4D Africa Language Challenge - Round 2	This challenge hosted in partnership with GIZ and the FAIR Forward initiative and the Artificial Intelligence for Development Africa (AI4D-Africa) Network from 1 June 2020 to 3 August 2020	Access challenge webpage
AI4D Predict the Global Spread of COVID-19	This challenge asks data scientists on Zindi to accurately predict the spread of COVID-19 around the world in the first few months of the 1st lockdown. Solutions were evaluated against future data from 13 March 2020 to 20 April 2020	Access challenge webpage • Winner #1 – candidate from Russia (GitHub code) • Winner #2 – candidate from Nigeria (GitHub code) • Winner #3 – candidate from France (GitHub code)

Milestone	Achievement evidence	Hard evidence
Micro-projects via innovation grants		
Micro-project	Effective Creation of Ground Truth Data-set for Malaria Diagnosis Using Deep Learning	Access: • Project webpage • *Malaria Blood Smear Image Dataset Creation* dataset • Presentation slides
Micro-project	Preservation of Indigenous Languages	Access: • Project webpage • *An explorative Investigation into Neural Machine Translation: The Case of Low-Resource Language Pairs in Burkina Faso* dataset • GitHub data and code release
Micro-project	Building a Medicinal Plant Database for Preserving Ethnopharmacological Knowledge in the Sahel	Access: • Project page here • *Medicinal Plant Database for Facilitating the Exploitation of Local Ethnopharmacological Knowledge* dataset

		• GitHub data and code release
Micro-project	Arabic Speech-to-MSL Translator: Learning for Deaf	Access: • Project page here • *Mobile app to translate Arabic speech into Moroccan sign language* dataset • Presentation slides
Micro-project	End-to-End Learning for Autonomous Driving on Unpaved Roads - A Study Towards Automated Wildlife Patrol	Access: • Project page here • *Grassland African Road Images (GARI): A Driving Dataset from Kenyan Highways and National Parks* dataset • Presentation slides
Micro-project	Early detection of preeclampsia using ambulatory blood pressure monitoring using wearable devices and Long Short-Term Memory Networks (LSTM-NN) on the edge	Access: • Project webpage • Presentation slides
Micro-project	A Semi-Automatic Tool for Meta-data extraction from Malawi Court Judgments	Access: • Project webpage • Presentation slides
Micro-project	A Computer vision Tomato Pest Assessment and Prediction tool	Access: • Project webpage • *Deep learning for Tomato Pest Leafminer Tuta Absoluta* dataset • Presentation slides
Micro-project	Using Artificial Intelligence to Digitize Parliamentary Bills in Sub-Saharan Africa	Access: • Project webpage • Article in press • Publication paper • Presentation slides
Micro-project	Improving the Pharmacovigilance system using Natural Language Processing (NLP) on Electronic Medical Records (EMRs).	Access: • Article in blog • In regards of datasets, the research used patient medical history dataset. • An ethical clearance certificate is required to access them, so we cannot share them on the public website, but as researchers, we are ready to collaborate with anybody who wants to use these datasets. • The group has Patient records from The University of Dodoma Hospital,

		Benjamini William Mkapa Hospital and MIMIC III • Presentation slides

Milestone	Achievement evidence	Hard evidence
Events organisation		
Research and promotional events	As part of the AfricaNLP - Unlocking Local Languages workshop at ICLR conference, we hosted the micro-projects presentations. The presentations were filmed.	Access to webpage and news item here
Research and promotional events	IJCAI workshop on AI and the United Nations SDGs: Invited talk: *Artificial Intelligence for Development (AI4D) programme or how can a Global South Network of AI researchers be built and what are the benefits?* by Phet Sayo, Senior Program Officer at Canada's International Development Research Centre	Access to webpage and news item here
Research and promotional events	Presentations of 10 winners and invitation to the Awardees to present their solutions at the AI4D workshop during the Deep Learning Indaba 2019[11] conference.	Access to news item here

Milestone	Achievement evidence	Hard evidence
Dissemination and Communication		
Release of Government AI Readiness Index 2019	The team was involved in the overall design of the report and the website featured on its frontpage the release of the Government AI Readiness Index 2019.	Access to page here
Interviews	The Nairobi workshop was used to create as much dissemination material as possible, and therefore it generated 20 blog posts and 22 video interviews. The videos are published at VideoLectures.Net and YouTube and currently have around 11,000 views.	Access to interviews here
Promotional video	The promo has been developed so as to cover the needs of events and communication actions of the project for different target public levels	Access to promo video here

[11] Deep Learning Indaba 2019 https://www.k4all.org/2019/09/deep-learning-indaba-is-the-most-exciting-ai-event-around/

	such as general public, policymakers, educational providers, scientific community, etc.	
Publication	The micro-projects generated publications (for example Collecting Blood Pressure and Activity Data Using an Integrated Mobile and Smartwatch Application)	Access to publication

Milestone	Achievement evidence	Hard evidence
Online interviews		
AI4D interview series: Isaac Rutenberg, Strathmore University	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here
AI4D interview series: Vukosi Marivate from University of Pretoria	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here
AI4D interview series: John Shawe-Taylor, University College London	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here
AI4D interview series: Olubayo Adekanmbi from MTN and Data Science Nigeria	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here
AI4D interview series: Maria Fasli, University of Essex	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here
AI4D interview series: Philip Apodo Oyier from Jomo Kenyatta, University of Agriculture and Technology	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here
AI4D interview series: Prateek Sibal from UNESCO	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here

AI4D interview series: Fernando Perini, IDRC	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here
AI4D interview series: Arthur Ernest Gwagwa, Strathmore University	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here
AI4D interview series: Bolanle Oladejo, University of Ibadan	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here
AI4D interview series: Erik Bongcam Rudloff, SLU	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here
AI4D interview series: Paula Hidalgo-Sanchis from United Nations Global Pulse	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here
AI4D interview series: Benjamin Rosman from University of the Witwatersrand	Organised by K4A, IDRC, SIDA at workshop "Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa", Nairobi, Kenya, April 2019	Access to video here

Result 1: Network of Excellence in Artificial Intelligence in Sub-Saharan Africa and kick-off workshop

The Network of Excellence has been setup with an initial governance structure and clear ownership of African colleagues and network members. This initial scoping resulted in establishing a Steering Committee comprising of four members in charge of preparing separate chapters in the format of concept notes, matching the three identified pillars of activities during the kick-off workshop (i) *Communities: Applications, innovations and start-ups*, (ii) *Capacity building: Infrastructure, education and skills*[12], and (iii) *Policy and regulatory structures: Human rights enabled AI*[13]. The members of the board were comprised of Dr. Ciira wa Maina (Dedan Kimathi University), Dr. Vukosi Marivate (Rutgers University), Alex Comninos and Kathleen Siminyu (IDRC). The Network was designed for two potential modalities, (1) as a distributed virtual institute with hundreds of members both institutional and individual researchers, based on the experiences with K4A forming the European machine learning research communities, or

[12] https://docs.google.com/document/d/1qMj6-jqRaSNkabn3cn_-6flcm9DNdkhXDp1MB1ENues/edit#heading=h.s4ocxne0kroa

[13] https://docs.google.com/document/d/1BsS81u2AZUTCbfXGYk7ZaUaO7pbmZQCTa3xAki7q2KU/edit

the (2) typical and longstanding model by IDRC where a network is a project consortium delivering research on a specific topic[14]. The Steering Committee or the network as proposed in Nairobi was not formalized, but facilitated the establishment of the Artificial Intelligence for Development in Africa (AI4D Africa) program in a partnership between the Swedish International Development Cooperation Agency (Sida) and Canada's International Development Research Centre (IDRC) which was launched in 2020. The 4-year program will support the development of an artificial intelligence ecosystem via 4 networks of Centres across Africa. The Steering Committee members were included in the majority of other activities including the setup of the new networks structure.

Result 2: Report Series: Artificial Intelligence in Sub-Saharan Africa capacity building agenda via a survey of universities; HEIs, and communities of practice

Taking available data into account together with the desktop review of literature and the findings from the UNESCO report, below is a summary of the key takeaways from this research.

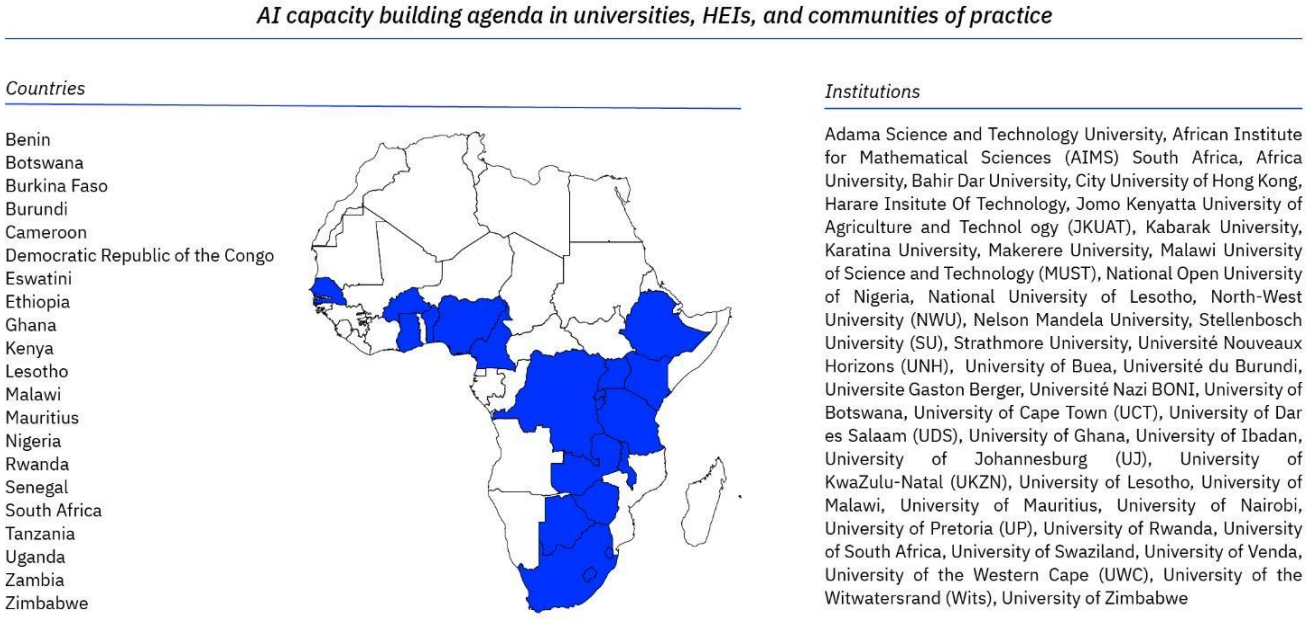

Figure 2: Reach across 32 African countries

Findings on AI-related Academic Activities

- Formal education, on-the-job experience and teaching oneself are regarded as the most beneficial ways to develop AI expertise. Respondents evidently derived value from teaching themselves about AI and related concepts, implying that the role of upskilling people with technical skills should not be limited to formal education, although formal education also has a key role to play.
- Comprehensive formal education that equips students with knowledge and skills across their school careers will better position them to enter AI-related fields. This includes education that focuses on building competencies in the hard sciences such as Science, Technology, Engineering and Mathematics (STEM), as well as building soft and critical thinking skills in the Humanities and Social Sciences.

[14] https://docs.google.com/document/d/1IEUVodSuac5cPwKeOJiW4QVi_ndHZTv_YtfO6ON57Ns/edit#heading=h.iig6483e6p75

- Skills related to training Machine Learning (ML) algorithms and associated competencies are one of the most important skills sets required to develop AI activities. This is followed by programming skills and probability and statistics.
- There was considerable enrolment across the region in AI-related courses and qualifications at both undergraduate and postgraduate levels, with males in the majority. Being mindful of the small number of courses for which enrolment data was provided, the graduate output and enrolment data suggests that a number of students are participating in AI-related qualifications and courses and that in many cases, demand exceeds supply.
- The difference in enrolment figures between undergraduate and postgraduate students shows that large numbers of students do not go on to pursue postgraduate training in AI-related fields. There are likely to be various reasons for this, including that there are generally fewer postgraduate than undergraduate enrolments in any field, but the specific reasons were not clear in the data available so further research is needed to explain this trend.
- Several institutions that participated in the study did not provide detailed enrolment data. This lack of enrolment data from a broad sample of institutions indicates a need for comprehensive data collection and sharing practices on enrolment, graduation and attrition rates for AI-related degrees and qualifications, together with national level higher education data collection and reporting. This data will be critical to ensuring the success of AI-related academic offerings at universities, as well as measuring how they relate to broader institutional and national goals of promoting AI-related activities.
- The majority of institutions who participated in the research are planning on offering new AI-related courses or qualifications in the next three to five years, as well as adding AI-related aspects to existing degrees or courses instead of creating standalone degrees. This includes offering courses on image processing, machine learning (ML), Robotics and Natural Language Processing. It was clear that new offerings were dependent on both student demand for AI qualifications and institutional capacity.
- It is crucial to consider demand and supply of AI-related courses and qualifications at these institutions – building capacity for AI at Centres of Higher Education and Training depends significantly on raising awareness amongst students about the option of studying these types of programmes, as well as upskilling them with the foundational skills to be eligible to enrol.
- There is a need for greater capacity – both in terms of the number of Centres of Higher Education and Training working on AI and in terms of potential employers – to ensure employment opportunities for their graduates. This should take a holistic view of the AI ecosystem in SSA. Just as it is important to ensure that Centres of Higher Education and Training prepare students to work in AI-related fields and sectors, so too is it important to build capacities within the organisations that employ them, particularly because countries all over the world are expected to experience significant job displacement across all industries as a result of AI.
- Other capacity issues included a need for AI experts and lecturers, time constraints in undertaking teaching and research duties, and needing more capacity to take in and supervise larger numbers of postgraduate students. Some of these constraints might be addressed by developing joint academic programmes in partnership with other Centres of Higher Education and Training, supported by industry or government partners.
- There was an interest in and attendance of AI-related short courses, training opportunities and workshops, although events were still mostly attended by males. Respondents also noted considerable involvement in AI communities of practice, including Data Science Africa and the Deep Learning Indaba. These provide a basis for further development of AI work and demonstrate that there is a growing African AI community of practice. Integrating communities of practice into Centres of Higher Education and Training would be a useful way of consolidating and growing AI activities.
- At the national level, governments require greater support for AI education, research and training. This includes ensuring that education systems are responsive to AI skills and competency requirements, improving research capacity, and providing AI-related trainings for workers.

Findings on Research and Development

- Respondents provided numerous examples of research in various AI-related fields, including Robotics and Autonomous Intelligence, Health and Biology Agriculture and Disaster management, Development, Language and Physics.
- Although most interview respondents indicated that AI research and development is a priority for their institutions, some noted that their department or school was prioritizing AI as opposed to their institution more broadly.
- There is considerable engagement between academia and organisations working with AI and related technologies. This included R&D, lecturing, providing content for course materials, supervising theses, hosting events, providing internships and bursaries, as well as developing programmes, streams, and modules in Data Science, AI, and ML. However, there was a lack of engagement between government and the broader AI community.
- Creating a robust AI ecosystem in SSA will require institutional commitment to AI-related activities – it will be necessary to implement solutions in higher education with a view to changes we want to inspire and capacities that we want to develop in broader society. This will require institution-wide support for AI-related research and development, particularly given the emphasis of respondents on the multi-disciplinary nature of AI work.
- At Centres of Higher Education and Training, most respondents indicated that their institutions did not have mechanisms solely available to fund AI research and development. Many noted, however, that there were general funding mechanisms available that could be used for AI research and development. Partnerships with government and industry could raise additional funding for AI-related research and development.
- There is a need to increase output of AI-related educational resources, to increase fundamental and applied AI research, and provide access to resources for research, including AI research networks.

Findings on Policy Environment

- The research identified very few policies aimed directly at AI-related activities at Centres of Higher Education and Training, with respondents indicating that many of them were general policies that governed their institutions and not AI teaching and research in particular. Despite this, respondents did seem to derive some value from existing policies.
- While it might hold true that an over-regulated environment can sometimes stifle innovation and that this is particularly applicable to AI, encouraging Centres of Higher Education and Training to adopt a few critical policies can go a long way to ensuring fair practices.
- At the national level, countries in SSA need to create legal and regulatory frameworks for AI governance, as well as improving and implementing policy initiatives for AI governance. This might include implementing legal measures for new applications of AI and related technologies; launching AI strategies and policies; implementing legislation; and developing ethical guidelines for AI.

Findings on Challenges and Capacity Building Needs

- Respondents noted a diverse set of challenges that they thought were hindering the development of AI in their countries. One of the most prominent of these was a lack of quality education in AI and related fields. Other requirements include a need for capacities in AI governance; and human capacity for addressing the ethical implications of AI.
- Respondents also highlighted funding issues regarding AI-related activities – early-stage start-ups struggle to raise capital, universities have difficulty in securing funding for their equipment and research, and governments are operating in resource constrained and often corrupt environments.
- They also noted a lack of technical expertise and issues with funding and infrastructure – including a lack of reliable internet.

- In considering which sectors would see the most growth in demand for AI applications over the next five years, healthcare applications were most popular. Respondents also noted commercial enterprises, financial services, and education.
- Although SSA countries' AI priorities are diverse, they provide an opportunity for collaboration on key priority areas such as personal data and data governance; leveraging AI for economic growth; and supporting start-ups and digital innovation.

Findings on Diversity in AI-related Activities

- Many respondents saw diversity as being an issue in AI in their country, institution or organisation, the most prominent of these being a lack of gender diversity.
- In the Higher Education and Training sector, there were more males involved in AI-related activities than females. This is perhaps unsurprising given global gender imbalances in the sector as well as a general lack of diversity. Most respondents indicated that their institutions did not offer incentives for women, people with disabilities, or people from other groups considered as minorities to participate in AI-related courses or qualifications. There were, however, broader merit-based programmes or opportunities. It became clear over the course of the research that some efforts were being made to try to encourage women, people with disabilities and minorities to pursue AI-related paths. These efforts are being made at all levels, from undergraduate to postgraduate, as well as within communities of practice and the broader AI community. They appear to mostly be aimed at gender imbalances.
- The findings indicate a significant opportunity for the AI market in SSA, where AI and related technologies can be used as an opportunity to create and reinforce diversity. Key to this will be to facilitate and promote skills development of diverse people and make concerted efforts at levelling the playing field for women and other minorities in the industry. There is a clear role for Centres of Higher Education and Training in these efforts. These institutions can introduce funding schemes to improve the uptake of diverse groups, remove biases from staff recruitment procedures and ensure that women and other minorities are supported and incentivized to study further than the undergraduate level.

Result 3: Report Series: Artificial Intelligence Needs Assessment Survey in Africa

The partners involved in this report were UNESCO and International Development Research Centre (IDRC) for funding support, Knowledge for All Foundation (K4A) and Neil Butcher Associates (NBA) for supporting the creation of the survey as part of the ongoing collaboration with the AI4D Network in Africa. Specifically, AI4D helped incorporate the survey on capacity building.

Artificial Intelligence Needs Assessment Survey In Africa

Angola	Republic of the Congo	Ghana	Rwanda	Togo
Benin	Democratic Republic of the Congo	Guinea	Sao Tome and Principe	Uganda
Botswana	Egypt	Lesotho	Senegal	Zambia
Cape Verde	Equatorial Guinea	Madagascar	Seychelles	Zimbabwe
Cameroon	Ivory Coast	Malawi	Sierra Leone	
Chad	Eswatini	Namibia	Somalia	
Comoros	Gambia	Nigeria	Sudan	

Figure 3: Artificial Intelligence Needs Assessment Survey in Africa

Findings on Policy initiatives for AI governance

- Development and use of AI is a priority as per the national development plans in 21 out of 32 countries in Africa that responded to the survey. Some of these countries have already initiated measures to guide the development and use of AI through the launch of AI strategies and policies, enactment of legislation, establishment of Centers of Excellence on AI, and through the development of ethical guidelines for AI. There is a need for strengthening.

Findings on Legal and regulatory frameworks for AI governance

- Even as 22 countries have reported having legal frameworks concerning personal data protection, it may be noted that these legal provisions may need to be updated to the new uses and applications of data engendered by AI to offset biases and discriminations, including on the basis of race and gender, or loss of personal privacy through predictive analysis among others. Beyond data governance and personal data protection, there is also a need for legal protection against algorithmic bias and discrimination, however; only nine countries have developed some measures against the same.
- There is recognition for the power of open government data in strengthening transparency and innovation through the development of data-driven public services. Out of those who

responded, 19 countries reported having initiatives for making government data openly available in easy-to-access formats. There is a need for fostering.

Findings on the needs for enhancing capacities for AI Governance

- In order to support the development and use of AI, both policy frameworks to guide and human and institutional capacities to develop and implement such frameworks are needed. The need for strengthening capacities to address legal implications of AI was reported by 19 countries. These countries reported a dearth of legal frameworks to address challenges posed by AI and a significant human resource capacity gaps to tackle ensuing legal implications.
- The use of AI technologies has given rise to ethical challenges that require urgent attention to inform the governance of these technologies. Twenty-six countries have reported significant human resource capacity gap in addressing the ethical implications of AI. Only six countries reported having the capacities to address the ethical implications of AI.
- The capacities of the legislature, executive, judiciary to formulate, implement and enforce policies and laws concerning AI is important for upholding the rule of law and to provide and enabling environment for innovation. Out of 32 countries that responded to the survey, five countries reported having initiatives taken to strengthen knowledge and capacities of personnel within the government. Only one country has done the same for its legislature and two have taken initiatives to strengthen capacities of the judiciaries in their countries.
- Need for enhancing capacities for AI Governance is widely recognized

Findings on AI priorities for countries in Africa

Findings on AI priorities for countries in Africa are varied but offer an opportunity for cooperation. More than half of the countries who responded to the survey reported following priority areas to advance AI: protection of personal data and data governance; leveraging AI for economic growth; supporting start-ups and digital innovation; updating education, skills and training systems for imparting AI skills and knowledge; facilitating AI research and development. Further, it is important to underline that a majority of the responding countries have identified addressing gender related bias and discrimination in the development and use of AI as a priority.

- Personal data protection and data governance is an urgent and important area of work for 71 per cent of the countries, i.e. 23 countries, while another five consider it to be important but not urgent.
- Leveraging AI for economic growth, development and digital transformation is of urgent importance for 22 countries. Similarly encouraging digital innovation and start-ups working on AI is an urgent and important concern for 65 per cent of the responding countries. Whereas the impact of AI on employment and decent work is urgent and important for 31 per cent of the respondents i.e. ten countries, for another 50 percent it is important but not urgent.
- Updating education, skills and training systems to strengthen human and institutional capacities for the development and use of AI is important for 84 per cent of the responding countries.
- Facilitating AI research and development is important for 84 per cent, i.e. 27 countries out of 32, who responded.
- Addressing ethical implications of AI systems is important for 27 countries, of which 12 consider it to be urgent. Similarly, 71 per cent, i.e. 23 countries, consider the use of AI for the protection of human rights as important, 14 of which consider it to be urgent.
- The implications of AI for cultural diversity is important for 20 countries, of which ten consider the issue to be urgent.
- Addressing gender biases in the development and use of AI systems is important for 26 countries, of which 16 consider it to be urgent.

Findings on needed to advance on AI education, research and training

More efforts are needed to advance on AI education, research and training. Updating education systems to adapt to the challenges posed by AI and new technologies in terms of the skills and competencies required in the twenty first century, strengthening research capacities and networks and provision of AI related trainings for existing workers are some areas that concern most Member States. They have launched several initiatives for AI education, research and training:

- In seven countries, universities and educational institutions have developed specialized courses for AI, and initiatives have been launched to strengthen media and information literacy among students and citizens through schools.
- In eight countries, universities are in the process of developing courses for AI and there is interest in incorporating AI education at the secondary school level. In 12 countries, no specific measures for AI skills and education have been implemented at university or school level but there is an interest to do so. In four, the level of incorporation of AI in research and education varies widely across universities and educational institutions.

Capacity building for development of educational resources for AI, fundamental and applied AI research and access to resources for research remains a major challenge.

- AI educational resources: Nineteen countries highlighted gaps in the availability of educational resources for teaching and learning AI and in the availability of trained individuals to provide AI-related instruction. In another 10 countries, educational resources related to AI are available but there are significant human resource capacity gaps.
- Research Capacities for AI: The digital and knowledge divides regarding the quality and the quantity of AI research are growing between and within countries. Twenty-two countries have reported having limited research facilities and significant human resource capacity gaps for AI research.
- AI Research Networks: Sixteen countries have indicated limited engagement between national and global AI research networks and 15 indicated that no links exist between the national and international AI expert networks.
- Access to training data for AI is a major priority for all countries Nine countries have underlined the availability of datasets to train AI systems but a lack of human resources for developing datasets. Another 16 do not have datasets to train AI systems nor the capacities to develop new datasets.

Result 4: Report Series: Responsible Artificial Intelligence in Sub Saharan Africa: Landscape and general state of play

This paper examines four areas that are part of the projects diversified portfolio, namely innovation, capacity building, policy, infrastructure from the perspective of responsible AI principles as outlined, for example, by the Organisation for Economic Co-operation and Development (OECD), which identifies five principles for responsible stewardship of AI. The paper then addresses critical issues that cut across these dimensions, including political participation, scaling, and inclusion, particularly as it relates to gender.

In exploring these four areas, the paper provides a bird's-eye view of the state of AI in African settings and proposes a general roadmap of key activities required for Africa to position itself to better harness responsible AI technologies — and even become a leading voice on the subject. As a high-level overview, the paper does not cover the application of AI in specific sectors such as healthcare, manufacturing, governance, nor does it exhaustively address all cross-cutting issues. However, it does pose questions relevant to setting domain-specific research agendas for Africa at its current stage of adopting AI.

Result 5: Report Series: Road Map for Research on Responsible Artificial Intelligence for Development (AI4D) in Africa- A focus on Agriculture

Although AI has made huge strides in driving efficiency and penetrating every sphere of modern life in western countries, its reach in African countries has not been ubiquitous. There are many factors which have led to the slow pace of the introduction, growth and embedding of AI in Africa. This report has researched the phenomenon and tried to shone a light on the state of AI in the African setting.

This paper is the result of one strand of these collaborative efforts. Its focus has been to review the state of penetration of AI technologies in Africa, specifically in the field of agriculture. Agriculture is the backbone of many African economies and despite its vast tracts of arable land, the continent is blighted by environmental and capacity challenges, which have resulted in crop failures, sub-optimal land use, and mass hunger in many regions.

This report gives a bird's eye view of the areas in which AI technologies have been deployed to tackle some of these challenges, and delves into the African AI ecosystem to demonstrate how international and African developers have created AI technologies which, if scaled and targeted appropriately, could go a long way towards reducing perennial problems of disease and poor harvests. Here we highlight the unique opportunities which exist to introduce the concept of ethical AI which can be developed for the common good of African populations.

Result 6: Micro-projects and Innovation Applications

The AI4D Africa call for applications[15] was launched on June 6th 2019 and lasted for 6 weeks until July 18th. The projects selected for funding were notified on August 20th with an invitation to present their solutions at the AI4D workshop during the Deep Learning Indaba 2019 conference[16]. The requirements for projects were (i) the creation of a dataset, (ii) novel and motivated goal, (iii) challenging yet manageable task with scalable long-term vision and (iv) accessible to the general public and research community. The selected projects were awarded from 5,000 - 8,000 USD which were disbursed in two funding rounds. Procedures for monitoring the project progresses, timelines and deliverables have been put in place. The following researchers were awarded:

1. Dr. Abdelhak Mahmoudi from Mohammed V University of Rabat, Morocco;
2. Dr. Adewale Akinfaderin, Olamilekan Wahab and Olubayo Adekanmbi from Data Duality Lab, Data Science Nigeria, MTN Nigeria, Nigeria;
3. Dr. Amelia Taylor, Eva Mfutso-Bengo and Binart Kachule form University of Malawi and the Polytechnic, University of Malawi, Malawi;
4. Dr. Aminata Zerbo Sabane, Dr. Tegawendé Bissyande, and T. Idriss Tinto from L'université Joseph Ki-Zerbo and La Communauté Afrique Francophone des Données Ouvertes, Burkina Faso;
5. Denis Pastory Rubanga, Dr. Zekaya Never, Dr. Machuve Dina, Lilian Mkonyi, Loyani K. Loyani, Richard Mgaya from Tokyo University of Agriculture, The Nelson Mandela African Institution of Science and Technology, and Sokoine University of Agriculture, Tanzania;
6. Martha Shaka, Nyamos Waigama, Emilian Ngatunga, Halidi Maneno, Said Said, Said Mmaka, Frederick Apina, Simon Chaula, Emani Sulutya, Merikiadi Mashaka from University of Dodoma and Benjamin Mkapa Hospital, Tanzania;
7. Dr. Moes Thiga and Dr. Pamela Kimeto from Kabarak University, Kenya;
8. Ronald Ojino and Khushal Brahmbhatt from Cooperative University of Kenya, Kenya;

[15] https://docs.google.com/document/d/1MdLmwR7nU-r92teKwNIIxB4MCYOqhcvCAv5sMZZv60c/edit
[16] Knowledge 4 All Foundation sponsors #AI4D Africa Innovation Awards @Indaba https://www.k4all.org/2019/09/ai4d-africa-innovation-2019-winners/

9. Steven Edward, Edward James, and Deo Shao from Nelson Mandela African Institute of Science and Technology, Tanzania;
10. Dr. Tegawendé F. Bissyande, Dr. Aminata Zerbo Sabane, and T. Idriss Tinto from Université Joseph Ki-Zerbo and La Communauté Afrique Francophone des Données Ouvertes, Burkina Faso.

The call for proposals has resulted in 32 responses with applications ranging from the following fields: Healthcare (10), Inclusion and Gender (6), Agriculture (5), Governance (4), Education (4), Algorithmic Governance (1), Energy (1), Future of Work (1), Wildlife Conservation (1). We have selected 10 projects that fitted the selection criteria, delivered via a ranking system in Easychair and assessed by independent reviewers for each field. The projects kick-off was on September 15th.

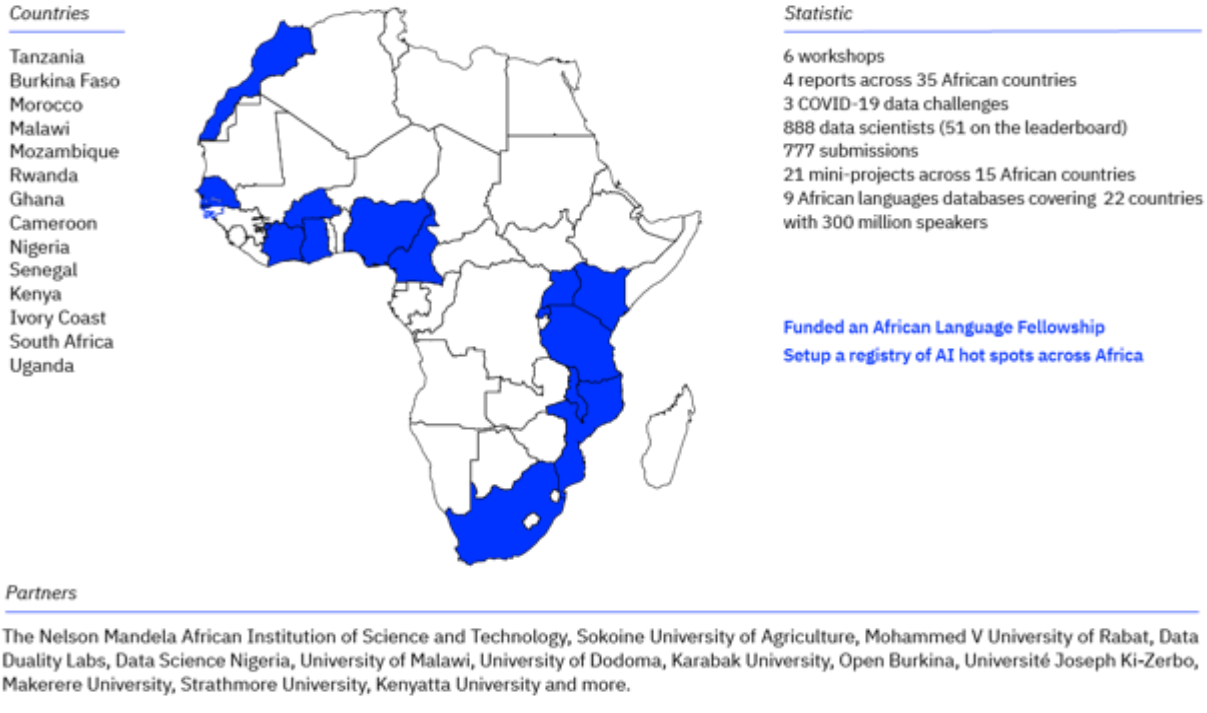

Figure 4: AI4D micro-projects distribution

The 10 multidisciplinary innovation projects within and outside the African AI4D Network, exploring local frontiers of research in AI from autonomous vehicles to healthcare, agriculture, language, education, agriculture, environmental conservation;

1. **Tanzania** - Effective Creation of Ground Truth Data-set for Malaria Diagnosis Using Deep Learning (link)
2. **Burkina Faso** - Preservation of Indigenous Languages (link)
3. **Burkina Faso** - Building a Medicinal Plant Database for Preserving Ethnopharmacological Knowledge in the Sahel (link)
4. **Morocco** - Arabic Speech-to-MSL Translator: Learning for Deaf (link)
5. **Kenya** - A Public Dataset on Poaching Trends in Kenya and a Study on the Predictive Modeling of Poaching Attacks (link)
6. **Kenya** - Early detection of preeclampsia using ambulatory blood pressure monitoring using wearable devices and Long Short Term Memory Networks (LSTM-NN) on the edge (link)
7. **Malawi** - A Semi-Automatic Tool for Meta-data extraction from Malawi Court Judgments (link)

8. **Tanzania** - A Computer vision Tomato Pest Assessment and Prediction tool (link) (dataset link)
9. **Nigeria** - Using Artificial Intelligence to Digitize Parliamentary Bills in Sub-Saharan Africa (paper link)
10. **Tanzania** - Improving the Pharmacovigilance system using Natural Language Processing (NLP) on Electronic Medical Records (EMRs). (link)

Result 7: Database building and Machine Learning Data Challenge Series

AI4D Africa Language Challenge - Round 1[17]

The *AI4D - Language Dataset Challenge* was conceptualised as an effort to incentivise the creation, collation and uncovering of African Language datasets. This 5-month process saw the submission of 35 datasets from a variety of African languages/dialects, among them Amharic, Ewe, Fongbe, Swahili, Twi, Wolof and Yoruba. In total 190 data scientists enrolled to solve the challenge.

GIZ, AI4D Africa Language Challenge and Fellowship programme - Round 2[18]

The second phase for the *AI4D - Language Dataset Challenge* has provided datasets for the 2nd Challenge. While the overall outcome of the 1st was overwhelmingly positive, one challenge encountered was the submission of small datasets given that evaluation was done on a monthly basis. In response and as a continuation of these efforts, this subsequent work involved the selection of 5 teams, out of the 10 that emerged as winners during the initial challenge and inviting them to continue working on their datasets for a period of 5 extra months.

Therefore, this challenge's objective is the creation, curation and collation of good quality African language datasets for a specific NLP task. This task-specific NLP dataset will serve as the downstream task we can evaluate future language models on. This challenge is undergoing and sponsored by GIZ and UNESCO with IDRC support and is hosted in partnership with the Artificial Intelligence for Development Africa (AI4D-Africa) Network.

In early June 2020 we have contacted the authors of the winning submissions, to inform them that through the additional support of UNESCO, we are able to work with up-to 5 teams that had outstanding submissions for a further period of few months. During this time, we proposed to support them to further build and annotate the dataset to meet some minimum requirements that we set collaboratively in order to obtain datasets that we can in future use to host shared tasks/ML challenges. This interaction would kick off with a one-day virtual workshop where we set minimum deliverables, agreed on an accountability structure for the coming months and identify what mentorship they may need and set about providing them with it. Data has been be published on a dedicated channel in Zenodo[19], which is a simple and innovative service enabling researchers to share and showcase research results from all fields of science.

AI4D Challenge to predict the Global Spread of COVID-19[20]

This was an attempt at accurately modelling the spread of viral diseases, as it is critical for policymakers and health workers to take appropriate actions to contain and mitigate the impact of these disease. This challenge asked data scientists on Zindi to accurately predict the spread of COVID-19 around the world over the next few months. Solutions were evaluated against future data. The effects of COVID-19 have yet to emerge as the situation at the time was evolving rapidly. With this challenge we contributed to the global body of knowledge which is helping stem the impact of pandemics such as this one as well as those in the future. The top 3 solutions

[17] AI4D Africa Language Challenge https://zindi.africa/competitions/ai4d-african-language-dataset-challenge

[18] GIZ AI4D Africa Language Challenge - Round 2https://zindi.africa/competitions/ai4d-african-language-dataset-challenge

[19] African Natural Language Processing (AfricaNLP) https://zenodo.org/communities/africanlp/search?page=1&size=20

[20] AI4D Predict the Global Spread of COVID-19 https://zindi.africa/competitions/predict-the-global-spread-of-covid-19

were made available on GitHub[21]. All together the Challenge[22] involved the enrolment of 773 data scientists, 47 data scientists on the leaderboard and 777 submissions. The top score was 208, which means on the average the estimates for cumulative deaths per country each day was 208 off of the actual number. The winners of the challenge were 1) from Russia, 2) Nigeria and 3) France.

Result 8: Guidelines to support African researchers in developing open access resources

The project with its challenges and dataset building showed that there was a need for in-depth, research and analysis of the legal implications of obtaining textual, visual and audio data from a variety of sources that were noted over the course of the challenge. These legal implications were needed to be assessed ahead of the publication and further public use of the datasets. Then moving forward, we decided to create guidelines to support researchers in developing open access resources, using these winning 10 datasets as case studies[23].

We connected with CIPIT personnel Isaac Rutenberg and Mellissa Omino who are working with us on projects within the AI4D Initiative. They both specialise in Copyright and Intellectual Property Law and are affiliated to the Centre of Intellectual Property and Information Technology at Strathmore University in Nairobi, Kenya. Our intention is that through their involvement, we can better streamline gaining access data for research purposes, deciding licensing of datasets for publication, and anything else relevant that may additionally propose. The main results were (1) templates in request of permission to use data for research purposes, (2) licensing advice for datasets to be published and (3) general case by case advice pertaining to datasets.

4. Project outputs

The following activities were supported by the project during the entire reporting period, including the originally planned project objectives and additional ones:

Outcome 1: Project workshop

The main workshop to kick-start the African chapter of AI4D titled *"Workshop Toward a Network of Excellence in Artificial Intelligence for Development (AI4D) in sub-Saharan Africa"* was organized from April 3rd to 5th 2019 at Strathmore University in Nairobi, Kenya. The initial list of invitees included 82 names across the African continent including industry, research institutions, NGOs, and development agencies, with the final number of 60 participants at the workshop site. In order to present the human side of the researchers involved in the workshop, we decided to interview 20 participants to kick-start a web presence. We employed rapporteurs to take minutes and notes[24] of each breakout group in a standardized format[25] in order to help the committee to kick-start the work on the roadmap. A dropbox folder with all contacts, presentations and documents[26] was shared among participants, as well as a feedback evaluation form[27].

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[21] https://GitHub.com/ArefievMC/AI4D-Predict-the-Global-Spread-of-COVID-19
https://GitHub.com/Dr-Fad1/Zindi-wins-AI4D-Predict-the-Global-Spread-of-COVID-19-insights
https://www.kaggle.com/mathurinache/zindi-predict-the-global-spread-of-covid-beluga

[22] Presentation of Challenge results
https://www.dropbox.com/s/l53vb26q9ociewy/AI4D%20Predict%20the%20Global%20Spread%20of%20COVID-19.pdf?dl=0

[23] Sheet containing some details of the 10 winning datasets
https://docs.google.com/spreadsheets/d/1b2pzLwzVVxeDS9SbwtzOT0Vk2QK_IJrZNhL5d6EkD-8/edit#gid=94512478

[24] https://www.dropbox.com/s/424orvthlia93xj/AI4DEVELOPEMENT%20WORKSHOP%20NOTES(Complete).docx?dl=0

[25] https://docs.google.com/document/d/1Gr4AiTmKveSp1V8vKxsxWMC-wg6_Ay9KLFuR6Mj1u_s/edit#

[26] https://www.dropbox.com/sh/4lksi7bm18vcdwr/AAAj65pfKETx95fI-ZchKWBua?dl=0

[27] https://docs.google.com/forms/d/1QVs3Tne1AeVJoJ8fvGmrjSYA8b8U1ESX65MSxsVixVk/viewform?edit_requested=true

Outcome 2: Roadmap or Call to Action

The work on the roadmap has begun directly after the Nairobi workshop via the Steering Committee members whose work was divided into the thematic structures discussed at the meeting. This became the foundation for the idea of the four new networks. In the later stages of the project the creation of the roadmap was diversified through the report series to acquire as much knowledge on how to proceed forward and the involvement of the Steering Committee was not needed. Seemingly, the hiatus in the Steering Committee involvement has produced, at least to our knowledge, a number of research project proposals within the network partners, submitting to international research grants.

Outcome 3: Research instruments and reports

The initial research instruments[28] were designed only for two target groups, namely HEI and governments, however on April 8th 2019 after inputs from the Nairobi workshop it was decided to add a third group of stakeholders involved in African AI, the bottom-up communities. The research instruments for governments were then shared with UNESCO and included in the AI assessment survey across 32 African member states, and introduced in our compendium report.

Outcome 4: Call for proposals for applications

The AI4D Africa call for applications has generated 10 projects. The projects piloted a mentorship programme partially inspiring the Deep Learning Indaba[29] programme with procedures for monitoring the project progresses, as well as timelines and deliverables. We also released a public form[30] for researchers to give feedback on their exploitation plans. Datasets were uploaded to Zenodo.

Outcome 5: Project website

This result has been achieved[31] and is being redesigned and updated with news, videos, blogs and science talks sections[32].

Outcome 7: Data Challenge

The initial objective of having one challenge has turned into a portfolio of challenges focused on the creation, curation and collation of good quality African language datasets for a specific NLP task. This attracted other funding and a larger project proposal with a detailed structure comprising all challenges into one coherent project focused on ***Cracking the Language Barrier for a Multilingual Africa***[33].

5. Problems and Challenges

AI4D Africa has started in January 2019 with an extension ending in December 2020 (M21) and has resulted in the establishment of the Network, a research "roadmap" comprised of two reports, one vision paper and one research paper, a portfolio of 10 innovation projects, a set of datasets, a set of recommendations for capacity building for ethical and locally relevant AI research around the African continent, a Fellowship to develop datasets and strengthen capacities and innovation potential for Low Resource African Languages which went on to eventually win a Wikimedia Award of the year 2021[34]. The project was extended, as on 11 March 2020, the World Health Organization (WHO) officially classified COVID-19 as a pandemic. This

[28] Research instruments https://www.dropbox.com/s/2ezh3e2s8nn8jqc/AI4D%20Instruments.zip?dl=0
[29] Indaba Mentorship Programme https://deeplearningindaba.com/mentorship/
[30] AI4D mini-projects exploitation plans https://forms.gle/V7fuScsavhF3pMpc9
[31] AI4D website https://ai4d.ai/
[32] AI4D science talks https://ai4d.ai/talks/
[33] Fellowship and NLP project https://docs.google.com/document/d/10Zm7AjJCUu-6nkp1qr_BfYFZcJCSnRoVqGhWGsyZYGw/edit?usp=sharing
[34] Participatory Research for Low-resourced Machine Translation: A Case Study in African Languages and the Masakhane Community https://research.wikimedia.org/awards.html

impacted all aspects of the project delivery, therefore we asked for an extension to finalise the work on three main project actions;

1. Finalize the Capacity Building Report with the Governmental data pertaining to our partners at UNESCO;
2. Finalize the Call for Action in Artificial Intelligence 4 Development in Africa and
3. Finalize the mini-projects and help create effective exploitation routes for post COVID-19 opportunities.

6. Testimonials

Figure 5: IJCAI presentations of AI4D that show appetite for AI and SDGs

Figure 6: Nairobi meeting of the African Network in Artificial Intelligence

Figure 7: Mini-projects Innovation Awards workshop @Indaba 2019

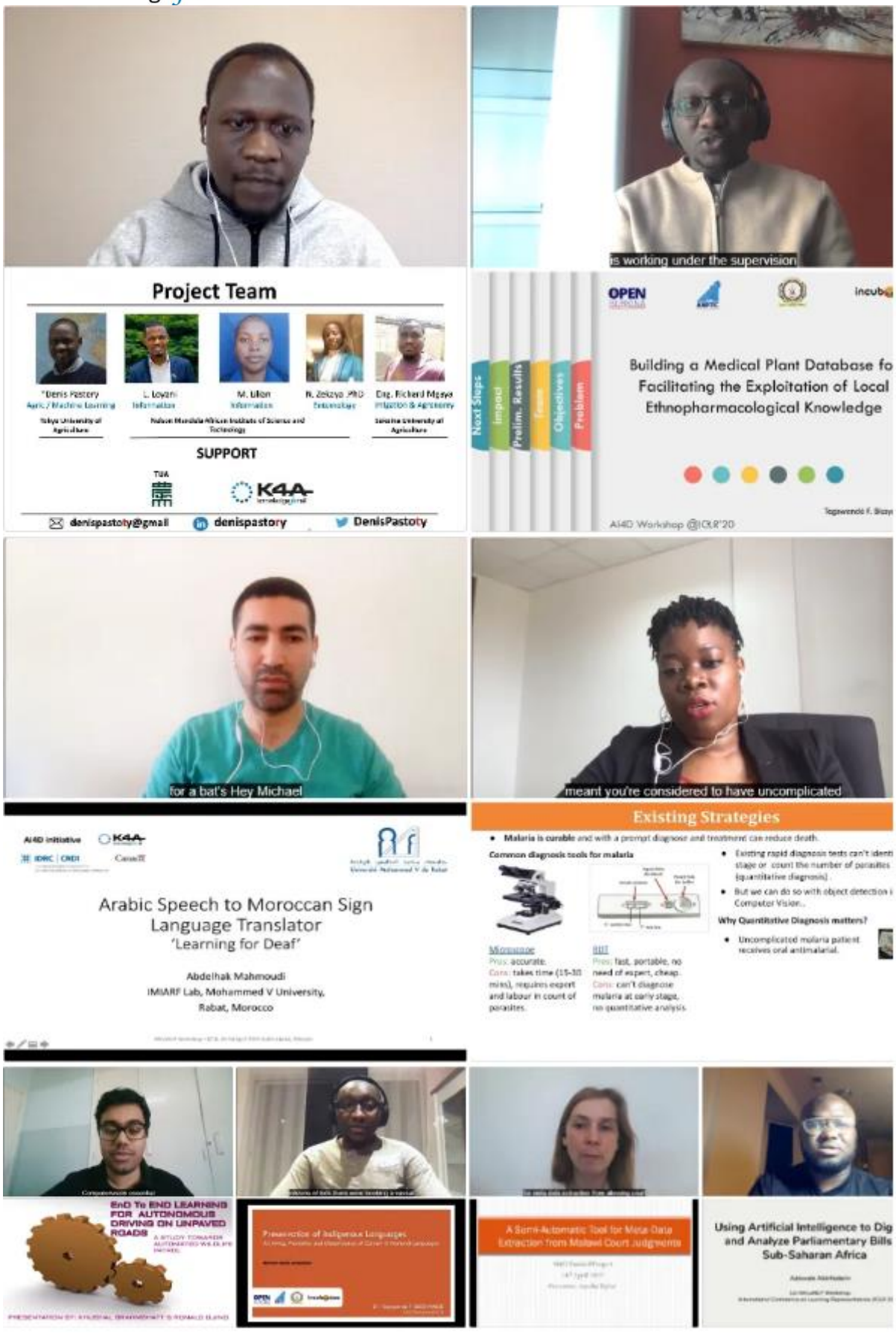

Figure 8: ICLR 2020 presentations of AI4D mini-grants