

NURTURING AI SOLUTIONS
THROUGH USER-CENTERED
APPROACH

AI COMMONS
SAHARA VENTURES
TANZANIA AI LAB

MAKING ARTIFICIAL
INTELLIGENCE SOLUTIONS
WORK IN TANZANIA, LESSONS
FROM IDEALAB.AI PROJECT.



AI COMMONS,
SAHARA VENTURES &
TANZANIA AI LAB

BACKGROUND

This report provides an overview of the AI landscape in Tanzania as well as captures lessons learned from the IdeaLab project carried in Tanzania by AI Commons, Sahara Ventures, and Tanzania AI Lab through the support of The Botnar Foundation. The sister projects of the same projects were happening in Nigeria and Ghana in partnership with Data Science Nigeria (DSN) and Superfluids Ghana.

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OVERVIEW AI TANZANIA

ARTIFICIAL INTELLIGENCE
SOLUTIONS TRANSFORMING
DIFFERENT SECTORS IN
TANZANIA

Last quarter of 2020 when we were working on the report *Artificial Intelligence in Tanzania, What's Happening* the second edition, we learned a lot about the potential of AI in developing economies. Beyond academic publications and lab works already we are seeing the technology being adopted across multiple sectors to address complex issues.

AI in Tanzania is not “future technology”, it is already being used and adopted across multiple sectors.

From startups such as *Mtabe App* and *Shule Direct* through their product *Ticha-Kidevu* are using AI in EduTech solutions, to companies such as *Mantrac* who uses Artificial Intelligence to slash fatigue events and downtime on a mine site in North Mara Tanzania. AI in Tanzania is not “future technology”, it is already being used and adopted across multiple sectors.

The *Barrick Gold Mine* in North Mara, Tanzania, encountered several cases of unplanned downtime from mishaps, fatigue events, and injuries. The company through *Mantrac* has adopted an AI solution that is on the verge of eliminating the problem. Even though the adoption of AI by local startups is still at an early stage mainly through Chatbots. This opens up a lot of possibilities for further adoption of technology in Education. Because of the COVID-19 crisis, a good number of Edutech startups emerged to address the issue of remote teaching. It will be good to study after a year the progress of these startups especially those that will be adopting Artificial Intelligence.

AI FOR WILD ANIMALS PROTECTION

ADOPTING AI TO PROTECT WILD ANIMALS

During a test phase, a solution called *Trailguard AI*, used as a security system for national parks to detect, stop, and arrest poachers, the solution was able to enable the seizure of 1,300 lb. of illegal bushmeat and immediate arrest of 30 poachers at Grumeti Reserve in Tanzania. *TrailGuard AI's* camera head uses artificial intelligence to detect humans within the images and relays pictures containing humans back to park headquarters via GSM, long-range radio, or satellite networks. Another solution *WildEyes AI* enhances allows elephant monitoring through non-invasive technology.

Community crushes with elephants are a common issue in many villages that are close to national parks and game reserves in Tanzania. It is estimated \$600,000 worth of crop-damages is caused by elephants in rural Tanzania. *WildEyes AI* is a sophisticated artificial intelligence algorithm used to detect elephants based on synthetic data models created by CVEDIA, running on the Intel Movidius Vision Processing Unit (NVU) embedded in the *WildEyes AI* camera. Both technologies *Trailguard AI* and *WildEyes AI* can play a crucial role in animal and rural communities' security.

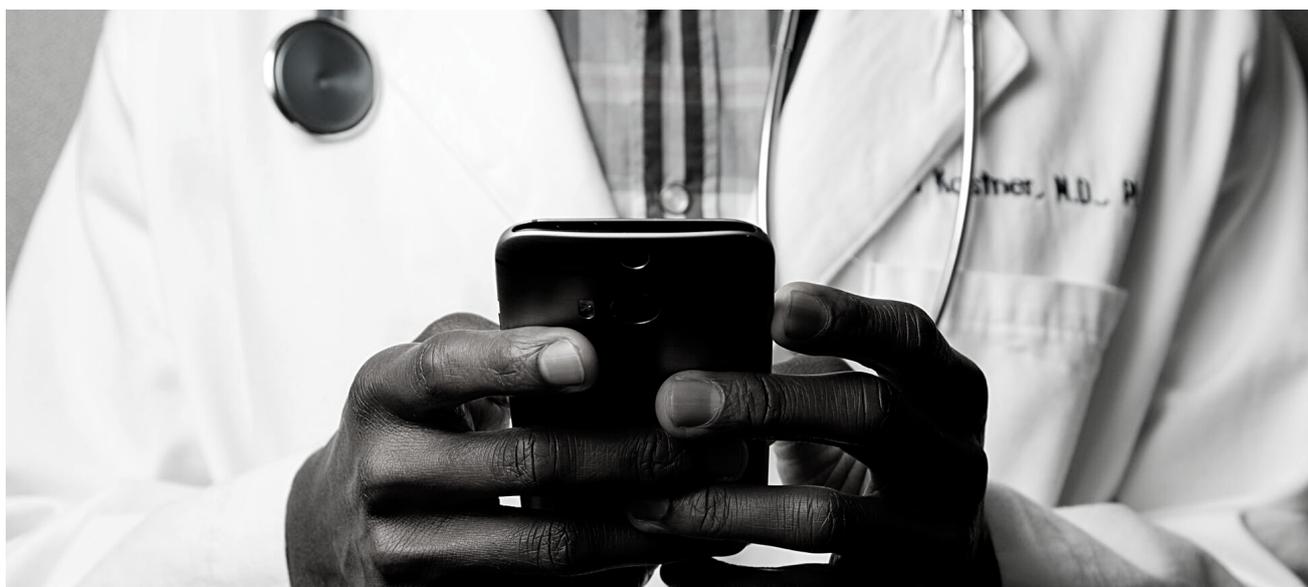


AI IN HEALTH

AI IN HEALTH SECTOR AND MEDICAL RESEARCHES

More AI-powered solutions launched and researches are being conducted targeting Tanzania's health sector. *Macro-eyes* uses artificial intelligence to improve vaccine delivery and patient scheduling. The startup is helping in predicting how many children will show up for vaccinations at each health clinic through their vaccine forecasting tool that leverages a unique combination of real-time data sources, including new insights from front-line health workers.

The tool branded *CHAIN—Connected AI Health Network* was able to reduce vaccine wastage by 96 percent across three regions of Tanzania. Ada Health launched the world's first AI health guidance app in Swahili. *Ada Health* is a free, symptom-checking app created by a Berlin-based health tech company. The solution is looking to address the issue of the Doctor-Patient ratio in the country whereby one doctor serves 25,000 patients.



A researcher from *Ifakara Health Institute (IHI)*, Fredros Okumu, received a grant of \$100,000 from Bill and Melinda Gates Foundation to use AI to accelerate malaria vector control. Fredros adopt Artificial Intelligence and Infrared Spectroscopy to address the problem. The solution is expected to quantify the efficacy of any control intervention targeted at malaria mosquitoes, by combining artificial intelligence and infrared-spectroscopy to obtain real-time information on mosquito populations and their disease transmission potential.

Emmanuel Mwanga also from Ifakara Health Institute (IHI) is working on rapid assessment of blood-feeding histories and parasite infection rates in field-collected malaria mosquitoes. He is also using machine-learning and mid-infrared spectroscopy. This approach will allow a cheaper, quicker, and non-invasive alternative for predicting age and species of mosquitoes, and detecting pathogens. The project has been funded by Wellcome Trust and it is currently ongoing.

AI IN MAPPING

AI IN MAPPING AND HUMANITARIAN EFFORTS

Tanzania is among the countries that have taken a major step in land mapping through emerging technologies. The Zanzibar Mapping Initiative is known to be the most ambitious drone mapping project in the world. The project is a partnership between the World Bank, the government of Zanzibar, and the State University of Zanzibar (SUZA). The Zanzibar mapping initiative is creating a high-resolution map of the islands of Zanzibar and Pemba, over 2300 km², using low-cost drones instead of satellite images or manned planes.

Tanzania Flying Labs, Data Kind, and WeRobotics are using AI to accelerate image processing and review for detecting buildings from Drone Imagery to easy disaster response targeting areas in Dar es Salaam that are prone to flooding. The challenge has been while drone allows quick information collection the problem is on the analysis of the information collected. Analyzing the data from a single less than 30 minutes flight can generate over 13 hours of analysis time. The team was looking at using artificial intelligence (AI) to accelerate



the generation of insights which is extremely valuable for rapid disaster response.

It used to take teams of analysts days, if not weeks or months, to survey affected areas damaged from floods, fires, and other natural disasters. The neural network model and associated data pipeline developed by DataKind and its team of pro bono data scientists allow TFL to compare images before and after heavy rainfall, to identify damaged or destroyed homes in hours. — Datakind.Org

Also, *Facebook's AI-powered maps* helped kick-start efforts to bring renewable electrification to rural Tanzania. The maps were used to better understand which locations would benefit from decentralized energy solutions. This was achieved by combining *Facebook's* high-density population maps with detailed data on settlement locations and structures from *OpenStreetMap*. The project played a crucial role in addressing gaps in energy supply to the rural population making it difficult to supply power from one centralized source.

AI IN MAPPING

AI IN MAPPING AND HUMANITARIAN EFFORTS

This project is part of the mini-grid component of the Scaling-Up Renewable Energy Program (SREP) funded program in Tanzania, the International Finance Corporation (IFC), in close collaboration with the Rural Energy Agency (REA) of Tanzania, commissioned a consortium including *Humanitarian OpenStreetMap Team (HOT)*, *Reiner Lemoine Institute (RLI)* and *INTEGRATION Environment and Energy*. Tanzania was among the beneficiaries of the Humanitarian OpenStreetMap (HOT OSM) partnership with Microsoft. Microsoft released 18M building footprints in Uganda and Tanzania to enable AI-Assisted Mapping.

Under *Microsoft's AI for Humanitarian Action* program, *Bing Maps* together with Microsoft Philanthropies is partnering with HOT on an initiative to bring AI Assistance as a resource in open map building. The project is addressing the challenge facing first responders who offer relief supports in areas that are prone to disasters. *Bing Maps* is making this data open for download free of charge and usable for research, analysis, and of course, OSM. This is good news for planners and researchers looking to capitalize on AI for disaster recovery efforts, especially in rural areas.



In the last ten years, 2 billion people were affected by disasters according to the World Disasters report 2018. In 2017, 201 million people needed humanitarian assistance and 18 million were displaced due to weather-related disasters. Many of these disaster-prone areas are literally “missing” from the map, making it harder for first responders to prepare and deliver relief efforts — Microsoft.

Initiatives such as *Mapwith.AI* are capitalizing on this opportunity. *Mapwith.AI* their mission is to map the world using Artificial Intelligence. They are using artificial intelligence to predict features on high-resolution satellite imagery. These features are then populated in *Rapid* map editing tool. The goal is to help facilitate a connected world in addressing the global-scale humanitarian crises through AI. Other startups such as *Ecopia.AI* are showing the efficiency of using AI for mapping. The startup published an article on mapping Tanzania in three weeks using their technology.

FINTECHS ADAPTING AI

ARTIFICIAL INTELLIGENCE FOR FINANCIAL TECHNOLOGIES

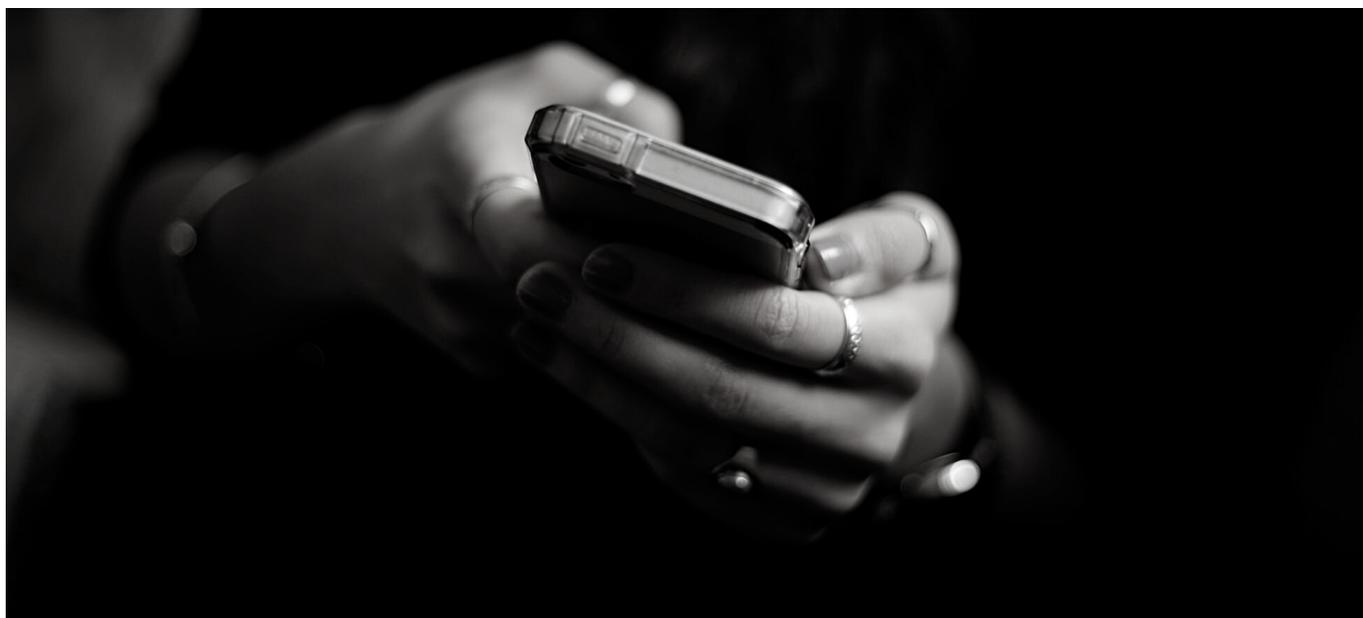
Local and global Fintech Startups are exploring AI in their B2C solutions. *Branch* is a mobile app digital lender operating in Kenya, Nigeria, Tanzania, Mexico, and India. Branch applies machine learning to create an algorithmic approach to assess the creditworthiness of potential borrowers based on thousands of data points on the individual and the accumulated experience across borrowers. Since its establishment in 2015, Branch has provided more than 15 million loans to over three million customers, disbursing a total of \$350 million. A local startup *Mipango App* uses artificial intelligence to guide users to better financial management and financial deals towards attaining financial freedom.

The co-founder of the app *Lilian Makoi* has vast experience working in fintech startups. She co-founded another startup *Jamii Africa*, a start-up that provides health insurance for the low-income population primarily using mobile phones. Adoption of Artificial Intelligence in business to consumer products opens a new window of opportunities for startups to use the technology to assess and anticipate consumer behaviors towards their products and solutions. Another fintech startup *TemboPlus* is also currently researching that. The startup integrates with mobile money accounts to help users save, invest, and plan their finances using their mobile phones while analyzing their behaviors.



CONVERSATIONAL AI

BUILDING AI SOLUTIONS FOR SWAHILI LANGUAGE



Frederick Apina and *Ibrahim Mtandu* cofounded Belltro a startup that is looking to transform conversational AI in Africa. The startup which was part of the *Vodacom Accelerator* currently is working on exploring adopting conversational AI in the consumer experience and customer service industry. Frederic and Ibrahim are graduates of the University of Dodoma in central Tanzania.

Another team is working on a project called Nena. During the 2020 general election, nobody was able to capture Social Media Sentiments from Swahili Language users to analyze how people were feeling about the general election because almost all digital media analysis tools lack the ability to analyze Swahili contents. Nena which is still in the beta stage is the first Swahili Language tool that allows developers and organizations to use the language in their projects.

The team behind the project is linked to the startup Inspire Ideas known for the Dr. Elsa product. The lack of Swahili Digital Libraries creates a lot of challenges for AI enthusiasts who are looking to create solutions from data obtained from social media platforms for sentiment analysis. The recent publication of UNDP Tanzania about misinformation related to the COVID19 pandemic. The organization was looking into the issue of misinformation in social media platforms using Artificial Intelligence in partnership with a local startup, XSense AI. The analysis had to be done only for English Tweets (Analysis Was Done on Twitter) due to the absence of Swahili digital libraries. The effort to promote Swahili Machine Learning has increased recently. Through the Zindi Africa, NLP Virtual Hackathon focuses on African Languages. The Hackathon was organized and the goal was to build an NLP model using Swahili Dataset.

IDEALAB.AI

With all the mapped AI solutions and interventions happening in Tanzania, it remains extremely difficult to come up with practical, relevant, and adaptable solutions to address complex problems using Artificial Intelligence in the country. Understanding problem owners, having the right technology and data, access to funding, talents, and skills are among things that can massively hinder the adaption of Artificial Intelligence to solve community problems. IdeaLab.AI is a project which is looking to address some of those challenges.

IDELAB.AI

IDEALAB.AI CREATING
AI SOLUTIONS FROM
THE PROBLEM
OWNER'S
PERSPECTIVE.

IdeaLab.ai is *AI Commons* project to develop Artificial Intelligence solutions that allow anyone, anywhere to benefit from the possibilities that AI can provide. The project aims to demonstrate how the global and local communities of AI experts can co-create mutually beneficial solutions with local problem owners with the opportunity for cross-country incremental enhancement. The project in Tanzania is implemented in partnership with Sahara Ventures and the Tanzania AI lab. Similar versions of this project are being implemented in Nigeria and Ghana in partnership with Data Science Nigeria and Superfluid respectively.

The AI Commons is a nonprofit organization supported by the ecosystem of AI practitioners, entrepreneurs, academia, NGOs, AI industry players, and organizations (individuals) focused on the common good. The organization has gathered the best minds in academia, industry, and thought leaders in AI to support the creation of a knowledge hub in AI that can be accessible by anyone, that can help inform governance, policymaking, and investments around the deployment of AI solutions, and be a catalyst for supporting diversity and inclusivity in how AI is deployed for sustainable development goals. The idealab.AI project looked into opportunities for Open-Source AI-powered solutions

in addressing health challenges in Tanzania. Open-sourcing of AI solutions have the potential to accelerate growth and create feedback loops to solve problems and improve products, foster the development of much-needed AI talent, and inspire trust in AI models and predictions. An open-source community around AI can accomplish these goals and do it faster with fewer barriers like high licensing fees and limited talent getting in the way of AI results. This approach addresses some of the challenges in implementing AI projects and developing AI solutions.



PROJECT APPROACH

The IdeaLab approach towards the creation of AI-Powered solutions relied on three things;

Creation of a methodology for open-sourced AI solutions.

Solutions that can be replicated, modified, and adapted to local contexts, through robust documentation of the solutions that included factors considered when building it, methods used, data used, and more such aiding information.

Working with local communities of AI practitioners.

Solutions built by local practitioners who understand the unique challenges faced when building and implementing ai solutions for the local challenges to ensure relevancy and adaptability of the identified solutions.

Working with local problem

owners. Working with problem owners throughout the development of the solutions. Ensuring the relevance of the solution when being built and its effectiveness in solving the challenge faced by the problem owners.



PROCESS FLOW

The process flow which was adapted to capture project's main objective.



1

Stakeholders Mapping & community building.

Identifying stakeholders From The local ecosystem of stakeholders, data owners, problem owners and experts.

2

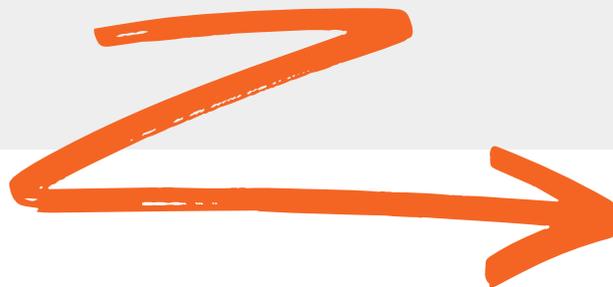
Challenge Definition & Documentation.

Mapping and documenting challenges in health & well-being ecosystem that can be solved by AI.

3

Hackathon (Ideation & Prototype development).

Creating prototype solutions to the challenges identified from the documented problem statements.



4

International Evaluation.

Opening Up The Solution to The International Community to Receive Feedback For Further Improvement

5

Solution Improvement

Working With The Problem Owners For Testing and Validating the Improvement on The Solutions.

6

Solution Deployment

Deployment The Solution to The Knowledge Hubs Including All The Updates; Materials, Tools and Other Resources.



PROJECT ACTIVITIES

Three Activities Were Implemented;
Challenge Definition Session,
Problem Documentation, and the
Hackathon.

Challenge Definition Session

The challenge definition session brought together the stakeholders; data owners, ai experts, and problem owners to identify the most prevalent challenges in the health & wellbeing sector that can be solved using Artificial Intelligence. Some of the stakeholders who attended the workshop include; staffs from *Ifakara Innovation Hub* and *Ifakara Health Institute*, *InSupply Health JSI*, *Benjamin Mkapa Foundation*, *Students From Muhimbili University and University of Dar es Salaam*, and few medical practitioners including doctors. From the activity, two tools developed by AI Commons were adopted to understand and shape the problem statements; The AI Commons Problem Submission Tool and the Project Summary Tool.

Problem Documentation

it was the second phase of the activity to document relevant insights gathered and information regarding the challenges identified in the challenge definition session. A tool created by Data Science Nigeria (DSN) and other partners involved in the program was adopted to ensure consistency on the approach used to do solution documentation in the three countries (Nigeria, Ghana, and Tanzania). The documented problem statements were supposed to offer as much information as possible and to be as specific as possible to allow hackers to have enough information as they start to hack for the solutions in the next phase of the process flow. The diagram below the list of the documented challenge statements after the problem documentation phase.

Hackathon

It was the third activity in the process flow. With the problem statements clearly defined and other insights gathered and well documented. The documented problem statements were given to hackers in virtual hackathon sessions to hack and offer solutions. The hackathon was conducted in form of a virtual innovation challenge with teams competing to come up with the best solutions to the identified challenges. The hackathon brought together AI Practitioners, problem owners, and healthcare practitioners forming teams to create technical AI solutions and work on prototypes for the documented challenges. The hackathon had 85 participants from Tanzania, Nigeria, and Zimbabwe.



HACKATHON WINNERS

HACKATHON WINNERS AND NEXT STEPS

10 teams registered with their chosen challenge track, 6 completed open-source prototypes. As part of the hackathons 4 specialized AI technology workshops were organized to help participants learn new things in AI; *AI for Health Workshop*, *Data analysis workshop*, *Natural Language Processing Workshop*, and *Computer Vision Workshop*.

The winning team from the hackathon were;

- **Elixir:** Cancer Diagnostics Utilising Microscopic Imagery
- **Cellipedia:** Melanoma Diagnostics utilizing smartphone camera
- **Data Pirates:** Early Detection of Tuberculosis in Tanzania

The next phase of the project will focus on sharing the solutions and documentations with the international AI Communities such as *MILA & AI crowds* for improvement in the technical side of the conversation. This will be followed by the real-world implementation and testing of the solutions in their target environment. The information and learnings gathered from here will be used to continually improve the solutions. Sahara Ventures and Tanzania AI Lab will continue to monitor, mentor, and support the winning teams to continue developing their solutions to the next stage.



LESSONS LEARNED

From the project there multiple lessons learned at different stages of the project. Most of the lessons emerged from the engagement with different stakeholders. The lessons learned have been grouped with respect to different stages of the project.

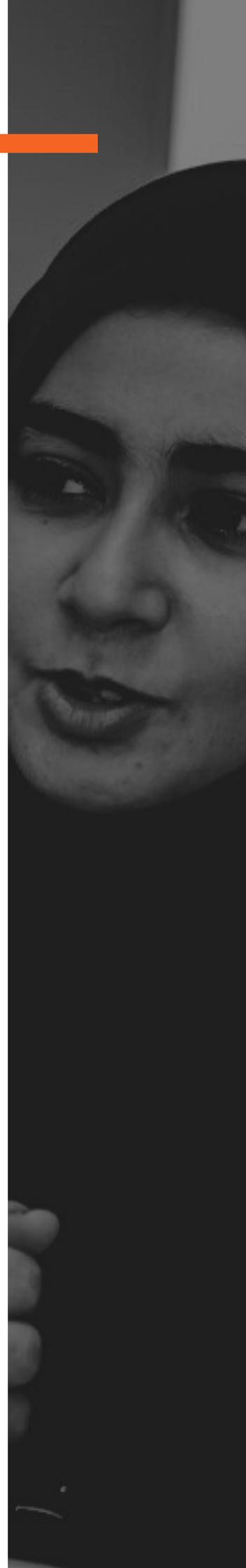
CHALLENGE DEFINITION

- **Open Sourcing Solutions** — while stakeholders were excited to take part in the challenge definition session to share their problems and to start thinking about potential solutions. They were somehow concerned about the issue of making the solutions Open Source. This also affected the process of collecting the challenges as many stakeholders preferred to work on new challenge statements instead of existing projects or ideas they were working on.
- **Stakeholders Engagement** — stakeholders from the challenge definition session felt more stakeholders could have been engaged in the program. They felt organizations such as USAID, AMREF, etc could add more value since they support organizations that work and produce health data that could be used in some of the challenges statements. The proposed incentives for them to participate in future sessions is to allow them to come in with their own challenge statements for hackers to hack using their data.
- **Technical Support** — involvement of experts with technical skills in AI is crucial. Participants felt the idea of having at least one technical person at each table to support the team was very useful and it helped to ease the process of stakeholders shaping the challenge statements..
- **Government Involvement** — stakeholders proposed the need to have representatives from the government since some of the challenge statements and proposed solutions direct involve changing some of the legal and regulatory frameworks. Also, in order to scale some of the interventions, you need access to public medical facilities, data from public offices, etc. Initially, a representative from the government confirmed but unfortunately he couldn't make it.
- **The intensity of The Session** — participants felt one day for the workshop was very intense. They needed more time to work on the canvases (Problem submission Canvas) and do desktop researches to better shape the problem statements.



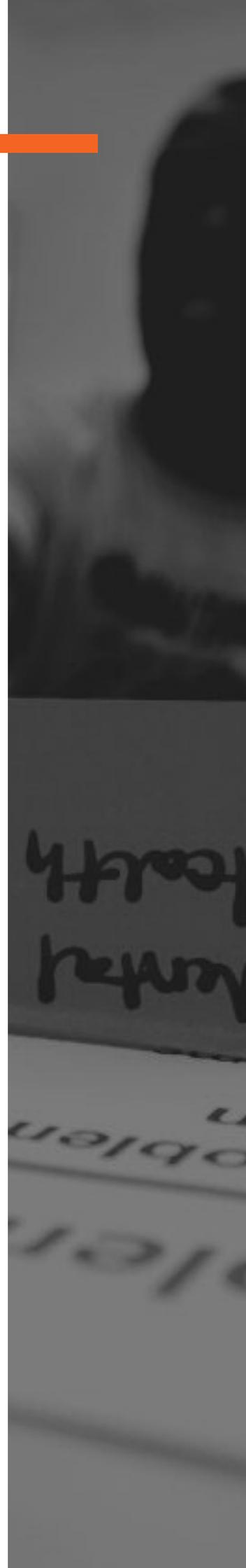
PROBLEM DOCUMENTATION

- **AI Literacy** — the general understanding of Artificial Intelligence and how it can play a part to solve problems is very low in local organizations which made it difficult for them to share useful information to perfect the problem statements. Organizations and individuals engaged didn't have a clear picture of how technology like AI can solve issues like efficiency in disease detection, etc. Hence lack of relevance in some of their response.
- **The Documentation Tool** — the problem owners felt the problem documentation tool was too long (very detailed) hence they felt doing extra work to respond to the questions. While the intention of the tool was good to capture as many details as possible from the respondents' perspective it seems like a burden to respond to all the questions and share the insights needed. There is a need to find to make the documentation tool more user-friendly in form of a canvas or something.
- **Existing Publications** — there wasn't much research done on some of the identified problem statements hence making it difficult to get scientific insights and feedback on some of the issues. While some of the problem statements you could back the insight shared by the respondents by existing research works some you couldn't. When defining and prioritizing problem statements one of the criteria should be the availability of enough data and insights to support the problem statement.



THE HACKATHONS

- **Problem Documentation** — the hackers felt it was great the problems were well documented and provide enough insights for them to work with but in some of the problems e.g Mental Health, the documentation seemed to be very general even though it was detailed. The lesson here was the issue is not about having a detailed general document but rather a more focused one. it eases the process of hacking the problem.
- **Stakeholders** — stakeholders who primarily took part in the hackathon were mainly University students. While this was good and there is a good chance of attracting more of them in future hacking sessions. There is a need to make hackathons more appealing to other stakeholders from organizations, public offices, corporates, etc to encourage diversity and experience.
- **Proactiveness** — the successful team in the hackathon were individuals who were more proactive than others. In one way or the other, this was influenced by their prior understanding of AI and possessing technical skills which encouraged them to commit to the program.
- **Solution Documentation Tool** - the hackers felt the solution documentation tool was lengthy and they suggested there should be a simplified version of the tool in future sessions.



Conclusion

The Artificial Intelligence ecosystem in Tanzania is still at the nascent stages with some activities happening here and there. Projects like IdeaLab.AI can play a crucial role in bringing key stakeholders together and ensure emerging solutions from the sector address real problems facing the community. The IdeaLab.AI approach of bringing together Problem Owners and Solution Creators ensures the generated solutions meet the needs. Still, there is a lot of work that needs to be done to build a stronger AI ecosystem in the country. Through strategic collaborations and partnerships, the ecosystem can leapfrog to the later stages.

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