



**ARTIFICIAL  
INTELLIGENCE  
FOR  
DEVELOPMENT  
AFRICA**



## **ARTIFICIAL INTELLIGENCE FOR AGRICULTURE AND FOOD SYSTEMS (AI4AFS) INNOVATION RESEARCH NETWORK**

### **CALL FOR EXPRESSIONS OF INTEREST (EOI)**

Date of issue: **30 March 2022**

Deadline for Submission of EoI: **10 May 2022**

#### **A. Background**

With the current geometric rise in Africa's population estimated to reach about 2.6 billion by 2050 and a growth rate of more than 2.5% p.a. (Population of Africa, 2019), it becomes imperative that agriculture and food systems (AFS) are reviewed to embrace innovative approaches for sustaining and improving the system from production to utilization. One of the most promising ways for achieving this target is through science, technology and innovation (STI) (Ozor and Urama, 2013; UNCTAD, 2017). STI is recognized as a means for achieving the sustainable development goal (SDG) 2 (End hunger). Artificial Intelligence (AI), which is the capacity of a machine to perform cognitive functions associated with human minds, such as perceiving, reasoning, learning, interacting with the environment, solving problems, and even exercising creativity (Manyika et al., 2017), stands out as one of the emerging technologies with a great potential to transform the AFS and ensure that all aspects of food security including food availability, access, utilization and stability are achieved even for small-scale farm enterprises in Africa. The introduction of AI for AFS is enabled by other technological advances such as big data, robotics, machine learning (ML), Internet of Things (IoT), availability of affordable sensors and cameras, drone technology, and even wide-scale internet coverage on geographically dispersed fields (Eli-Chukwu, 2019). Despite the growth of movements applying ML, IoT, and AI, among other tools to solve the AFS challenges, it remains necessary to identify how these tools may best benefit Africa under its peculiar circumstances.

It is against this background that the [African Technology Policy Studies Network](#) (ATPS) is partnering with the [International Centre of Insect Physiology and Ecology](#) (*icipe*) and [Kumasi Hive](#) as a consortium to manage an innovation research network (Hub) on AI for AFS in Africa (AI4AFS). The overall objective of this initiative is to advance the responsible development, deployment, and scaling of home-grown AI research and innovations to tackle pressing challenges in agriculture and food systems in Africa. This will be accomplished through setting up, managing, and supporting an innovation research network on AI for agriculture and food systems. This network will consist of 6-10 innovation research projects that will develop, deploy, test, and seek to scale responsible and home-grown artificial intelligence research and innovations. This research will deepen our understanding of developing, deploying, and scaling responsible AI innovations for sustainable AFS in Africa. The project will also seek to use these lessons learned to inform African and international AI policy and practice conversations. This project is part of the innovation stream of the Artificial Intelligence for Development Africa (AI4D Africa) program dedicated to a future where Africans across all regions create and use artificial intelligence to lead healthier, happier, and greener lives. AI4D Africa is co-funded by the Swedish International Development Agency and Canada's International Development Research Centre. The specific objectives of this project include:

1. Deepening the understanding of how to develop and scale sustainable African agriculture and food system AI innovations;
2. Building the capacity of African innovators and researchers to develop, deploy and scale such AI applications; and
3. Facilitate the contribution of African research to relevant international AI policy and practice conversations.

## **B. About the Call**

The Hub invites eligible applicants to submit their Expression of Interest (EoI) for the Artificial Intelligence for Agriculture and Food Systems Innovation Research Network in Africa project. This research fund will support research projects and innovations for up to 18 months duration in the following four priority focus areas in Agriculture and Food Systems:

- a) **Availability**, the thematic areas may include: *Prediction of crop yields* (tools to help farmers make ideal decisions in crop yield forecasting and improve smart farming practices that lead to higher yields); *Prediction of soil management properties* (tools for understanding soil conditions and how to boost its performance to support productivity); *Farm management systems* (tools for precision agriculture to detect and perform farm management operations such as planting, irrigation, pollination, weeding, fertilizer application, harvesting, etc.); *Pest and disease detection* (early detection of pests and diseases in the farm and eventual prevention or control); *Smart mechanization* (tools to reduce drudgery in agriculture and minimize inputs, high autonomous and intelligent machines and agribots); and *Livestock surveillance* (for monitoring illnesses, injuries, and even pregnancies).
- b) **Access**, priority will be given to: *Food demand monitoring* (tools for real-time monitoring and control of changes in food demand); *Supply chain management* (tools for monitoring food origin, quality, and safety that affords transparency, trust, certification, and traceability of food product supply chain from farm to fork); *Food retailing* (tools for predicting consumer

demands, perceptions, and buying behaviour); and **Transportation and storage** (preservation of food product quality, to ensure safe food products and to minimize the product damage); **Inventory management** (prediction of daily food demand and to ensure that there are no inventory-related problems).

- c) **Utilization, thematic areas** include: **Modern processing techniques** (software algorithms for enhancing heating, cooling, milling, smoking, cooking and drying to ensure high quality and quantity of agrifood products and, at the same time, avoiding overutilization of resources and wastages); **Minimizing postharvest losses** (tools for preservation, processing, safe storage of foods); **Societal impacts** (ecology, infrastructure, livelihoods, nutrition, social systems, crisis and cultural practices of the food systems, understanding implications for inclusion and gender equity);
- d) **Stability**, some of the thematic priority areas will include: **Climate and weather prediction** (to help farmers increase yields and profits without risking the crops or livestock from climate vagaries); **Decision support** (support systems to enhance farmers' choices in crop cultivation, consumer preferences, fashion and trends); **Yield prediction** (prediction of gaps between food production, supply and consumption to inform national agricultural policies, tracking and tracing agricultural commodities along transportation routes); **Disaster prediction** (able to identify impending disasters such as pests and diseases invasions, locust invasion, etc. and enable farmers mitigate them); **Collective decisions** (modeling social interactions, informing policy, and designing markets); **Training, education and knowledge exchange** (enhancing extension service delivery and information sharing); and **Access to production factors** (enhancing access to factors of production such as land, inputs, capital, labour etc. especially for marginalized groups like women, youth and persons with disabilities [PWDs]).

Applicants are required to develop projects that strongly align with increasing the sustainability and productivity of food systems by leveraging the considerable power of data science, leading-edge agri-food research, and biodiversity science; and positioning Africa as an emerging leader in the development of innovative solutions that improve both the sustainability and productivity of agriculture and food systems at the landscape and micro levels.

Eligible projects will include the development and/or testing of experimental-stage pilots and/or prototypes, as applicable. The funded projects are required to apply **Responsible Artificial Intelligence** (Machine Learning, Data Science, etc.), be multidisciplinary, adhere to the highest standards of research excellence, and strive to have direct and lasting benefits to communities in their home countries.

### C. Who can apply?

Eligible research teams with demonstrated experience that are multi-disciplinary, gender-sensitive, inclusive, and equitable in the development, deployment and scaling of responsible AI for agriculture and food systems. Please note there must be a lead organization who will take on the grant as individuals cannot receive funding. Funds will be disbursed through the lead organization.

Preferably, the teams should be drawn from a consortium of the following entities:

- Research institutions (public research institutions / government organizations / universities) comprising of scientists, policymakers, engineers, agriculturists, etc.

- Private sector entities including Micro, Small and Medium-scale Enterprises (MSMEs), Entrepreneurs, Innovation hubs/parks, etc.
- Civil Society actors including Think Tanks, Rights-based Organizations, NGOs, Consumer Organizations, etc.

#### **D. Eligible Countries**

Applicants must come from any of the sub-Saharan African (SSA) countries. However, applicants can team up (form consortia) with other organizations outside the SSA countries. The lead applicants **MUST** be from SSA.

#### **E. Grant Amount and Duration**

The research and innovation projects' lifespan is **18 months**. Each project will be required to have a budget ranging between **US\$40,000** and **US\$60,000** depending on the scope and scale of the proposed project which must be well justified.

#### **F. The application process**

Applicants are required to develop EoI providing details of their research or innovation projects. The project should clearly demonstrate how it is aligned with the priority areas described in **Section B** above. The EoI should contain the following sections (***Project description outline***):

##### ***Section 1. Contact information***

Please provide the contact information of the lead applicant and the other partner organizations.

##### ***Section 2. Abstract***

Please provide a short abstract of the proposed project, which should not exceed 250 words. It should be written clearly for a non-technical audience. Avoid acronyms and technical jargons. Describe the development of the problem being addressed, the purpose/objectives of the project, and expected results in the form of project outputs and outcomes.

##### ***Section 3. Research problem(s) and justification (800 words)***

This section describes the potential range of problem(s) and or problem area(s) that could be investigated and the questions that will guide the innovation research conducted by the applicant. To show the importance of the problems, this section should discuss: how the research relates to tackling pressing challenges in agriculture and food systems in its area of coverage, the magnitude of the problems and how the research will contribute to its solution.

##### ***Section 4. Objectives (250 words)***

This section should provide both the research's general and specific objectives that are aligned to 1 or more of the four (4) dimensions of food security (*availability, Access, Utilization and Stability*). The general objective should state the development goals being pursued by the research. The specific objectives should indicate the specific types of knowledge to be produced, the audiences to be reached, and forms of capacity to be reinforced. These are the objectives against which the project's success will be judged and not activities for the project.

### **Section 5. Methodology (1500 words)**

Describe your plan on how your project aligns to **Responsible Artificial Intelligence for Agriculture and Food Systems** Innovation and how the research objectives are to be addressed. This section should list key research questions the applicant will seek to address and show how they will be answered in the most rigorous way possible. The applicant must be clear about what activities are envisaged and how they will contribute to achieving each objective and define the budget in terms of these activities. The applicant should also vividly indicate how they plan to tackle other important aspects such as gender considerations, cross-cutting issues and ethical considerations. The [IDRC's Equality Statement](#) and the [Actions Promoting the Equality and Status of Women in Research provided by the Global Research Council](#) will serve as a reference guide and applicants should ensure that their projects adhere to these.

### **Section 6. Project schedule**

The research project schedule should include a list of key outputs (key events or deliverables) and outcomes that can be related to the items included in the project budget. A theory of change can be included in this section if desired.

### **Section 7. Responsible AI, Gender equality, Support and inclusion (GESI), and Carbon Footprint reporting statements. (450 words)**

Please refer to the materials found in section(s) J, K, and L. The applicant's (and any collaborating organization's) must demonstrate commitment to incorporate and **promote Responsible AI<sup>1</sup>, inclusion, Gender-sensitive<sup>2</sup> principles, and Carbon footprint reporting<sup>3</sup>**.

Describe how your project meets the following:

- i. Responsible AI key considerations (150 words)
- ii. Key gender equality, support, and inclusion considerations (150 words) and
- iii. Responsible carbon footprint reporting (150 words)

### **Section 8: Project budget summary**

Please provide indicative budgets for your proposed project considering key items such as Personnel costs, Equipment Costs, Consumables, Local travels, Consultancy, Communications, Indirect costs, and any other costs relevant to your proposed project with a brief description on each as shown in Table 1.

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<sup>1</sup> **Responsible Artificial Intelligence** is the practice of designing, developing, and deploying AI with good intention to empower people and fairly impact society. It also ensures there is transparency, accountability, no bias, fairness, security, privacy and has minimal ecological footprint. Please see section J for more on guiding principles of responsible AI

<sup>2</sup> **Gender sensitivity** is taking into account the impact of policies, projects, technologies/innovations and programmes on men, women, boys and girls and trying to mitigate the negative consequences thereof and enhance inclusion. It is incorporating gender needs and interests and or eliminating gender discriminatory policies, strategies and practices.

<sup>3</sup> **Carbon footprint** report is the total amount of greenhouse gas emissions that come from the production, use and end-of-life of a product or service. It includes carbon dioxide - the gas most commonly emitted by humans, and others, including methane, nitrous oxide, and fluorinated gases, which trap heat in the atmosphere, causing global warming. Usually, the bulk of an individual's carbon footprint will come from transportation, housing, food and all activities.



**Table 1: Sample indicative budget**

Budget Category	%	Amount (US\$)	Brief description of budget item
Personnel			
Consultants			
Equipment			
Local Travel			
Communications			
Consumables			
<b>Total Direct Costs</b>			
Indirect Costs			
<b>Grand Total</b>			

**Section 9. Institutions and personnel (800 words)**

The applicant should describe the institutions/ SMEs/ organizations, including its history and objectives. List key personnel, their qualifications, roles, and time commitments. State who will own the equipment during and after the project. Describe any administrative arrangements that may include third parties.

**Section 10. Additional materials**

In the appendix to your EoI, you are allowed to include any further documentation that supports your proposal. This should include:

- Abridged CVs of key project members;
- Letters of affiliation to an institution;
- Support letters from the participating partners/organizations;
- Relevant experiences/project references from previous projects;
- Certificate of incorporation or registration for the Lead Institution.

**G. Review of applications and selection criteria**

The assessment criteria will focus on six main areas namely:

- Qualifications and team composition** (10%): Researchers/innovators are expected to have at least a Degree in relevant fields. The team must be multidisciplinary, gender-sensitive, inclusive, and equitable. Multi-stakeholder teams, including but not limited to government, private sector, academia, farmers, and agribusiness entrepreneurs, are highly encouraged and will be an added advantage. The team must demonstrate how it will be governed and managed to accomplish the stated objectives.
- Experience in the relevant area of research and innovation** (10%): The team must prove that they have relevant experience in the chosen field of endeavour demonstrated by previous project references.
- Technical capabilities** (35%): The EoI must align with the overall objective of the AI4AFS and the identified thematic priority areas. It must have clarity on the aim and objectives, research/innovation designs and methods, activities, outputs, outcomes, impact, and sustainability. Methodologies should include human centred design principles and should clearly articulate questions that take into account gender and other questions.

- iv) *Responsible AI (10%)* The proposal should clearly articulate the steps to be undertaken to ensure responsible AI development approaches, including a commitment to ensuring research design is gender responsive (as articulated in section J, K, L)
- v) *Impact pathway for achieving responsible AI4AFS (25%)*: The EoI must show a clear impact pathway for the development, deployment and scaling of AI4AFS in Africa.
- vi) *Budgeting (10%)*: Demonstrated clear and coherent plans for the use of available funds for the proposed project activities.

At the EoI stage, only fifteen (15) best projects will be selected by an elite panel of reviewers and taken through preliminary training with the help of the Hub multidisciplinary experts. They will then be required to develop their EoIs into full project proposals. Opportunity for alliances of similar initiatives and research consortia will be encouraged at that stage for a more impactful project. Only 6-10 projects will be awarded after final reviews and due diligence, taking into account both technical excellence scores and equity criteria such as geographic diversity.

## H. Timelines for this call

Activities	Dates
Launch of Expression of Interest	30 March 2022
Deadline of Expression of Interest submission	10 May 2022
Review of the applications	27 May 2022
Responses to applicants	05 June 2022

## I. How to Apply

All EoIs to this call **MUST** be submitted electronically through the Link: [APPLY](#)

The EoI should be submitted in **English** using **Times New Romans 11 font size**. Please note that when developing web pages or tools, the accessibility of such sites/tools must be checked to meet the accessibility requirement for this program that considers people with disability<sup>4</sup>.

For more information about this application process, always visit the ATPS website - <https://atpsnet.org/> OR the dedicated project website - <https://atpsice.org/artificial-intelligence-agriculture-and-food-systems/> to receive updated news and information for guidance.

## J. Specific Responsible AI Statement/Guidelines

As a general guiding statement; a responsible AI development, deployment and use must be lawful (respecting all applicable laws and regulations), ethical (respecting ethical principles and values), and robust (both from a technical perspective while taking into consideration its social environment) For all applicants please fully understand the guiding principles of responsible or trustworthy AI development, deployment, and utilization principle as found out a set of 7 key requirements that AI systems should meet in order to be deemed trustworthy. A specific assessment list aims to help verify the application of each of the key requirements:

<sup>4</sup> Check and install the plugin WAVE Web Accessibility Evaluation Tool @ [wave.webaim.org](http://wave.webaim.org)

- i) **Human agency and oversight:** AI systems should empower human beings, allowing them to make informed decisions and fostering their fundamental rights. At the same time, proper oversight mechanisms need to be ensured, which can be achieved through human-in-the-loop, human-on-the-loop, and human-in-command approaches
- ii) **Technical Robustness and safety:** AI systems need to be resilient and secure. They need to be safe, ensuring a fall back plan in case something goes wrong, as well as being accurate, reliable and reproducible. That is the only way to ensure that also unintentional harm can be minimized and prevented.
- iii) **Privacy and data governance:** besides ensuring full respect for privacy and data protection, adequate data governance mechanisms must also be ensured, taking into account the quality and integrity of the data, and ensuring legitimised access to data.
- iv) **Transparency:** the data, system and AI business models should be transparent. Traceability mechanisms can help achieving this. Moreover, AI systems and their decisions should be explained in a manner adapted to the stakeholder concerned. Humans need to be aware that they are interacting with an AI system, and must be informed of the system’s capabilities and limitations.
- v) **Diversity, non-discrimination and fairness:** Unfair bias must be avoided, as it could have multiple negative implications, from the marginalization of vulnerable groups, to the exacerbation of prejudice and discrimination. Fostering diversity, AI systems should be accessible to all, regardless of any disability, and involve relevant stakeholders throughout their entire life circle.
- vi) **Societal and environmental well-being:** AI systems should benefit all human beings, including future generations. It must hence be ensured that they are sustainable and environmentally friendly. Moreover, they should take into account the environment, including other living beings, and their social and societal impact should be carefully considered.
- vii) **Accountability:** Mechanisms should be put in place to ensure responsibility and accountability for AI systems and their outcomes. Auditability, which enables the assessment of algorithms, data and design processes plays a key role therein, especially in critical applications. Moreover, adequate an accessible redress should be ensured.

Further materials that will guide the research network on Responsible AI are found on the following links: [RAI Design Assistant – Explore AI Ethics, https://www.nature.com/articles/s42256-022-00440-4](https://www.nature.com/articles/s42256-022-00440-4), [Fairness Checklist](#), [FairLearn](#), [Inclusive Design](#), [GitHub - google/ml-fairness-gym](#), [Fairness indicators](#), [Handbook on Data Protection and Privacy for Developers of Artificial Intelligence \(AI\) in India](#), [Smart Noise](#), [Privacy in Machine Learning](#), [GitHub - microsoft/presidio: Context aware, pluggable and customizable data protection and anonymization SDK for text and images](#)

## K. Gender Support and Inclusion Resources

Gender support, and inclusion resource link:

<https://docs.google.com/document/d/1aJ5XdZ5OWkukFFXYZG0cK7Wp7waZMLCQzuMhkbyDoeI/edit>



## L. Carbon Footprint Resources

All project for this call must use <https://mlco2.github.io/impact/> and <https://codecarbon.io/index.html> to track carbon footprint of the proposed project for ML and other project activities.. More materials are found on the following link: <https://towardsdatascience.com/compute-and-environmental-costs-of-deep-learning-83255fcabe3c> . [Carbon Emissions and Large Neural Network Training](#). [Towards the Systematic Reporting of the Energy and Carbon Footprints of Machine Learning](#)