

Terms of Reference – *The AI opportunity for livelihood advancement in agriculture in rural Indonesia*

Introduction

GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Solutions and Events.

GSMA Mobile for Development Foundation

The GSMA Mobile for Development Foundation, Inc. (“GSMA”) is a U.S. 501(c)(3) charitable organisation. The Mobile for Development team (M4D) operates at the intersection of the mobile ecosystem and the development sector. Our aim is to stimulate digital innovation and deliver both sustainable business and large-scale socio-economic impact. Our research and insights platform, in-market expertise and community of partners push forward digital innovations and implementations that empower underserved populations. To date, we have impacted the lives of over 220 million people.

Central Insights Unit

The Central Insights Unit (CIU) sits at the core of GSMA M4D. It produces thought-leading research on frontier technologies, digitalisation and society and the impact of mobile and digital technologies in sustainable and inclusive development. The CIU works closely with the UK Foreign, Commonwealth and Development Office (FCDO) and the rest of M4D to ensure that research highlights the role of mobile technology as an enabler, draws on the expertise GSMA holds and builds capacity within the FCDO.

Context

The GSMA Mobile for Development’s Central Insights Unit is seeking a research supplier to conduct a research on the additional value that Artificial Intelligence (AI) can bring to improve the livelihoods of smallholder farmers and small-scale fishers in rural Indonesia.

Agriculture in Indonesia

Indonesia’s rural communities, which form 43%¹ of its population and are spread over 17,504 islands, face numerous challenges in agriculture, including climate variability, low productivity, limited market access, and vulnerability to economic and environmental shocks.

¹ World Bank press release. (2022). [The World Bank Supports Indonesia’s Agriculture Sector to Become More Resilient and Inclusive.](#)

The agriculture sector accounted for around 12.6% of the GDP in 2024² and almost 29 % of the population is working in the agriculture sector.³ More than 72% of farmers in Indonesia can be characterised as smallholder farmers. Smallholder farmers rely heavily on family labour and traditional farming methods, with limited access to capital, mechanisation, or markets.

A significant challenge across all provinces is the low level of technical knowledge and poor agricultural practices that result in substantially lower yields than what could be achieved. Although approximately 10% of agricultural households are female-headed, and women represent 24% of farmers, women usually own a smaller landholding size, compared to men.⁴ Women farmers also face greater barriers in accessing credit, despite their substantial contribution to food production and post-harvest activities.

Aquaculture in Indonesia

As the largest archipelagic state in the world, Indonesia has an extensive coastline of approximately 81,000 km and it is estimated that as many as 140 million Indonesians live in coastal areas. The country boasts an estimated 7.23 million hectares of potential aquaculture area, divided among mariculture, brackish water, and freshwater aquaculture;⁵ however, only a small fraction of this potential is currently utilised, indicating a lost opportunity.⁶

Indonesia is among the top producers worldwide and its aquaculture output in the third quarter of 2021 was 12.25 million metric tons, a 6% increase from the same period in 2020.⁷ Key aquaculture products include shrimp, prawns, milkfish, catfish, tilapia, carp and seaweed.

Smallholder aquaculture farmers in Indonesia face multiple challenges related to feed cost and efficiency, water quality, and the quality of fish stocks that constrain productivity and profitability. Feed is a primary cost in aquaculture production, but is often inefficient, accounting for 60-90% of production costs. Low water quality and poor water management limit fish growth and increase rates of fish disease and death.⁸ Labour productivity in aquaculture is also very low, and both digitalisation and capacity building are needed to make aquaculture households more productive.⁹

Smallholder crop farmers and aquaculture farmers in Indonesia therefore operate under significant constraints that limit their productivity and resilience, with women, who play key roles in processing aquaculture products in the value chain, and, it was estimated in 2019, formed 74% of the labour force in aquaculture¹⁰, facing notably more barriers than men in participating in the sector and accessing economic opportunities.¹¹

Digitalisation of agriculture

² Statista. (2025). [Contribution of agriculture, forestry, and fishing to the gross domestic product \(GDP\) in Indonesia from 2019 to 2024](#).

³ Trading Economics. (2025). [World Bank Statistics. Indonesia Employment in Agriculture \(% of total employment\)](#).

⁴ World Bank press release. (2022). [The World Bank Supports Indonesia's Agriculture Sector to Become More Resilient and Inclusive](#)

⁵ Aquaculture magazine. (2023). [Supporting the Aquaculture of the World's Largest Archipelago \(Indonesia\)](#)

⁶ International aquafeed. (2024). [Aquaculture in Indonesia- Harnessing the Ocean's Potential](#).

⁷ Mongabay. (2022). [Indonesia aims for sustainable fish farming with aquaculture villages](#).

⁸ AgResults. [Indonesia Aquaculture Challenge Project](#).

⁹ Statistics from FAO (2020) in Napitupulu, L., S. Tanaya, I. Ayostina, I. Andesta, R. Fitriana, D. Ayunda, A. Tussadiah, K. Ervita, K. Makhas, R. Firmansyah, and R. Haryanto. 2022. [Trends in Marine Resources and Fisheries Management in Indonesia.' Report. Jakarta: World Resources Institute Indonesia](#).

¹⁰ Napitupulu, L., S. Tanaya, I. Ayostina, I. Andesta, R. Fitriana, D. Ayunda, A. Tussadiah, K. Ervita, K. Makhas, R. Firmansyah, and R. Haryanto. 2022. [Trends in Marine Resources and Fisheries Management in Indonesia.' Report. Jakarta: World Resources Institute Indonesia](#).

¹¹ Ibid.

Indonesia's agricultural and aquaculture sectors are undergoing a significant digital transformation, driven by increasing connectivity and mobile penetration, a vibrant startup ecosystem, and the urgent need to reach rural and remote communities to improve farmer productivity and resilience.

Increased smartphone use and better internet access in rural areas is enabling farmers to connect to information and services. Indonesia has also seen accelerating private sector innovation, with agritech startups providing tools like digital advisory services, digital marketplaces, and platforms for finance and logistics tailored to smallholder farmers' needs. There has also been an ambition in the Indonesian government to accelerate the adoption of digital tools in agriculture, both through policy frameworks and targeted initiatives.

The third sector in Indonesia also plays an important role in the adoption and effective use of agritech for smallholder farmers. Farmers often face significant challenges in accessing and utilising digital tools due to limited resources and low digital literacy. NGOs, social enterprises and collectives have been serving as critical intermediaries, helping bridge these divides through digital literacy training, in piloting and scaling new agritech solutions, contributing to shaping policies that support inclusive digital transformation in agriculture and advocating for the needs and rights of smallholders. While traditional women's farmer collectives and women's organisations embedded in village community organisations integrate and advocate for women in rural settings, the third sector is also playing a role in promoting gender inclusion in digitalisation more broadly, and in digital agriculture, delivering programs that specifically target women to ensure that the benefits of digital transformation are equitably distributed.

The additionality of AI for agriculture

In the context of agritech, Artificial Intelligence (AI)—supported by technologies such as mobile phones, satellites, unmanned aerial vehicles and drones, sensors, the Internet of Things (IoT), and Blockchain—offers a fast-emerging and transformative opportunity to address some of the most persistent challenges faced by smallholder farmers and fishers.

AI has the potential to significantly improve agricultural and aquacultural productivity, resilience, and profitability by enabling smarter, faster, and more localised decision-making—something existing traditional or digital tools often struggle to achieve at scale. As climate variability, resource constraints, and market unpredictability increasingly affect rural livelihoods, AI represents a timely and powerful tool to mitigate risks and increase efficiency across the agricultural value chain.

Project Overview and Objectives

Given the central role of agriculture and aquaculture in Indonesia's rural economy and for food security, it is both timely and urgent to explore how AI can deliver tangible benefits to rural producers, boosting productivity, improving resilience to climate and market shocks, and helping build more inclusive and sustainable rural livelihoods.

The key objective of this research, led by GSMA's Central Insight Unit for the UK FCDO, is to assess the potential for AI to strengthen agriculture and aquaculture livelihoods among rural communities in Indonesia, and understand gender dynamics in AI adoption and use in this sector.

To this end, this research seeks to address the below key research questions:

- What unique opportunities and capabilities can AI bring to improve smallholder farmer's livelihoods in rural Indonesia?
- What impact have existing AI-enabled solutions had in this sector in Indonesia?

- Are AI solutions accessible and usable by different types of smallholder farmers?
- What is needed for AI-enabled solutions to be effectively utilised within existing agricultural systems?
- How can AI-enabled solutions be sustainable and scalable?
- What are the ethical, inclusion, equity and privacy risks and how can these be effectively managed?

Methodology

The GSMA M4D proposes taking a persona-based approach, using illustrative “typical” farmer profiles, by type of agricultural activity, access to digital technology, and digital literacy, to propose appropriate and corresponding AI-enabled solutions for improved outcomes in terms of income, productivity, reduced effort and decreased vulnerability to climate impacts.

Some illustrative personas are proposed below and would be refined through FGDs and interviews.

Profile	Tech Access	Main Activities	Key Challenges
Rice farmer, Central Java, Male, <30 years old High school	Advanced smartphone, reliable 4G	Rice farming, off-farm work	-Balancing farming with off-farm work -Unpredictable weather affecting planting schedules -Water scarcity during dry season -Pest outbreaks
Smallholder farmer, West Java, Female, >45 yrs Primary education	Shared basic smartphone, limited data	Vegetable farming, caring responsibilities	-Managing multiple crop cycles simultaneously -Pest attacks -Price volatility

Profile	Tech Access	Main Activities	Key Challenges
<p>Catfish farmer</p> <p>West Java,</p> <p>Male, 30-40 yrs</p> <p>High school</p>	<p>Android smartphone, reliable 4G</p>	<p>Small-scale catfish farming</p>	<p>-High competition from neighbouring farms affecting prices</p> <p>- High feed costs</p> <p>-Water quality deterioration from dense farming area</p> <p>-Disease outbreaks spreading quickly between farms</p>

The supplier is welcome to propose a refinement of this approach, or alternatives, should there be a strong rationale.

AI use cases are to be mapped based on their impact potential and feasibility of adoption for each profile type, and the research supplier will then analyse the pathways to AI adoption and scalability, and identify risks and challenges.

The proposed research pathway is captured in the figure below.

Figure 1: Research stages in assessing the additionality of AI for smallholder farmers in Indonesia



A strong gender lens is to be applied throughout, with particular attention to how women perceive and engage with AI and what inclusive design looks like in the rural Indonesian context.

Data collection methods

The research supplier is expected to undertake the following research tasks for the project.

<p>Desk research</p>	<p>A rapid review of literature to understand the AI and agritech landscape, and key expert interviews to validate farmer personas.</p>
<p>Focus group discussions (FGDs)</p>	<p>3-4 FGDs with innovators, startups and NGOs in key tech hubs (e.g., Jakarta, Bandung) to understand the development, adoption,</p>

	<p>scaling, opportunity and risk of scaling AI-enabled agriculture solutions from a supply-side lens</p> <p>3-4 FGDs with smallholder farmers and fishers (disaggregated by gender) that are using AI-enabled services to explore experiences, perceptions, and impact of AI tools.</p> <p>Note: All FGDs to use gender-sensitive participatory tools to identify barriers specific to women.</p>
Key informant interviews (KIIs)	Semi-structured virtual interviews with 15-20 stakeholders from startups, NGOs, and research institutions to deepen understanding of themes emerging from FGDs.
Case study analysis	<p>Comparative analysis of up to 6 case studies of AI applications in rural agriculture from Indonesia and relevant LMICs.</p> <p>Note: Case studies are to highlight both best practices and lessons learnt from unsuccessful implementations.</p>

Because we aim to conduct focus group discussions with end-users as well as start-ups and NGOs in-country, the supplier is expected to have access to the local language as well as ability to travel to up to 4 locations, two cities and two rural areas. In this regard, our preference is for an Indonesian, or regionally-based supplier.

In scope / out of scope

This research will focus on rural agriculture in Indonesia, specifically the food and estate crops, and aquaculture subsectors.^{12, 13} Other agricultural sub-sectors, which include horticulture, livestock, marine fisheries (except aquaculture) and forestry are out of scope.

The target groups are smallholder farmers as well as small-scale aquaculture farmers, as well as tech. startups and NGOs.

Deliverables and timelines

Activities	Timeline
Proposal submission from supplier	14 th August 2025
Interviews with short-listed suppliers	20 th – 21 st August

¹² BPS Statistics. Indonesia.(2023). [Agricultural indicators 2023](#).

¹³ Ibid. Note: The GDP contribution of 12.6 % was split as follows in 2023: estate crops (3.88%), fisheries (2.66%), food crops (2.26%), livestock (1.56%), horticulture crops (1.37%) forestry (0.62%), agricultural services and hunting (0.18%).

Activities	Timeline
Contract research supplier and project kick-off	12th September 2025
Inception report for GSMA review	28 th September 2025
GSMA feedback on inception report	2 nd October 2025
Revised inception report	9 th October 2025
Literature review and landscape analysis	September-October 2025
Stakeholder consultations and focus group discussions	September-December 2025
Interim report draft to GSMA	12 th November 2025
GSMA review of Inception report	19 th November 2025
Revised draft of interim report to GSMA	27 th November 2025
Analysis and report writing	December-January 2026
Draft submission of final report to GSMA	15 th January 2026
GSMA review	22 nd January 2026
Final draft report submission to GSMA	5 th February 2026

5. Deliverables

The primary deliverable for this research will be a public-facing research report (approx. 50-60 pages), examining the additionality of AI for improvements in rural agriculture and aquaculture in Indonesia, with dedicated analysis of gender inclusion, and multi-stakeholder recommendations.

In addition, the supplier will develop a 10-page dedicated briefing and recommendations for FCDO to inform the pilot for an AI-enabled solution in rural Indonesia.

The supplier will be expected to present findings at the inception, interim and final stages to the GSMA and its stakeholders (e.g. the FCDO)

The supplier will additionally support up to 2 virtual dissemination events, post- research. If participation in any in-person events is expected, GSMA will ensure this is only where local to the supplier, with no expectation of international travel.

Firm and proposal requirements

Looking for: *consultancy team*

Required experience

Essential:

- *Demonstrable track record of completing similar assignments.*
- *Thematic expertise in start-up, development, and infrastructure financing.*
- *Expertise in agriculture and emerging technologies (such as AI).*
- *Clear and demonstrable experience in working with mobile network operators.*
- *Full working proficiency in English, writing to publication quality.*
- *A strong network, including potential interviewees.*

Proposals should include a separate technical and financial proposal:

Technical proposal

1. A short (1 page) statement of suitability, highlighting recent relevant experience.
2. A short (2-4 page) discussion of the proposed approach including: the analytical frameworks to be used, identified data sources, and initial proposals on case studies.
3. Any proposed changes to the ToR.
4. Details of relevant firm project experience.
5. Gantt chart outlining major project stages and timelines
6. CVs, and location of team members.

Financial proposal

1. Level of effort (person-day) by activity.
2. Fee rates (per day in GBP).
3. Total project cost (GBP), without VAT¹⁴.
4. The Respondent's Total Price is inclusive of all costs, insurances, fees, costs, expenses, liabilities, obligations, risks, and all financial requirements for the performance of Services and provision of Deliverables.
5. Any charge not stated in this Proposal, which extends above to the Total Price, is not permitted.

Due to GSMA compliance requirements, exact project budgets cannot be provided at this stage. You are, however, able to provide a few implementation/budget options that can help us assess value for money and we can align our project scope to the relevant budget after a consultant has been selected.

Proposal assessment and selection Process

¹⁴ GSMA Foundation Inc is a US registered 501(c)(3) charity and is exempt from VAT.

The proposal will be scored on the following set of criteria:

Criteria	Importance	Weighting
Cost	Proposal's value for money	20%
Quality	Quality of the research approach outlined in the proposal, including degree to which it addresses the outlined research questions and proposal elements	35%
Bidder's capacity to manage the project on time and on budget	Demonstrated experience of conducting research projects, selection of experienced high-quality research partner(s) and ability to manage the project on time and on budget	30%
Relevant experience	Bidder's experience in successfully conducting similar projects	15%

- Proposals are to be submitted no later than 4pm BST on 14th August 2025 to Nigham Shahid (nshahid@gsma.com) and Daisy Macaskie (dmacaskie@gsma.com).
- Clarification questions can be sent to Nigham Shahid (nshahid@gsma.com) and Daisy Macaskie (dmacaskie@gsma.com).
- Shortlisted consultants may be contacted for an interviews, which will be take place 20th – 21st August.

GSMA Mobile for Development

Foundation Inc.
Armour Yards, 165 Ottley Dr. NE
Suite 203
Atlanta, GA 30324
United States