



Assessing the impact of IoT for sustainable aquaculture in Indonesia – research on use cases and their social and environmental impact

Terms of Reference

October 2024

Overview

GSMA is seeking the services of a specialist consultant or agency to conduct collaborative research on IoT use cases for sustainable aquaculture in Indonesia, with a focus on shrimp farming. This project seeks to analyse and assess the social and environmental impacts, particularly on Indonesia's coastal mangrove communities.

The details are outlined within this Terms of Reference document. **The deadline to submit expressions of interest is 23:59 (UK time) on 15th November 2024.** GSMA will review submissions on a rolling basis and may extend the deadline, if needed.

GSMA Mobile for Development

GSMA's Mobile for Development team drives innovation in digital technology to reduce inequalities in our world. Singularly positioned at the intersection of the mobile ecosystem and the development sector, we stimulate digital innovation to deliver both sustainable business and large-scale socio-economic impact for the underserved.

Our unique research and insights platform advances digital innovations and implementations that empower underserved populations to build a better future. Our in-market expertise informs partnerships between the mobile industry, tech innovators, governments and the development sector.

GSMA ClimateTech Programme

Climate change is one of the most pressing challenges facing humanity and we continue to see its impacts, including: frequent extreme weather events; food and water insecurity; displacement of vulnerable populations; increase in temperatures; wildfires and droughts; reduction of wildlife populations and biodiversity; lower agricultural yields; sea-level rises and daily loss of forest.

The mission of the [GSMA's ClimateTech Programme](#)¹ is to unlock the power of digital technology for climate action to create a low-carbon, climate resilient, and environmentally sustainable future. Through our research activities, we identify, promote and inform opportunities for digital innovation and develop pathways for aligning climate action with the sustainable development agenda. We also catalyse vital partnerships between the GSMA, the mobile industry, tech innovators, governments and the development sector with the aim of reducing fragmentation, facilitating scale and promoting collective action.

GSMA Mobile Innovation Hub - Indonesia

The [GSMA Mobile Innovation Hub \(MIH\)](#)² in Indonesia was launched in collaboration with the [Deutsche Gesellschaft für Internationale Zusammenarbeit \(GIZ\)](#) and worked closely with the GIZ Digital Transformation Centre (DTC), supporting the Indonesian government and local stakeholders to work towards climate and digital twin transition. The mission was to assess opportunities for creating socio-economic impact through mobile digital innovations, foster partnerships among the local digital/mobile ecosystem players to provide capacity building on the role of digital for good, and advocate for enabling environments.

Using Internet of Things (IoT) to strengthen sustainable aquaculture in Indonesia

Indonesia experiences severe adverse effects of climate change, from extreme flooding to extended droughts, changes in rainfall patterns and temperature and sea level rise. These risks and challenges have been intensified by Indonesia's carbon-intensive economy, which has been consistently ranked in the top 10 of the most significant global emitter of greenhouse gases (GHGs)³, with forestry and other land use, energy and waste key contributors⁴. In response, the country has committed to reduce carbon emissions by, and to strengthen its capacity to adapt and become more resilient to climate change through sustainable socio-economic development and livelihoods

Aquaculture plays a crucial role in Indonesia's economy, contributing significantly to employment, food security and exports. As the second-largest producer of farmed fish globally, Indonesia's aquaculture sector supports millions of livelihoods, especially in rural coastal areas, while also serving as a vital source of protein for the population⁵. Shrimp farming is a particularly key component of Indonesia's aquaculture industry. However, it has led to widespread mangrove deforestation, as farms often replace these vital coastal ecosystems. Mangroves provide critical services such as carbon storage, coastal protection, and biodiversity support. To mitigate this impact, improving sustainable aquaculture practices, including shrimp farm productivity, is essential. By adopting more efficient farming techniques

¹ [GSMA | ClimateTech | Mobile for Development](#)

² [GSMA | Mobile Innovation Hub - Indonesia | Mobile for Development](#)

³ [WRI | Changes in the World's Top 10 Carbon Emitters](#)

⁴ [UNFCC | Indonesia Long-Term Strategy for Low Carbon and Climate Resilience 2050](#)

⁵ [Stockholm Resilience Centre | Indonesian aquaculture futures — identifying interventions for reducing environmental impacts](#)

and better monitoring, farmers can increase yields without expanding into mangrove areas. Enhanced data collection on farm practices and environmental impacts is needed to promote sustainable methods, reduce deforestation, and balance economic growth with environmental conservation.

In 2023, in collaboration with the German Development Cooperation (GIZ) and Indosat Ooredoo Hutchison (IOH), [MIH Indonesia piloted a project in Tarakan, North Kalimantan](#), which introduced an IoT system for improving shrimp farming productivity; water quality monitoring and enhancing decision-making capabilities⁶. By improving productivity, this project also aims to mitigate mangrove deforestation and promote a shift to more ecologically sustainable shrimp farming practices. The project also used mobile geospatial technology to map the utilisation of the coastal belt and monitor the distribution and clearance of mangroves. Smartphones were used to capture and communicate data on mangrove conditions and the state of the surrounding ecosystem. This project has since scaled to four new locations (Aceh, Jawa Tengah, Maluku, Sulawesi Tengah) with a view to leveraging IoT technology to promote sustainable aquaculture practices and improve mangrove conservation.

Objectives of the assignment

GSMA requires the services of a specialist consultant or agency for collaborative research on use cases of IoT for sustainable aquaculture (with a focus on shrimp farming) in Indonesia, and an analysis of their social and environmental impact, particularly on Indonesia's coastal mangrove communities.

The aims of this assignment are to:

1. **Map and analyse** cases of how IoT is being used in Indonesia to enhance the productivity of sustainable aquaculture, particularly shrimp farming, while simultaneously safeguarding mangrove ecosystems.
2. **Evaluate** the ecological impacts of these initiatives to date, as well as their impact on shrimp farmers and local communities, and establish a baseline for future monitoring and comparisons.
3. **Develop recommendations** for best practices in use of IoT and innovative digital technology for sustainable aquaculture, shrimp farming and mangrove conservation. These findings will support the scale-up of IOH's efforts in mangrove conservation and identify future opportunities for synergies between mobile operators, start-ups, conservation and development partners, as well as farmers for longer-term collaboration.
4. **Design a framework for monitoring, evaluation, and learning (MEL)** to guide ongoing and future initiatives, ensuring consistent impact assessment and measurements.

Methodology

The research is expected to include the following key phases. Suggestions for alternative approaches by consultants are welcome.

1. Desk research

Conduct a rapid review to map existing use cases of IoT for sustainable aquaculture, shrimp farming and mangrove conservation in Indonesia. Identify key stakeholders

⁶ [GSMA | Digitising Mangrove Conservation | Mobile for Development](#)

(e.g., mobile operators, start-ups, conservation groups) and analyse relevant case studies and best practices.

2. Qualitative data collection

Using qualitative interviews, surveys, or focus groups, engage with stakeholders including shrimp farmers, local communities, IoT solution providers, and mangrove conservation experts. Explore challenges, enablers, and potential for collaboration between mobile operators, development partners, and farmers.

3. Quantitative data collection

Conduct site visits (exact number of which to be agreed upon) to IoT-enabled shrimp farms and surrounding mangroves. Collect data on IoT system use, farm productivity, and biodiversity and environmental impact using geospatial and environmental monitoring tools.

4. Impact assessment

Evaluate the social and environmental impact of IoT on farm productivity and mangrove ecosystems. Establish a baseline, and a framework for monitoring future changes, assessing metrics like deforestation rates, livelihoods, biodiversity, and ecosystem health.

5. Recommendations

Provide recommendations for scaling IoT solutions and fostering collaboration between mobile operators, tech innovators, and conservation partners. Propose frameworks for ongoing monitoring and sustainable practices in shrimp farming and mangrove conservation in the Indonesian context, ensuring that these frameworks are adaptable to evolving technology and environmental conditions, while promoting inclusivity and engagement with local communities to ensure long-term sustainability and success

Key Deliverables

1. Inception report – a high-level work plan outlining the research approach, key milestones, and timeline. This should include a refined methodology and list of stakeholders to be consulted.
2. Desk research report - a comprehensive review of existing IoT use cases in shrimp farming and mangrove conservation in Indonesia, including key findings from global best practices and stakeholder mapping.
3. Final report - a comprehensive final report synthesising all findings and providing actionable recommendations for scaling IoT solutions, fostering long-term collaborations, monitoring and evaluating ongoing impact of IoT on aquaculture and mangrove conservation, and ensuring sustainable practices. This report should include an analysis of stakeholder interviews and field data collection. The report will be published externally.

Timeline

- December 2024 – March 2025:
 - Inception report – December 2024
 - Desk research – January 2025
 - Data collection – February 2025
 - Final report – March 2025

Key Consultant Requirements

- Experience of conducting mix-methods research in South-East Asia, particularly within Indonesia
- Experience of developing and implementing monitoring, evaluation and learning processes
- Knowledge of sustainable shrimp farming practices and their environmental impacts, particularly in the context of coastal ecosystems in Asia.
- Experience in applying mobile and digital technologies to enhance aquaculture practices, including IoT applications for improving productivity and monitoring environmental conditions.
- Ability and willingness to travel across Indonesia for research, if and when required.

Application and Selection Process

Interested applicants should submit the following:

1. Documentation of expertise
2. Samples of Relevant Work
3. Consultant CVs:
 - Names and CVs of the consultants proposed for the role, highlighting relevant experience and qualifications.
4. Proposed Approach:
 - A high-level plan and methodology for completing the work, including any potential limitations, risks, and mitigation strategies.
5. Budget:
 - A detailed budget in GBP, outlining personnel fees, expected expenses, and any additional costs related to specialist tools or services.

The budget should reflect a maximum of 30 days of work per consultant for the duration of the project.

Submission Deadline

Proposals should be submitted by 23:59 (UK time) on **15th November 2024**. Please send submissions to Samir Hafiz (shafiz@gsma.com) and Shae Kazi (skazi@gsma.com). Interviews with shortlisted candidates will be conducted on a rolling basis, with final selection expected by 9th November 2024.

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.

This research project is funded by the UK Foreign, Commonwealth & Development Office (FCDO).