



# SDG BLOCKCHAIN ACCELERATOR

## ROADMAP

# Challenge Definition

## UNDP Challenge Summary

*Traditionally, hill paddy are planted for self subsistence and is a good source for food security due to its climate resilient properties of requiring less water and can withstand harsh weather and diseases. However, recent years saw erratic weather patterns due to climate change affecting the harvest seasons (eg. drought and floods) and volume for small holder farmers in rural Sabah. the industry is also shrinking as young people shy away from labour intensive vocations, and most are shifting to more lucrative cash crops eg. cocoa, coffee, chilli, palm oil, rubber etc. Though hill paddy has a high selling value of RM9/kg vs normal paddy of RM0.50/kg and high export potentials due to its organic nutrient composition, the fallow periods are long and there is a general lack of research on high quality seeds and precision farming among the many types of hill paddy. The community also lacks access to technology and knowledge to practice productive, sustainable and climate smart agriculture. With better supply chain tracing and block chain technology, the market value and demand for hill paddy can increase in the sustainability market, with more revenue flowing back to the farmers rather than the middlemen.*

## Local Context

*Small holder farmers and producers in rural areas in Sabah, who are mostly indigenous people. They face threats to food security in the long term and depleting incomes due to climate change and inequitable access to technology and market. Women are also particularly vulnerable as they do not own the lands majority of the time and face higher barriers to accessing capitals. Many of them are unpaid family workers and have lower income and job security. Young people are also losing traditional knowledge on hill paddy planting and opportunities for a lucrative business in hill paddy planting, with high rural-urban migration which leaves ancestral lands exposed to unsustainable development.*

## Relevance to UNDP CO Priorities and Resource Mapping

*Supports resilient livelihoods and inclusive digital rails that work with basic phones. Aligns with agricultural modernization, digital inclusion, and certification/export objectives.*

## Expected Impact (from CO perspective)

- 1. Increased hill paddy yield per hectare from 1 tonne to 3 tonne per season.**
- 2. Increase planting seasons from 1 to 2 times a year without compromising environmental sustainability.**
- 3. Increase livelihood income for farmer communities (disaggregated from gender and age) to 25% by end of 4 planting seasons.**

## Target SDGs and SDG Indicators

2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment

- 2.3.1 Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size

- 2.3.2 Average income of small-scale food producers, by sex and indigenous status

2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality

- 2.4.1 Proportion of agricultural area under productive and sustainable agriculture

## User & Problem Mapping

Understanding the users and stakeholders affected by the challenge is essential for building impactful and context-aware solutions. This section helps articulate who the primary users are, what they aim to achieve, and which other actors are involved or impacted.

### Primary User Persona

*Small holder farmers and producers in rural areas in Sabah, who are mostly indigenous people. They face threats to food security in the long term and depleting incomes due to climate change and inequitable access to technology and market. Women are also particularly vulnerable as they do not own the land majority of the time and face higher barriers to accessing capitals. Many of them are unpaid family workers and have lower income and job security. Young people are also losing traditional knowledge on hill paddy planting and opportunities for a lucrative business in hill paddy planting, with high rural- urban migration which leaves ancestral lands exposed to unsustainable development.*

### User Story

*I am a hill paddy farmer. This year my harvest is greatly improved and I have extra stockpiles that I am able to sell to those interested. I am working with my local cooperative to market and sell the paddy. I want to monitor the amount of hill paddy that I have given to my cooperative, how much of it has been sold, know who my customers are and the amount of money I am earning within the expected time frame. I hope that by using this solution I can have all this information which is relevant to me to better serve my customers and change my livelihood in the process.*

### Key Stakeholders/Partners

This project will be implemented by the Ministry of Agriculture, Fishery and Food Industry, supported by UNDP. Responsible parties include Malaysia Digital Economy Corporation (MDEC) and Malaysia Industry and Government Group for High Technology (MIGHT) collaborating on climate technology and policy research respectively. Academia, Sabah Paddy Board, Department of Agriculture and district offices are also stakeholders involved.

## Solution Summary

### Overview

AXK LEDGER built by Afrikabal rethinks how rural agricultural economies can work for everyone. It is practical for farmers, transparent for cooperatives, and trustworthy for buyers. In Sabah's hill paddy communities, the goal is not only higher yields but also to repair the rails of trust and trade so people can thrive despite climate shocks, migration, and gaps in access to formal markets.

Hill paddy in Sabah is traditionally grown by indigenous communities for food security and culture. It has premium potential in specialty markets, yet the system struggles with erratic weather, long fallow periods, labour shortages as youth move away, limited credit, uneven gender norms, and movement constraints that complicate market access. The result is value leakage, slow payments, and weak bargaining power for producers.

AXK LEDGER acts as programmable agricultural infrastructure rather than a point solution. It provides verifiable farmer identities, milestone based escrow, USSD access for basic phones, a cooperative, buyer, logistics dashboard, and an auditable record of events. We do not replace cooperatives, buyers, or logistics providers. We help them coordinate through transparent rules and shared, tamper evident records.

The system is built for field reality and market standards at the same time. Farmers may not have smartphones or steady internet, while buyers require verifiable traceability, certificates, and data to support sustainability claims. Under the hood we use NestJS for the backend, MariaDB for operational data, IPFS for evidence such as certificates or lab results, Google Cloud Platform for reliability, and Cardano with Aiken contracts for escrow and multi signature treasury rules. Event proofs live on-chain as Cardano transaction metadata. Sensitive data stays off chain but remains verifiable through hashes and content identifiers.

In practice, AXK LEDGER ensures that every farmer can hold a verifiable identity issued via USSD or mobile, every lot is registered and tracked from field to cooperative to buyer, every sale is protected by milestone based escrow that releases funds on proof of delivery, cooperatives can enforce price floors and payout rules with a dashboard and signer quorum, partners have real time visibility into custody and compliance, critical events are anchored to Cardano for auditability, and each pilot cycle produces clean data that maps to SDG indicators and national reporting.

### Core Functionalities and Tech Stack

AXK LEDGER is a multi-layer programmable infrastructure system. Its functions address traceability, fast and fair payments, and cooperative governance, while its stack keeps costs low and deployment portable.

**Lot and identity attestation:** Every farmer receives a digital identity. Every lot created by that farmer is assigned a unique record with timestamp and attributes. After cooperative review the record is anchored to Cardano as transaction metadata.

**Payment flows with escrow:** Buyers place orders and fund an escrow. When delivery is confirmed, the contract releases funds according to the cooperative's rules. Distribution splits for farmers, cooperatives, and logistics are transparent and predictable.

**Handover and logistics verification:** Each custody change is confirmed via QR scan in the app or a one time USSD confirmation. This creates a clear trail across the chain.

**Traceability and SDG tags:** On-chain we store non personal metadata such as crop, district, season, and lot hash. Evidence such as certificates and lab results live on IPFS, linked by content identifiers. This balances buyer visibility with farmer privacy.

**Governance and treasury controls:** N of M multi signature policies protect cooperative funds. A native governance token (**AXKCoin**, wrapped as **wAXK**) is used for access control and, in later phases, optional ballots.

**Stack overview:** Backend in NestJS/TypeScript. MariaDB for operational data, encrypted backups on schedule. Cardano with Aiken validator scripts for escrow and treasury controls. IPFS for documents. USSD via telco gateway, mobile app for field capture, and React based web dashboard for back office operations.

## Access Channels

USSD keeps access universal. Farmers dial a short code and complete core tasks in a few steps such as registering a lot, confirming a handover, and checking balances. Sessions are resilient so a dropped signal does not cause data loss.

A lightweight mobile app supports agents and cooperative staff. It captures photos, GPS, scale readings, and certificates even when offline, then syncs when back online.

The web app is the back office cockpit. Cooperative officers complete records, upload evidence, apply validation rules, resolve disputes, approve custody events, and trigger payouts under the signer policy. Every change is recorded in an audit trail.

## How the Solution Works End to End

A farmer registers a lot on USSD. A cooperative officer reviews and approves it in the web app. At pickup, the officer or agent confirms custody in the mobile app. A buyer places an order and funds escrow. Once delivery is confirmed, the backend checks conditions and requests disbursement. The transaction hash and the evidence identifiers are posted for verification. Compliance packs and SDG aligned reports are available for regulators and buyers.

## Payments and Settlement with Aiken Smart-Contracts

Payments follow milestone based settlement. Buyers deposit funds up front. Release occurs only after delivery or acceptance is confirmed by an authorised party. Treasury safeguards use N of M multi signature rules implemented as Aiken validator scripts so disbursements require a quorum of signers. This prevents unilateral payouts and builds shared accountability.

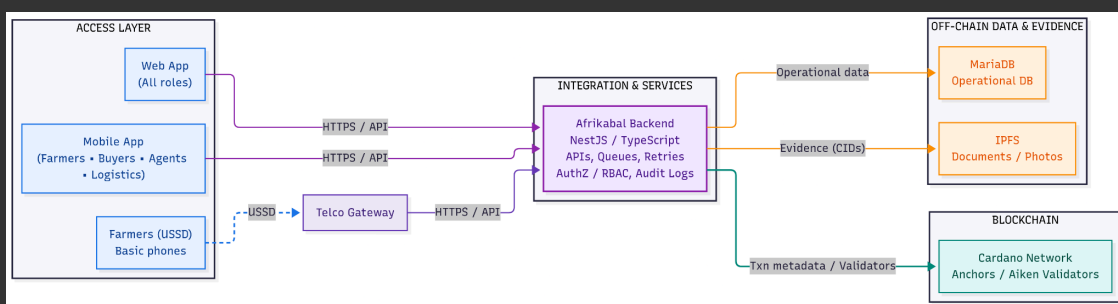
## Traceability and Privacy

Traceability is achieved without revealing personal data. Only non personal, provenance relevant metadata is written on-chain. Sensitive data remains in a secure database with role based access. Evidence such as certificates and lab results is stored on IPFS and linked via CIDs. Buyers can verify that a document they receive matches the hash anchored on Cardano, without seeing private information.

## Implementation Approach and Technical Design

The pilot adapts Afrikabal's existing components to local cooperative workflows rather than building from scratch. The approach is field first, uses provider portability for blockchain access, and introduces governance progressively so teams are not overwhelmed.

Architecture layers include an access layer for USSD, mobile, and web; a backend services layer in NestJS; a blockchain layer for Cardano anchors and Aiken validators; an off chain data layer in MariaDB and IPFS; and a governance layer with signer policies and optional ballots.



## Prototype Plan (Sprint Based)

Goal: adapt AXK LEDGER to Sabah's flows and demonstrate the full loop in real conditions with low connectivity and limited digital literacy. The sprint configures USSD, anchors at least one trade event on Cardano mainnet, and delivers dashboards and compliance packs tailored for the country office and regulators.

Expected outputs include live USSD menus for registration, balances, and delivery confirmations; issuance of digital identities to pilot farmers; an Aiken escrow contract funded and settled; cooperative dashboards; buyer and logistics exports; and an automated compliance pack generator with hashes and anchors.

### Sprint Timeline (10 Days)

Day	Focus Area	Outcome
1	Define pilot scope and SDG indicators	Scope confirmed and data dictionary finalised
2	Mainnet checks (keys, policies, environment)	Mainnet ready environment
3	USSD short code setup with telco	USSD routing confirmed
4	Backend-chain integration	USSD → backend → Cardano flow validated
5	Dashboard polish	Pilot ready cooperative dashboard
6	Stakeholder testing (cooperative officers)	Feedback gathered
7	Stakeholder testing (buyers and logistics)	Feedback gathered
8	Iteration and fixes	Issues resolved and features improved
9	Compliance pack testing	Reports validated and visible SDG tags
10	Demo submission	Video and documents delivered for review

### Success Metrics and Milestones

Cardano integration: at least one meaningful on-chain function demonstrated with an explorer link in the compliance pack. USSD functionality: a full task completes in four steps or fewer with high success under weak signal. Stakeholder testing: at least three sessions across roles with improvements shipped before the end of the sprint. Reporting: SDG tags embedded in lot attestations and CSV or PDF exports generated. Demo readiness: recorded walk through and quickstart kit prepared.



## **Pilot Vision and Scalability Plan**

The Sabah pilot is a contained but catalytic intervention that demonstrates a verifiable digital trade economy. With a seed budget of approximately USD 103,000, the plan is to onboard about 1,300 smallholder farmers across two pilot sites, execute at least 1,500 verified trade transactions anchored on Cardano, and generate compliance ready traceability packs for regulators and premium buyers. Training covers farmers, cooperative leaders, buyers, and logistics partners. At the end of twelve months the pilot should prove that even in low connectivity contexts, programmable infrastructure can deliver fast, fair, transparent payments and traceability.

Target users include 1,300 farmers with a focus on inclusion of women and youth, three to five cooperatives, ten active buyers with at least two focused on export markets, and local logistics providers. Engagement with public agencies ensures the pilot behaves like a real economy in miniature.

### **Scalability Model**

Scale is planned by cooperative and district clusters using a repeatable kit that includes USSD scripts, short training role cards, brief videos, and a pre configured dashboard. A training of trainers model develops local champions who train others. Provider portability allows Cardano access to switch between managed APIs and self hosted nodes as needed.

### Cost per District (Illustrative)

Scale	Farmers	Districts	Estimated Cost (USD)	Cost per Farmer (USD)	Notes
Pilot	1,300	2	30,000	23	Lean build; co-investment
Phase 2	5,000	6-7	150,000	30	More short codes, more dashboards, training of trainers
Phase 3	10,000	12-15	250,000	25	Economies of scale; unified registry
National rollout	50,000+	60+	1,000,000	20	Shared infra; stable node hosting; coops train

Costs per farmer drop with scale. Running small pilots first reduces risk and lowers the cost of later rollouts.

### Local Workforce Empowerment

AXK LEDGER builds local capacity by hiring and training women and youth as field agents, data stewards, and farmer champions. Agents support onboarding, capture traceability data in the mobile app, troubleshoot handovers, and run demonstrations at collection points. Cooperative staff receive hands-on training on dashboards, treasury controls, and reporting, with badges for data quality, safe handling, and privacy. Incentives recognise timely pickups, complete records, and low dispute rates.

## Expected Impact and KPIs

AXK LEDGER is expected to accelerate payouts, reduce leakage, and produce compliance records that are ready for premium markets. In selected channels the target is up to a thirty percent increase in net payout per kilogram relative to baseline farm gate prices. Payouts are targeted within two days after delivery confirmation for eligible lots. Data completeness for SDG reporting improves as lot records, event proofs, and certificate references become routine.

Indicator	Baseline	Pilot Target	Measurement Method
Net payout per kg in selected channels	Local farm gate prices	Up to 30% uplift vs baseline	Lot level price and weight data; $(\text{net\_with\_Afrikabal} - \text{baseline}) / \text{baseline}$
Time to cash after delivery	Often multi day	24 to 48 hours for eligible lots	Timestamps from handover to payout
Lots with verified provenance	0%	$\geq 80\%$ of pilot lots	Presence of Cardano metadata and IPFS CID
Cooperative treasury with multi signature	Not in use	Active policy with quorum rules	On-chain policy and disbursement approvals
Buyer participation	Few buyers	$\geq 10$ active buyers ( $\geq 2$ export)	Signed MOUs and purchase orders
Data completeness for SDG reporting	Ad hoc	$\geq 75\%$ required fields	Data quality audits and dashboard exports

## Risks and Assumptions

Risk	Likelihood	Impact	Mitigation
USSD provisioning delays	Medium	Medium	Work with two aggregators; provide SIM gateway fallback; preconfigure menus
Buyer liquidity shortfalls	Medium	High	Stage orders; require partial pre funding; diversify buyers
Low device availability for agents	Low	Medium	Provide shared devices; offline capture; basic phone alternatives
Connectivity outages	Medium	Medium	Queue requests; resume sessions; allow SMS fallbacks
Data privacy concerns	Low	High	Minimal on-chain data; role based access; signed data sharing agreements
Cooperative governance resistance	Medium	Medium	Start with transparency; introduce signer policy gradually; training and incentives

### Appendix A: Example Aiken Escrow Logic (Narrative)

The validator accepts a payout only if a delivery confirmation event exists for the referenced lot in the permitted window, the outputs match the configured split for producer, cooperative, and logistics, and the transaction is co-signed by the required quorum under the N of M policy. Otherwise the validator rejects the transaction.

### Appendix B: USSD – Farmer Intent

USSD is for farmers. It captures intent and queues pickups without heavy typing. Precise details are captured later by an Afrikabal agent or cooperative officer in the mobile app.

#### Main menu shown to farmers:

Afrikabal – Farmer

- 1) Sell harvest
- 2) Market prices
- 3) Payouts
- 0) Exit

**Use case:** A farmer selects Sell harvest, chooses variety, size band, collection point, and a handover time such as Today or Tomorrow. An optional numeric field allows a precise weight if the farmer knows it. The system shows a short review screen and issues a lot-code to present at handover.

### Appendix C: Agent or Cooperative – Detailed Data Capture (Mobile App)

An agent or officer scans the farmer's lot code, confirms identity, records precise weight from a scale, grade, and moisture, and captures GPS location and time. They add photos and certificates, pick the logistics route, and save. The app uploads to the backend, anchors an event hash to Cardano, and stores files on IPFS.

### Appendix D: Minimum Traceability Data Pack (Lot Level)

- Lot reference (auto)
- Farmer profile (app)
- Variety code (USSD)
- Size band (USSD)
- Precise net weight (app)
- Grade/quality (app)
- Moisture percent (app if available)
- Collection point (preset)
- GPS coordinates and timestamp (app)
- Custody event (app)

- Evidence photos and certificates (app → IPFS)
- Buyer reference or purchase order (app)
- On-chain anchor: Cardano metadata with IPFS CIDs

## **Appendix E: Pre Pilot Configuration Checklist**

### Localization

- Language labels for menus
- Variety list and codes
- Collection points and districts

### USSD Setup

- Short code provisioning / aggregator access
- Session timeout and retry parameters

### Agent and Web App Setup

- Digital scale model link or photo readout
- GPS permissions and offline cache
- Photo quality and size limits

### Governance and Payments

- N of M signer list for cooperative treasury
- Escrow split rules per channel

### Compliance

- Data sharing agreement for non personal fields
- Certificate or lab partner onboarding

## **Cardano Tooling Used**

*The solution uses Cardano transaction metadata for event anchoring, Cardano native tokens for governance (AXKCoin/wAXK), Aiken smart contracts for escrow logic and validator-enforced multi-signature treasury controls, and either cardano-node or managed APIs for network access. Documents and certificates are stored on IPFS and linked to Cardano via content identifiers to maintain auditability without revealing sensitive data.*

## Expected Impact and KPIs

*The solution is expected to deliver faster and fairer payouts, reduced value-chain leakage, and export-ready compliance for certified lots. Pilot targets include up to 30 percent value recapture for producers in selected channels, shorter settlement cycles, and measurable improvements in data completeness for SDG-aligned reporting. By anchoring critical events on Cardano and linking evidence via IPFS, the project creates verifiable impact with a clear path to scale.*

## Core Functionalities

- *Lot & identity attestations — signed, timestamped records for lot events; cannot be edited later.*
- *Payment flows — milestone-based release; clear link between lot events and settlements.*
- *Handover & logistics — verifiable custody transitions; QR/USSD confirmations.*
- *SDG tags — a few non-personal labels (crop, district code, season) for aggregate reporting.*

## Tech Stack Overview

- *Blockchain: Cardano mainnet. We write a record for each key step. When a rule is needed (escrow), we use an on-chain program.*
- *App server: A small TypeScript service that builds, signs, and sends transactions; it retries and keeps clear logs.*
- *Channels: USSD for basic phones; web dashboard for coops; mobile app for scans and quick confirms.*
- *Data: Only tiny, non-personal labels on-chain. Names, contacts, and documents stay in our database with access control. If needed, a file hash on-chain proves integrity.*
- *Integrations: Telco USSD; buyer webhooks; CSV exports. Settings live in environment files so providers can change without code edits.*

## Cardano-Specific Elements

- *Use of native tokens/policies for lightweight flows; validators only when strict rules are required.*

- *Minimal on-chain metadata to reduce cost and protect privacy; off-chain store for detail and reports.*
- *Provider portability (managed API by default, own node optional) to avoid lock-in.*

## Prototype Plan (Sprint-Based)

This section outlines your team's rapid prototyping plan. The goal is to build a functional and demonstrable version of the solution within 10 working days, with user feedback integrated.

### Prototype Goal

*Align a ready product for the Malaysia pilot: configure, integrate, and validate.*

**No core rebuild; focus on mainnet readiness, USSD, and partner integrations.**

### Expected Outputs

- *Working USSD menus connected to Afrikabal's backend.*
- *Mainnet-ready configuration and security checklist complete.*
- *Buyer/logistics integrations live (webhooks/tags/CSV).*
- *Training kit (quickstart cards, USSD scripts) and acceptance demo.*

### Sprint Timeline

Day	Description	Outcome
1	Define scope & SDG indicators/tags	Scope clarity
2	Mainnet checks (keys, policies, env hardening)	Ready for mainnet
3	USSD short code + menus with telco	USSD route ready
4	Chain integration from USSD/backend (lot, handover, balance)	USSD → chain validated
5	Web/mobile minor tweaks (labels, localization, error states)	Frontend aligned



6-7	Stakeholder testing (coop, buyer, logistics)	Feedback gathered
8-9	Iteration & polish	Demo-ready version
10	Final submission	All deliverables done

## Success Metrics & Milestones

We will track baseline metrics during the sprint, refine after the sprint, and prepare for pilot. We also add product-specific metrics for Afrikabal where useful.

### Sprint Phase

Focus: Rapid prototyping, initial user testing, and validation of core functionality.

Category	Baseline Metric	Status/Plan
Blockchain Interaction	One meaningful blockchain function (e.g., token minting, on-chain hash)	Complete on test network; mainnet path configured
User Interface	At least one working UI screen/flow	USSD menu + coop dashboard flow working
Stakeholder Testing	≥ 3 testing/feedback sessions	Plan: coop, buyer, logistics (booked during Week 1-2)
SDG Integration	Include SDG logic/tags in metadata/UI/output	Non-PII tags included in lot attestations
Demo Readiness	Demo link or video by Day 10	Will record a short walk-through; link provided in deliverables

## Post-Sprint Refinement

Focus: iterate based on feedback, stabilize MVP, align with pilot.

Focus Area	Baseline Metric
Feedback Integration	$\geq 2$ user/stakeholder-driven changes
MVP Stabilization	Functional testing with consistent results
Stakeholder Alignment	$\geq 1$ follow-up with CO/stakeholder

## Pilot Readiness

Focus: Preparing the solution for deployment and scaling.

Goal Area	Suggested Metric	Target
Institutional Buy-In	CO expresses interest; early MoU	Confirm pilot intent; draft MoU language
Solution Readiness	MVP tested in extended/external env	Field test with coop; USSD + dashboard live
Sustainability Path	Initial post-program plan	Support model + coop-friendly fee tiers

## Cumulative Tracking Suggestions

- % completion of prototype milestones
- % of users tested
- % of stakeholder feedback items received & integrated
- % SDG contribution implemented in technical flow
- Progress toward pilot validation (e.g., 0–100 scale)

## MVP Planning Table

After the prototype sprint, you'll begin shaping the full MVP. This table helps identify what's already been built, what needs improvement, and how each component will evolve into a pilot-ready version.

Component	Prototype Status	Improvement for MVP
UI/UX	USSD menus + basic coop dashboard flows live	Refine copy/localization; add mobile polish
Blockchain	On-chain lot attestations working	Add stricter escrow validator where needed
SDG Tags	Non-PII tags attached to events	Make filterable in dashboard exports
Feedback	≥ 3 sessions planned	Expand to 5+ with field officers

## Risk & Assumptions

Risk/Assumption	Description	Risk Level	Risk Mitigation Strategy
Connectivity	USSD steps may be slow or drop in weak-signal areas	Medium	Short menus; retries; offline queue design
Process alignment	Roles/steps differ by coop	Medium	Co-design SOPs; role cards; training
Provider dependency	API or explorer outage	Low	Fallback provider; API-first evidence; retries
Privacy	Personal data exposure	Low	Only non-PII on-chain; consented off-chain storage

## Team Profile

### Solution Makers - AFRIKABAL

Project Name

**AXK LEDGER**

#### Team Members & Roles

- *OGHENETEJIRI Jesse - CEO*
- *Joseph BIZIMUNGU RUKUNDO - CTO*

### Challenge Owners

Challenge Owner Organization Name:

**UNDP Malaysia, Singapore and Brunei Darussalam**

#### Team Members & Roles:

- *Yin Wei Chong - [Head of Unit, SDG Impact, Finance and Innovation(SIFI)]*
- *Mohd Firdaus Ab Latif - [Programme Analyst- Digital (SIFI)]*

Area of Focus:

**Transparent agri value chains with fair, fast payments for smallholder producers.**

## Notes & Insights

- *USSD must be fast and simple; deep menus reduce completion.*
- *Keep on-chain small and non-personal; keep detail off-chain with access control.*
- *Explorer sites can lag; rely on API-level proof first, explorer later.*

## Pilot Vision & Scalability Plan

### Pilot Vision (6–12 months)

- *District rollouts with coops; 50–100 producers per phase.*
- *Regular payments tied to verified lots; clear custody trail.*

## Target Users or Communities for Pilot

*Cooperatives and producer groups in selected Sabah districts; buyers/exporters connected to the supply chain.*

## Scalability Plan

- *Roll out by district: we add one district (or coop group) at a time using the same onboarding kit (USSD script, one-page role guides, short videos).*
- *Train local leads (training-of-trainers) during early phases to reduce external dependency. Local leads will help with user onboarding and first-line support.*
- *Provider portability allows deployment in new regions without code changes.*
- *Scalable Infrastructure: The app is light and can run multiple copies behind a load balancer. We scale by adding instances (no code changes). Data can be tagged by district, encrypted, and backed up daily. Monitoring and alerts are on; if a network/API is slow, we retry and can switch to a fallback endpoint by configuration.*

## Support Needed

- *Local facilitation for cooperatives onboarding and training sessions.*
- *Engaging local telcos, and different involved key stakeholders.*

## Sustainability & Business Model (optional)

### Business or Funding Model

*Public-interest deployment; modest service fees at scale; cooperative-friendly tiers.*

### Key Resources & Partnerships

- *Coops for field operations and trust.*
- *Buyers/logistics for market pull and data.*
- *Academic/extension partners for agronomic guidance.*

### Long-Term Ownership / Maintenance

**Afrikabal** will continue operating the solution alongside selected local partners.

# Team Reflection

## Challenge Owner's Perspective

- *"We gained a deeper understanding of how blockchain can be applied to solve complex development issues within our country context."*
- *"Collaborating closely with technical teams helped us refine our challenge statement and prioritize features for maximum community impact."*
- *"This experience helped us develop internal capacity for innovation-focused partnerships, which we intend to scale.")*

## Solution Maker's Perspective

*We focused on deployment, not a rebuild since we already had the product built. The sprint locks mainnet readiness, USSD, and partner integrations.*