CIRDAP

Rural ECONOMIC AND EDUCATIONAL Development Society
REEDS' *Improving Rural Life*
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Seeds of Change: Innovations in Rural Development Across Asia Pacific







EDITORS

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CIRDAP

Centre on Integrated Rural Development for Asia and the Pacific (CIRDAP)

Seeds of Change: Innovations in Rural Development Across Asia Pacific



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PREFACE

Rural development is entering an era in which innovation is no longer an option but an essential pathway towards resilient, inclusive and sustainable rural transformation. Across Asia and the Pacific, rural communities are confronting increasingly complex challenges- climate change, environmental degradation, changing markets, technological disruption, youth migration, unemployment, food and nutrition insecurity, and unequal access to essential services. Yet, alongside these challenges, rural communities continue to demonstrate an extraordinary capacity to innovate, adapt and create solutions rooted in local realities.

It is in this context that the Centre on Integrated Rural Development for Asia and the Pacific (CIRDAP), in collaboration with Rural Economic and Educational Development Society (REEDS), India launched the **CIRDAP-REEDS International Rural Development Challenge 2026**. The Challenge provided a platform for identifying, recognizing and sharing innovative ideas, practices, technologies and community-based solutions that respond to real rural development challenges and demonstrate potential for wider application across the region.

This book is a direct outcome of that endeavor. The innovations compiled in this volume have emerged from the **CIRDAP-REEDS International Rural Development Challenge 2026** and represent the creativity, commitment and problem-solving capacity of rural development practitioners, researchers, innovators, institutions and communities across CIRDAP Member Countries. They demonstrate that meaningful innovation does not necessarily depend on sophisticated technologies or large investments. In many cases, the most powerful solutions are those that combine local knowledge, community participation, appropriate technology, institutional cooperation and entrepreneurial thinking.

The range of innovations presented in this volume is particularly encouraging. They address diverse dimensions of rural development- from climate finance and circular agriculture to digital advisory services, rural logistics, post-harvest management, fisheries-based tourism, waste management, disaster resilience, rural entrepreneurship, women's empowerment and youth engagement. Some innovations employ advanced digital technologies, artificial intelligence and data-driven systems, while others draw upon simple materials, indigenous knowledge, traditional practices and locally available resources. What unites them is their orientation towards solving practical problems and improving the lives and livelihoods of rural people.

Several contributions illustrate how apparently separate rural challenges can be addressed through integrated approaches. Innovations such as CARBODIT seek to connect environmental stewardship with rural income generation; GramiGO transforms existing rural transport into an affordable logistics network; Walking Cooler applies a simple zero-energy solution to post-harvest losses; and digital platforms such as Digital Farmer 4.0 and DAC-Nepal seek to connect farmers with information, markets and climate-smart services.

The geographical diversity of these innovations is equally significant. Experiences from Bangladesh, India, Iran, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, the Philippines, Sri Lanka, Thailand, Vietnam and other parts of the Asia-Pacific region demonstrate that rural communities face many common challenges while also developing highly context-specific responses. This diversity offers an important opportunity for **South-South learning, adaptation and replication**.

CIRDAP believes that knowledge generated through rural innovation should not remain confined to the communities or institutions where it originated. It should be documented, shared, discussed, adapted and, where appropriate, replicated. This publication therefore seeks to serve not merely as a record of the 2026 Challenge, but as a practical knowledge resource for policymakers, rural development practitioners, researchers, development organizations, innovators and community leaders.

At the same time, the innovations presented here should not be viewed as finished products or universally transferable models. Their real value lies in the ideas, principles and experiences they offer. Replication will require sensitivity to local institutions, cultures, ecosystems, markets and community priorities. The pathway from innovation to impact must remain participatory and locally owned.

I commend all the innovators and contributors whose work has made this collection possible. I also appreciate the support of REEDS and the efforts of CIRDAP team in organizing the International Rural Development Challenge 2026 and in bringing these experiences together in a form that can be shared across the region.

I hope this publication will inspire further innovation, strengthen regional cooperation and encourage policymakers and development partners to invest in solutions that emerge from rural communities themselves.
Let this collection be a reminder that rural communities are not merely recipients of development. They are innovators, problem-solvers and partners in shaping the future of rural development.



Dr. P. Chandra Shekara
Director General
CIRDAP

FOREWORD

Innovation in rural development is often born not in laboratories or boardrooms, but in the everyday realities of rural communities. It emerges when farmers respond to changing climates, when young people find new ways of using technology, when communities turn waste into productive resources, when women transform traditional skills into enterprises, and when local institutions find new ways of delivering services to people who have historically remained at the margins.

This volume brings together a remarkable range of such innovations from across the Asia-Pacific region. The collection is an outcome of the **CIRDAP-REEDS International Rural Development Challenge 2026**, an initiative designed to identify and showcase practical solutions to contemporary rural development challenges. The contributions gathered here provide a valuable window into the ways in which individuals, communities, public institutions, universities, development organizations and social enterprises are experimenting with new approaches to rural transformation.

One of the most striking features of the collection is its diversity. The innovations range from digital carbon finance and smart agriculture to rural logistics, mobile cold storage, microbial agriculture, digital extension, community-based tourism, circular economy models, disaster resilience, rural entrepreneurship and livelihood diversification. The contents themselves reflect this breadth, with contributions including CARBODIT, PyroFuel Rural, GramiGO-Smart Rural Logistics Network, Walking Cooler, Digital Farmer 4.0 Platform, Eco_Protek, AgriConnect KOPIA and Digital Agri-Connect Nepal, among many others.

Despite their differences, these innovations reveal several common principles.

First, **innovation does not always mean high technology**. Some of the most compelling examples in this volume rely on simple, affordable and locally available resources. Walking Cooler, for instance, uses evaporative cooling and locally accessible materials to address post-harvest losses without electricity or fossil fuel. Similarly, other initiatives demonstrate how existing communication systems, community institutions and local human resources can become powerful development infrastructure.

Second, **rural innovation is increasingly interdisciplinary**. The traditional boundaries between agriculture, technology, environment, livelihoods, governance and social development are becoming less meaningful in the face of complex rural challenges. GreenLoop, for example, brings together circular agriculture, climate-smart farming, digital decision support, environmental intelligence and renewable rural systems within a single framework.

Third, **inclusion is central to sustainable innovation**. Across the contributions, particular attention is given to smallholder farmers, women, youth, marginalized communities and populations living in geographically underserved areas. Digital Agri-Connect Nepal, for example, combines mobile technologies with local youth facilitators to overcome digital-literacy and last-mile barriers while connecting farmers with advisory, market and climate information.

Fourth, **scalability and replication are important dimensions of rural innovation**. An innovation becomes particularly valuable when its underlying principles can be adapted to other communities and countries without losing its local relevance. Several contributions explicitly explore pathways for replication across CIRDAP Member Countries. The collection therefore

provides not only examples of what has been attempted, but also ideas about how successful approaches might travel, evolve and be adapted to different contexts.

The editors have sought to preserve the distinctive character of the contributions while bringing them together within a coherent publication. The chapters vary considerably in their maturity, methodology and form. Some describe innovations that have already demonstrated measurable community-level impacts; others present promising prototypes, emerging models or approaches with significant potential for future implementation. This diversity is itself important. Rural innovation is a process, and ideas move through experimentation, learning, adaptation and scaling.

Readers are therefore encouraged to approach the chapters not simply as descriptions of successful projects, but as **sources of ideas and learning**. Each contribution can prompt questions: What problem is being addressed? Why does the solution work in its particular context? What resources and institutions make it possible? What evidence supports its effectiveness? What would need to change for the approach to work elsewhere? And, perhaps most importantly, what can other rural communities learn from it?

The value of this publication ultimately lies in the possibility of connection—between innovators and practitioners, between communities and institutions, and between experiences in different countries. CIRDAP's regional mandate provides a particularly appropriate platform for such exchange because many rural communities across Asia and the Pacific experience remarkably similar challenges while possessing different histories, resources and institutional capacities.

We hope this volume will encourage policymakers to look more closely at locally generated solutions, inspire practitioners to experiment and adapt, support researchers in documenting evidence, and motivate innovators to continue refining their ideas. Above all, we hope it contributes to a culture in which rural communities are recognized not simply as beneficiaries of development programs, but as **sources of knowledge, creativity and innovation**.

The CIRDAP-REEDS International Rural Development Challenge 2026 has demonstrated that innovative thinking is alive and thriving across the region. This book brings some of those ideas together so that they can be seen, discussed, learned from and, where appropriate, carried forward.

Ganga Dutta Acharya
P. Chandra Shekara

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1

MALAYSIA

PyroFuel Rural

Turning Village Plastic into Affordable farm Fuel

Thinakaran Narayanan
Ministry of Youth and Sports, Malaysia

Prologue

On a warm afternoon in Kampung Bantan, a paddy-farming village in Arau, Perlis, a small crowd gathered around a single-cylinder diesel engine of the kind that drives irrigation pumps all across northern Malaysia. Into its tank went a funnel of amber liquid that, only days earlier, had been a heap of fertiliser sacks, mulch film and old containers collected from the surrounding farms. Someone pulled the starter cord. The engine caught, settled into a steady beat, and kept running. For a moment nobody spoke. Then the questions began, and in that village, they have not stopped since.

That single engine run captures the whole idea of PyroFuel Rural in a village using its own plastic waste to power its own farms.



Figure 1: Fuel made from village plastic waste

.

Two problems that turned out to be one

Rural Malaysia lives with a quiet contradiction. Villages like Kampung Bantan generate two to five tonnes of mixed plastic every month, yet fewer than fifteen percent of it ever reaches a

recycling stream. The rest is burned in the open or buried at the edges of fields, sending dioxins into the air the community breathes and leaching into the soil that feeds it. At the very same time, the farmers of that same village watch diesel prices climb year after year, cutting into the thin margins of paddy cultivation and forcing painful choices about how often the irrigation pump can run.

Plastic, however, is essentially solidified petroleum. A kilogram of waste polyethylene carries nearly as much energy as a litre of diesel; the energy was always there, locked inside the very material the village was struggling to get rid of. The communities drowning in plastic and the communities starved of affordable fuel are the same communities. PyroFuel Rural simply connects the two.

How it works

At the heart of the system sits a plain steel reactor that any rural metal workshop can fabricate. Shredded, sun-dried plastic is heated to between 350 and 450 degrees Celsius in the near-absence of oxygen. Deprived of air, the plastic does not burn; it un-makes itself. Long polymer chains crack apart into shorter hydrocarbons, rise as vapour, pass through a water-cooled condenser and drip out as liquid fuel. A zeolite catalyst added to the charge sharpens the quality of that liquid, and each kilogram of clean feedstock gives back roughly 700 to 900 millilitres of it. The gases that refuse to condense are not vented but looped back to fire the reactor's own burner, so once the process is started it largely feeds itself. Even the leftover char finds a use, spread on paddy fields as a soil conditioner. Very little leaves the loop.

The innovation runs at two scales. In the Polymer Technology laboratory at IKTBN Sepang, a bench reactor handles five to ten kilograms per batch while diploma students test every output for density, viscosity and flash point, learning green chemistry through a problem that is real rather than borrowed from a textbook. At Kampung Bantan, a community reactor built to the same design processes fifty to one hundred kilograms per batch, three to four times a week, operated entirely by six village youths who were trained in under a week and are now paid for the work.



Figure 2: Crude pyrolysis oil collection

What it costs, and what it saves

A complete community reactor costs between USD 800 and 1,500 to build, using off-the-shelf steel and local welding skills. It needs no grid electricity, no compressor and no pressurised vessel, which keeps it both cheap and safe. Training a new operator takes three to five days. On the other side of the ledger, participating farmers buy the finished fuel at 35 to 45 percent below the pump price of diesel, which works out to roughly MYR 150 to 300 kept in each farming household every month. For a smallholder, that is the difference between rationing irrigation and running the pump when the crop actually needs it.

What has changed on the ground

Since operations began, the project has diverted about 8.5 tonnes of plastic from open burning and produced close to 6,000 litres of fuel. Forty-two households now collect and sort plastic instead of burning it; eighteen paddy and vegetable farms run partly on the fuel it becomes; six young people hold paid technical jobs that did not exist before; and more than sixty vocational students have passed through the project as trained researchers. Measured against the open-burning baseline, roughly 21 tonnes of carbon-dioxide-equivalent emissions have been avoided.

“Before, we burned our rubbish and breathed the smoke,” says Pak Wahab, a paddy farmer in Kampung Bantan. “Now we use it to run our pump, and earn some income too. I wish this had come to our village ten years ago.”

Where it goes next

A Teaching Factory at Tanjung Malim, Perak, now demonstrates the full process end to end for visiting institutions, and an open-access implementation manual is in final preparation so that any village with a metal workshop and a plastic problem can build its own. Nothing in the design is specific to Malaysia. The same pairing of plastic waste and fuel poverty runs through farming communities in Bangladesh, Indonesia, Vietnam, Nepal, the Philippines and Sri Lanka, and the reactor travels well: it is small, unpatented in spirit, and made to be copied. If one village engine running on its own rubbish could quiet a crowd in Perlis, thousands more villages across Asia and the Pacific are waiting for the same silence, and the questions that follow it.



Know the Innovator

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2

SRI LANKA

Transforming Construction and Demolition Waste into Road Infrastructure

A Recycled Concrete Aggregate and Coconut Shell Biochar Technology

A. K. P. Arandara
The Open University of Sri Lanka

1. Background and Rationale

Rural communities across Sri Lanka and the Asia-Pacific region face persistent infrastructure challenges, including poor road accessibility, environmental degradation, increasing Construction and Demolition Waste (CDW), and depletion of natural construction materials. Rapid urbanization and infrastructure development have significantly increased CDW generation, particularly concrete waste, which accounts for approximately 30–40% of global solid waste generation. Meanwhile, rural road construction continues to rely heavily on natural aggregates and river sand, placing increasing pressure on natural resources and causing land degradation, erosion, and biodiversity loss.

This innovation presents a sustainable solution developed through doctoral research at the Department of Civil Engineering, The Open University of Sri Lanka, titled *"Utilization of Recycled Construction and Demolition Concrete Waste as a Raw Material for Rural Roads in Sri Lanka."*

The innovation introduces a Recycled Concrete Wearing Course (RCWC) using Recycled Concrete Aggregate (RCA) derived from demolished concrete and Coconut Shell Biochar (CSB) as a novel additive to mitigate Alkali–Silica Reaction (ASR). The research confirmed that 100% replacement of natural coarse aggregate with RCA is technically feasible while maintaining satisfactory mechanical performance and durability.

The innovation directly supports the objectives of the CIRDAP Rural Development Innovation Challenge by:

- Promoting affordable and sustainable rural infrastructure
- Advancing circular economy practices
- Reducing environmental pollution and landfill disposal
- Creating green employment through waste recycling
- Conserving natural resources
- Enhancing climate resilience

By transforming construction waste into durable road-building materials, this innovation converts environmental challenges into sustainable infrastructure opportunities while supporting rural development.

2. The Innovation

The innovation transforms Construction and Demolition Waste (CDW) into high-quality Recycled Concrete Aggregate (RCA) for sustainable rural concrete roads. It integrates:

a. Collection and segregation of CDW concrete waste
b. Production of Recycled Concrete Aggregate (RCA)
c. Optimization of RCA-based concrete mix designs
d. Incorporation of Coconut Shell Biochar (CSB) to mitigate Alkali–Silica Reaction (ASR)
e. Development of specifications for sustainable rural road construction

The innovation uses Coconut Shell Biochar (CSB), a low-cost and locally available agricultural by-product, to adsorb alkali ions responsible for ASR deterioration, thereby improving the durability of recycled aggregate concrete.

The study demonstrated that Grade 25 recycled aggregate concrete containing 2.5% CSB achieved:

- 28-day compressive strength: 25.4 MPa
- Split tensile strength: 2.5 MPa
- Flexural strength: 4.1 MPa

while significantly reducing ASR expansion in RCA-based concrete.

The research also established recycling specifications, quality control procedures, and construction guidelines to support the practical implementation of sustainable rural roads in Sri Lanka.

3. Problem Statement

This innovation addresses several interconnected challenges by establishing a scalable, low-cost, environmentally sustainable rural road construction model based on locally available waste resources.



Figure 1: Challenges addressed by the proposed sustainable rural road innovation.

4. Research Methodology and Scientific Validation

The innovation was validated through laboratory testing, field investigations, and advanced material characterization. The study included a PRISMA-based literature review, field surveys and material collection from the COWAM Centre, Galle, mechanical strength testing, XRF, XRD, petrographic analysis, SEM/EDS, and ASTM C1260 mortar bar testing to evaluate Alkali–Silica Reaction (ASR).

The research also established specifications for RCA production, quality control, mix proportioning, construction practices, and durability criteria for recycled concrete wearing courses.

5. Rural Development Impact

The innovation delivers economic, environmental, social, and technological benefits by reducing rural road construction costs through recycled materials, conserving natural aggregates, minimizing landfill waste and greenhouse gas emissions, and promoting circular economy practices. It also improves rural connectivity, supports local employment through CDW recycling, and introduces biochar-enhanced recycled concrete technology for sustainable rural road construction.

6. Scalability and Replication Potential

The innovation is readily scalable across Sri Lanka and the Asia-Pacific region, where construction and demolition waste and coconut shell biomass are widely available. Compatible with existing rural road construction practices, it provides a practical solution to construction waste management, resource scarcity, and climate resilience. The innovation supports national sustainability strategies and contributes to UN Sustainable Development Goals (SDGs) 9, 11, 12, and 13.

7. Potential Deliverables

The innovation will deliver practical guidelines, technical specifications, demonstration road projects, community-based recycling models, capacity-building initiatives, and policy recommendations to support the sustainable adoption of recycled concrete technology for rural road development.

8. Conclusion

This innovation presents a scientifically validated, sustainable, and cost-effective solution for rural road infrastructure by transforming construction and demolition waste and agricultural by-products into durable road-building materials. Using Recycled Concrete Aggregate (RCA) and Coconut Shell Biochar (CSB), it advances circular economy practices while addressing construction waste management, natural resource conservation, and rural infrastructure needs.

Beyond its environmental benefits, the innovation supports local employment, sustainable resource utilization, and climate-resilient rural development. With strong potential for replication across Sri Lanka and the Asia-Pacific region.



Know the Innovator

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BANGLADESH

ECOLERY

A Replicable Women-Led Rural Green Economy Model

Nafesa Anzum Helaly
ECOLERY, Bangladesh

1. The Innovation

Ecolery is Bangladesh's first women-led edible cutlery enterprise and a replicable rural green economy model. It connects agricultural waste upcycling, women's economic empowerment, community climate action, and sustainable rural livelihoods into a single, practical system that any Asia-Pacific community can adopt.

Core products:

- Edible cups (wheat, corn flour, natural binders)- holds beverages 45 min, fully vegan, biodegradable within days
- Edible spoons, forks, and bowls in sweet and savoury flavours
- Areca leaf plates handcrafted by rural women- no chemicals, zero waste
- Rice bran straws- biodegradable within days
- Food-waste prototypes using jackfruit seeds and banana peels (active R&D)

Tagline: Eat, Re-eat and Forget.



Fig.1: *Ecolery's biodegradable edible cup*

2. The Problem

Rural communities in Bangladesh and across Asia-Pacific face compounding crises: persistent poverty and limited livelihood options for women on one side; escalating plastic pollution on the other. In Bangladesh, 646 tonnes of plastic waste are generated in Dhaka daily — only 37.2% recycled. Urban per capita plastic consumption tripled (3.0 kg → 9.0 kg, 2005–2020). Plastic fragments enter marine food chains, directly harming fishing communities. At the same time, underprivileged rural women in Mymensingh have no access to dignified, well-paying work. Ecolery addresses both crises simultaneously.

3. How This Model Works

Women as Producers and Leaders

The areca leaf production line is run entirely by underprivileged rural women in Mymensingh- gathering naturally fallen areca leaves, processing without chemicals, and selling to urban clients. 60% of Ecolery's senior leadership is female, including Founder, CEO, CMO, and CFO.

Agricultural Waste as a Resource

Every input- fallen areca leaves, rice bran, jackfruit seeds, banana peels- is otherwise discarded. This circular model costs less as it scales and creates value where none existed.

Building Rural Market Linkages

With 22+ active B2B partners and presence at the UN Office in Bangkok, Ecolery connects rural producers directly to urban institutions, bypassing traditional market access barriers.



Fig.2: Women producers- areca leaf plate production training



Fig. 3: Ecolery products showcased at UNESCAP's Net Zero Journey exhibition, Bangkok

4. Evidence of Impact

Metric	Result
Units Sold	160,000+ edible cutlery units since late 2023
Plastic Prevented	300+ kg of single-use plastic diverted
Production Capacity	60,000 edible cups/month
B2B Partners	22+ restaurants, cafes, and corporate clients
International Sales	Edible cups sold at the UN Office, Bangkok
Grants Received	USD 16,200+ (Dutch Govt, UNDP, Save the Children, ActionAid, BD gov)
Awards	Champion: Generation Hope Goals 2025 (UNESCAP, UNDP); Orange Corners; StartKoro S4; Daily Star Climate Justice; EWC Bangladesh; Winner #Change100 (Microsoft, Techstars);

5. Scalability

The innovation's significance lies in the model, not just the product. Areca palms grow across India, Sri Lanka, Myanmar, Indonesia, the Philippines, and Vietnam. Rice bran is abundant in virtually everywhere. Food waste from jackfruit and banana is universally available. Ecolery will publish an open-source Replication Guide- free to all- documenting how any rural community can establish a production unit, connect to markets, and measure environmenta impact.



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4

INDIA

GOLDEN CARE

Autonomous Emergency Detection for the Elderly Citizens

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Introduction

Golden Care is a wrist-worn medical device designed to autonomously detect three high-risk, time-critical conditions in older adults- ischemic stroke, cardiac ischemia, and hypoglycemia- and to summon assistance without any action by the wearer. Upon detection, the device places an emergency call, transmits the wearer's location, and delivers a pre-hospital data packet to the receiving hospital within approximately ten seconds. It serves every user through a single hardware specification, so that the same capability is available regardless of the wearer's means or location. Unlike existing devices, it does not merely display measurements for a person to interpret; it fuses several sensing channels into one continuous, autonomous decision and acts on that decision on the wearer's behalf.

Motivation

The motivation for Golden Care arose from a recurring limitation of existing elderly-care technology: each available tool addresses only part of the problem. Manual alert buttons require a conscious, capable user- the very capacity that a stroke, cardiac event, or hypoglycemic collapse removes- while consumer smartwatches detect falls but neither perform autonomous, graded, multi-sensor escalation nor transmit a clinical record ahead of the ambulance. The difficulty is therefore not an absence of sensors but the absence of an integrated system that senses, decides, and acts on its own. Golden Care was conceived to be that system rather than another single-function device.

Problem Statement

India is home to approximately 149 million people aged 60 years and above, a figure projected to rise to 347 million by 2050, and a growing proportion of this population live alone or spend much of the day unaccompanied. For this group, the decisive failure in the emergency-care pathway is not the cost of treatment but the interval that elapses before an emergency is recognized. During the onset of a stroke, a cardiac event, or a hypoglycemic episode, the affected individual is frequently unable to speak, to operate a device, or to reach a telephone, and when alone may remain undiscovered for a prolonged and clinically decisive period. Existing solutions do not close this gap: marketplace alert devices depend on user action, fall detectors miss non-fall emergencies, and clinically capable wearables are priced between ₹30,000 and ₹45,000. The consequence is a broadly distributed risk whose severity is greatest wherever timely discovery cannot be assumed.

Objectives

- To design and implement a single wrist-worn device that autonomously detects ischaemic stroke, cardiac ischaemia, and hypoglycaemia through multi-sensor fusion, overcoming the fragmentation of tools that each address only part of the emergency-care pathway.
- To generate an autonomous emergency response- an ambulance call, caregiver notification, location broadcast, and pre-hospital data transfer- that requires no action from the patient at any stage.

- To achieve this at a cost accessible to a broad population through a single hardware specification, so that capability is not reduced for those who can pay least.

Methodology and Implementation

The device integrates five clinical-grade sensing channels: a MAX30102 optical sensor for heart rate and peripheral oxygen saturation; an AD8232 front end for a single-lead electrocardiogram, in which the digital crown serves as the Lead I electrode and a case-back ring as the reference; an MPU6050 six-axis inertial measurement unit for impact, posture, and stillness; galvanic skin-response electrodes for sudomotor activity, an early autonomic indicator of hypoglycaemia; and an MLX90614 infrared thermopile for skin temperature. Inference is performed locally on an ESP32 microcontroller, so a loss of network connectivity may delay the outbound response but does not impair detection

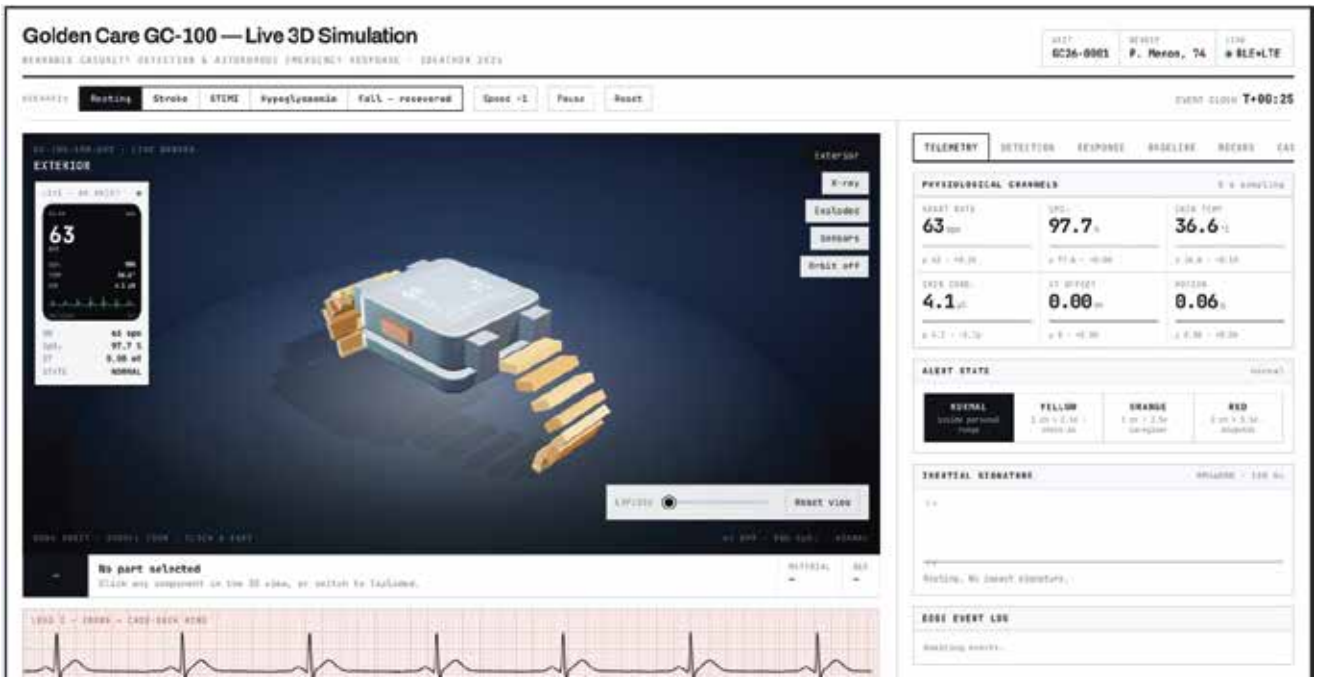


Figure 1: *The Golden Care simulation. Top: the live console, with the device rendered in 3D, physiological channels streaming against the wearer's personal baseline, and the graded alert-state ladder. Bottom left: the autonomous response pipeline. Bottom right: live position and condition-based hospital routing.*

During an initial seven-day period the device establishes a personalised statistical baseline- the mean and standard deviation of each channel- for the individual wearer, and thereafter evaluates readings as deviations from that individual baseline rather than against a population norm. A graded state machine escalates through Yellow, Orange, and Red states: a single channel exceeding approximately 2.5 standard deviations produces an on-wrist check-in; two channels exceeding approximately 3.5 standard deviations, or a hard trigger such as ST-segment elevation or an impact followed by sustained stillness, advance the device toward dispatch, subject to a ten-second cancellation window during which purposeful movement or a crown press aborts a false alarm.

Upon confirmation of a red event, the paired mobile device summons an ambulance from the appropriate hospital- selected by condition rather than proximity- and transmits the patient's history with the request, so the responding team arrives already informed. It simultaneously notifies caregivers by push notification, SMS, and a two-way voice channel, streams the GPS

location, and delivers a pre-hospital packet- a 30-second ECG segment, vitals trends, medication list, allergies, and the recorded onset time- to the hospital before arrival.

Working, Cost-Effectiveness and Impact

The device is constructed entirely from commercially available modules, which keeps cost low and removes any dependence on custom fabrication. The prototype bill of materials is approximately ₹2,435 per unit, against ₹15,000–₹45,000 for commercial wearables that nonetheless cannot summon help autonomously. Development is staged as a completed proof of concept, a clinical-validation study of 200–500 participants, a regulatory phase, and a subsidised rollout.

At a production volume of approximately 10,000 units, with an injection-moulded enclosure and a consolidated printed circuit board, the projected unit cost falls to approximately ₹1,800, within the subsidy brackets of national schemes such as Ayushman Bharat and Ayushman Vay Vandana- the latter extending up to ₹5 lakh in annual cover to citizens aged 70 and above without income testing. At this price the device is affordable both for direct purchase and for subsidised distribution. The recorded onset time is of particular clinical value: a large proportion of stroke patients present with an unknown onset, and recording it converts an unwitnessed event into a witnessed one, frequently determining eligibility for time-dependent intervention.

Social Impact

Beyond its immediate clinical function, Golden Care is intended to extend independent living for the elderly and to reduce the anxiety borne by families and caregivers of older relatives who live alone. Because the device operates without requiring the wearer to read a screen, press a button, or speak a command, it is usable by individuals with limited technological familiarity, cognitive impairment, or reduced dexterity. A single specification serves every user identically, so the same protection is available irrespective of means, and condition-specific guidance presented to bystanders- in the wearer's preferred language in future revisions- enables an untrained neighbour or relative to act effectively before professional help arrives.

Conclusion

Golden Care is more than a monitoring wearable: it integrates continuous multi-sensor sensing, personalised anomaly detection, and a fully autonomous emergency response into a single low-cost device, summoning help within approximately ten seconds and requiring no action from the patient. Rather than expecting users to acquire new skills or healthcare systems to be rebuilt, it operates through infrastructure that already exists and at a cost accessible to a broad population. The system is presently a validated prototype rather than a certified medical device, and its reported performance figures are design targets pending a planned clinical study; a successful study would support scaling to wider deployment and to additional detected conditions.

Future Scope

- Incorporate non-invasive glucose sensing and atrial-fibrillation detection to broaden the range of conditions the device can identify.
- Integrate directly with emergency-dispatch networks such as ERSS-112 and with hospital information systems for automated bed allocation and ambulance routing.
- Provide a multilingual, voice-assisted caregiver interface so that setup and alerts are accessible in the user's preferred language.

- Develop a caregiver and clinician dashboard for longitudinal monitoring of vitals trends and device-recorded events.

Know the Innovators



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5

BANGLADESH

CARBODIT

A Community-Based Digital Carbon Finance Model for Rural Empowerment

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CARBODIT, Bangladesh

Executive Summary

CARBODIT is a rural climate-finance innovation that enables smallholder households to convert tree-based assets into measurable and tradable carbon credits. Across Bangladesh and similar regions, millions of smallholders maintain trees within homesteads, agroforestry plots and community lands, yet receive no compensation for the environmental services these trees provide. Carbon market remains inaccessible due to high verification costs, technical complexity and aggregation barriers. CARBODIT bridges this gap using an aggregation platform supported by a simple digital measurement system. Village Carbon Groups collectively register trees, youth monitors conduct standardized measurements and aggregated carbon credits are linked to institutional buyers using CARBODIT aggregation platform. Farmers retain ownership of their carbon rights and receive transparent payouts through written agreements and digital record-keeping. CARBODIT transforms rural communities from passive climate actors into active participants in global climate finance and contributes to rural income generation and community empowerment.

Background

The global voluntary carbon market is valued at approximately USD 6 billion and continues to expand rapidly. Bangladesh, however, has captured only a marginal share of this opportunity, despite possessing an estimated 2.23 million hectares of Trees Outside Forests and 0.27 million hectares of home gardens — a substantial, largely untapped carbon resource.

Rural communities remain excluded from this market for structural reasons: carbon measurement methods are costly and technical, landholdings are fragmented across millions of small households, awareness of carbon finance is low and no accessible mechanism currently connects smallholders to international carbon buyers.

Rural Challenge

Rural households in Bangladesh face income instability, climate vulnerability, fragmented landholdings and limited access to technology and formal markets. Although they maintain tree-based farming systems that store carbon and provide valuable ecosystem services, they receive no financial carbon credit benefit for these contributions. As a result, smallholders remain excluded from emerging carbon markets and climate-finance opportunities that could diversify rural livelihoods while promoting environmental conservation.

The Innovation

CARBODIT is a community-based digital carbon aggregation platform designed specifically for smallholder farmers and rural communities. The model enables participants to collectively measure, aggregate, verify and market carbon credits generated from trees growing on homesteads, farms, and other privately owned lands.

The platform operates through Village Carbon Groups, where participating households register their trees collectively. Rural youth are trained as local carbon monitors to conduct standardized field measurements using simple tools. CARBODIT acts as a service provider by facilitating project registration, carbon estimation, verification, certification, and market linkage with voluntary carbon buyers. Revenue generated from carbon credit sales is distributed transparently among participating households through digital payment systems while CARBODIT retains a service fee for project management.

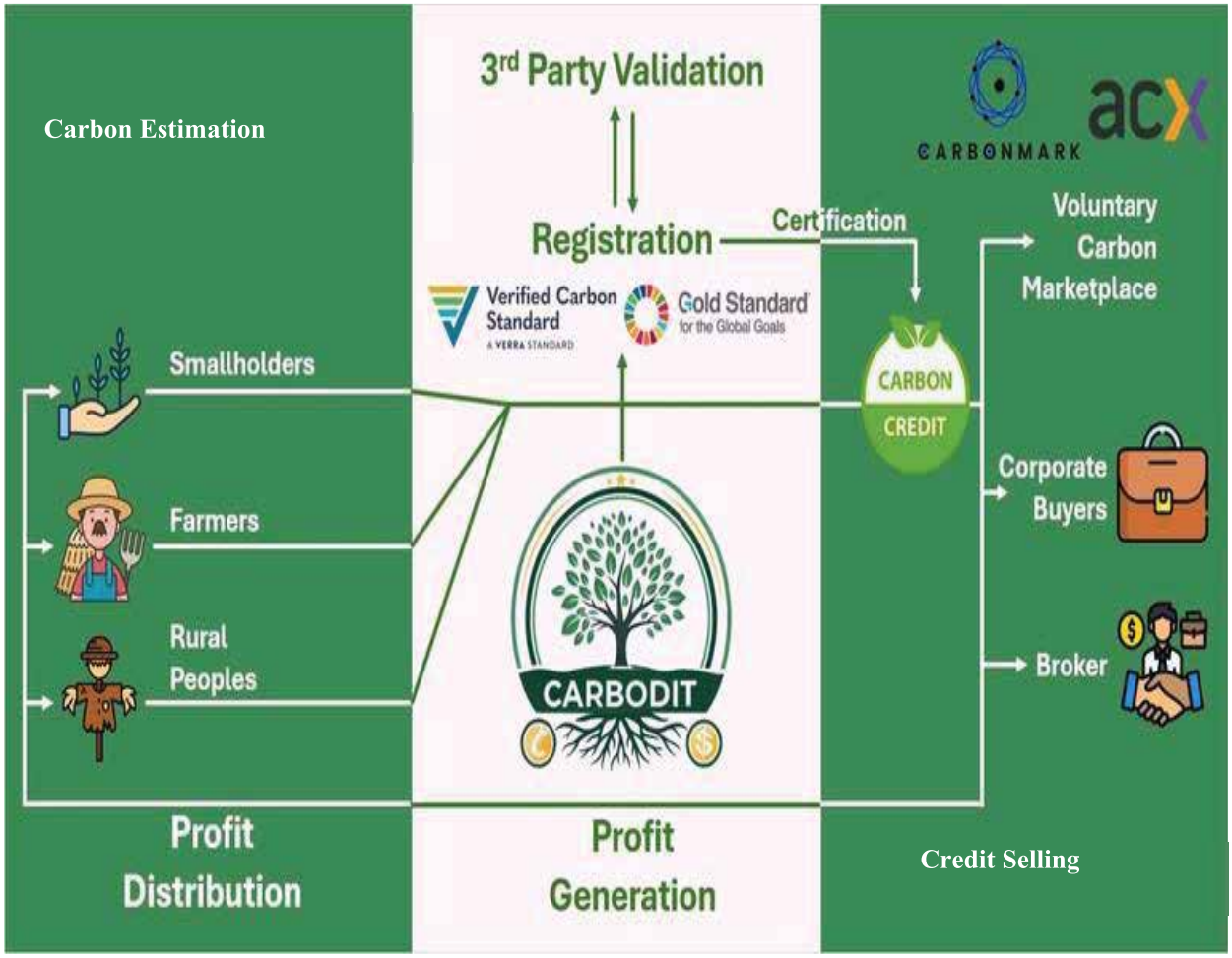


Figure 1: CARBODIT model

How CARBODIT Works

Participating households register on the CARBODIT platform using their mobile phone number. The application provides simple guidance on measuring tree diameter at breast height (1.3 meters above the ground) using an ordinary measuring tape. Farmers then enter basic information such as land area, tree species, and tree measurements into the Carbon Calculator. Using species-specific allometric equations, the platform estimates above-ground biomass, carbon stock, and potential carbon credits. Carbon generated from multiple households is

aggregated under a common project and linked to voluntary carbon markets. Through their individual profiles, participants can monitor estimated carbon generation, carbon credit transactions, and payments received from verified carbon sales.

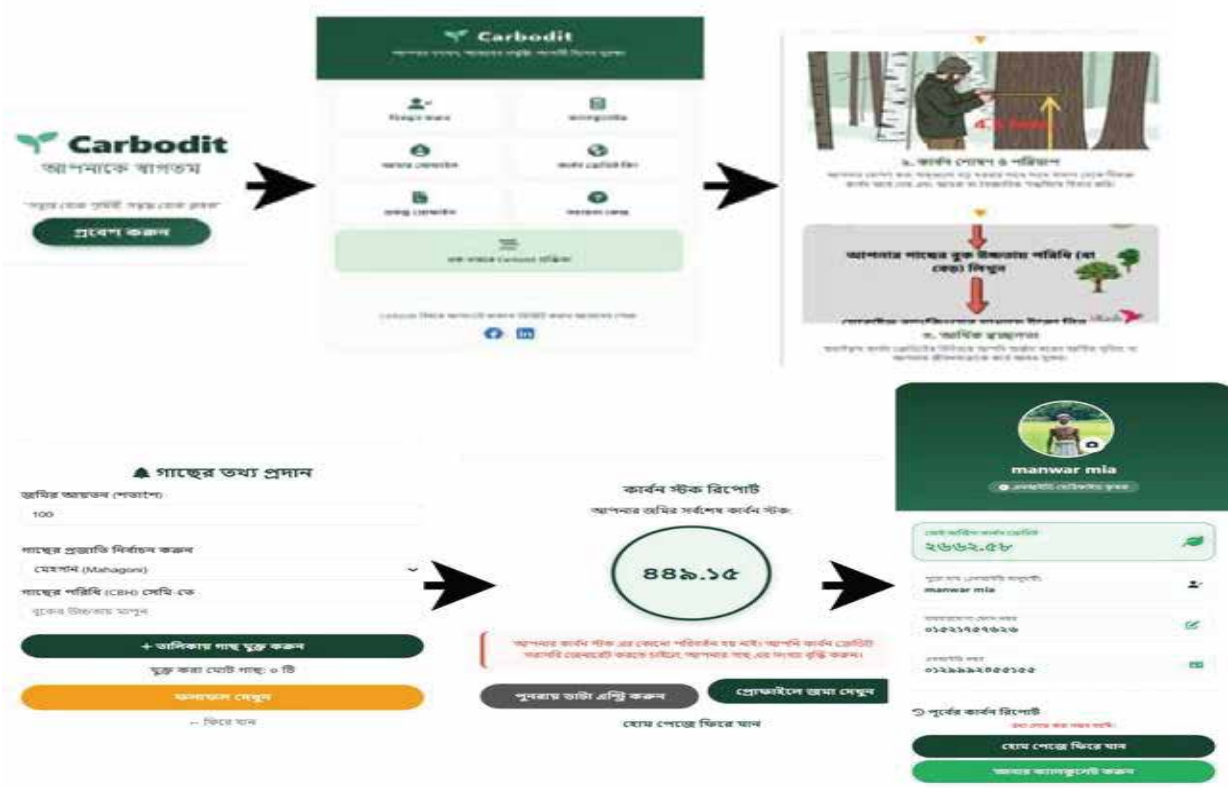


Figure 2: CARBODIT webapp interface

Cost-effectiveness

CARBODIT significantly reduces the financial barriers associated with carbon market participation. Farmers require only a smartphone and an inexpensive measuring tape to collect field data, eliminating the need for costly specialized equipment. Community-level aggregation distributes validation and certification costs across many participants, making carbon market access affordable for smallholders who would otherwise be excluded. The digital platform also minimizes administrative costs through automated calculations, digital record management and mobile-based payments.

Current Status

CARBODIT is currently at the prototype (Minimum Viable Product) stage. The digital platform has been developed and preliminary prototype testing has demonstrated the technical feasibility of estimating tree-based carbon using simplified field measurements and integrated allometric equations. The next phase will focus on pilot implementation, community engagement and validation under internationally recognized carbon standards in collaboration with local stakeholders.

Impact on Rural Communities

CARBODIT is designed to generate social, economic and environmental benefits together. By unlocking supplementary income from tree resources households already maintain, it strengthens rural resilience without requiring additional land or changes to existing agricultural

practices. It also encourages long-term tree conservation and agroforestry adoption, while creating green employment for rural youth and reinforcing local institutions through Village Carbon Group participation. More broadly, CARBODIT shows how climate finance can double as rural development: by rewarding ecosystem services directly, it turns environmental stewardship into a livelihood opportunity rather than an unpaid obligation.

Scalability and Future Outlook

CARBODIT envisions a future in which every rural household- regardless of land size- can participate in global climate finance by transforming trees into measurable carbon assets. By combining digital infrastructure, community organization, and transparent governance, the model offers a practical pathway to reduce rural poverty, strengthen local economies, conserve tree resources, and build climate resilience. Given its adaptable, low-cost design, CARBODIT holds strong potential for replication across Bangladesh and other countries facing comparable rural development challenges.

Know the Innovators



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6

IR IRAN

From Land Consolidation to Local Branding through Capacity Building

A Narrative of a Rural Extension Facilitator in Kermanshah, Iran

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1. Executive Summary

This innovation success story in Gohar-Chaqa, Kermanshah, leveraged a participatory approach and trust-building to overcome land fragmentation and water scarcity. Through this model, 24 plots were consolidated into a 16.5-hectare farm, boosting productivity and reducing costs. Beyond economic gains, this process strengthened collective trust and empowered rural women through value-chain integration (processing and branding), transforming land consolidation into a comprehensive platform for economic and social development.

2. Problem Statement

Iran's agricultural sector is shifting toward participatory models to unlock new potential. The Gohar-Chaqa project demonstrates this by consolidating 24 fragmented plots into a 16.5-hectare productive enterprise, empowering rural women and driving entrepreneurship through processing, packaging, and market-oriented branding. Its successful expansion to "Sur-Kal" proves that integrating structural reform with women-led, value-added entrepreneurship offers a scalable and replicable blueprint for sustainable regional development.

3. The Innovation

The core innovation of this experience lies in transforming the role of the facilitator from a "traditional trainer" to a "community broker," and shifting from one-way training to participatory and co-designed processes. Through a six-stage implementation pathway—encompassing stakeholder identification, trust-building, legal facilitation, and entrepreneurial skills training—this model successfully converted 24 fragmented plots into a 16.5-hectare unified farm, creating a foundation for increased productivity and reduced production costs. By incorporating specialized training in packaging, branding, and e-marketing, the initiative demonstrated that agricultural extension cantered on social learning and the active participation of women in the value chain and digital sales is an effective strategy for simultaneously overcoming structural barriers—such as land fragmentation—and behavioural challenges related to weak entrepreneurship.



Figure 1: The Participatory Facilitation Process in Action.

4. Innovation Highlights

Facilitator Role: Transition from "traditional teaching" to "community brokering" with a focus on participatory action.

Stage Framework: Includes stakeholder identification, motivation, trust-building, legal titling, training, and replication.

Integrated Approach: Linking structural land reform with economic empowerment and market access.

Accessible Tech: Using simple, accessible tools (e.g., messaging apps) for marketing and sales.

Women's Role in Processing and Packaging: Rural women serve as the operational backbone for product processing and standard packaging, creating value-added opportunities that drive regional market success.

Proven Impact: Consolidated 16.5ha (24 plots), 35% efficiency gain in mechanization, 28% cost reduction, doubled income, and successful replication in neighbouring villages.

5. Measurable Impact

Economic: Consolidated 16.5 hectares, improved mechanization efficiency by 35%, reduced labor costs by 28%, and doubled income via branding.

Social: Enhanced collective trust and empowered women through digital marketing and value-chain integration.

Environmental & Scalability: Promoted conservation techniques (mulching/biological management) and successfully replicated the model in Surkal, with 3 new farmers adopting it within two years.



Figure 2: Field Monitoring

6. Sustainability, Scalability & Replicability

This sustainable rural development model centres on local facilitation, land consolidation, and climate-smart, value-added practices, which have effectively doubled farmer incomes. Its 6-

stage implementation framework has proven highly scalable, evidenced by successful expansion from Gohar-Chaqa to Surkal, while ensuring long-term impact requires consistent institutional support and access to rural innovation funds for farmers post-consolidation.

7. Conclusion

This sustainable rural development model leverages a six-stage, human-cantered framework to transform low-productivity farmland into thriving economic enterprises. By integrating land consolidation, social cohesion, market-oriented branding, and the active participation of rural women in entrepreneurship and employment—specifically within processing and packaging—this initiative offers a scalable and replicable solution for sustainable rural prosperity. Beyond simply increasing income and resilience, the model's efficacy has been validated by its successful scaling from Gohar-Chaqa to Surkal.



Know the Innovator

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7

INDIA

GramiGO-Smart Rural Logistics Network

A Shared, Route-Based Delivery Model for Underserved Rural Communities

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The Innovation

GramiGO is a smart rural logistics platform that converts transportation already operating in rural communities- auto-rickshaws, buses, milk vans, school vans, and bike riders travelling fixed daily routes- into a shared, affordable last-mile delivery network. Rather than deploying a dedicated fleet of delivery riders, a model that has repeatedly failed to reach financial viability in low-density rural markets across Asia and the Pacific, GramiGO matches customer delivery requests to vehicles that are already travelling toward the destination. The driver carries the parcel as part of a journey they were making regardless, earning supplementary income without any additional trip, fuel cost, or time burden.



Why It Matters

A majority of the population across Asia and the Pacific lives in rural areas that remain excluded from the delivery and e-commerce economy that has transformed urban centres. This exclusion is structural: low order density, long inter-village distances, and thin margins make dedicated delivery fleets commercially unviable, while conventional urban platforms cannot profitably extend into sparsely populated geographies. The result is that rural households pay more for less reliable access to goods, local shops cannot expand beyond walking-distance customers, and smallholder farmers regularly lose income because they cannot economically transport small produce volumes to buyers. GramiGO addresses this gap directly by monetising unused capacity that already exists on rural roads, rather than asking investors or communities to fund new vehicles or infrastructure.

How It Works

Customers and local shops place a delivery request through a lightweight mobile application, or through an SMS/IVR interface designed for areas with low smartphone penetration. GramiGO's route-matching engine identifies nearby vehicles already travelling toward the requested destination, using learned patterns of recurring routes such as school-van schedules, milk-collection runs, and regular bus and auto-rickshaw circuits. A compatible driver receives the request, accepts it with one tap, and collects the parcel at an agreed pickup point along their existing journey. Delivery is confirmed through a one-time PIN shared by SMS, and payment-collected digitally or as cash-on-delivery- is settled automatically, with the driver's earnings credited without delay. No new vehicles, dedicated riders, or fixed delivery infrastructure are required at any stage.



Cost-Effectiveness

Because GramiGO adds delivery to journeys that are already taking place, its marginal cost per parcel is a fraction of that incurred by dedicated-fleet models, which must fully fund vehicle time, fuel, and driver wages for every trip. This asset-light structure allows GramiGO to offer delivery fees that rural households and small shopkeepers can genuinely afford, while still paying drivers a meaningful supplementary income. The model also requires comparatively modest capital investment to launch and scale: the primary costs are software development, driver and shopkeeper onboarding, and lightweight local operations support, rather than fleet acquisition or logistics infrastructure-making it an efficient and scalable proposition for investors and development partners seeking measurable impact per dollar deployed.

Impact

- Extends affordable, reliable delivery access to villages historically excluded from organised retail and e-commerce.
- Generates flexible supplementary income for existing transport operators, with no upfront investment required on their part.

- Expands the customer reach of local shopkeepers beyond walking distance, increasing rural retail turnover.
- Improves market access for smallholder farmers, reducing post-harvest losses from unsold or delayed produce.
- Reduces the environmental footprint of last-mile logistics by eliminating the need for additional dedicated delivery trips and vehicles.
- Creates a scalable, replicable model applicable to rural communities across diverse geographies in Asia and the Pacific, with strong potential for regional and cross-border adaptation.

GramiGO offers international investors and development partners a capital-efficient, high-impact opportunity to close the rural logistics gap at scale — using infrastructure that already exists, rather than building new infrastructure from the ground up.





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8

SRI LANKA

WALKING COOLER

A Low-Cost, Zero-Energy Mobile Cold Storage Solution for Smallholder Farmers

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Introduction and Importance of the Innovation

Smallholder farmers across the Asia-Pacific region, particularly in dry zones such as Anuradhapura, Sri Lanka, lose between 30% and 40% of their fresh fruits and vegetables before produce ever reaches the market. High ambient temperatures accelerate spoilage, while transport on bicycles and open carts subjects produce to heat stress and mechanical damage. Refrigerated trucks and grid-connected cold rooms remain financially and physically out of reach for most rural households, leaving farmers with no affordable way to protect the value of their harvest during transit. The Walking Cooler was developed to close exactly this gap. It is a lightweight, mobile and completely non-electric evaporative cooling chamber that can be mounted on a bicycle, push cart or small flatbed already used by rural farmers turning an everyday means of transport into a functioning cold chain, without a single unit of electricity or fuel.

How the Innovation Works

The device is built on a simple 'box within a box' design. An inner storage chamber, made of lightweight treated wood or aluminium, holds the produce. This is surrounded by an outer shell of permeable woven bamboo mesh and the cavity between the two layers is packed with a mixture of sand and coir pith a coconut fibre waste product prized for its ability to hold up to eight times its own weight in water, which keeps the cooling medium wet for hours while adding minimal load for the farmer to carry. A small, reused 2 litre (prefer amount) plastic bottle mounted at the top feeds the coir-sand layer through a simple IV-style drip line, releasing water drop by drop. As dry, warm ambient air passes through the moistened outer mesh, the water evaporates and draws heat away from the inner chamber the same latent-heat-of-evaporation principle used in traditional clay pot coolers, but adapted into a mobile format. In field conditions, this lowers the internal temperature by approximately 5°C to 10°C (can be vary with heat and other factors) relative to the surrounding environment, keeping vegetables measurably fresher on the journey to market.

Cost-Effectiveness

Every material in the Walking Cooler bamboo, sand, coir pith, treated wood or scrap aluminium sheeting and a reused plastic bottle is low-cost, locally available or repurposed from agricultural waste. The design deliberately avoids compressors, batteries, ice or any powered component, eliminating running costs, maintenance of electrical parts and dependence on fuel or grid access. Because the unit can be assembled by a local carpenter or artisan using basic tools, the cost of production and repair stays firmly within reach of individual smallholder households and community groups, rather than requiring institutional investment.

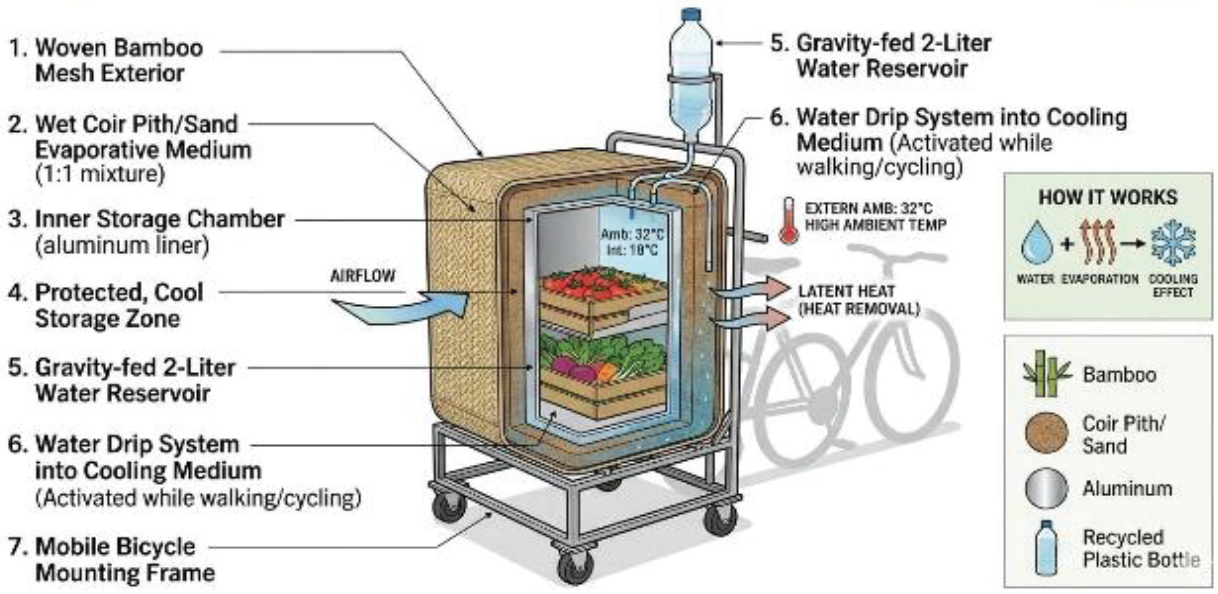
Impact on the Rural Community

Higher farmer income - produce reaches the market fresher, crisper and closer to its original weight, allowing farmers to command better prices and cut post-harvest losses.

Empowerment of rural women - many rural women manage small-scale vegetable trading because the Walking Cooler is lightweight and mobile, it lets them transport fresh produce comfortably without heavy physical exertion.

Sustainability - the system runs on zero electricity and zero fossil fuels, relying entirely on agricultural waste and basic physics, aligning with climate-smart agriculture goals.

Scalability - the design is simple and fully replicable any village artisan across CIRDAP member countries can build a Walking Cooler using local bamboo, sand and coconut waste, with no imported components required.



Structure and working principle of the Walking Cooler

Conclusion

By combining low-cost agricultural waste with a well-understood evaporative cooling principle, the Walking Cooler offers a practical, zero-energy answer to post-harvest loss for smallholder farmers in dry and rural regions. Its simplicity keeps it affordable and replicable, while its mobility and light weight make it especially suited to empowering rural women engaged in small-scale produce trading delivering a solution that is at once climate-smart, women-inclusive and immediately implementable at the village level.



Know the Innovator

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9

VIETNAM

Digital Farmer 4.0 Platform

Real-time Forecasting and Market Connectivity for Smallholder Farmers

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Ministry of Agriculture and Environment, Vietnam

Background

In less than one hour, one ton of oranges was sold out through a livestream in Bac Ninh, Vietnam. For many, it was a success story. For farmers, it was a glimpse of hope. But for the future of agriculture, it raised a deeper question: can such moments of success become a sustainable system?

Problem Statement

Agriculture remains a cornerstone of Vietnam's economy, employing a significant share of the rural population and ensuring food security for over 100 million people. Despite notable progress, smallholder farmers continue to face persistent structural challenges that limit their productivity, income stability, and resilience. Key constraints include:

- Limited access to reliable and timely market information
- Weak forecasting systems for weather, pests, and diseases
- Fragmented supply chains with heavy reliance on intermediaries
- Lack of long-term production planning tools
- Uneven digital capacity among rural populations

These challenges often result in a recurring cycle commonly described as "good harvest - low price," where farmers suffer losses due to oversupply and volatile markets.

Practice Insight: Livestream Agriculture - A Breakthrough, but Not Enough

In recent years, livestream-based agricultural sales have emerged as a new distribution channel in Vietnam, creating opportunities to directly connect farmers with consumers through digital platforms. A notable example was recorded in Bac Ninh province. At Quang Anh farm, owned by Mr.Tran Van Nhuc in Phuong Son ward, a livestream session selling oranges delivered remarkable results: in less than one hour, nearly one ton of oranges was sold directly to consumers without intermediaries. The livestream was hosted by Mr. Nguyen Huy Than, a specialist in brand development and digital sales. The combination of high-quality agricultural products and professional selling skills created a strong ripple effect, significantly accelerating sales and enhancing product value.

This case highlights several clear advantages:

- The ability to sell large volumes within a short time, especially during peak harvest periods
- Shortening the supply chain, thereby increasing profits for producers
- Leveraging the power of digital media to promote local agricultural products

However, the model also reveals several structural limitations:

- Dependence on human factors: Success relies heavily on experts or individuals with livestreaming skills, while most farmers lack such capabilities
- Limited scalability: Not all localities have access to experts or can generate similar levels of media attention

- Lack of long-term market data: Livestreaming solves immediate sales but does not support forecasting of supply, demand, pricing, or production planning
- Risk of supply-demand imbalance: Short-term success may encourage farmers to expand production based on trends, leading to oversupply in subsequent seasons

Therefore, while livestreaming is an effective tool for agricultural sales, it needs to be integrated into a more comprehensive digital ecosystem - one that enables farmers not only to sell faster, but also to produce smarter and sustain long-term market stability.



A livestream session selling oranges directly at the farm of Mr. Tran Van Nhuc

3. Proposed Innovation: Digital Farmer 4.0 Platform

The Digital Farmer 4.0 Platform is designed as an integrated, scalable, and user-friendly digital solution that goes beyond selling to support data-driven agricultural decision-making.

The platform consists of four core modules:

(1) Real-time Market Intelligence

- Daily price updates across regions
- Demand signals from enterprises and cooperatives
- Trend analysis for production planning

(2) Weather Forecasting and Early Warning

- Localized weather forecasts
- Alerts on extreme climate events
- Pest and disease warnings

(3) Smart Farming Advisory

- Region-specific crop calendars
- Best practices on cultivation and harvesting
- Climate-resilient farming recommendations

(4) Market Linkage and Digital Trading

- Direct connection between farmers and buyers
- Integrated e-commerce marketplace
- Reduced dependency on intermediaries

- The platform will be accessible via smartphones and simplified channels such as SMS and Zalo, ensuring inclusivity for farmers with limited digital skills.

4. Innovation Value and Uniqueness

The Digital Farmer 4.0 Platform differentiates itself through:

- Integration: Combining market, climate, and technical data in one system
- Scalability: Designed for nationwide and regional replication
- Affordability: Leveraging existing digital infrastructure
- Inclusiveness: Supporting farmers with varying levels of digital literacy
- Data-driven approach: Moving from reactive selling to proactive planning

5. Expected Impact

The platform is expected to generate both economic and social impacts

Economic Impact:

- Increase farmers' income by 10 - 20%
- Reduce post-harvest losses and market risks
- Improve productivity through informed decisions

Social Impact:

- Empower smallholder farmers
- Reduce rural poverty and inequality
- Promote inclusive digital transformation

Environmental Impact:

- Support climate-resilient agriculture
- Optimize resource use
- Reduce unsustainable production practices

6. Potential Deliverables

- A functional mobile and SMS-based digital platform
- A national database of market prices and climate data
- Training programs for farmers and cooperatives
- Pilot implementation in selected provinces
- Monitoring and evaluation reports

7. Implementation Plan

Phase 1 (0 - 6 months):

- Develop prototype and pilot in 1 - 2 provinces
- Establish partnerships with government agencies and enterprises

Phase 2 (6 - 18 months):

- Expand coverage to multiple regions
- Improve data integration and user experience
- Conduct large-scale farmer training

Phase 3 (18+ months):

- Scale nationwide
- Integrate AI-based forecasting tools
- Link with export markets and global supply chains

8. Scalability and Sustainability

With high mobile penetration and increasing demand for digital agriculture, the platform can be replicated across Vietnam and other Asia-Pacific countries.
Sustainability will be ensured through:

- Public-private partnerships
- Subscription-based premium services
- Support from development organizations

9. Conclusion

The Digital Farmer 4.0 Platform builds upon the initial success of digital tools such as livestream commerce but goes further by addressing fundamental gaps in market intelligence, forecasting, and production planning. By transforming fragmented information into actionable insights, the platform empowers farmers to shift from reactive selling to proactive decision-making. This innovation has the potential to create a more resilient, efficient, and inclusive rural economy - contributing significantly to sustainable agricultural development in Vietnam and beyond.

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10

PHILIPPINES

Eco_Protek

A Rural Microbial Innovation Driving Circular Agriculture, Food Security, and Environmental Resilience

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On a smallholder farm in Ilocos Norte, Philippines, twelve years of culturing indigenous microorganisms produced something rare in rural development: one laboratory-certified microbial technology that now makes fertilizer for farmers, manages waste for three local governments, and trains the next generation of farmers for soil restoration — all from inputs any rural community already has.

The Problem

Three converging crises frame this innovation. (1) Synthetic fertilizer has moved beyond the reach of many smallholders, while the organic alternatives distributed by local governments — typically vermicompost and composted cow manure at 1–3% total NPK — qualify only as soil amendments; farmers trial them, see insufficient yield response, and return to expensive chemicals. (2) Republic Act 9003 obliges every village to process its own biodegradable waste, yet most lack the infrastructure to comply. (3) Rural youth continue to leave agriculture, which they perceive as technologically stagnant and economically unviable. Eco_Protek addresses all three with one technology.

What is Eco_Protek?

Eco_Protek is a microbial consortium that originated in ordinary on-farm practice. At Agape land Integrated Farm, a culture was brewed from rice, molasses, and indigenous forest and bamboo microorganisms- the Indigenous Microorganism (IMO) method practised widely across Asia — then refined through twelve years of continuous field use. In September 2024 it was submitted to the Philippine National Collection of Microorganisms (PNCM) at the University of the Philippines Los Baños, which confirmed a general aerobic plate count of 4.6 × 10^8 CFU/mL, four functional guilds, and total coliforms not detected. The formulation is now reproduced under controlled laboratory conditions and manufactured at scale by Taginayon, Inc., a social enterprise.

Microbial Guild	Primary Function
Lactic Acid Bacteria	Acidification, pathogen suppression, fermentation control
Bacillus spp.	Enzymatic decomposition, uric-acid hydrolysis
Yeasts	B-vitamin synthesis, growth factors
Putative N-fixing bacteria	Associated with N_2 fixation and phytohormone production

Source: PNCM Test Reports 24090401-1-A to -1-F, UPLB-BIOTECH, October 2024.

How It Works

Bio-fertilizer production: Dried poultry manure inoculated with Eco_Protek, combined with a carbon-rich carrier from farm and community bio-wastes, is processed in a rotary composter. Lactic acid bacteria acidify the mass and suppress pathogens; Bacillus species hydrolyse uric acid into plant-available amino acids. The output, verified by the Department of Agriculture Regional Field Office 1 Soils Laboratory in April 2026, reaches 6.47–6.88% total NPK —

meeting the Philippine National Standard for organic fertilizer. Active thermophilic composting begins within seven days, against four to six months conventionally.

Organic waste management: Two deployment tiers serve villages and commercial properties. A bucket system using the fermentation method needs no electricity. A Bio-Thermal Composter enables overnight active composting at village level, removing the need to haul biodegradable waste to a centralized facility. Fermented output feeds the Gulayan sa Barangay village vegetable-garden, where households can buy organic produce — closing the loop.

Soil restoration: Degraded soil often holds enough nutrients — what it lacks is the living biology to release them. Each application returns live microbial guilds to the root zone, rebuilding biology that intensive farming has stripped bare. The effect compounds with every cycle, as spent compost carries the same guilds back to the field.



Figure 1. Bio-fertilizer inoculated with Eco_Protek,.

Cost-Effectiveness

The entry-level bucket package costs under ₱1,500 (USD 25) and consumes no electricity. Rotary-composter integration uses infrastructure already distributed by government programs, so no new capital equipment is required. The recurring cost is the inoculant alone, at ₱500 (about USD 8) per bottle. The substrates — poultry manure, crop residues, food waste, coconut husks — are materials communities already possess and currently treat as disposal problems. Against this, the model displaces imported synthetic fertilizer, compresses a four-to-six-month composting cycle into seven days, and converts a disposal expense into a productive input. For hospitality operators and livestock raisers, a modest inoculant budget replaces the cost of hauling, landfilling, and managing odour complaints.

Impact

The evidence spans laboratory certification, government and commercial adoption, independent replication, and youth livelihood:

- **Government adoption.** The City of Laoag purchases Eco_Protek for landfill odour management; the Municipality of Marcos uses it as the primary inoculant for its Materials Recovery Facility composting program. The City of Batac uses it for household bio-waste diversion. All three adoptions were unsolicited, arising from observed field performance.
- **Independent replication.** The Timpuyog OFW Association of Paoay replicated the method on its own using entirely different substrates — corn stalks and cow manure in place of poultry manure. Their previously underperforming composter now produces a microbe-rich soil amendment for community agriculture. This confirms the core design principle: the microbial system is the constant; the substrates are variable.

- **Waste diversion.** Bucket-fermentation pilots at two hospitality properties divert 100-200kg of food waste per day into vegetable-garden production.
- **Agronomic results.** The bio-fertilizer functions as a germination and seedling medium without the root burning associated with raw chicken manure. Eggplant reached harvest in under a month from transplanting; leafy and mixed vegetables produced healthy yields.
- **Youth livelihood.** Partnership programs include internships that give youth start-up capital for their own organic farms, plus TESDA courses for National Certification and enterprise-based skills. Four interns hosted, two funded their enterprise, hundreds trained through on-the-job training, and out-of-school youth employed across Eco_Protek-linked operations.



Members of the Timpuyog OFW Association of Paoay operating their composter with Eco_Protek and locally substituted inputs- the first independent community replication of the system.

Replication Across the Region

Three conditions make this model portable across CIRDAP member countries, and in each the difficult work is already done. The substrates are universal: poultry manure, agricultural residues, and food waste exist in every rural community in Asia and the Pacific. The knowledge base is already present: IMO culturing is practised region-wide, if inconsistently. And the institutional architecture is demonstrated rather than theoretical: a farm research unit, a technical-vocational training centre, and a commercialization enterprise, launched jointly in June 2026 as the North Circular Agri-Hub. What no community should have to repeat is the trial and error of collecting IMO and living with unpredictable results. That is what Eco_Protek resolves- consistent results, batch after batch. Eco_Protek began on a farm in Ilocos Norte. It now closes the loop between farm, household, and local government - circular agriculture, food security, and environmental resilience from a single microbial system.



Know the Innovator

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11

INDIA

Community-Based Rural Transport Connectivity Model

An Affordable and Sustainable Innovation for Rural Development

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Executive Summary

Reliable and affordable transportation is one of the key drivers of rural development. Yet, in many villages, inadequate transport services continue to limit access to schools, healthcare facilities, markets, banks, and government offices. These mobility challenges affect education, healthcare, employment opportunities, and overall quality of life.

The Community-Based Rural Transport Connectivity Model proposes a practical solution that combines shared electric mobility, community participation, and renewable energy. By placing local communities at the centre of transport management, the model creates a reliable, affordable, and environmentally sustainable system that improves rural connectivity while supporting long-term socio-economic development.

The Innovation

Many rural transport systems are either irregular, expensive, or unavailable when people need them most. This innovation addresses those challenges through a community-managed shared transport service that uses electric rickshaws, mini electric vans, or similar low-emission vehicles operating on fixed routes and at scheduled times.

The service connects villages to schools, healthcare centres, markets, banks, government offices, and nearby public transport hubs. It is managed by Village Transport Committees, which oversee routes, fares, maintenance, and daily operations, ensuring community ownership and accountability. Where suitable, solar-powered charging stations can be integrated into the system to reduce operating costs and promote clean energy.



Fig.1: Community-operated e-rickshaw service connecting villages with essential destinations

Community → Mobile App/ Booking System → Shared Electric Vehicle → Solar Charging Station → Schools/Healthcare/Markets/Banks/Public Transport

Key Features

- Affordable – Low operating and maintenance costs make the service economical for both operators and passengers.
- Community-Led – Local transport committees manage daily operations, ensuring transparency and responsiveness.
- Environmentally Friendly – Electric vehicles supported by renewable energy reduce carbon emissions.
- Inclusive – Designed to improve mobility for women, older adults, persons with disabilities, and other vulnerable groups.
- Scalable – The model can be adapted and replicated across different rural regions with minimal modifications.

Working Mechanism

The model follows a straightforward and community-centred operational approach. Shared electric vehicles operate along predefined routes connecting villages with nearby service centres. Village Transport Committees coordinate daily operations, including scheduling, maintenance, fare management, and service quality.

Rural youth are trained as drivers and maintenance personnel, creating local employment opportunities. Passenger fares support day-to-day operations, while Panchayats, SHGs, CSR initiatives, financial institutions, and government programmes can help during the initial phase. Where feasible, solar-powered charging stations reduce energy costs and support clean, sustainable transport.



Fig.2: Solar-powered charging station supporting clean and sustainable rural transport

Cost-Effectiveness

One of the major strengths in this framework is its financial sustainability. Electric vehicles require significantly lower fuel and maintenance costs than conventional vehicles, making

transportation more affordable for rural communities. Community management reduces administrative expenses while improving accountability and service efficiency. The integration of renewable energy further minimises long-term operational costs, making the model a practical and economically viable option for rural areas.

Benefits and Impact

Social Benefits

- Improves access to education, healthcare, markets, financial services, and public services.
- Enhances safe and reliable mobility for women, the elderly, and vulnerable groups.
- Promotes social inclusion and improves quality of life.

Economic Benefits

- Creates employment opportunities for local youth.
- Expands market access for farmers, artisans, and small businesses.
- Reduces travel time and transportation costs, improving rural productivity.

Environmental Benefits

- Reduces greenhouse gas emissions through the adoption of electric mobility.
- Encourages the use of renewable energy for vehicle charging.
- Supports cleaner and more sustainable rural transportation.

Future Outlook

The Community-Based Rural Transport Connectivity Model goes beyond improving transportation. It strengthens rural connectivity through affordable electric mobility, community participation, and clean energy. With local ownership and institutional support, the model can improve access to essential services, create employment opportunities, and promote inclusive and sustainable rural development.



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12

PAKISTAN

AgriConnect KOPIA

A Low-Cost ICT Advisory and Feedback Model for Certified Seed Potato Farmers in Pakistan

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Innovation at a Glance

AgriConnect KOPIA is a proposed ICT-enabled rural advisory and feedback model designed to support certified seed potato farmers through simple, low-cost and familiar communication tools. It links farmer registration, crop-stage advisory messages, WhatsApp/SMS/voice-based communication, query-response tracking and basic dashboards into one service model for continuous advisory support and institutional learning.

The innovation is connected with KOPIA Pakistan Center's certified seed potato scaling work and an MPhil Rural Development research prototype. Its purpose is to convert one-time training and project contact into continuous farmer support, practical field learning and measurable practice change.

Core idea: AgriConnect KOPIA is not an app-first solution. It is a low-cost advisory and feedback layer that connects farmers, extension actors, technical experts and project teams.

The Rural Development Problem

Pakistan's potato sector faces recurring challenges related to inconsistent seed quality, weak post-harvest handling, limited adoption of improved practices and uneven farmer access to timely technical advice. Modern seed potato technologies such as aeroponics, tissue culture and controlled multiplication systems can improve local seed systems, but their benefits depend on effective farmer outreach, trust, follow-up and practice adoption.

Certified seed potato adoption requires more than seed availability. Farmers need practical and timely guidance on seed selection, disease identification, rogueing, pest and disease management, irrigation, harvesting, grading, storage and post-harvest handling. Conventional outreach through trainings, field visits and meetings remains valuable, but it may not provide regular two-way communication throughout the crop season.

The missing middle is a structured advisory and feedback system between agricultural technology and farmer practice change.

How the Innovation Works

AgriConnect KOPIA is designed as a practical service and coordination mechanism that complements KOPIA, PARC/NARC, provincial extension departments, farmer trainers and seed multipliers. It can begin with tools already available to farmers and field teams, including WhatsApp, SMS, voice notes, Google Forms, Kobo/ODK, Excel or Google Sheets. At scale, it may evolve into a more integrated digital advisory system, including WhatsApp Business API, SMS/IVR, QR-based seed traceability and cluster-wise dashboards.

Component	Function
Farmer registry	Basic farmer profile, location, crop area, seed source, variety, sowing stage, contact details and advisory needs.
Advisory needs assessment	Identification of knowledge gaps, communication preferences, digital readiness and crop-stage information needs.
Digital advisory delivery	Seasonal recommendations through WhatsApp, SMS, voice notes, fact sheets, infographics and short videos.
Query-response and feedback	Farmer questions, photos, voice messages, field complaints and advisory requests are logged and routed.
Technical response system	KOPIA-PARC/NARC experts, extension focal persons and trained farmer trainers provide validated responses.
Dashboard and learning	Query logs, recurring issues, adoption signals and feedback summaries support monitoring, learning and planning.

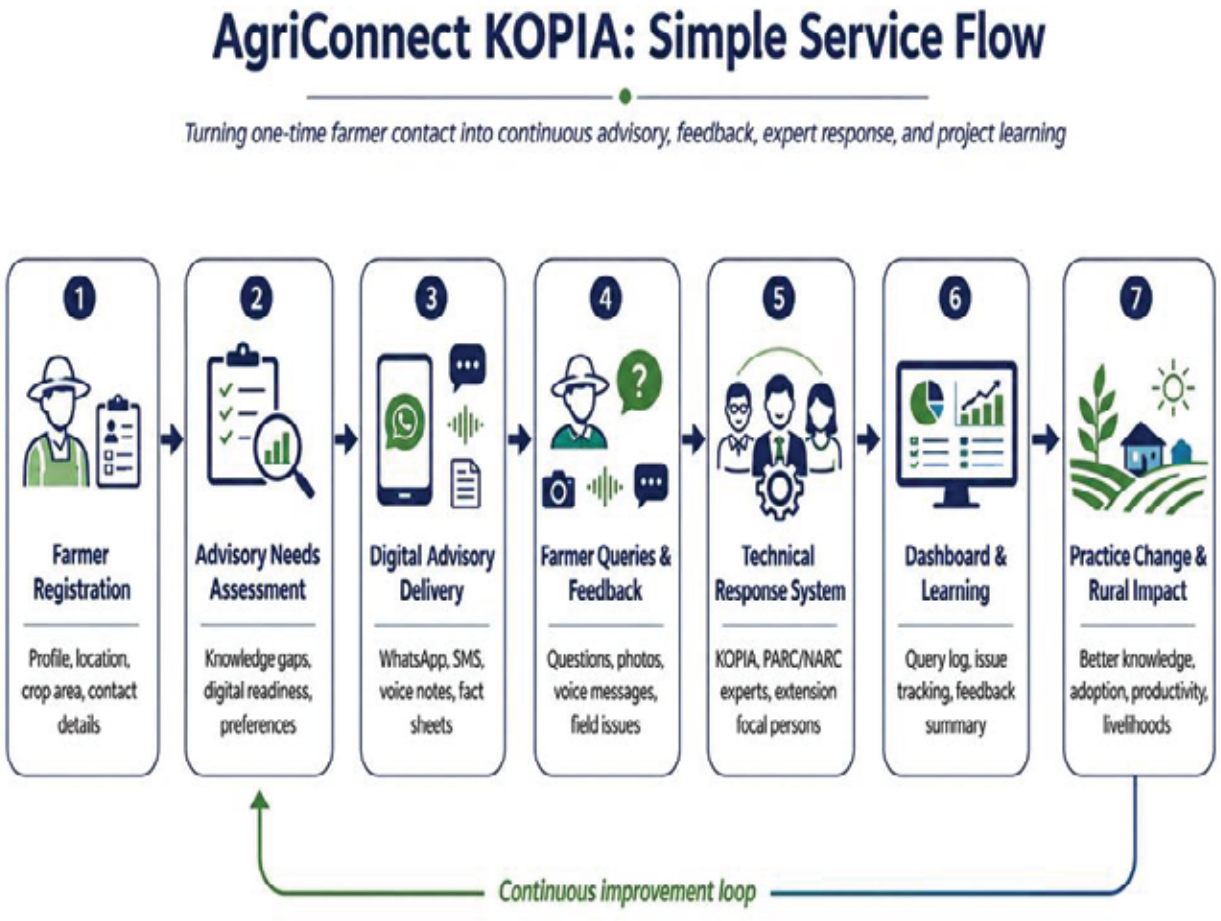


Figure 1. AgriConnect KOPIA service flow: converting one-time farmer contact into continuous advisory, feedback, expert response and project learning.

Cost-Effectiveness

The model is cost-effective because it does not require a large software platform or new institutional structure at the initial stage. It uses widely available mobile communication channels and simple data tools, while building on existing KOPIA, PARC/NARC, extension and farmer-trainer networks. This reduces start-up costs and allows the model to be tested,

improved and scaled gradually. AgriConnect KOPIA also improves the value of existing investments in training, seed production and field demonstrations. By keeping farmers connected after trainings, it helps convert project activities into continued learning, advisory response and adoption support. The same approach can later be adapted for other crops and rural technology dissemination projects.

Cost-effectiveness principle: start simple, use existing farmer communication channels, strengthen existing institutions and scale only after testing.

Expected Impact

AgriConnect KOPIA is expected to create value at four levels: farmer, project, institution and rural system. At the farmer level, the model can improve awareness of certified seed practices, strengthen knowledge of disease management, seed handling and storage, and provide faster access to trusted advisory support. At the project level, it can strengthen farmer follow-up after trainings and improve monitoring, evaluation and learning. At the institutional level, it can improve coordination between project teams, technical experts and extension actors. At the system level, it can support stronger seed systems, better adoption of recommended practices and improved rural livelihoods.

Farmer impact	Project impact	Institutional impact	System impact
Timely advice, better knowledge and stronger confidence in certified seed adoption.	Improved follow-up, issue tracking, training feedback and learning loops.	Stronger KOPIA-PARC/NARC-extension coordination and expert response.	Better adoption, productivity, crop quality and replicable rural advisory practice.

Scale-Up and Replicability

The innovation can be tested through an MPhil Rural Development prototype and then scaled through KOPIA Pakistan's certified seed potato outreach pathway. A practical scale-up sequence would begin with a small WhatsApp-based prototype, move to a controlled cluster pilot, and then support wider KOPIA-2 outreach through farmer registries, advisory calendars, query-response systems and dashboards.

Level 1: MPhil prototype - around 30 farmers over 6-8 weeks, subject to institutional permission.

Level 2: Controlled cluster pilot - 100-300 farmers with structured registry, advisory calendar and feedback dashboard.

Level 3: KOPIA-2 scale - 5,000-6,000 farmers through hub clusters, ToT/master trainers and extension support.

Level 4: KOPIA Pakistan Center scale - adaptation for seed potato, fodder, livestock and training feedback.

Level 5: Regional learning toolkit - a replicable advisory and feedback model for other KOPIA and CIRDAP contexts.



Photo 1: Protected seed potato production facilities supported under Pakistan-Korea agricultural cooperation at KOPIA Pakistan Center, NARC, Islamabad.



Photo 2: Farmer advisory and training activities can be strengthened through AgriConnect KOPIA's ICT-enabled advisory and feedback model.



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13

INDONESIA

DOI GAMPANG

A Low-Cost Digital Transformation for Rural Circular Economy

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The Innovation

The 'Doi Gampang' (Easy Money) innovation proves that digital inclusivity in rural areas does not necessarily require high-cost application infrastructure or advanced network systems. By utilizing a Minimum Viable Product (MVP) scheme based on WhatsApp Business and Google Sheets combined with facilitation by Youth Digital Ambassadors, this USD 100 initiative successfully connects local micro-supply with village demand, driving internal cash flow circulation in an inclusive and sustainable manner. In many rural areas across the Asia-Pacific region, particularly in Eastern Indonesia such as East Nusa Tenggara (NTT), limited advanced telecommunications infrastructure and low digital literacy rates often present major barriers to adopting conventional financial technology and e-commerce solutions.

Most rural households- including housewives, smallholder farmers, and artisans- possess active local economic potential, ranging from farm produce and home-cooked culinary items to carpentry services. However, this potential remains isolated due to the lack of an efficient connecting medium at the local level. The significance of the 'Doi Gampang' innovation lies in its breakthrough digital development paradigm: democratizing market access without waiting for tens of thousands of dollars in infrastructure investment. 'Doi Gampang' (meaning 'Easy Money' in the local dialect) demonstrates that rural digital transformation can begin instantly, inclusively, and at a very low cost by optimizing technologies already familiar to the community and leveraging the social capital of local youth.

2. How the Innovation Works: Low-Cost "WhatsApp Hub" Model

The 'Doi Gampang' innovation operates through a combined ecosystem of affordable technology and human-cantered facilitation. The approach utilizes a Minimum Viable Product (MVP) with the following operational architecture:

- **Lightweight Infrastructure (WhatsApp Business & Google Sheets):** Avoids the development of expensive and complex custom Android/iOS applications. The village product and service catalogue is managed centrally within the WhatsApp Business Catalogue feature and recorded in real-time on Google Sheets as the transaction database.
- **Role of Youth Digital Ambassadors (Human Interface):** In the pilot village of Oelamasi, five tech-savvy local youths were recruited and trained as 'Digital Ambassadors'. They proactively visit residents' homes (housewives making food, farmers, carpenters), take product/service photos, establish price descriptions, and register them into the system. The youth act as a 'walking application' that bridges the digital literacy gap for senior citizens.
- **Purchasing & Village Logistics Mechanism:** Neighbours or villagers needing products/services simply place an order through a single central number (WhatsApp Hub). The Digital Ambassador confirms the order, connects the buyer with the provider, and facilitates direct local delivery within the village neighbourhood.

3. Cost-Effectiveness

One of the key strengths of 'Doi Gampang' highly relevant to practitioners and policymakers in the Asia-Pacific region is its extreme cost efficiency. With a total pilot budget of USD 100 (approximately IDR 1.5 million), the program yields direct economic impact without overhead waste. The budget allocation is precisely designed as follows:

Activity Component	Budget Allocation	Operational & Strategic Purpose
Local Branding & Physical Presence	USD 30 (30%)	Printing high-visibility banners and QR Code stickers at kiosks/community halls to ensure residents know the village is 'digitally open'.
Youth Digital Ambassador Incentives	USD 40 (40%)	Internet data packages and transportation allowances for 5 youth mapping MSMEs and assisting less digitally literate residents.
Initial Transaction Stimulus	USD 20 (20%)	'Cashback' or shipping subsidies for the first 40 transactions to lower transaction barriers between neighbours.
Administration & Documentation	USD 10 (10%)	Printing 'Income Trackers' for families and documenting Proof of Concept (PoC) for investors/government.

4. Measurable Impact & Sustainability

Within the first 30-day pilot period, the USD 100 capital generated a significant multiplier effect on the rural ecosystem:

Digitalization of Micro-Enterprises: Digitalized at least 20 local micro-enterprises (such as 'Sambal Mama', handwoven textiles, agricultural products, and woodworking services).

Transaction Activation & Cash Flow Circulation: Facilitated over 50 initial local transactions. Direct cash/digital payments reached housewives and household heads without burdensome platform commission deductions.

Youth Empowerment & Social Inclusion: Created a new productive role for village youth as digital facilitators receiving performance-based incentives, while strengthening neighborly solidarity within the circular economy.

Scalability & Sustainability: The structured 'Income Tracker' sheet and transaction data on Google Sheets serve as a credible Proof of Concept (PoC) to replicate this model across other villages and attract government grants or village fund investments.

5. Conclusion & Policy Recommendations

The 'Doi Gampang' innovation offers valuable lessons for policymakers and rural development practitioners across the Asia and Pacific region: Micro-scale digital transformation does not always require massive funding or complex software solutions. By leveraging existing communication ecosystems (WhatsApp) and empowering local youth social capital, a modest budget of USD 100 can ignite an inclusive, measurable, and scalable rural circular economy ready for replication in diverse developing rural regions.



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Wokha District Entrepreneurship Task Force

A Zero-Additional-Cost, One-Stop Convergence Model for Rural Entrepreneurship

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1. The Challenge: A Region Rich in Potential, Poor in Access

Wokha District, home to the Lotha Naga tribal community in the hills of Nagaland, Northeast India, has long possessed entrepreneurial energy that the system could not convert into enterprise. Before August 2022, not a single commercial bank had sanctioned an MSME business loan in the district. Twenty-two government schemes ran in parallel silos, forcing an entrepreneur to visit ten or more offices merely to be heard. Skill-training programmes existed in isolation from credit and markets, so trainees graduated into unemployment rather than enterprise. The Lotha Naga Village Councils, the community's traditional and trusted governance institutions, were bypassed by top-down delivery models, and remote villagers had no reliable way to even learn which schemes existed. The result was a credit desert and an opportunity vacuum in one of India's most promising, least-served tribal economies.

2. The Innovation: One Roof, Fourteen Institutions, Zero New Budget

On 18 August 2022, the Wokha District Administration constituted the District Entrepreneurship Task Force, popularly known by its Lotha name *'Shihsoi Oshom'*- Friend of Business. Rather than asking entrepreneurs to navigate the government, the ETF reorganised the government around the entrepreneur. Fourteen-plus institutions- nationalised and cooperative banks, line departments, NABARD, NGOs and research bodies such as ICAR-KVK- were brought under a single nodal officer and a shared monthly review calendar.

The Task Force delivers five integrated services under one roof:

- ***Free preparation of Detailed Project Reports*** and active bank liaison, which unlocked eleven credit schemes and brought MSME lending to Wokha for the first time;
- ***Skills and incubation*** in agriculture, weaving, fisheries, IT and food processing, with post-training handholding so certificates convert into livelihoods;
- ***Market linkages*** through TRIFED, NERAMAC and the Weavers' Service Centres that carry Lotha tribal produce to national buyers;
- ***Deliberate embedding of Village Councils*** and VDB Secretaries so indigenous governance owns the process rather than being sidelined by it; and
- ***Free project formulation***, trade licensing and chartered-accountant support that strip out the transaction costs which once made entrepreneurship the preserve of the well-connected.

3. Cost-Effectiveness: Innovation Without a Rupee of New Spending

The ETF's defining feature is that it required no new budget line. Its entire cost is the redirection of existing staff time, existing scheme funds and existing institutional mandates toward a shared, entrepreneur-centred purpose- political will and coordination substituting for capital expenditure. Because credit, training and market access were already funded through their respective schemes, the ETF's marginal cost was the time it took a Deputy Commissioner-led Task Force to meet monthly and hold departments accountable to a common outcome. This is

precisely what makes the model replicable. The Nagaland Chief Secretary evaluated the model as replicable in any district within eight weeks, with no new financial sanction required.



MLA, Y. Mhonbemo Humtsoe and DC Wokha with department officials and others during the skill training programme held at Humtso village, Wokha on 5th September 2023. (DPRO Wokha)

Skill Development Training programme with the DC Wokha and department officials

4. Impact: Three and a Half Years of Documented Change

In Year 1 alone (September 2022 – August 2023), the ETF unlocked ₹5.13 crore in credit for 393 entrepreneurs, trained 1,980 people, benefited 4,028 entrepreneurs and youth, and created 2,249 market linkages across 17 new sectors and organisations- figures independently documented by the District Administration. Sustained at the same pace of growth, cumulative reach by May 2026 exceeds ₹26 crore in credit to over 1,900 entrepreneurs, 19,000-plus rural lives touched, 9,600-plus people skilled, and 10,000-plus market linkages, across 28-plus converged government schemes.

Indicator	Year 1 Documented	Cumulative (May 2026)
Credit unlocked	₹5.13 Cr (393 recipients)	₹26 Cr+ (1,900+ recipients)
Entrepreneurs and youths benefited	4,028	19,000+
Skill-training recipients	1,980	9,600+
Market linkages created	2,249	10,000+
Govt. schemes converged	22	28+

First-of-their-kind enterprises seeded through the ETF include Wokha's first fish-processing unit and organic mini tea factory, the only hydroponics unit in Nagaland, the Wokha Organic Ginger Producer Company Ltd., seven new Farmer Producer Organisations, and a Common Facility Centre for Weaving serving 700-plus artisans. Women were central to this transformation: dedicated programmes in handloom weaving, Jacquard weaving with capital

linkage, and food processing certified under the National Skills Qualification Framework made women primary drivers rather than passive beneficiaries of Wokha's new enterprise economy.

5. Recognition and the Case for Regional Replication

The ETF's 'One-Stop Centre Model of Assistance to Rural Business/Entrepreneurs' was selected by the Centre for Innovations in Public Systems (CIPS), Administrative Staff College of India, for the CIPS Innovation Award- Rural Development Category, presented by the Hon'ble Chief Minister of Meghalaya at Shillong on 19 January 2024. The Chief Secretary, Government of Nagaland, subsequently directed its replication across all districts of the state. Because the model rests on coordination rather than capital, it is designed for adoption anywhere: any district administration with the will to make its agencies serve the entrepreneur, rather than their own scheme targets, can stand up an equivalent Task Force within eight weeks and, in time, achieve comparable gains against SDG 1 (No Poverty), SDG 5 (Gender Equality), SDG 8 (Decent Work) and SDG 17 (Partnerships).



The Wokha District ETF receiving the CIPS Innovation Award



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15

NEPAL

Digital Agri-Connect Nepal (DAC-Nepal)

A Low-Cost Digital Innovation for Inclusive, Climate-Smart and Market-Linked Rural Livelihoods

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1. Background and Problem Statement

Rural communities in Nepal continue to face low agricultural productivity, limited access to timely extension services, weak market linkages, climate vulnerability, and youth out-migration. Although mobile technology is increasingly available, many smallholder farmers, particularly women and marginal farmers, still lack localized, actionable, and affordable agricultural information. Traditional extension systems are overstretched, while information asymmetry in agricultural markets can reduce farm incomes and discourage innovation. DAC-Nepal responds to this gap by connecting farmers with agricultural advisory services, market information, climate information, and local support through a low-cost, community-based digital model.

2. The Innovation and How It Works

Digital Agri-Connect Nepal (DAC-Nepal) is a hybrid digital rural extension and market-linkage platform that integrates mobile-based advisory services, community digital facilitators, and local market intelligence. The model uses simple tools, SMS, Interactive Voice Response (IVR), and WhatsApp, together with trained local youth known as "Digital Agri-Sathis." These facilitators help farmers access and understand digital information and strengthen last-mile delivery. Partnerships with cooperatives and local governments provide an institutional channel for implementation and adaptation to local agro-ecological and socio-economic conditions.

The advisory component provides voice and text-based information in local languages on crop management, livestock care, climate risks, and nutrition-sensitive agriculture, allowing the service to reach farmers using basic mobile phones. The market intelligence component provides information on farm-gate prices, buyer contacts, demand, and collective marketing opportunities through cooperatives. Climate-smart features include weather alerts and recommendations for climate-resilient farming, with emphasis on prevention, preparedness, and sustainable production. The model also prioritizes women farmers, marginal households, remote communities, and unemployed rural youth.

3. Novelty and Significance

The key innovation is not dependence on sophisticated or expensive technology, but the integration of accessible digital channels with trusted local human resources and existing rural institutions. Digital Agri-Sathis provide a bridge between farmers and digital services, helping overcome digital-literacy and last-mile barriers. At the same time, market information is combined with advisory support so that farmers can make production decisions with greater awareness of both climate risks and market opportunities. The approach is therefore designed to be low-cost, locally driven, inclusive, and adaptable to different crops, languages, and rural contexts.

4. Demonstrated Results and Rural Development Impact

The pilot evidence reported for DAC-Nepal indicates substantial improvements in access to agricultural advisory services. Access increased from 25% of farmers at baseline to 85% after intervention. Farmers reported that voice and text advisories in local languages supported better crop and livestock management decisions. Through informed decision-making and collective purchasing facilitated by Digital Agri-Sathis, seed, fertilizer, and feed costs were reported to decline by 15-20% while maintaining or improving yields. In one Madhesh case, 12 farmers pooled resources to purchase quality seed and reduced costs by NPR 12,000 compared with individual purchases, while achieving better germination rates.

Market-linkage activities were associated with average farm-gate price increases of 10-15% for vegetables and grains. Farmers were able to negotiate more directly with buyers using market information and aggregation. One reported farmer experience in Madhesh involved selling tomatoes at NPR 50 per kg rather than the usual NPR 35 after receiving market alerts. Youth engagement is another important outcome: 15 rural youth were engaged as Digital Agri-Sathis, receiving training in digital skills, advisory interpretation, and market facilitation. The pilot reports a 40% reduction in seasonal migration among participating youth. One case describes a 22-year-old Digital Agri-Sathi in Karnali supporting 40 farmers while earning a steady local income.

The reported monitoring approach combines SMS/IVR logs, market-price tracking, farmer interviews, and case studies. Together, these results demonstrate the potential of a digitally enabled but community-anchored model to improve access to services, reduce selected farm costs, strengthen market participation, create rural employment, and support climate resilience.

5. Cost-Effectiveness, Sustainability and Scalability

DAC-Nepal is designed around basic mobile technology, local human resources, and existing institutions such as cooperatives and extension offices. This reduces dependence on costly physical infrastructure and creates opportunities to integrate the model into established rural service systems. Its content can be adapted to local crops and languages, while Digital Agri-Sathis provide a flexible mechanism for continued community-level support. These characteristics make the model potentially cost-effective and suitable for replication in diverse rural settings.

The pilot is designed for selected rural municipalities in Madhesh and Karnali Province, representing relatively accessible Terai areas and remote hill communities. Lessons from these settings can inform expansion to other provinces of Nepal. The same principles can also be adapted across CIRDAP Member Countries where farmers face similar challenges related to information access, climate risk, market asymmetry, and rural employment. Replication would require localization of language, crops, market information, institutional partnerships, and implementation arrangements.

6. Contribution to Rural Development

DAC-Nepal directly addresses multiple rural development challenges: rural poverty and livelihood insecurity through improved advisory, market, and employment opportunities; poor access to services through basic mobile technology and local facilitators; climate vulnerability through weather alerts and climate-smart recommendations; and youth unemployment and migration through paid local roles and digital-skills development. By strengthening the connection among farmers, service providers, cooperatives, markets, and local governments, the innovation supports more inclusive and resilient rural livelihoods.

The innovation also has potential institutional value. Evidence and lessons generated through implementation can inform efforts to strengthen and institutionalize digital agricultural extension services. Its combination of simple technology, local ownership, and existing institutional partnerships provides a practical pathway for reaching underserved rural communities without requiring highly sophisticated digital infrastructure.

7. Conclusion

Digital Agri-Connect Nepal demonstrates how simple, low-cost digital technology can be combined with empowered local youth, inclusive outreach, and existing rural institutions to improve agricultural and livelihood outcomes. The reported pilot results, higher access to advisory services, lower selected input costs, improved farm-gate prices, and increased youth engagement, illustrate the potential of the model to contribute to inclusive, climate-resilient, and market-linked rural development. With further support and learning, DAC-Nepal can be scaled across Nepal and adapted to other CIRDAP Member Countries, while generating practical evidence for strengthening digital agricultural extension and rural livelihood systems.



Figure 1: Harvesting Cucumber from the field



Figure 2: Preparing Nutrient Application Pits



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THAILAND

Community-Based Fisheries Lifestyle Tourism

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The Innovation

Community-Based Fisheries Lifestyle Tourism is not just organizing a trip to sit on a boat and view the sea scenery, but it is Experiential Tourism that provides an opportunity for tourists to truly experience and be a part of the local fishermen's way of life. This is done through staying together with local people (Homestay), learning local wisdom such as reading wind directions, going out on a boat to catch squid and fish using environmentally friendly tools, and cooking local food together using the sourced ingredients. This type of tourism emphasizes building bonds and cultural exchange, cantered around the abundance of the sea.

Main activities include 1) Learning to make nets, trap crabs, or raise aquatic animals. 2) Going out on a boat to catch fish with local fishermen. 3) Cooking/tasting local seafood from fresh ingredients in the community. 4) Staying in a homestay in the fishing village. 5) Studying the culture, traditions, and beliefs of the coastal community. and 6) Learning about the conservation of coastal and marine ecosystems.

Benefits and Positive Impacts of Community-Based Fisheries Lifestyle Tourism

The key characteristic of this Community-Based Tourism is emphasizing real experiences rather than just tourism for entertainment, which helps generate income directly for the local community, reduces the problem of migration to find work in the city, and promotes the conservation of natural resources by the users and traditional ways. Driving this tourism model creates benefits in 3 main dimensions:

Economic Dimension: Income distribution to rural communities and secondary cities. Normally, tourism industry revenue is often concentrated in major cities or with large operators. However, this community lifestyle tourism is a mechanism that draws cash flow directly into the pockets of local people. Whether it's accommodation fees, boat rental fees, food costs, or income from selling the community's processed products, it stimulates local employment and the Grassroots Economy in secondary cities that may not have grand man-made attractions but possess strong lifestyle and cultural capital.

Social Dimension: Reducing migration to large cities. When the community can generate a stable and sufficient income from using resources in their hometown, the working-age population and the younger generation do not need to leave their homes to sell their labor in large cities. This helps solve structural problems at the community level, allowing families to stay together and reducing the problem of Skip-Generation families (the elderly living with children). Furthermore, it provides an opportunity for the younger generation to bring back knowledge, technology, and new ideas to manage their family's tourism business, making it grow and become more systematic.

Environmental Dimension: Transforming resource users into nature protectors. This is the most sustainable and powerful resource management mechanism. When the community's income and quality of life are tied to the abundance of the ecosystem (if the sea is degraded and there are no fish, tourists won't come), fishermen will shift their roles from aiming to extract the most marine resources to caring for nature with a sense of ownership. The

community will automatically begin to establish shared social rules, such as refraining from catching aquatic animals during the spawning season, stopping the use of destructive fishing gear, managing plastic waste by banning single-use plastics in the community area, and jointly restoring aquatic nurseries. This is because they realize that nature is not just a source of daily sustenance, but life capital that must be preserved to pass on this wealth to future generations sustainably.

Moving towards Low-Carbon Community-Based Fisheries Lifestyle Tourism

Chumphon province of Thailand serves as a highly potential target area for this business model. As a distinctive secondary city, it boasts the rich marine resources of the Gulf of Thailand while perfectly preserving the traditional local fishermen's way of life. Designating Chumphon as a pilot area will help materialize this model by systematically integrating economic and environmental management dimensions. This begins with transitioning to a low-carbon tourism model that aligns with the green standards of the Thailand Taxonomy, thereby establishing a clear stance on mitigating climate change impacts and enhancing opportunities to access future funding sources.

Furthermore, the model emphasizes the practical application of basic Measurement, Reporting, and Verification (MRV) systems. By tracking metrics such as fishing boat fuel consumption, waste reduction, and the carbon footprint of each meal, the community can create compelling storytelling that demonstrates the tangible environmental value of a tourist's visit. Concurrently, socio-economic impacts will be evaluated using productivity indicators to assess the value added to fishery products compared to traditional wholesale fish markets. Finally, collecting empirical data—such as youth employment statistics and the number of fishermen's descendants returning to develop their hometowns—will provide concrete evidence of the project's success in sustainably reducing urban migration.

"Community-Based Fisheries Lifestyle Tourism is more than just a new travel trend;
it is a crucial tool for development.
It concretely and sustainably integrates the enhancement of local communities' quality of life
with the conservation of natural resources and the environment."





Business Model Canvas (BMC) for Community-Based Fisheries Lifestyle Tourism

HOW

8. Key Partners

- **Community Network:** Swap boat queues, emergency help, and share ingredients.
- **Local Transport Providers:** Vans for transferring tourists.
- **Government/Local Orgs:** Licenses, promotion, waste management.

6. Key Activities

- Accommodation
- Boat Trip Management
- Food Management
- Training & Learning program
- Marketing & Booking

7. Key Resources

- **Human:** Boat captains, cooks, safety assistants.
- **Physical:** Homestays, safe boats, first aid, fishing gear.
- **Intellectual:** Local knowledge of seasons and spots.

WHAT

1. Value Proposition

- **Ocean-to-Table:** Fresh self-caught seafood & local cooking.
- **Authentic Lifestyle:** Escaping the city for a slow life.
- **Immersive Learning:** Reading wind, squid catching, conservation.
- **Regenerative Tourism:** Restoring ecosystem (releasing fry, planting mangroves, building reefs).
- **Low-Carbon Experience:** Managing and reducing footprint.

WHO

4. Customer Relationships

- **Family-like Hospitality:** Friendly, warm, close guidance.
- **Community Building:** Social media for updates, festivals, and pre-orders.

3. Channels

- **Social Media:** Reels/TikTok (Visual marketing of atmosphere).
- **OTAs:** Airbnb (Experiences), Agoda, Booking.com.
- **Travel Reviews:** Community/Food Bloggers and Vloggers.

2. Customer Segments

- **Urban Escapees:** Stressed workers wanting a slow life.
- **Cultural Explorers:** Foreigners wanting authentic local culture.
- **Families:** Parents seeking outside-classroom nature learning.
- **Foodies/Seafood Lovers:** Craving fresh ingredients from the source.

MONEY

9. Cost Structure

- **Fixed Costs:** Maintenance (boats/houses), tourist accident insurance, license fees.
- **Variable Costs:** Boat fuel, food ingredients, water/electricity, community revenue sharing, online marketing.

5. Revenue Streams

- **Main Revenue:** Selling packages (Accommodation + Boat + Meals +Workshop) per head/night.
- **Supplementary:** Community souvenirs (dried seafood), transfers, extra food/drinks/workshops/activities outside package.



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SRI LANKA

EcoKola:

A Community-Managed, Home-Based Banana Leaf Eco-Packaging Network

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Abstract

EcoKola is a community-driven rural innovation designed to transform locally available banana leaves into value-added, environmentally friendly food-packaging products while creating income opportunities for rural women and youth. The model combines home-based production with a decentralized network of rural helpers and community coordinators. Rather than concentrating production in a single factory, EcoKola distributes production and operational responsibilities among rural households, enabling communities to participate directly in production, quality control, packaging, order fulfilment and income generation. The initiative addresses three interconnected challenges: limited livelihood opportunities for rural communities, continued dependence on single-use plastic food packaging, and the underutilisation of locally available banana leaves. EcoKola proposes a scalable community-based model in which rural people can convert an abundant local resource into a marketable product while retaining economic activity within their villages.The proposed development pathway begins with a pilot network and progressively expands toward national coverage and export readiness. The long-term vision is to demonstrate that rural communities, when organised and supported through an appropriate decentralised model, can develop sustainable businesses using resources available within their own communities.

1. The Rural Challenge

Many rural communities face limited opportunities for stable income generation, particularly for women and young people. This can contribute to migration away from villages in search of employment. At the same time, single-use plastic packaging remains an environmental concern, while naturally available banana leaves are often underutilised. EcoKola seeks to address these challenges through one integrated approach: turning a locally available biological resource into an income-generating rural enterprise while providing an alternative to plastic food packaging. The concept is intentionally designed around rural participation rather than a centralised industrial production model. The objective is not simply to manufacture an environmentally friendly product, but to create an ecosystem in which rural households become active participants in production and value creation.

2. The Innovation- Eco-Kola

The central innovation of EcoKola is its fully community-managed, home-based production network. Rural helpers—primarily women and youth—produce steamed banana-leaf lunch sheets within their own homes using locally available banana leaves. Community coordinators provide training, support and monitoring at the local level.

The proposed system distributes key activities across the community. These include:

- Recruitment and training of rural producers
- Production within participating homes
- Allocation and management of orders
- Individual quality inspection
- Packaging

- Courier coordination
- Customer connection and promotion
- Payment coordination

Every bundle is intended to undergo individual quality checking before dispatch. This decentralised human network allows EcoKola to combine the flexibility of home-based production with coordinated quality management and market access. EcoKola is therefore designed not merely as a banana-leaf product, but as a people-to-people rural empowerment ecosystem in which community members collectively participate in creating and managing economic value.

3. Empowering Rural Women and Youth

A central objective of EcoKola is to create dignified, home-based economic opportunities for rural women and youth. The model is designed so that participants do not need to leave their communities in order to become economically active. Instead, production can take place within existing rural households, while coordination and market access are organised through the wider community network. The original implementation vision begins with 50 rural helpers across 10 districts, followed by progressive expansion to approximately 200 or more active helpers during the first six months. By the end of the proposed 12-month period, the vision is to have more than 300 rural participants actively involved in the network.The intended outcome is therefore broader than individual employment. EcoKola aims to create interconnected village-level production communities in which participants support one another and collectively contribute to a sustainable rural enterprise.

4. Environmental and Economic Value

EcoKola seeks to create environmental value by replacing a portion of single-use plastic food packaging with banana-leaf-based alternatives. At the same time, it seeks to create economic value by using a locally available resource that may otherwise remain underutilised. This combination is central to the innovation: an environmental solution becomes a mechanism for rural livelihood creation. The project proposes that sales revenue should contribute to continued network expansion and coordinator payments, allowing the system to develop through its own commercial activity rather than relying entirely on external funding. The proposal also envisions zero capital requirements for individual rural helpers.

5. From Village Production to Export Readiness

EcoKola is designed with scalability in mind. The proposed 12-month pathway begins with a controlled pilot, followed by stabilisation, national expansion and preparation for international markets:

Month 1 (Foundation and Pilot Launch): Recruit and train the initial 50 helpers across 10 districts and begin pilot production.

Months 2–3 (Early Growth and Stabilisation): Expand to approximately 100 active helpers and begin supermarket shelf placement while strengthening district coordination.

Months 4–6 (National Expansion): Expand toward all 25 districts, grow beyond 200 active helpers, and complete the proposed EDB registration and certification process.

Months 7–12 (Export Readiness): Prepare for international trial shipments, strengthen export-quality processes and establish EcoKola Village Clusters. The original proposal identifies the UAE, Europe and USA as potential target markets.

The purpose of this staged approach is to allow the community network to develop progressively rather than attempting immediate large-scale expansion.

6. Sustainability and Scalability

The EcoKola model is intended to be community-owned and community-managed. Its sustainability principle is simple: production creates income; income supports continued operation and expansion; and successful village clusters create the foundation for further growth. The decentralised structure also creates the possibility of replicating the model beyond Sri Lanka. The proposal specifically identifies the potential for adaptation within other CIRDAP member countries. By combining locally available resources, home-based production, community coordination and access to wider markets, EcoKola aims to demonstrate that rural development does not necessarily require communities to abandon their villages in search of economic opportunity.

7. Vision

The ultimate vision of EcoKola is to transform rural homes into productive economic units and rural communities into coordinated, sustainable production networks. By the end of the proposed first year, the initiative aims to be export-ready, with initial international trial shipments completed and more than 300 rural people participating in the network. EcoKola therefore represents a simple but ambitious proposition: When rural communities are trusted, organised and connected to markets, locally available resources can become the foundation for sustainable livelihoods.

8. Conclusion

EcoKola is a community-driven approach to rural development that connects environmental responsibility with livelihood creation. It seeks to transform banana leaves into value-added eco-packaging while simultaneously transforming rural households into participants in a coordinated economic network. Its core principle is that rural development should not only bring solutions to villages; it should enable communities to create solutions from within their own villages. Through community ownership, home-based production, rural women and youth participation, decentralised coordination and progressive market expansion, EcoKola aims to demonstrate a scalable pathway from local resource, to rural livelihood, to community enterprise, to international market readiness.



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PAKISTAN

Bee Circle Rural Bioeconomy Model (BRBM)

An Integrated Beekeeping-Based Bioeconomy Engine for Income Generation, Climate Resilience, and Sustainable Agriculture

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1. Innovation Overview

The Bee Circle Rural Bioeconomy Model (BRBM) is a transformative rural development framework that converts traditional beekeeping into a multi-sector economic engine. Rather than treating apiculture solely as an isolated source of raw honey, BRBM establishes decentralized community "Bee Circle Hubs". These hubs integrate high-value nutraceutical production (bee bread, propolis, royal jelly, wax products), systematic crop pollination services, natural bio-protective agricultural inputs, and digital productivity tracking via a mobile platform called "Bee Ledger". Designed specifically for rural landscapes across Pakistan and the broader Asia-Pacific region, BRBM addresses low crop yields, climate vulnerability, chemical dependency, rural poverty, and limited economic roles for women and youth. It turns bees into a fundamental resource for sustainable agriculture, household income, and environmental resilience.

2. Importance and Regional Relevance

Developing rural economies across Asia and the Pacific face a matrix of interconnected structural vulnerabilities:

- Pollinator Decline & Low Agricultural Productivity: Intensive chemical farming has severely depleted wild pollinators, leading to suboptimal crop yields for smallholder farmers.
- Limited Livelihoods for Women and Youth: Rural women and young people frequently lack localized, low-capital enterprise opportunities, fueling rural-to-urban migration.
- Ecological Degradation: Over-reliance on synthetic pesticides harms soil micro-ecosystems and reduces community resilience against climate shocks.
- Malnutrition: Vulnerable populations often lack access to natural functional foods and micronutrient-dense nutrition.

3. Why BRBM Matters

BRBM bridges these gaps by utilizing bees as an entry point for an all-inclusive bioeconomy. By moving beyond simple honey extraction into complex value-added goods and formal crop pollination services, the model generates multiple revenue streams from a single low-cost intervention. It directly aligns with regional goals for poverty reduction, food security, biodiversity restoration, and gender-inclusive economic growth.

4. How It Works (Technical & Operational Mechanism)

The Bee Circle Model operates across four synchronized pillars:

Core Pillars:

a. Bee-Based Nutritional Economy: Community members are trained to harvest and process value-added, nutrient-dense products including bee bread (a potent functional food), raw honey, medicinal-grade propolis extracts, and natural wax cosmetics/balms.

b. Agricultural Enhancement System: Managed hive placement is integrated directly into regional cropping patterns. Honeybees provide targeted pollination services that naturally boost crop yields while supporting the formulation of natural bee-derived protective inputs.

c. Rural Micro-Enterprise & Cooperative Network: Establishing village-level processing and packaging units owned by rural women and youth cooperatives, ensuring localized profit retention.

d. Digital Bee Ledger System: A lightweight mobile platform used by hive keepers to record colony health, track honey/bee-bread yields, record household earnings, and connect directly with urban buyers.

5. Cost-Effectiveness & Sustainability

BRBM is engineered to deliver high economic returns with low initial capital outlays, making it ideal for resource-constrained rural settings.

5.1 Financial & Operational Comparison

Parameter	Traditional Apiculture	Bee Circle Model (BRBM)
Output Range	Raw Honey Only	Honey, Bee Bread, Propolis, Wax, Pollination Services, Bioproducts
Target Revenue Streams	Single Stream (Unpredictable)	Multiple Diversified Streams
Agricultural Impact	Passive / Unmonitored	30–60% Increase in Crop Yield via Managed Pollination
Inclusivity	Male-dominated field labor	Women/Youth-led processing & value addition
Impact Monitoring	Paper / non-existent	Digital "Bee Ledger" Mobile Tracking System

5.2 Sustainability Strategy:

- Community Ownership: Bee Circle Hubs transition into self-sustaining cooperatives managed by trained community members.
- Reinvestment Mechanism: A percentage of sales revenue is funnelled into a local community pool to maintain equipment, acquire additional colonies, and expand capacity.
- Replicability: Built strictly on locally available bio-resources and modular equipment, enabling effortless adaptation across diverse Asia-Pacific ecological zones.

6. Impact and Measurable Results

The pilot framework delivers verifiable socio-economic and environmental impacts:

- Economic Growth: Yields a 2–5x increase in participating household incomes through the high market value of processed bee bread and propolis products.
- Agricultural Productivity: Enhances crop fruit set and seed production by 30–60%, improving rural food supply without synthetic additions.
- Social Empowerment: Directly engages women and youth as processing hub owners, co-op managers, and digital ledger operators, boosting gender inclusion.
- Ecological Restoration: Enhances ecosystem biodiversity, restores natural pollinator numbers, and incentivizes farmers to reduce toxic chemical pesticide usage.



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INDIA

The Chinmaya Rural Action Network (C-RAN)

A Mechanism through which a University Serves Its Neighbourhoods

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The Innovation

Universities are expected to make a continuous and consistent positive impact on the very society in which they are situated. Chinmaya Vishwavidyapeeth (CVV)- a deemed to be university- located in the State of Kerala, India offers programs rooted in Indian knowledge systems. Its rural location is not incidental, but reflects the institution's *gurukula* inspired belief that community is integral to education. Yet CVV has had no structured way of engaging with the villages around it which are predominantly agrarian. Despite CVV's presence in this landscape for years, there has been no sustained mechanism for engagement, creating a paradox where a university that teaches service and social responsibility remains, in practical terms, disconnected from the society at its doorstep.

The CHINMAYA Rural Action Network or C-RAN, is a structured response to this felt gap. It is a student volunteer organisation that also draws in faculty and non-teaching staffs, designed as a standing institutional body with defined leadership, thematic focus areas and formal government partnerships. Guided by the Chinmaya Mission's principle of giving maximum happiness to maximum people for maximum time, C-RAN moves beyond one-time charity towards long-term engagement, building trust between CVV and its neighbours. Through this, students gain practical service experience while residents gain reliable support, allowing C-RAN to function as both a student development initiative and a rural development mechanism.

The Operational Mechanism

A formally constituted organisation offers real advantages over informal student activity. C-RAN builds institutional ownership, so continuity does not depend on individual faculty members. It carries relationships and knowledge forward across academic batches instead of restarting each year. Volunteers, in turn, receive professional training through government agencies and other relevant partners. The result is both documented and measurable impact that can be reported to accreditation bodies and international partners. And it helps develop holistic graduates shaped by lived experience of service and empathy.

The vision is for CVV to become a living laboratory of compassionate action, where academic wisdom meets rural reality to build self-reliant communities. This vision positions the university not merely as a centre of learning but as an active participant in the social and economic well-being of the region it calls home. Its mission is to harness the intellectual and human resources of CVV to provide sustained and multi-dimensional support to rural communities through trained student volunteers guided by faculty mentors. This work is carried out in partnership with government agencies and civil society, ensuring that engagement is credible and built to last well beyond any single academic year.

The governance mechanism flows from a Patron (either the Vice Chancellor or Registrar) through an Advisory Council that includes representatives from the partner organizations, and government

liaison officers. At operational level there will be a Programme Director, an Administrative Committee drawing faculty from each school along with ward councillors, and a Student Executive Committee. The Executive Committee includes a President, Vice President, Secretary, two Joint Secretaries and six elected Thematic Unit Heads, with gender balance built into its design. Faculty mentors and staff coordinators support each unit voluntarily, and their contribution is recognised in performance appraisals. C-RAN's work spans six thematic units, each named to reflect its purpose. *Aarogya Seva* (the health wing) partners with the Kerala Health Department to run screening camps for blood pressure and diabetes, maternal and child health drives, mental health conversations, menstrual hygiene workshops, geriatric home visits and first aid training.

Vidya Jyoti (the education wing) works with the Education Department and KITE to provide remedial tutoring, digital literacy for adults, career guidance, a mobile library, e-governance assistance and scholarship awareness drives.

Suraksha Vahini (the safety wing) partners with KSDMA, Kerala Police and Fire and Rescue Services for disaster preparedness training, community vulnerability mapping, mock drills, cybercrime and traffic safety awareness, women's self-defence programmes, child safety education and legal aid support.

Prakriti Mitra (the environment wing) works with the Forest Department and Pollution Control Board on plastic free campaigns, wetland conservation, tree planting, waste segregation, bio-diversity documentation and organic farming promotion.

Swarojgar Shakti (the livelihood wing) partners with the Labour Department, NORKA Roots and Kudumbashree on skill workshops, entrepreneurship guidance, farmer support, self-help group strengthening, migrant worker support and financial literacy.

Sanskriti Seva (the cultural wing) strengthens social cohesion through festivals, Sanskrit and heritage workshops, storytelling for children, oral history documentation with elders and community wellness sessions. Formal agreements with each department will define roles, training commitments and reporting obligations.

Funding will come from the CVV University Fund, UGC community engagement grants, state department support in kind, CSR contributions, Kudumbashree and NABARD linkages, and alignment with the National Service Scheme. Implementation runs over four phases across two years. The foundation phase in the first three months covers university approval, community needs assessment, constitution drafting, volunteer registration.

The capacity building phase in months four to six involves department led training workshops, pilot activities and a formal launch event. Active delivery runs from months seven to eighteen, with full activity schedules, monthly and quarterly reporting and a mid-term impact assessment. The final phase covers scaling to additional villages and reporting.

Progress will be tracked through indicators for each thematic area, including volunteers engaged, villages covered, patients screened, children supported, households trained in disaster preparedness, trees planted and self-help groups assisted. Data flows from weekly volunteer logs through monthly unit reports and quarterly consolidated reports to an annual impact assessment.

Benefits and Impacts

Every stakeholder gain from this initiative. Rural communities receive better health access, digital inclusion, disaster resilience and a trusted bridge to government schemes. Students gain certified

training, holistic skills, academic credit for service and networking. Faculty and staff gain research and publication opportunities and recognition in appraisals. CVV strengthens its accreditation, rankings and eligibility for grants.

Government departments gain a trained volunteer workforce that extends their reach at no additional cost. C-RAN reflects a belief that knowledge without service is incomplete. The measure of a university is not the height of its buildings, but the depth of its roots in the society it serves.



Know the Innovator

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MALAYSIA

Resilient Community Ecosystem KRT Kampung Satey /Pantai

An Independent and Sustainable Community Model

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The Innovation

The resilient community ecosystem KRT Kampung Satey/Pantai is a Social Innovation model developed by the Rukun Tetangga Committee (JKRT) of Kampung Satey/Pantai aimed at solving social problems, improving community well-being, and empowering the community through a practical and sustainable approach. It encompasses community activities at the Rukun Tetangga Activity Centre (PART), a Collaborative Approach, and Community Sustainability as efforts to strengthen the social, economic, safety, and sustainable community development.

KRT Kampung Satey/Pantai is a rural community with strong social values and community spirit. However, despite its existing strengths, the community faces several interconnected socio-economic challenges that limit its long-term development and resilience. These challenges include limited opportunities for community-based economic activities, continued dependence on external assistance, low participation of Young Neighbors (Jiran Muda) in community development initiatives, and the need to further strengthen social cohesion and improve the overall well-being of residents.

A community needs assessment conducted by KRT Kampung Satey/Pantai further revealed several critical development gaps. The community lacked a well-organized and multifunctional community hub to coordinate activities, facilitate knowledge sharing, and strengthen social interaction. In addition, there was an urgent need to establish sustainable income-generating opportunities that could improve household livelihoods while reducing dependency on external support. The assessment also highlighted the importance of empowering young people through structured leadership and volunteerism programs, as well as strengthening community support systems capable of responding to emerging social, economic, and environmental challenges.

Recognizing these needs, KRT Kampung Satey / Pantai developed an integrated community innovation that combines social empowerment, economic participation, youth engagement, and strategic partnerships into a sustainable community-driven model. The initiative transforms local challenges into opportunities by leveraging community resources, fostering self-reliance, and promoting inclusive participation. More importantly, the model demonstrates how a community-led approach can generate measurable social and economic impact while strengthening unity, resilience, and sustainable rural development.

The approach taken integrates various skills of Rukun Tetangga Volunteers as a community asset and is translated through the Voluntary Patrol Scheme (SRS) activities, Event Management, Graphic Design Services, Community Kitchen Catering, Audio System Services, Culture and Heritage (Silat and Kompang Training) as a Social Innovation Model in KRT Kampung Satey / Pantai.

KRT Kampung Satey / Pantai has successfully gained national recognition, emerging as the Champion for Best Rukun Tetangga Management, Fourth Place for Best Young Neighbors (Jiran

Muda) Management, and the Overall Champion of the National Premier Rukun Tetangga Award 2023 organized by the Ministry of National Unity. This success proves that rural communities can become a model for progressive, sustainable, and resilient community development at the national and international levels.

Innovation Objectives

The primary objective of this innovation is to empower local communities by enhancing community safety, strengthening social harmony, and improving the overall well-being of residents through an integrated, community-led development approach. The innovation is designed to build resilient, inclusive, and self-reliant communities by addressing social, economic, environmental, and governance challenges through a comprehensive range of projects, programs, and community-driven initiatives.

The innovation is implemented across eight strategic pillars that collectively contribute to sustainable community development. These include Economic Empowerment and Livelihoods, which promotes entrepreneurship, income generation, and financial resilience; Community Safety and Resilience, which strengthens disaster preparedness, neighbourhood security, and community response mechanisms; Leadership Development, which nurtures capable, accountable, and inclusive community leaders; Community Well-being, which supports physical, mental, and social well-being through health, welfare, and social inclusion initiatives; Lifelong Learning, which enhances knowledge, skills, and capacity building for all age groups; Environmental Sustainability, which encourages responsible environmental stewardship and climate resilience; Heritage and Cultural Preservation, which safeguards local traditions while fostering mutual respect and social cohesion; and Creativity and Innovation, which inspires innovative solutions, digital adoption, and community-driven initiatives to address emerging local challenges.

By integrating these eight pillars into a single community development framework, the innovation creates a holistic ecosystem that strengthens community participation, encourages cross-sector collaboration, and empowers residents to become active agents of change. Ultimately, the innovation seeks to improve quality of life, reduce dependency on external assistance, foster sustainable livelihoods, and establish a resilient, harmonious, and prosperous community capable of adapting to future social and economic challenges.

Impact/effectiveness of the resilient community ecosystem KRT Kampung Satey

The Resilient Community Ecosystem KRT Kampung Satey has created positive impacts on the community by strengthening social unity, youth involvement, economic independence, and community safety. Socially, the initiative has increased cooperation among residents, strengthened the volunteer culture, and improved overall community well-being through active participation and mutual support. For youth, the program has encouraged greater involvement in community activities, developed leadership skills, and provided positive platforms to reduce social issues. Economically, the initiative has supported the community in generating income through local entrepreneurial activities, while creating more opportunities for women to participate in economic development. In terms of safety, the program has enhanced community awareness, strengthened relationships among residents, and encouraged collective responsibility in creating a safer and more resilient community environment.

"Together We Build the Community, United We Progress, Empowered We Prosper"



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21

SRI LANKA

Village Biofactories

A Decentralized High-Value Aquatic Plant Export Model Transforming Rural Livelihoods

Anjula Sachintha Mahaliyana
Uva Wellassa University of Sri Lanka

Background and rationale

Rural economies across the Asia-Pacific region remain trapped in low-value, high-effort production systems, resulting in persistent poverty, youth migration, and underemployment. Traditional agriculture offers low returns per unit land, making it increasingly unattractive for younger generations who increasingly view farming as a livelihood of last resort rather than a pathway to prosperity. At the same time, a quiet billion-dollar global market, the ornamental aquatic plant and aquascaping industry, is rapidly expanding, driven by hobbyists, collectors, and commercial aquarium sectors worldwide. Rare species command exceptionally high prices in this market, yet supply remains constrained, inconsistent, and often dependent on unsustainable wild collection that depletes natural populations. Tropical rural regions possess a natural advantage for entering this market through ideal climate conditions, abundant water resources, and rich indigenous biodiversity including genera such as Cryptocoryne, Lagenandra, and Aponogeton. However, this opportunity remains largely untapped by rural communities who continue to cultivate low-value crops despite possessing the biological resources and environmental conditions that could position them as competitive suppliers to global niche markets.

The Innovation

This project transforms rural villages into biofactories for high-value aquatic plants using a decentralized production system that integrates four complementary components. The system combines micro-scale tissue culture for science-driven multiplication, community-based nurseries for skill-driven acclimatization, farmer-led emersed cultivation for low-cost mass production, and village-level export hubs for market access and value capture. Instead of growing low-value crops, rural households produce export-grade, high-value biological products from very small spaces. This is not merely an agriculture project but represents a structural shift in rural production economics. The model converts spaces as small as one to ten square meters into high-income production units, generates continuous non-seasonal income streams that provide financial stability throughout the year, links village-level production directly to global niche markets without the value erosion caused by multiple intermediaries, replaces destructive extraction through wild harvesting with controlled propagation that ensures long-term resource sustainability, and distributes value across multiple community actors rather than concentrating benefits with a single producer. One small laboratory can economically activate an entire village ecosystem, creating a multiplier effect that extends far beyond the direct participants.

Implementation model

The project focuses on globally demanded, high-margin species that offer strong market potential and premium pricing. These include Bucephalandra, which commands collector-grade premium prices; Anubias, known for its stability and consistent demand; Cryptocoryne, including endemic species with unique market appeal; Lagenandra, rare and under-commercialized with significant growth potential; Aponogeton, suitable for bulb-based export; and Eriocaulon, high-value

specialty plants with strong demand in elite aquascaping markets due to their unique morphology, rarity, and cultivation difficulty. Emphasis will be placed on endemic species branding, increasing both market value and conservation impact by creating economic incentives for protection rather than exploitation.

The implementation model is structured around four interconnected components that create a seamless value chain (Figure 1). The Village Tissue Culture Unit is a small, low-cost laboratory that produces thousands of plantlets monthly and is operated by trained rural youth who gain valuable biotechnology skills. The Decentralized Nursery Network is managed by women and youth groups, handling the critical hardening and acclimatization of plantlets using low-cost shade-net systems constructed from local materials. The Emersed Grow-Out Units consist of small net-house structures with soil-based shallow beds that require minimal water, fertilizer, and energy use, significantly reducing production costs while increasing survival and growth rates compared to submerged cultivation. The Village Export Hub handles aggregation, grading, and packaging while establishing direct linkages to exporters or international buyers and implementing branding and quality standardization that command premium pricing in global markets.

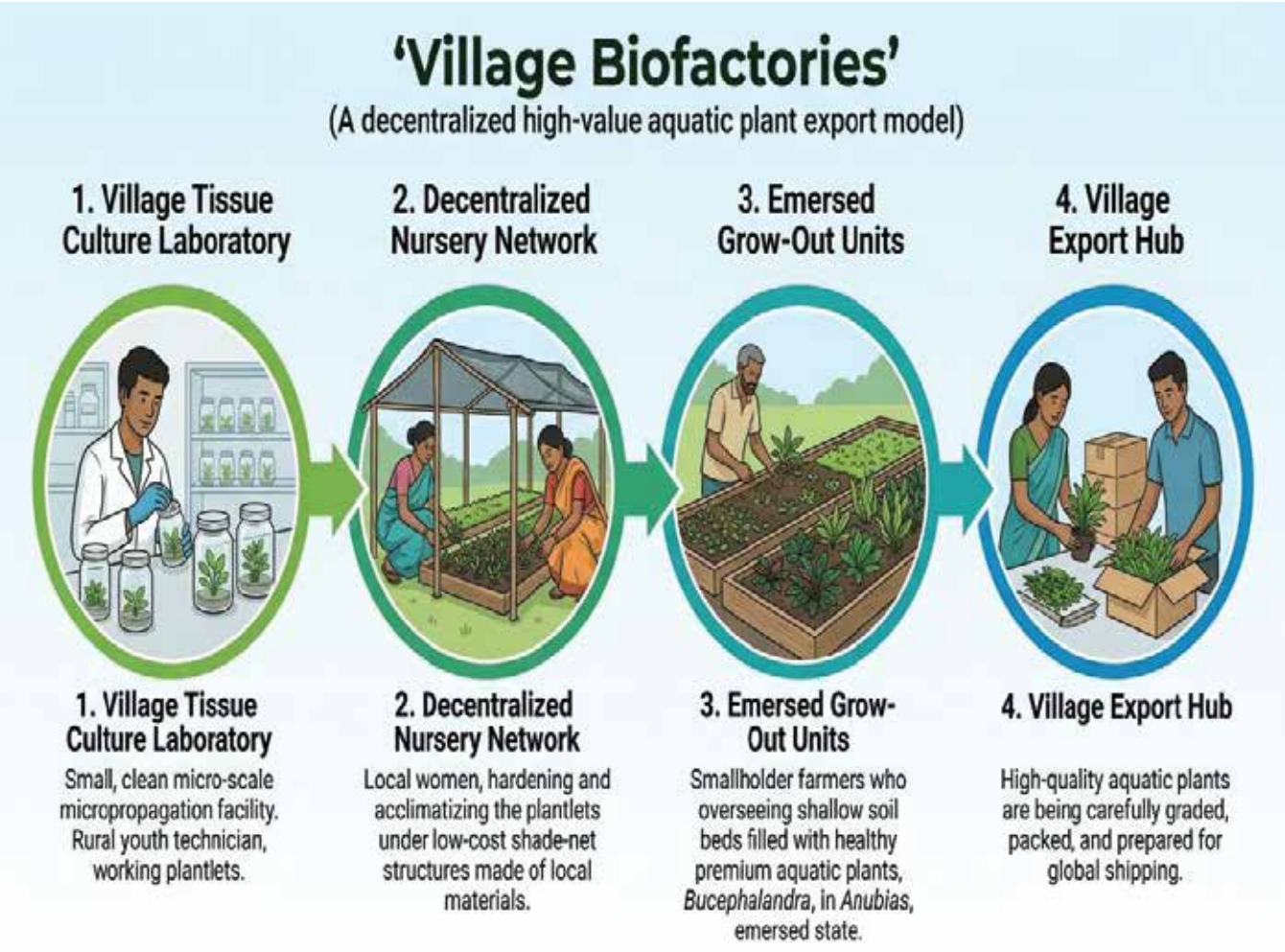


Figure 3: Key components of the proposed innovative approach

Economic logic and beneficiaries

This model is built on extreme value multiplication. A tissue culture plantlet costs very little at the laboratory stage. As it moves through the nursery, its value increases three to five times. After emersed cultivation, the mature plant increases ten to twenty times in value. At the export stage, premium global pricing captures the highest returns. A single plant moves from a few cents to several dollars, with each stage generating income for different rural actors. This distributed value chain ensures benefits flow throughout the community.

The beneficiaries span multiple segments of rural society. Rural youth find opportunities as lab technicians and entrepreneurs, gaining biotechnology skills for long-term employability. Women participate as nursery operators and packers, achieving leadership roles and financial independence. Smallholder farmers integrate grow-out units into existing land use, generating supplemental income. Local traders and export facilitators connect villages to global markets. One village cluster directly supports thirty to fifty livelihoods, with strong indirect economic effects.

Expected impact, scalability, and potential deliverables

The impact is comprehensive across economic, social, and environmental dimensions. Economically, households achieve three-to-five-fold income increases through high-value global markets, while new rural micro-enterprises emerge. Socially, youth migration reduces as young people find attractive livelihoods, women-led income generation strengthens household resilience, and skill development builds human capital. Environmentally, conservation occurs through cultivation-based protection, wild harvesting is eliminated, and the low water and chemical footprint minimizes impact.

The model is designed for rapid replication. Its modular structure from laboratory to nursery to farm to export allows flexible implementation adaptable to local conditions. Minimal infrastructure requirements make it accessible to resource-limited communities. A successful pilot can scale to hundreds of villages across CIRDAP member countries. Deliverables from each cluster include a fully functional production village, over one hundred thousand plants annually, thirty to fifty direct beneficiaries, an established export supply chain, and comprehensive documentation.

Sustainability and why this idea matters now

Sustainability is embedded in the design. Revenue at every value chain stage ensures financial continuity without external subsidies. Strong global demand provides consistent market access. Community ownership ensures local commitment. Low operational costs build resilience against economic shocks. Risk mitigation includes standard tissue culture protocols, species diversification for market variability, partnerships with existing exporters, and continuous training.

This idea matters now because it responds directly to CIRDAP's core challenges. Poverty is addressed through high-value income generation. Youth migration is countered by attractive modern rural livelihoods. Limited opportunities are overcome through global market integration. Environmental degradation is reversed through conservation through cultivation. This model demonstrates how science, biodiversity, and rural entrepreneurship combine to create transformational change.

The bigger picture

This project is about choice. It offers rural communities the chance to move beyond subsistence and participate in a growing global economy. It gives young people a reason to stay, women the opportunity to lead, and farmers the ability to generate meaningful income from small spaces. It protects biodiversity through cultivation rather than extraction. The Village Biofactories model is a practical pathway to make this vision a reality across the Asia-Pacific region.



Know the Innovator

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PHILIPPINES

GREEN HARVEST RURAL ENTERPRISE

Low-cost, high-impact utilization of pineapple leaf waste for fiber and paper production

Maria Victoria Silva Anahaw

Caviteño Isabelino Multipurpose Cooperative (CAISA MPC), Philippines

Executive Summary

Isabela, the second largest province in the Philippines, is a major pineapple-growing area, with farms in Echague, San Guillermo, and other municipalities producing large quantities of leaf waste each year. This project turns this waste into valuable pineapple leaf fiber (PALF) and paper products. Low-cost mechanical adoption to provide additional income for farmers, to reduce the environmental pollution from leaf burning, and to develop a sustainable rural enterprise that is in line with the global trend of being eco-conscious. The initiative will leverage local resources and potential government support to enable community empowerment.

Problem Statement

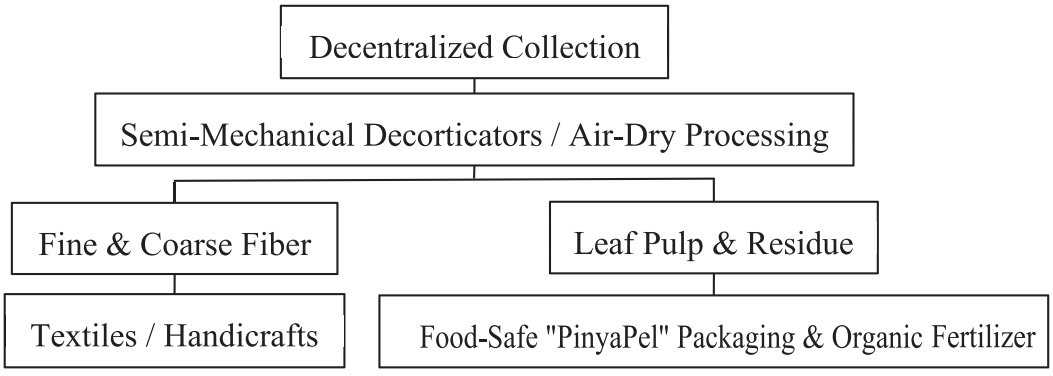
Pineapple leaves are frequently burned or left to decompose in fields post-harvest, contributing directly to air pollution and greenhouse gas emissions while wasting a valuable cellulose-rich resource.

a. Smallholder farmers currently rely almost exclusively on seasonal fruit sales, leaving them without income diversification or protection against market fluctuations.
b. The Philippines imports approximately 450,000 metric tons of paper annually, driving a strong demand for domestic, sustainable paper alternatives like "PinyaPel" (pineapple leaf paper for packaging).

Strategic Opportunity

a. Demand for pineapple leaf fiber is rising rapidly across eco-conscious industries, including sustainable textiles (42%), handcrafted goods (28%), and eco-packaging (20%).
b. Excellent Raw Material Quality - Pineapple Leaf Fiber (PALF) is very strong with a high alpha-cellulose content (69.7%) and is ideal for strong paper, packaging, and textile products.
c. Low-cost extraction equipment and community-owned processing models ensure high operational profitability, fast adoption, and easy scalability across regions.

The Green Harvest Innovation: How It Works



The company applies a circular bio-economy model in three decentralized hubs (Echague, San Guillermo, and Santiago City) through three main mechanisms:

i. Selective harvesting and decentralized processing

- Farmers collect mature, post-harvest leaves (a) without damaging the main plants. Leaves are collected and taken to local community collection hubs, reducing transportation overhead.

ii. Low-cost extraction & Air-Drying

- Hubs use semi-mechanical decorticators for PALF extraction (high alpha-cellulose content of 69.7%). Processing, extraction, and drying are done by air-dry setups (b), which lower utility costs by 30-40% and keep the processing off-grid.

iii. Zero-Waste Value Chains

- Fiber Line Coarse fibers harvested for local handicrafts and ropes. Fine fibers are provided for eco-textiles and leather alternatives.
- Paper & Packaging Line: The leftover leaf pulp is transformed into food-safe paper packaging ("PinyaPel"), stationery, and biodegradable pots.
- Bio-Fertilizer: The residual biomass obtained from the extraction process is utilized as free organic compost in cooperative farms, closing the resource loop.

Visual Documentation: Field Operations & Processing



a. Selective Leaf Harvesting



b. Extraction & Air-Drying

Financial Projections (Preliminary)

The innovation is designed as a low-capital high-return cooperative model:

- ***Minimal Initial Capital Footprint:*** The total set-up cost is Php 700,000 (~USD 12,280), which includes 5 semi-mechanical decorticators, 1 small papermaking set-up, training, and initial working capital.
- ***Direct Farmer Cash Flow:*** The member-farmers are paid directly for their leaves at Php 3–5/kg. Waste alone can generate up to Php 120,000 in pure supplementary income per year for a medium 10-hectare farm.
- ***High ROI Projections:*** The project processes ~5 tons of leaves per month, generating Php 1.2–1.8 million (~USD 21,052 – 31,578) per year in sales of fiber, paper, and products.

Government Support & Partnerships

- Applying for DA-PhilFIDA grants (past support included Php 8.5M for fiber co-ops) or PHILMEC program subsidies.
- Partnering with PTRI for fiber quality testing and DOST for continuous product development.
- Securing organic or fair-trade certifications via the Department of Trade and Industry (DTI) to access premium retail markets

Environmental & Social Impact

- Delivers at least a 25% income increase for participating farmer households through direct leaf purchase agreements and shared cooperative profits.
- Each processing unit diverts 360 tons of pineapple leaves from open-air burning annually, resulting in a significant reduction in carbon emissions.
- Generates 20-30 direct processing jobs per cluster, prioritizing rural women (60%+ of workforce) and youth through specialized skills training delivered by technical partner institutions.
- Establishes direct supply linkages with eco-brands, local food companies, and e-commerce platforms (Shopee/Lazada).

Conclusion

Green Harvest turns what was once discarded into opportunity: simple, affordable ways to lift up rural families while caring for our land. What works here can work elsewhere—this model is built to be shared, adapted, and replicated by rural enterprises and communities all across Asia and the Pacific, so more people can turn their own harvest waste into lasting hope and prosperity. Let us work together to grow this impact, one community at a time.



Know the Innovator

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23

BANGLADESH

AEGIS

From Generic Agricultural Advice to Personalized Farming Decisions.

Protik Das

Jahangirnagar University, Dhaka, Bangladesh

Executive Summary

AEGIS transforms conventional agricultural advisory into a personalized, AI-driven decision-support framework for smallholder farmers. Rather than issuing one generic recommendation per crop and region, it generates multiple ranked, explainable cultivation plans tailored to an individual farmer's budget, irrigation access, and risk tolerance, and extends decision support through to the post-harvest selling decision. A working desk-based computational pilot has been built and tested using exclusively free, publicly verifiable data sources -- NASA POWER, SoilGrids, BRRI variety data, Bangladesh government fertilizer and procurement prices, BBS wage data, and WFP/DAM market-price records across two agro-climatically contrasting regions: Barisal (coastal) and Rangpur (northern).

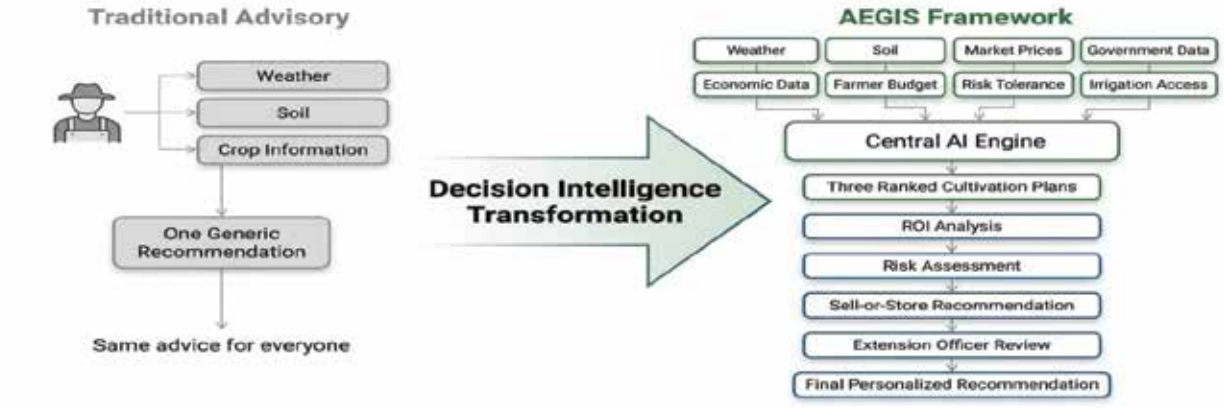
Why This Matters

Agricultural advisory in Bangladesh is largely generalised at the level of crop, soil, and season. Two farmers on adjacent plots with identical agro-climatic conditions, but different budgets, irrigation access, or risk tolerance, are typically given the same advice. This gap between generic agronomic guidance and a farmer's actual decision-making context is explicitly identified in FAO guidance on inclusive digital extension as an area requiring further practical development.

Problem Statement

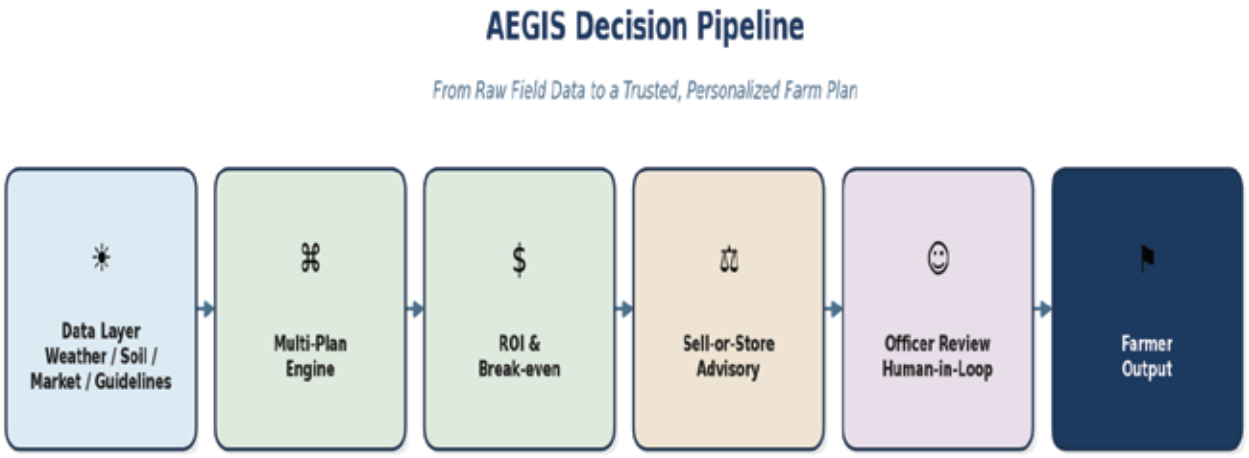
- Recommendations are rarely personalised to a farmer's financial capacity or risk tolerance.
- Post-harvest selling decisions are left entirely to the farmer, despite well-documented price crashes from seasonal oversupply- Aman paddy prices fell from roughly Tk 1,600-1,700/maund to Tk 1,000/maund in the 2025-26 season, a real, currently unfolding example of the problem this project addresses.
- Digital advisory tools that bypass local extension officers often struggle with farmer trust and adoption.

Figure 1. From Generic Agricultural Advice to Personalized Decision Intelligence



AEGIS shifts agricultural advisory from generic recommendations to personalized, explainable, and economically informed decision-making.

System Architecture



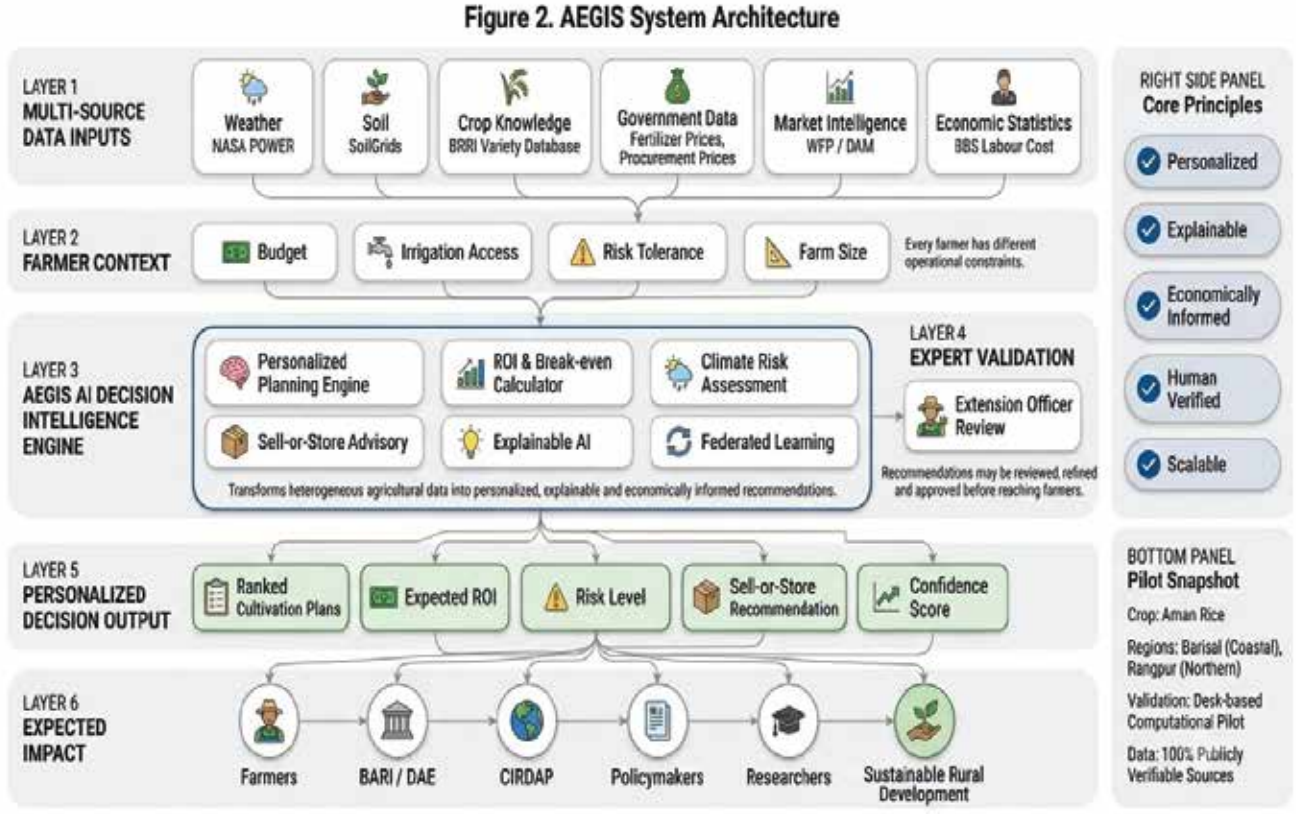


Figure 2. A constraint-aware, explainable agricultural decision intelligence framework integrating multi-source public data, farmer-specific constraints, AI reasoning, expert validation, and personalized recommendations.

Key Innovations

- 🌾 Personalized Planning Engine -- ranked, explainable cultivation plans per budget tier, not a single generic answer.
- 💰 ROI & Break-even Calculator -- concrete cost and profit figures built on verified government and BBS pricing data.
- 📦 Sell-or-Store Advisory -- low-burden, macro-signal-based guidance that requires no daily farmer price-tracking.
- 🤝 Human-in-the-Loop Trust Layer -- every recommendation is reviewed and can be adjusted by an extension officer before reaching the farmer.
- 🐝 Federated-Averaging Proof-of-Concept -- demonstrates cross-region learning without ever centralising raw farmer-level data.

Pilot Insight

- *Different optimal cultivation strategies emerged for Barisal and Rangpur despite the same crop, demonstrating the real value of personalized recommendations.*
- *Barisal: low-budget plan most profitable (Tk129,920/ha)*
- *Rangpur: medium-budget plan most profitable (Tk112,728/ha*
- *Driven by a 62% vs 12% dry-spell risk gap and a 70% seasonal rainfall difference.*

Comparison with Existing Systems

Feature	CropMind	AgroAskAI	AEGIS
Output type	Single synthesized answer	Single answer + reasoning log	Multiple ranked plans + confidence score
Farmer budget / risk constraint	Limited	Limited	Core feature
Economic optimization (ROI)	✗	Partial	✓ Full break-even/ROI engine
Region focus	APAC (broad)	Global	Bangladesh-specific pilot
Post-harvest sell/store advice	Not covered	Not covered	Dedicated module
Human review before delivery	Not core	Not core	Core architecture layer

Potential Impact

Farmers: personalised, financially-concrete guidance and reduced distress-selling losses.
BARI / DAE: a practical channel turning static research guidelines into actionable, field-tested advisory.
UN / FAO: a working, replicable demonstration of inclusive, personalised digital extension.
CIRDAP: regionally-relevant, data-grounded evidence for South Asian smallholder policy discussions.
Designed for Bangladesh, and structurally adaptable across similar smallholder contexts in South Asia.

Development Status

Approximately 85% of the pilot scope is complete. Seven modules have been built and individually tested: the Multi-Plan Engine, ROI/Break-even Calculator, Sell-or-Store Advisory, an Integrated

Pipeline, an Extension-Officer Review Loop, Community-Level Coordination, and a Federated-Averaging proof-of-concept. This has been validated as a desk-based computational pilot using real historical and current public data (2018-2025). It has not yet been tested with real farmers in the field, and is presented honestly as such.

Figure 3. From Research Concept to Real-World Agricultural Impact

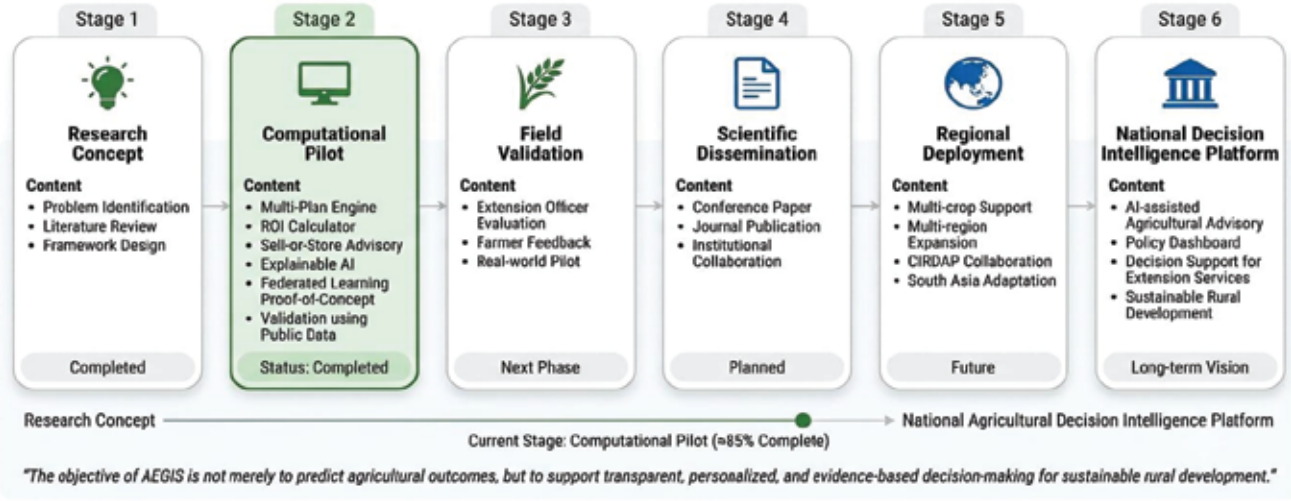


Figure 3. A phased roadmap illustrating the evolution of AEGIS from an academic research concept to a scalable, field-validated agricultural decision intelligence framework.

Strategic Roadmap

- Near-term: complete thesis documentation; conduct a small-scale field feedback exercise with an extension officer or a handful of farmers to move from computational to field-validated pilot.
- Mid-term: submit findings as a conference paper; seek institutional guidance through CIRDAP/BARI contacts.
- Long-term: expand to additional crops and regions; integrate IoT/satellite data; build a national policy dashboard.

Future Vision

AEGIS aims to grow from a validated academic prototype into a lightweight, replicable decision-support layer that sits on top of Bangladesh's existing agricultural extension network -- not replacing extension officers, but giving them a structured, explainable, locally-adapted tool to serve farmers with genuinely personalised guidance at scale.



Know the Innovator

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24

ASLICHAIN

MALAYSIA

Orang Asli Community Supply Chain Digitalization System

A community-centred traceability ecosystem for indigenous product supply chains

Hairulnizam Abd Rahman, Wan Md Hazlin Agyl Wan Hassan, Siti Norida Wahab, Azimah Daud, Norashida Othman, Azilah Anis, Melissa Shahrom

Malaysia

1. The Innovation

AsliChain is a community-centred supply chain digitalization and traceability ecosystem built for the Orang Asli (literally "original people"), the Indigenous peoples of Peninsular Malaysia, many of whom live in remote forest settlements and earn their livelihoods from farming, fishing, and forest products. It was developed as a pilot collaboration between three Malaysian partners: JAKOA, the federal Department of Orang Asli Development responsible for Indigenous community wellbeing, in the states of Perak and Kedah; MaraLiner Sdn Bhd, a national transport and logistics provider; and Universiti Teknologi MARA (UiTM), one of Malaysia's largest public universities.

Piloted in RPS Kemar, a remote Indigenous settlement in Hulu Perak, AsliChain digitalizes the entire indigenous product supply chain with transparent producer records, product traceability, shipment coordination, and ethical verification from village to marketplace. *Its defining feature is that it does not require communities to change what they produce; it changes how value is captured, recorded, coordinated, and connected to markets.* The result is stronger rural livelihoods, fairer trade, and greater trust in authentic Orang Asli products.

2. Why It Matters

RPS Kemar, home to the Temiar (one of the largest Orang Asli ethnic subgroups), lies deep in the inland forest of northern Peninsular Malaysia, reachable only by about 1.5 hours of boat travel plus 4–5 hours on logging roads that become nearly impassable in the rainy season. The community depends on agriculture, livestock, fisheries, and forest resources including lemongrass, vegetables, freshwater fish, forest honey, herbs, and traditional goods, yet essential information such as producer name, village (kampung) of origin, harvest date, quantity, and selling price is recorded manually or not captured at all. This makes supply forecasting, quality control, freshness tracking, and batch accountability extremely difficult.

Isolation also creates deep dependency on middlemen (peraih in Malay), who buy produce at extremely low prices in the villages and resell it outside at much higher market value. With no transparent pricing, no digital transaction records, and long journeys that force immediate sale to avoid spoilage, pricing control stays with intermediaries rather than the producers who contribute the labour. AsliChain matters because it directly restores bargaining power, fair pricing, and market access to indigenous producers.

3. How It Works

AsliChain organises fragmented village production into one structured, traceable flow:

Producer → Orang Asli Cooperative → Transporter → Collection Point → Wholesaler.

Products from multiple villages are first aggregated at the Orang Asli Cooperative in RPS Kemar, the central collection and coordination hub. The cooperative verifies producers, records product information digitally, consolidates volumes, and prepares goods for transport, letting small-scale producers collectively access larger markets with stronger bargaining power. Goods then move by coordinated land and water routes to regional collection points of the Orang Asli One-Stop Centre (OAOSC) in Bawong and the hub in Gerik, where they are received, verified, and prepared for onward distribution. Wholesalers source through one

centralized, trusted channel, and every product carries verifiable records of who produced it, where, and how.



The AsliChain digital platform



Supply chain map: villages to market



AsliChain at a glance: the challenge, supply chain flow, digital traceability layer, system interfaces, transformation, and impact

4. Cost Effectiveness

AsliChain is intentionally engineered as a low-cost platform. It is mobile-friendly and adaptable to low-connectivity environments, so it runs on devices communities already own rather than requiring new hardware or telecommunications infrastructure. It is cooperative-centred, building on existing community institutions instead of creating new administrative structures. Because one digital architecture serves every product line including agriculture, fisheries, livestock, honey, forest products, handicrafts, and ecotourism where the same investment is reused across sectors, and replication to new villages requires configuration rather than redevelopment. Most importantly, by consolidating volumes and shortening the chain between producer and wholesaler, the system recovers value currently lost to intermediary margins, a direct economic return that quickly outweighs the platform's modest operating cost.

5. Impact

In the pilot, AsliChain converts unrecorded, middleman-dependent trade into a transparent ecosystem: structured producer and product records, verified traceability from village to marketplace, coordinated logistics over difficult terrain, and fairer prices that keep more economic value inside the community to strengthening household incomes, cooperative capability, and sustainable rural development. The scaling opportunity is significant. Under the Perak state government's Sejahtera 2030 development agenda and JAKOA's strategic plan, there are 261 Orang Asli villages with more than 62,000 residents across Perak and Kedah alone, already active in lemongrass, cocoa, freshwater fisheries, stingless bee (kelulut) honey, ecotourism, and livestock enterprises, all facing the same fragmented supply chains and weak market visibility that AsliChain resolves. Beyond Malaysia, the platform aligns with CIRDAP's vision of inclusive rural development and is transferable to indigenous and rural communities across ASEAN and other developing regions. The long-term vision is a National Indigenous Supply Chain Network linking producers, cooperatives, collection centres, logistics providers, wholesalers, government agencies, and consumers, what begins in RPS Kemar can become the blueprint for rural economic transformation across Malaysia and beyond.



Lemongrass cultivation across RPS Kemar villages



Community freshwater fisheries production



Roadside weighing and manual harvest records

AsliChain -connecting Orang Asli producers to markets through transparency, traceability, and trust.



Know the Innovators

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A collaboration between JAKOA (Department of Orang Asli Development) Perak & Kedah, MaraLiner Sdn Bhd, and Universiti Teknologi MARA (UiTM), Malaysia.

Agri-Solar Synergy: An Agrivoltaics–Agroecology Model

Mohsin Ali
WAVE Foundation, Bangladesh



Figure: An integrated agrivoltaics-agroecology loop: a circular system of solar canopy, diversified shade crops, livestock and pond nutrient-and-water recycling, and low-cost sensors, managed by Farmer Producer Organization

The Innovation

Agriculture is central to employment and food security in Bangladesh, which leaves it exposed to both climatic stress and fossil fuel shocks. Diesel price spikes linked to the US–Iran conflict have struck farmers with a double burden- costlier irrigation and imported inputs-just as decades of external-input-dependent, Green Revolution-based farming have degraded soil health and biodiversity, and a widening electricity supply-demand gap strains the grid each irrigation season. Feeding and powering a growing population will demand more land for both food and energy, even as climate change disrupts the natural processes behind each (FAO, 2017)- a pressure that land overuse, habitat loss, and pollution are themselves helping to drive. The answer is to integrate them: siting solar power on farmland, designed around ecological principles, can be mutually advantageous rather than a trade-off. Bangladeshi policy is moving this way-land capable of three harvests a year cannot be converted into a solar plant, but can still host solar-powered irrigation provided the space beneath the panels stays productive: small ruminants such as Black Bengal Goats under a semi-intensive pasture system, shade-tolerant spices and cereals, or native and carp fish in a pond dug into the fallow land. Agri-Solar Synergy is designed around exactly this requirement — multiple, simultaneous uses of the same land, so solar power strengthens rather than displaces the farming that sustains it.

At its core, Agri-Solar Synergy is the fusion of two systems normally planned separately: solar power generation and agroecology. Clean energy supplies income stability, irrigation power, and reduced emissions; agroecology keeps the land beneath the panels healthy and productive. Six ecological principles tie them together: diversity (several shade-tolerant crops, livestock, and fish instead of monoculture); synergy (one activity's output — shade, manure, pond water — becomes another's input); efficiency (solar-powered pumps and sensors so every drop of water and unit of energy counts); recycling (manure, crop waste, and pond sludge return to the soil as compost and irrigation); resilience (risk spread across crops, animals, and steady solar income); and co-creation (farmers and DAE designing together). Solar panels are engineered as part of the same ecological system as the crops, soil, and water beneath them- not simply

installed over farmland. Solar power, crops, livestock, and water are planned together from the start rather than farming being squeezed in as an afterthought. Panels are mounted 10 feet high on simple frames- tall enough for people, animals, and tall crops to move freely underneath- and angled to cast gentle, even shade matched to two or three shade-tolerant crops. Every plot begins from farmers' existing knowledge- local seed varieties, intercropping habits, years of reading the soil and weather- with sensors, AI-based advice, and solar-powered pumps added to support that knowledge, not replace it. Soil and pests are managed naturally through vermicompost, Trichoderma compost, and solar-powered pheromone traps, with minimal or no chemical spraying. Each plot grows more micronutrient-rich vegetables, pulses, and spices- while supporting more biodiversity, soil life. Solar panels are not simply installed over farmland- they are designed as part of the same ecological system as the crops, soil, and water beneath them, so that clean energy generation and agroecological farming grow stronger together rather than competing for the same land.

The Challenge: Land and Energy in Bangladesh

Bangladesh is densely populated and losing farmland every year. Over 170 million people live on just 148,460 square kilometres, and farmland is shrinking by about 0.19% annually, now down to 18.68 million acres (BBS, Agriculture Census 2019). Small and marginal farmers make up about 83% of all farmers but hold only about 53% of the land; marginal farmers alone- 41% of all farmers work just 11% of it, and more than half of rural households own no land at all (IFPRI, 2024). For these families, every additional unit of income from a small plot matter.

Farmland has traditionally been kept off-limits to solar projects to protect food security, so ground-mounted solar has competed directly with fields, ponds, and grazing land. This is changing: the Renewable Energy Policy 2025 directs SREDA to design incentives for using land for solar, crops, and water together. In November 2025, the Power Division, GIZ Bangladesh, the EU, and BMZ launched Bangladesh's first national Agrivoltaics Pilot Project and a National Working Group on Agrivoltaics and Floating Solar. Agri-Solar Synergy is built to support that national effort and to reach the small and marginal farmers who need it most, building on WAVE Foundation's existing solar-powered irrigation project in Chuadanga by adding agroecology, circularity, and a sharper focus on farmer income.

System Design and Implementation

Before installing panels, each site is screened against a short checklist: current crop yield, land type, sunlight, drainage and irrigation facility. Soil is tested with an inexpensive field kit, avoiding the need for a costly outside survey. Staff and farmers walk the land together and apply the same agroecology principles to plan crops, livestock, and water use for the plot, with DAE extension officers and farmers confirming the final crop selection. Solar PV power the plot's irrigation pump directly, building on WAVE's proven solar-irrigation work in Chuadanga, so water is pumped with clean, on-site power instead of diesel or additional grid electricity. The system closes its own loops: manure feeds crops, pumped and pond water is reused for irrigation, and crop waste and pond sludge become compost-so little needs to be purchased or discarded.

Low-cost sensors track soil moisture, water discharge, soil pH, leaf sensor, water and soil temperature, and short-term weather, on site solar irradiance comparing shaded plots with nearby open ground to build simple evidence for watering, liming, and shade decisions. A small group of local youth, trained as digital champions, maintain the sensors and dashboards and translate the data into plain-language advice for farmers-turning technology into local skill and giving young people a stake in the project's success. A short, plain-language agreement makes clear who owns the data and what farmers can see, keeping the technology accountable to its users.

A 50 kW Agri-PV System provides clean electricity for agricultural irrigation through a 30-kW Pump Controller and a 22-kW Submersible Pump. Farmers typically use the irrigation system for about 200 days each year. During the remaining 165 days, when irrigation is not required, the system exports the surplus electricity to the national grid through a 50 kW On-Grid Inverter. With an average solar irradiation of 4.5 peak sun hours yearly average per day, the system can export approximately 37,125 kWh (37.1 MWh) of clean electricity to the grid every year. This system also can reduce carbon emissions by approximately 24.9 tons of CO_2 annually, while improving the utilization of solar assets, supporting the national grid, and creating additional economic and food security and agro-ecological value for farmers.

Evidence from the Field: The Chuadanga–Jhenaidah Pilot

Agri-Solar Synergy builds on a real, peer-reviewed pilot rather than a theoretical model. A published study (Shams, Reza, Mojumder and Matin, 2023, Bangladesh Journal of Scientific and Industrial Research) documents a solar irrigation pump (SIP) site model developed by WAVE Foundation and data collection by University of Dhaka's Institute of Energy in Chuadanga and Jhenaidah districts. On 15-decimal plots at each site, 43.68 kWp solar panel shades powered an 18.5 kW submersible pump, while the fallow land beneath and beside the panels was put to work: a raised goat shed housed 20 mother goats and 2 bucks reared under a semi-intensive system, and a fish pond of roughly 640–720 square feet supported native and carp fish farming, with crop and farm waste recycled through on-site compost pits. A grid-tied, net-metering connection allowed surplus solar power — beyond what irrigation required — to be exported to the national grid. The results validated the approach. Goat kid production rose from 18 kids in year one to a projected 35 or more per year as the herd matured, while fish production reached 325 kg in the first cycle against a 150 kg target. Financially, the two-site pilot required about USD 29,234 (BDT 2.48 million) over 24 months; after an initial loss in year one, it turned a net profit of USD 14,369 in year two and a projected USD 19,427 in year three, with total revenue — goat, fish, compost, and net-metering sales combined — reaching USD 67,485. This is the practical foundation on which Agri-Solar Synergy scales up, adding agroecological crop diversification and a stronger circular-resource design to a model already proven on the ground.

Environmental Impact

Reduced carbon emissions: Panel electricity displaces fossil-grid power, and recycling manure, crop waste, and pond sludge lowers emissions associated with chemical fertilizer and untreated waste.

Land-use efficiency: One plot produces energy, food, and livestock together, easing competition between solar power and farmland.

Circularity: Manure, crop waste, and pond sludge return to the plot as compost and irrigation water, keeping nutrients and water in circulation.

Bio-inputs and integrated pest management: Vermicompost, Trichoderma compost, and local bio-inputs build healthy soil, while solar-powered pheromone traps and other methods keep pest damage low with minimal chemical use.

Sustainable water management: Shade reduces evaporation, pond water is reused, and moisture sensors guide watering only when needed.

Climate resilience: Monitoring shaded versus open conditions and diversifying crops and income sources protects soil, reduces heat and moisture stress, and builds resilience to extreme weather.

Micronutrients and biodiversity: Mixed plantings of vegetables, pulses, and spices add nutrients to diets and support bees, soil life, and broader biodiversity.

Socio-Economic Impact

Aligned with national policy: Building on WAVE's Chuadanga project, the model advances the Renewable Energy Policy 2025's goal of combining solar, crops, and water, and supports the national pilot and working group.

Cost-effective: Existing checklists, phone surveys, and sensor dashboards keep monitoring affordable for Farmer Producer Organizations and smallholders, without dependence on outside researchers.

Financial benefit to farmers: Crop and livestock income continues; solar income or lease payments add steady cash; and lower input costs raise farm margins — together lifting household income above what farming or land leasing could deliver alone.

Sensor-based AI for better production: Low-cost soil and weather sensors feed a simple dashboard that gives farmers easy, AI-based advice on watering, liming, and crop choice without requiring technical staff on site.

Support for small and marginal farmers, including women: Low-cost, simple tools and farmer-led design include women and marginal producers by default, avoiding dependence on unaffordable programs.

Digital youth champions and rural development: Training local youth to run sensors and dashboards turns technology into local skills and jobs, giving young people a stake in village development.

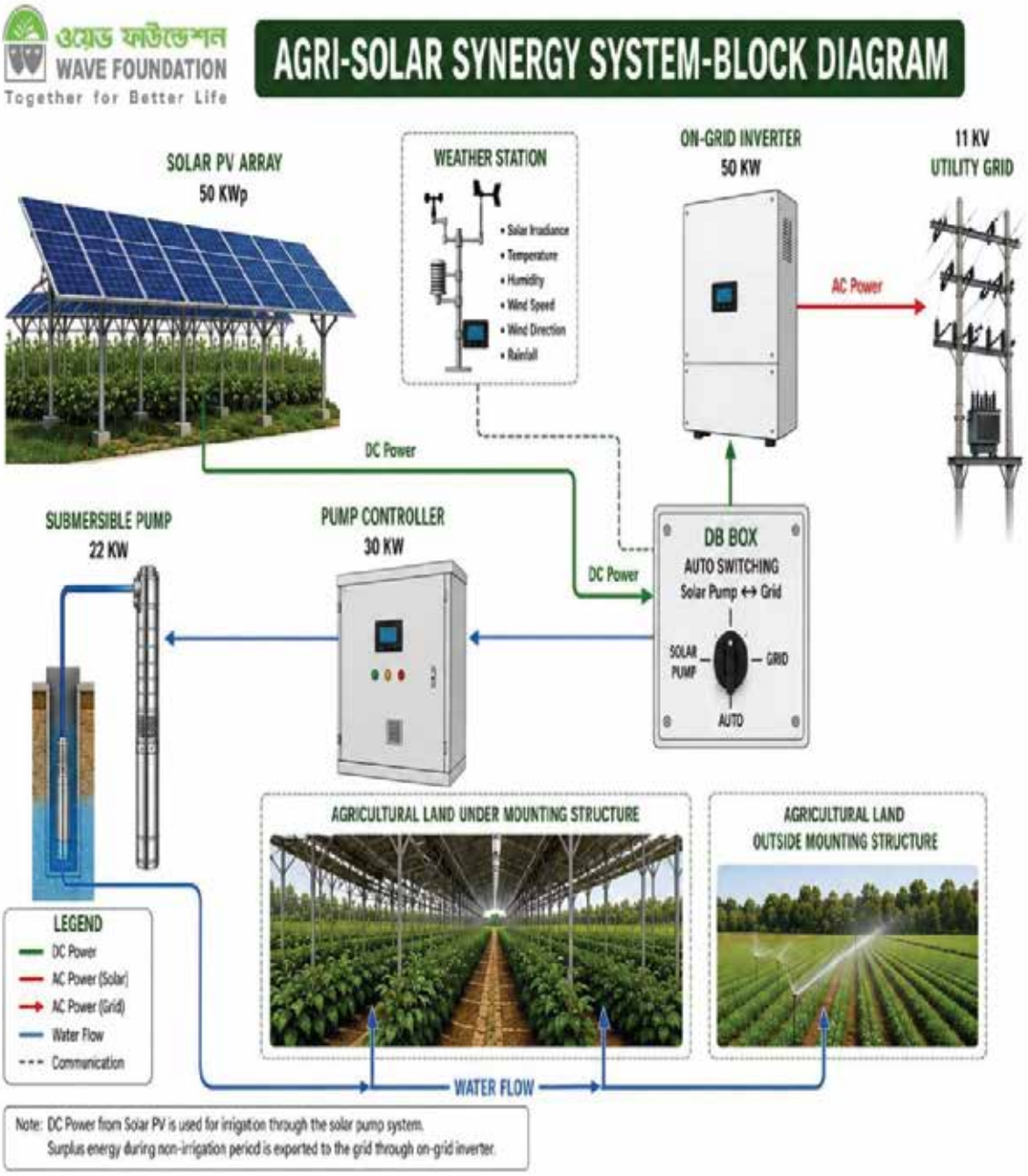
Blending tradition with technology: Local seed varieties, intercropping knowledge, and farmers' understanding of soil and weather guide each plot, with sensors, AI advice, and solar pumps supporting -not replacing- that knowledge.

Contribution to the national grid: Surplus electricity sold to the grid turns farms into small generators of clean power.

Risk management: Growing several crops alongside solar income reduces dependence on any single harvest or weather outcome.

Conclusion

Agri-Solar Synergy demonstrates that clean energy and small-scale farming can strengthen one another. By designing solar power, crops, water, and livestock together and using simple, affordable tools, the model delivers resilient, diversified, and inclusive livelihoods for small and marginal farmers — especially women - while improving food security and contributing clean energy to the nation.





Know the Innovator

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26 AI-Powered Water & Resource Management (HydroNet)

INDIA

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Introduction

Water scarcity and inefficient irrigation practices continue to threaten agricultural productivity and community water security worldwide. HydroNet is a smart water management system that combines Artificial Intelligence (AI) and Internet of Things (IoT) technology to monitor and optimize water usage across farms, communities, and public utilities. By uniting real-time sensing with predictive analytics, HydroNet moves water management from a reactive process to a proactive, data-driven one.

Importance

Traditional irrigation and water distribution systems rely heavily on manual monitoring and fixed schedules, leading to significant water wastage, undetected leaks, and inefficient crop yields. HydroNet addresses this gap by giving farmers, communities, and public authorities continuous visibility into water conditions, enabling timely, informed decisions that conserve a critical and increasingly scarce resource.

How It Works

HydroNet deploys IoT sensors across fields and water infrastructure to collect real-time data on water levels, soil moisture, and water quality. This data is transmitted to an AI engine that analyzes patterns to predict water scarcity, detect leaks early, and recommend optimal water distribution strategies. For farmers specifically, the system generates intelligent irrigation schedules by combining soil-condition readings with weather forecasts, ensuring crops receive precisely the water they need, when they need it - no more and no less.

Cost-Effectiveness

HydroNet is built on low-cost, readily available IoT sensor hardware and scalable cloud-based AI processing, keeping deployment and maintenance costs low relative to the water and yield savings it delivers. Early leak detection alone can prevent substantial water loss, while optimized irrigation reduces both water and energy consumption tied to pumping, making the system cost-effective for individual farmers as well as larger community or municipal deployments.

Impact

By conserving water, reducing waste, and improving crop productivity, HydroNet supports sustainable water management at multiple scales - from individual farms to entire communities and public water authorities. The system contributes directly to climate resilience and resource sustainability, helping ensure reliable water access even as scarcity pressures increase.



Figure 1: AI-Based Soil Moisture Sensor and Precision Drip Irrigation System



Figure 2: Smart Irrigation Control Unit with AI-Enabled Water Management

Know the Innovators



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PHILIPPINES

Integration of Indigenous Knowledge in Local Governance and Planning

Co-Design Approach to Climate-Resilient and Inclusive Rural Livelihood Systems

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Governance Innovation

The change that this initiative seeks to achieve is a fundamental shift in how climate adaptation is conceptualized, designed and institutionalized within local governance systems in the Philippines. Current approaches to climate change adaptation in the agricultural sector are largely characterized by the introduction of "modern" technologies and externally driven practices. While these have contributed to enhancing adaptive capacity, they continue to dominate local climate change action plans and agricultural development strategies. This results in missing opportunities in utilizing indigenous knowledge (IK) as an integral part of increasing the climate resilience and social inclusion in local agriculture in the Philippines. This raises an important development question on why IK has long been neglected in designing adaptation strategies even in areas with significant indigenous cultural communities (ICC) or indigenous peoples (IP) groups.

This governance innovation addresses this critical gap on the persistent "under integration" [or generally non-integration] of IK in formal planning and decision-making processes. Despite its proven relevance, IK remains insufficiently recognized as a legitimate and strategic knowledge resource for climate adaptation. It is also worth highlighting that many [if not all] IK-based agricultural practices can already be considered as nature-based solutions (NbS) as they work with ecological processes in sustaining productivity and strengthening the resilience of agricultural systems.

Furthermore, this innovation promotes the systematic integration of IK and gender-responsive perspectives into the design of climate adaptation strategies through governance-centered approach. Rather than positioning IK as an alternative to the so-called modern practices/approaches, this initiative advances a complementary framework where local knowledge systems and scientific approaches are harmonized. Thus, this enables the development of more holistic, context-specific, and inclusive adaptation strategies for local agricultural sector. Critical to this innovation is the institutionalization of IK through participatory and co-design processes. This ensures that IPs are recognized, not merely as beneficiaries, but as development partners and active contributors to planning and policy development. This approach strengthens local ownership and supports designing relevant interventions and policies. Finally, this initiative contributes to more equitable and inclusive climate governance by ensuring that climate adaptation strategies reflect realities and aspirations of the local IP communities. This further reiterates the principle that no one is left behind in local climate response efforts, particularly those whose knowledge and livelihoods are most closely linked to the natural environment.

Core Components of the Innovation

- Documentation of Indigenous Knowledge through participatory methods
- Co-design workshops with various local stakeholders
- Institutionalization through a local ordinance

Proof of Concept and Success Story

The pilot project, which was funded by the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD), was implemented within the context of selected municipalities in Northern Philippines. These include the Municipality of Sagada, Mountain Province in the Cordillera Administrative Region (CAR). A defining socio-cultural characteristic of the municipality was the dominance of the indigenous people within the local population. While Sagada is politically subdivided into 19 barangays (i.e., the smallest political unit in the Philippines), these barangays were divided into 4 ancestral domains. As defined by the Philippine Indigenous Peoples' Rights Act of 1997, "refer to all areas generally belonging to ICCs/IPs comprising lands, inland waters, coastal areas, and natural resources therein, held under a claim of ownership, occupied or possessed by ICCs/IPs, by themselves or through their ancestors, communally or individually since time immemorial, continuously to the present" (Section 3a). In the pilot project, only one out of the four ancestral domains were focused due to time and budget constraints. During the initial year of the project implementation, the team was able to secure all necessary legal permits including undergoing the whole process of the Free, Prior, and Informed Consent (FPIC) (from orientation to validation).

The primary data collection focused on understanding the social, economic, cultural, environmental, and institutional contexts of the ancestral domain, especially in relation to their agricultural sector. Among the critical questions raised include the climatic challenges affecting the local livelihood, gender roles in the agricultural sector in consideration also to their indigenous belief system, and existing formal and customary laws that can influence agricultural production. Finally, documentation of agricultural practices based on their indigenous knowledge (IK) was also a significant component of the research phase of the pilot project. Some of the documented IK-based agricultural practices was rice terracing (Figure 1).



Figure 1. The rice terraces in Northern Sagada, Philippines.

Once all the data were processed and analyzed, a validation workshop was conducted to ensure the accuracy of the interpretations made by the project team. It was then followed by a co-design workshop, which was participated by IP leaders from the four barangays within the ancestral domain, representatives from the different offices of the Local Government Unit of Sagada, representatives from different national government agencies, and community-based organizations. The result of the co-design workshop highlights that the vision of the local stakeholders for Sagada's agricultural sector includes (1) a community where families produce their own food through organic and sustainable farming practices while maintaining other sources of income to ensure food security and economic stability and (2) strengthen their agricultural systems through climate-resilient actions while also upholding the values of stewardship and solidarity. These visions are then integrated into the local ordinance, which was drafted and adopted by Sagada LGU, and later on, an equivalent ordinance was also passed at the provincial level (Mountain Province LGU).

The institutionalization of the integration of indigenous knowledge in local agriculture planning and governance systems provides institutional support for relevant programs, projects, and activities (PPAs). This further strengthens the role of indigenous knowledge systems and practices in building a more resilient agricultural sector. While there are national laws that provide recognition of the need to protect the rights of the IP, especially in relation to their use of their customary laws and IK-based agricultural practices, their actual integration in local sectoral planning remains limited. The institutionalization of the integration of IK in local agriculture planning ensures that related PPAs are locally funded. It can also support its continued practice across several planning horizons and political transitions.

Know the Innovator



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MALAYSIA

Bioflowt

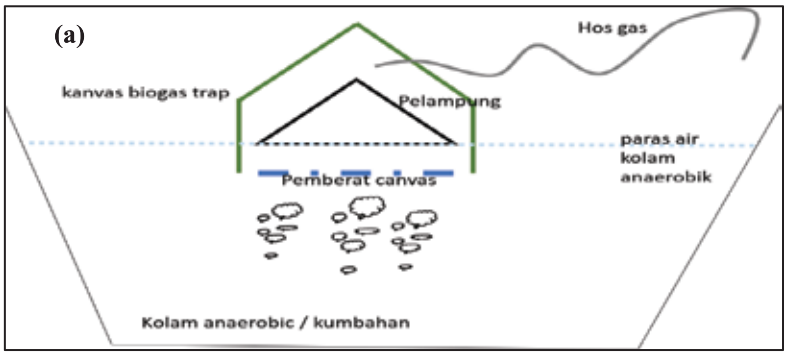
A Low-Cost, Free Flow, Self-Floating Methane Capture from Livestock Waste

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Innovation & Importance

Smallholder livestock farms commonly use manure lagoons or ponds where anaerobic decomposition generates methane (CH_4), a powerful greenhouse gas. Conventional biogas digesters can capture this gas but often require high capital investment, specialized infrastructure and imported components—barriers for small farms. Bioflowt is a low-cost, plug-and-play floating methane capture system designed for existing livestock waste ponds. Using a "Free-Flow and Float" concept, it is deployed directly on the pond surface without major structural modification. The captured biogas can be flare or channelled to a household stove, converting a waste-management problem into a renewable energy resource.

- Affordable access to methane capture for smallholder farmers.
- Waste-to-energy conversion that can reduce dependence on purchased LPG.
- Direct capture of methane at the source, supporting agricultural climate mitigation.
- Modular design adaptable to cattle, dairy, goat and mixed rural farming systems.
- Potential for local fabrication and replication across ASEAN and CIRDAP member countries.



b



Figure 1. (a) Conceptual illustration of Bioflowt flotation in anaerobic ponds; (b) Functional Bioflowt prototype installed at manure storage pond.

How Bioflowt Works

Bioflowt operates through simple buoyancy, ballast and gas-retention mechanics. A lightweight PVC pipe framework supports the floating cover (Figure 1). A secondary PVC ballast frame is filled with water and sealed, providing stability and partial submersion. As anaerobic biogas accumulates, the flexible gas chamber rises gradually, allowing the system to respond naturally to gas production without complex mechanical controls.

The main gas-capturing chamber is manufactured using heat-bonded seams rather than conventional stitching. Thermal fusion produces strong, airtight and leak-resistant joints suitable for prolonged outdoor use in tropical conditions. The system can be installed according to pond dimensions and, for long or rectangular units, side floating walkways made from recycled drums can improve mooring, stability, inspection and maintenance access.

For practical energy use, a 20 W solar-powered system supplies a DC pump, battery and controller to deliver captured gas to a minimally modified cooking stove. Field testing demonstrated up to two hours of continuous cooking operation, while a fully charged battery can power the pump system for more than four hours. The system therefore creates a simple renewable energy cycle from livestock waste to household cooking fuel.

Key Design Features

- Heat-bonded fabrication: thermally fused seams improve airtightness and reduce leakage compared with conventional stitched gas chambers.
- Locally available materials: PVC pipes, tarpaulin, hoses and standard fittings reduce cost and simplify repair.
- Floating walkways: recycled drums can provide a stable access platform for mooring, inspection and maintenance of larger or elongated units.

Validation & Performance

Bioflowt has been tested under Malaysian tropical conditions using gas chromatography and portable gas monitoring equipment. Field trials confirmed the system's ability to capture biogas from anaerobic waste ponds and support direct combustion applications.

Parameter	4 m^3 Unit	8 m^3 Unit
Peak CH_4 concentration	110.3%	94.4%
CH_4 operational range	70–106%	66–94%
CO_2 operational range	55–88%	15–37%

Measurement note: 4 m^3 unit data were obtained using an Agilent 7890B gas chromatograph; 8 m^3 unit data were obtained using a Combimass® GA-m portable gas analyzer.

Cost-Effectiveness & Scalability

Bioflowt is designed to provide the smallest practical entry point for farmers. The system can be installed as a basic methane-capture unit and expanded later with solar-assisted gas delivery and cooking equipment. This staged approach reduces upfront financial barriers.

Cost advantage: A basic gas-capture unit can be developed for below RM1,000, while a complete solar-assisted combustion package can be added for approximately RM400. The larger 8 m^3 canvas configuration is estimated at approximately RM1,164 before additional labour and deployment costs.

Why the Cost Model Is Attractive to Smallholders

- Uses locally available, low-cost materials rather than a fixed concrete digester.
- Can be scaled according to pond and herd size, gas demand and available budget.
- Requires no major modification to existing waste ponds.
- Solar-assisted pumping reduces dependence on grid electricity.
- Modular components can be repaired or replaced individually, lowering lifecycle maintenance costs.

Implementation Readiness

The system offers strong cost-effectiveness because it avoids the high capital and infrastructure requirements of conventional digesters while using locally available PVC, tarpaulin and recycled materials. Its modular construction also enables local fabrication, repair and adaptation. The resulting approach reduces investment barriers and improves the likelihood of adoption by smallholder farmers.

Bioflowt has been validated as a proof-of-concept under Malaysian tropical conditions and is designed for replication across ASEAN and CIRDAP member countries. Its modular, public-good-oriented design can be adapted to different pond sizes, livestock systems and local materials. By capturing methane, producing renewable cooking fuel and encouraging circular use of agricultural waste, Bioflowt contributes simultaneously to climate mitigation, rural energy resilience and improved smallholder livelihoods.

Overall Impact: Bioflowt transforms an unmanaged livestock-waste problem into a low-cost source of renewable energy or methane mitigation by simple flaring. Its combination of simple floating mechanics, airtight heat-bonded fabrication, solar-assisted gas delivery and affordable local materials provides a practical pathway for methane mitigation and clean-energy access among smallholder farmers.

Conclusion

Bioflowt is a practical, low-cost and scalable methane-capture innovation for smallholder livestock farmers. By combining a floating airtight cover, simple buoyancy mechanics, locally available materials and solar-assisted gas delivery, it converts unmanaged livestock waste into useful renewable energy. Its low initial cost, modular design and minimal infrastructure requirements make it particularly relevant to rural communities that are underserved by conventional biogas technologies.



Know the Innovator

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INDIA

Krishi Kavacham

An Integrated AgriShield

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Introduction

Agriculture is the backbone of many economies and the primary livelihood of millions of farmers. However, challenges such as unpredictable weather, pest and disease outbreaks, inefficient resource utilization, and fluctuating market prices reduce productivity and income. Existing agricultural solutions are often fragmented, requiring farmers to use multiple applications for monitoring, forecasting, and decision-making. Krishi Kavacham-Integrated AgriShield is an AI-driven decision support platform that integrates Artificial Intelligence (AI), Internet of Things (IoT), Computer Vision, Cloud Computing, and Mobile Technologies into a single ecosystem.

The platform collects real-time field data through IoT sensors and cameras, combines it with weather and market information, and uses machine learning and deep learning models to provide crop health monitoring, pest detection, irrigation scheduling, yield prediction, market price forecasting, and personalized farmer recommendations. Built using Python, TensorFlow, OpenCV, Flutter, Firebase, and ESP32-based IoT devices, the platform is cost-effective, scalable, and suitable for both academic research and real-world deployment. Its primary objective is to enable data-driven, sustainable farming by improving productivity, reducing losses, optimizing resources, increasing farmers' income, and contributing to food security and rural development.

Motivation

Farming is getting harder because of climate change, pests and diseases. It is also hard to manage resources and the prices of things we sell can be unpredictable. This makes it tough for farmers to make a living. Some tools can help with farming but they usually only solve one problem at a time. So, farmers have to use different tools to get everything done. This is why we made Integrated AgriShield. It is a platform that uses artificial intelligence, internet-connected devices, computer vision, cloud computing and mobile phones to help farmers. It gives farmers real time information about their crops helps them make decisions and gives them personalized advice. The goal is to help farmers by giving them technology that's easy to use and does not cost too much. We want to help farmers grow food reduce waste use resources wisely and farm in a way that is good, for the earth. We also want to help farmers make an income and make sure everyone has enough food to eat.

Problem Statement

Agriculture faces major challenges due to unpredictable weather conditions, pest and disease outbreaks, inefficient use of water and fertilisers, and fluctuating market prices. Most existing agricultural solutions focus on individual problems, requiring farmers to use multiple disconnected applications for crop monitoring, weather forecasting, irrigation management, disease detection, and market analysis.

This lack of an integrated decision-support system limits timely decision-making, increases cultivation costs, reduces productivity, and affects farmers' income. Therefore, there is a need for a unified, AI-driven platform that combines AI, IoT, Computer Vision, Cloud Computing, and

Mobile Technologies to provide real-time monitoring, intelligent recommendations, and data-driven decision support for sustainable and profitable farming.

Objectives

Objectives of integrated AgriShield are

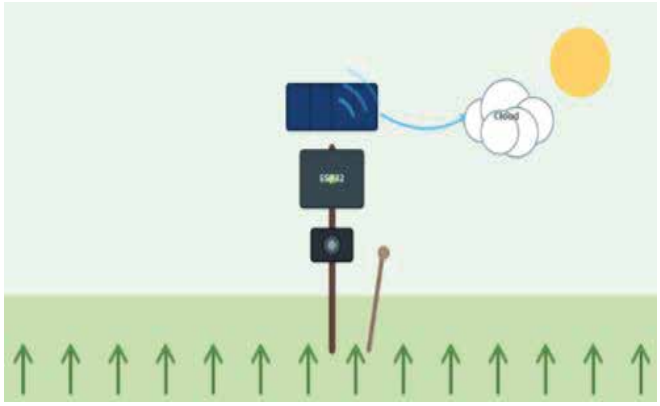
- Creating a tool that uses artificial intelligence to help farmers make good decisions by bringing together intelligence, special sensors, cloud computing and mobile phones into one easy-to-use platform.
- Keeping eye on how crops are doing and find any problems like pests or diseases right away using Computer Vision.
- Gathering information from the field like how wet the soil is, what the temperature is, and how humid it is, using special sensors.
- Predicting what the weather will be like, how well crops will. What prices will be like using artificial intelligence and Machine Learning models.
- Giving farmers special advice, on when to water add fertilizer, control pests and pick their crops.
- Helping farmers grow food use resources wisely, stop crops from getting damaged, and make more money so people have enough food.

Methodology and Implementation

The Krishi Kavacham system is made by putting a lot of different technologies like artificial intelligence, internet of things, computer vision, cloud computing and mobile technologies. This system uses sensors to collect information about the soil and the weather. These sensors check the moisture, temperature and humidity of the soil. There is also a camera that takes pictures of the crops. The system gets information about the weather and the market from sources. It stores all this information in a place using things like Firebase and MySQL. The information that is collected is then looked at and analysed using special computer models.

One of these models uses something called computer vision to look at the pictures of the crops and find any diseases or pests. Other models try to predict how well the crops will do and what prices they will sell for. The system then uses all this information to give the farmers advice on what to do. It tells them when to water their crops when to add fertilizer, how to deal with pests when to harvest their crops and when to sell them. The farmers get all this advice through an app on their phones. This app is available in languages and it gives the farmers real-time updates let them monitor their crops and helps them make decisions. The Krishi Kavacham system helps the farmers make decisions at the right time use their resources well, avoid losing crops and grow more food. The Krishi Kavacham system is very helpful, for farmers because it uses the technology to make farming easier and better.





Working, Cost-Effectiveness and Impact

Krishi Kavacham is like a shield for farmers. It works by collecting information from the fields in time using special sensors that measure things like how much water is in the soil the temperature and the humidity. It also takes pictures of the crops using a camera. Then it gets information about the weather and the market from sources and stores it safely on the internet using things like Firebase and MySQL. The information collects is analysed using computer programs that can learn and see things like Machine Learning and Computer Vision. These programs help figure out if the crops are sick or if there are pests and they can even predict how much food the crops will produce and how much it will sell for. They also give farmers personalised advice on things like when to water, when to add fertiliser, and when to harvest. All of this information is sent to the farmers on their phones in their language with alerts and charts to help them understand. It is not too expensive. The people who made it used open-source tools like Python and TensorFlow, which saved a lot of money.

The only things that cost money are the devices that collect information from the fields and some other services that are not necessary. This means that something that farmers and researchers can actually use. It helps them find out if their crops are sick or if there are pests. It tells them what to do to fix the problem. It also helps them use water and fertiliser in a way that's good for the crops and the earth. By giving farmers information about how much food their crops will produce and how much it will sell for, helps them make a steady income and plan for the future. It also helps make sure that everyone has food to eat and that the people who live in rural areas have good economic opportunities. Cost-Effectiveness: The cost of making was not too high because it was made with free and open-source technologies. This means that the people who made it did not have to spend a lot of money on software. The main things that cost money are the devices that collect information from the fields and some other services that are not necessary. This makes something that is affordable for people who are doing research and for farmers. Impact makes farming better by helping farmers find problems with their crops early by giving them real-time information about their crops and by giving them advice based on what the computer programs have learned. It helps farmers use water, fertilizer and pesticides, which saves them money and helps the environment. By giving farmers information about how much food their crops will produce and how much it will sell for helps them have a steady income and make good plans. It also helps make farming more sustainable, makes sure that everyone has food to eat and helps the economy in rural areas by giving small farmers access to advanced technology.

Social Impact

Integrated Agri Shield can really make a difference in people's lives. It helps marginal farmers by giving them access to affordable technology that uses Artificial Intelligence. This technology gives them the information they need to make decisions about farming. It also gives them advice, which helps them to farm better and get more produce. Integrated Agri Shield reduces the amount of crops that are lost which means farmers can earn an income. It also teaches farmers how to farm in a way that's good for the environment. This makes the lives of farmers better. Helps the communities around them. The people who made Integrated Agri Shield also made an app that can be used in many languages. This means that farmers who speak languages can use it too. Integrated Agri Shield is good for farmers. It is also good for the country because it helps us have enough food for a long time. It helps the rural areas to develop and become places to live. Integrated Agri Shield is really important for the farmers and, for the people who live in areas.

Conclusion

AI-driven smart agriculture platform that integrates Artificial Intelligence (AI), IoT, Computer Vision, Cloud Computing, and Mobile Technologies to support data-driven farming. By combining real-time crop monitoring, disease and pest detection, weather forecasting, yield prediction, market price analysis, and personalized recommendations into a single platform, it enables farmers to make informed decisions that improve productivity, reduce crop losses, optimize resource utilization, and increase income. Built with cost-effective open-source technologies, the platform provides a scalable and sustainable solution that promotes food security, environmental sustainability, and rural economic development while supporting the future of smart agriculture.

Know the Innovators



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VIETNAM

Mangrove-Based Livelihood Transition Model for Coastal Fishers

Integrating Eco-Shrimp Farming and Community-Based Ecotourism

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1. Background and Problem Statement

Vietnam's coastal fisheries sector is undergoing a critical transition. The country currently has approximately **80,000 fishing vessels**, most of which are operated by small-scale coastal fishers who heavily depend on marine resources for their livelihoods. In recent years, in response to declining fish stocks, illegal, unreported and unregulated (IUU) fishing concerns, and environmental degradation, the Government of Vietnam has been implementing policies to reduce fishing capacity and restructure the fisheries sector.

While these policies are necessary for long-term sustainability, they have created significant socio-economic challenges. A large number of vulnerable fishers-particularly those living in coastal areas-are facing declining income and limited alternative livelihood opportunities| The **Mekong Delta region**, which hosts the largest concentration of fishing communities, is also home to vast mangrove forest ecosystems. These mangroves are among the most extensive in Southeast Asia, yet many areas remain underutilized or lack effective livelihood integration models.



Figure 1. Coastal fishers operating in mangrove ecosystems in Vietnam.

At the same time, **global demand for organic and eco-certified black tiger shrimp** (*Penaeus monodon*) from Vietnam is rapidly increasing. However, current production is **insufficient to meet international market demand**, especially for sustainably farmed shrimp from mangrove-based systems.

In parallel, Vietnam's Mekong Delta has become a major tourism destination, attracting millions of visitors annually. There is a growing demand for:

- Nature-based tourism
- Mangrove forest experiences
- Homestay and community-based tourism
- Hands-on activities such as fishing, harvesting, and local food experiences

These trends indicate a strong and expanding market for integrated ecological livelihood models.

The core challenge remains: How can vulnerable coastal fishers transition to sustainable, scalable livelihoods that align with environmental conservation while meeting growing market demand?

2. Proposed Solution

This proposal introduces an *Integrated Mangrove Livelihood Transition Model,* combining:

(1) Eco-Shrimp Farming under Mangrove Canopy (2) Community-Based Ecotourism

This dual-income model enables coastal fishers to shift from extractive fishing practices to sustainable, regenerative livelihoods.



Figure 2. Mangrove forest landscapes integrated with aquaculture in the Mekong Delta.

Eco-Shrimp Farming (Mangrove - Shrimp System)

Fishers will be supported to adopt low-density, organic shrimp farming integrated with mangrove conservation.

Key features:

- No chemical inputs or industrial feed
- Natural shrimp growth within mangrove ecosystems
- Compliance with eco-certification standards (e.g., organic or eco-shrimp)
- Preservation of at least 50 - 60% mangrove coverage per farming unit

Advantages:

- Lower production cost
- Higher market value (premium eco-products)
- Reduced environmental impact
- Increased resilience to climate change



Figure 3. Extensive shrimp farming under mangrove canopy.

Community-Based Ecotourism

In parallel, participating households or cooperatives will develop small-scale ecotourism services.

Activities may include:

- Guided mangrove forest tours
- Traditional fishing experiences
- Homestay accommodations
- Local seafood and cultural experiences

Target visitors:

- Domestic and international eco-tourists
- Families, students, and experiential travelers

Integrated Livelihood Approach

The strength of this model lies in income diversification:

Income Source	**Characteristics**
Eco-shrimp farming	Stable, seasonal income
Ecotourism	Flexible, high-margin income

This reduces dependency on a single livelihood and improves economic resilience.

3. Implementation Strategy:

The model can be implemented through a phased approach:

Phase 1: Pilot Development (Year 1)

- Select 1 - 2 pilot communities in coastal provinces

- Identify 20 - 30 fisher households for participation
- Provide training on eco-shrimp farming and tourism services
- Establish basic infrastructure (pond preparation, homestay upgrades)

Phase 2: Market Linkage and Branding (Year 1 - 2)

- Partner with seafood buyers/exporters for eco-shrimp certification
- Collaborate with tourism operators and digital platforms
- Develop a local brand for "Mangrove Eco Products & Experiences"

Phase 3: Scaling and Replication (Year 2 - 5)

- Expand to additional coastal regions
- Build cooperatives or community enterprises
- Integrate with national rural development programs

Feasibility and Cost-Effectiveness

A key strength of this model is its **low cost and ease of implementation**.

- Extensive shrimp farming requires minimal technical training
- Training programs are simple and short-term
- Initial investment is relatively low

Depending on available funding, the project can begin with 1 - 2 pilot models. Once successful, the model can be scaled rapidly through:

- Community learning
- Demonstration sites
- Local technical guidance

This makes the model highly **practical, scalable, and cost-effective**.

4. Expected Impact

Economic Impact

- Increase household income by 30 - 70% through dual revenue streams
- Reduce financial vulnerability of former fishers
- Create new jobs in tourism and value chains

Environmental Impact

- Restore and protect mangrove forests
- Reduce fishing pressure on marine resources
- Enhance biodiversity and ecosystem services

Social Impact

- Provide sustainable livelihood alternatives
- Strengthen community cooperation through shared models
- Empower local communities, including women and youth

Market-Driven Impact

- Increasing international demand for eco-certified shrimp products
- Expanding domestic and international tourism flows to the Mekong Delta
- High interest from tourists in authentic, experience-based travel

This ensures that the proposed model is not only environmentally sustainable but also market-driven and economically viable.

5. Innovation and Uniqueness

This model stands out due to:

- **Integrated approach**: Combining aquaculture + tourism + conservation
- **Policy alignment**: Supports national fisheries restructuring efforts

- **Nature-based solution**: Uses ecosystems as economic assets
- **Scalability**: Applicable across multiple coastal regions in Asia-Pacific

Unlike traditional aquaculture or standalone tourism, this model creates a **self-reinforcing system** where environmental protection directly enhances economic benefits.

6. ESG and Carbon Credit Potential

This model aligns strongly with Environmental, Social, and Governance (ESG) principles.
Mangrove ecosystems are highly effective carbon sinks, storing significant amounts of blue carbon. By protecting and expanding mangrove coverage, this model contributes directly to climate change mitigation.
Socially, it supports vulnerable communities and improves livelihoods. From a governance perspective, it aligns with national strategies and promotes community-based management.

The model also has potential to access:

- Voluntary carbon markets
- Blue carbon initiatives
- ESG investment funds

This can create additional income streams and enhance financial sustainability.

7. Scalability and Replicability

- The model can be replicated in:
- Mekong Delta
- Southeast Asia coastal regions
- Key enabling factors:
- Existing mangrove ecosystems
- Available labour and knowledge
- Strong market demand

8. Conclusion

The transition from fishing to sustainable livelihoods is one of the most urgent challenges facing coastal communities. This proposal provides a practical, scalable, and market-driven solution by leveraging Vietnam's mangrove ecosystems. By integrating eco-shrimp farming with ecotourism, the model creates sustainable income while restoring ecosystems. This model has the potential to evolve into a scalable **blue carbon livelihood model**, connecting coastal communities with global climate finance and sustainable development pathways.

Know the Innovator

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LAO PDR

Forest to Foreign Fork: Sustainable Expansion of Wild Red Mushroom for Rural Resilience

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1. Innovation Overview

Forest to Foreign Fork is an integrated, community-based bio-innovation that establishes a sustainable production and value-chain model for the Wild Red Mushroom (*Hed Kor Deng*), one of the most valuable non-timber forest products (NTFPs) in the northern highlands of the Lao People's Democratic Republic. The innovation addresses the fundamental challenge of dependence on opportunistic seasonal harvesting by introducing a science-based approach that enhances the natural abundance of Wild Red Mushroom within community-managed forest ecosystems.

The innovation integrates fungal biotechnology, indigenous ecological knowledge, community-based natural resource management (CBNRM), sustainable forest governance, and inclusive market development into a single rural development framework. Rather than replacing natural ecosystems with artificial cultivation systems, the approach enhances the ecological symbiosis between Wild Red Mushroom and its associated forest tree species through controlled spawn production, forest inoculation, and ecosystem-based management practices.

A distinguishing feature of this innovation is the establishment of a complete "Forest to Foreign Fork" value chain, whereby community-managed forest resources are transformed into high-value commercial products through quality assurance, value addition, branding, certification, and organized market integration. The model simultaneously strengthens biodiversity conservation, climate-resilient livelihoods, food and nutrition security, and rural enterprise development while maintaining the ecological integrity of natural forests. This innovation represents a paradigm shift from extractive forest product collection toward ecosystem enhancement and regenerative bioeconomy development, positioning rural communities not only as resource users but also as custodians and investors in sustainable forest ecosystems.

2. Significance of the Innovation

Wild Red Mushroom constitutes one of the highest-value edible forest resources in Houaphan Province and contributes significantly to seasonal household income, dietary diversity, and local food security. The species is highly sought after in domestic markets and increasingly demanded by international consumers, particularly in China, Vietnam, and Thailand, where premium prices are offered for high-quality wild mushrooms.

Despite its considerable economic potential, current production remains entirely dependent on natural occurrence and uncontrolled seasonal harvesting. Consequently, mushroom supply is highly variable, commercial opportunities remain underdeveloped, and increasing harvesting pressure threatens the long-term ecological sustainability of natural populations. In addition, rural communities possess limited technical capacity for mushroom propagation, quality management, post-harvest processing, and organized market participation.

The proposed innovation addresses these systemic constraints by transforming passive resource extraction into an active ecosystem enhancement strategy. Through scientific propagation and community-led forest restoration, the initiative increases the productive capacity of natural forests while strengthening local stewardship and conservation incentives. Consequently, economic development becomes directly linked to environmental sustainability, creating mutually reinforcing ecological and socio-economic outcomes. Furthermore, the innovation contributes directly to the Government of Lao PDR's priorities on rural development, poverty reduction, sustainable natural resource management, biodiversity conservation, nutrition improvement, climate resilience, and green economic growth. Its integrated design also aligns closely with the Sustainable Development Goals (SDGs), particularly SDGs 1, 2, 8, 12, 13, and 15, providing strong potential for replication throughout Lao PDR and other forest-dependent communities across the CIRDAP region.

3. Technical Approach and Operational Framework

The innovation is implemented through an integrated five-component framework that combines scientific research, community participation, ecosystem restoration, enterprise development, and market integration.

Component 1. Scientific Propagation and Technology Development
Wild Red Mushroom specimens are systematically collected from natural forests and subjected to laboratory isolation and tissue culture techniques for the production of high-quality spawn. Appropriate inoculation protocols are developed through applied research to maximize colonization efficiency and ecological compatibility within native forest environments.

Component 2. Community Capacity Development
Participating households receive structured technical training on fungal propagation, sustainable harvesting practices, forest ecosystem management, quality control, and enterprise development. Demonstration sites and farmer-to-farmer extension approaches facilitate practical knowledge transfer and strengthen local institutional capacity for long-term implementation.

Component 3. Forest Ecosystem Enhancement
Unlike conventional commercial mushroom cultivation, the project introduces biological inoculation directly into selected forest ecosystems to enhance naturally occurring mushroom populations. This ecosystem-based approach conserves the symbiotic relationship between fungi and forest vegetation while increasing biological productivity without degrading natural habitats.

Component 4. Nutrition and Rural Livelihood Enhancement
The project promotes increased household consumption of nutrient-rich wild mushrooms while supporting product diversification through drying, processing, packaging, and other value-added activities. These interventions improve food security while generating higher market returns for participating households.

Component 5. Enterprise Development and Market Integration
Community producer groups are organized to establish collective production systems, quality assurance mechanisms, product branding, certification, and cooperative marketing arrangements. Strategic partnerships with restaurants, supermarkets, tourism enterprises, specialty food retailers, and export buyers facilitate access to premium domestic and international markets.

Collectively, these five components establish an integrated bioeconomy model that transforms rural communities from seasonal forest product collectors into sustainable producers, forest stewards, and competitive market participants.

4. Cost-Effectiveness and Sustainability

The proposed innovation demonstrates a high level of cost-effectiveness by maximizing the productive potential of existing natural forest ecosystems rather than relying on capital-intensive infrastructure or controlled-environment cultivation facilities.

Its economic efficiency derives from several complementary characteristics:

- Utilization of naturally existing forest ecosystems substantially reduces establishment and operational costs compared with commercial mushroom farming.
- Community-based implementation minimizes labor expenditures while strengthening local ownership, institutional sustainability, and long-term maintenance.
- Biological inoculation represents a relatively low-cost intervention capable of generating repeated ecological and economic benefits across multiple production seasons.
- Capacity-building investments create enduring technical expertise within local communities, thereby reducing long-term dependence on external specialists.
- Value addition, product diversification, branding, and organized marketing substantially increase income generation without requiring expansion of agricultural land or forest conversion.
- Simultaneous achievement of conservation, livelihood enhancement, and enterprise development generates multiple development outcomes from a single investment, thereby improving overall economic efficiency.

The model further enhances financial sustainability through community ownership, revolving income generated from mushroom sales, cooperative enterprise development, and strategic partnerships with private-sector market actors. These mechanisms progressively reduce reliance on external project financing while creating a self-sustaining rural enterprise model capable of long-term operation and expansion.

5. Expected Development Impact

The Forest to Foreign Fork innovation is expected to generate multidimensional impacts that contribute simultaneously to economic development, social inclusion, nutrition improvement, environmental conservation, and institutional strengthening.

Economic Impact

The innovation will diversify household livelihoods through sustainable commercialization of Wild Red Mushroom, increase household income, stimulate local employment, promote community-based enterprises, and strengthen rural value chains. These outcomes will contribute directly to poverty reduction and improved economic resilience among forest-dependent communities.

Social Impact

The project will strengthen community capacity through technical training, organizational development, and participatory forest governance. It will promote inclusive participation of women and youth in productive economic activities, create local employment opportunities that reduce outward migration, and reinforce community institutions responsible for sustainable natural resource management.

Nutrition Impact

Improved availability and consumption of Wild Red Mushroom will enhance dietary diversity and increase access to highly nutritious forest foods rich in protein, dietary fibre, vitamins, antioxidants, and essential minerals. These improvements will contribute to household food security and better nutritional outcomes, particularly among vulnerable rural populations.

Environmental Impact

By increasing mushroom productivity through ecosystem enhancement rather than intensified harvesting, the innovation strengthens incentives for forest conservation and biodiversity protection. Community stewardship of forest resources will reduce pressure on naturally occurring mushroom populations, improve ecological resilience, and encourage sustainable management of forest ecosystems under changing climatic conditions.

Beyond its immediate project outcomes, the innovation establishes a scalable and replicable model for sustainable forest-based rural development. By integrating biotechnology, ecosystem restoration, community enterprise, and market-led value chain development, the Forest to Foreign Fork approach demonstrates how biodiversity conservation can become a driver of inclusive economic growth. Its successful implementation will provide a practical model for forest-dependent communities throughout Lao PDR and across the CIRDAP member countries, contributing to resilient rural economies founded on the sustainable utilization of natural resources.



Dried red mushrooms processed using the new drying machine



Dried red mushrooms vacuum-packed using a vacuum sealing machine.



Know the Innovator

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INDIA

Plastic-Free Rural Commons

Carbon-Negative Construction Products, EPR Revenue and Grassroots Livelihoods

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1. Innovation and Policy Significance

Plastic-Free Rural Commons is a rural–peri-urban model that upscales non-recyclable Category III plastic (multi-layered and single-use packaging) into carbon-negative construction products such as eco interlock pavers, bricks, and kerb stones. The innovation converts a difficult waste stream into long-life infrastructure assets, directly supporting circular economy and climate objectives for local governments and national regulators. Mysuru City Corporation (MCC), in partnership with Jagruth Tech, became the first Urban Local Body in India to secure Extended Producer Responsibility (EPR) certification for Category III plastic waste, creating a demonstrable policy pathway for other cities and rural bodies to follow. This positions the innovation as a tested bridge between grassroots practice and evolving plastic waste regulation in the Asia–Pacific region.

2. Technology and Process

Jagruth Tech holds an Indian patent for eco-friendly interlocking paving blocks that use low-value and post-consumer plastic waste to produce high-strength, anti-skid, water-resistant pavers certified to bear 50–60 tonne loads. In Mysuru, these products already replace conventional cement tiles in pavements and footpaths, lowering costs and avoiding the high embodied carbon of cement. The process is modular and suited to rural and peri-urban clusters:

- Segregation of Category III plastics from dry waste collected at village and town level.
- Shredding and mixing with additives, followed by moulding into pavers and kerb stones.
- Cooling and deployment in local public works, creating visible, durable infrastructure from previously unmanaged plastics.

3. EPR Revenue and Policy Innovation

Under national Plastic Waste Management Rules, producers and brand owners must meet EPR obligations by funding or documenting recovery of post-consumer plastics. MCC's collaboration with Jagruth Tech demonstrates how local bodies can turn documented Category III plastic processing into tradable EPR certificates, which corporates purchase to comply with regulations. MCC has already monetised EPR credits generated from Category III plastics, earning direct revenue by selling them to companies such as Nestlé, making it one of the earliest civic bodies to receive cash benefits from EPR certificate sales. For rural and peri-urban units, registering on the EPR portal and following similar documentation standards can create a steady income stream that complements product sales, while also aligning with national and regional policy goals on circular economy and low-carbon development. This integrated waste-to-product-to-EPR-credit chain is a transferable policy innovation: it shows regulators and municipalities that Category III plastics can be formally accounted, safely upscaled, and financially valued rather than burnt, dumped or exported.

4. Grassroots Livelihoods and Infrastructure Transformation

The Plastic-Free Rural Commons model proposes small upscaling units operated by self-help groups (SHGs), cooperatives or rural enterprises, supported by district authorities and technology

partners. These units collect plastics from gram panchayats, markets, institutions and waste pickers and convert them into construction materials for village commons, schools, Anganwadi, markets, rural roads and farm infrastructure.

Each unit can:

- Divert significant volumes of plastic away from open burning and dumping each year.
- Upgrade rural and peri-urban paths and public spaces using plastic pavers and tiles, improving connectivity, safety and resilience in monsoon conditions.
- Create structured jobs in collection, segregation, processing and installation, prioritising former informal waste workers, thereby formalising and dignifying their work.

This approach links environmental infrastructure with livelihoods: assets like footpaths, school campuses and market yards built from local plastic waste generate both material benefits and social empowerment. Communities gain skills in green enterprise, participate in formal value chains, and access new revenue through EPR and potential future carbon-credit mechanisms.

5. Scalability Across Rural and Urban Contexts

The model is highly replicable because:

- The feedstock—Category III and other non-recyclable packaging—is abundant in rural markets, shops and households across the Asia–Pacific region.
- The technology uses standard equipment (shredders, mixers, moulds) and can be configured for 2–10 tonne per day capacities, suitable for both small rural clusters and larger peri-urban or municipal hubs.
- The institutional design—local body plus technology partner plus SHG/cooperative operator and corporate EPR/CSR supporter—can flex to different governance systems while keeping community ownership central.

By bundling technological innovation with social investment and regulatory compliance, Plastic-Free Rural Commons offers a low-cost, high-impact framework that rural and urban authorities can adopt to simultaneously strengthen policy implementation, transform infrastructure, and expand livelihoods.



Know the Innovator

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BANGLADESH

SilentGuard-RURAL

An Early Warning System for Rural Crisis Prevention

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Background

Rural early warning systems typically rely on indicators that are reported directly-prices, enrolment figures, health records. This work examines a different signal: what happens to reporting itself when a community comes under stress. Using 25 years of Bangladeshi data (2000–2024), we find that reporting quality-completeness, variance, timeliness-degrades measurably before a crisis is confirmed by conventional indicators. SilentGuard-Rural is built around this observation.

The Problem

Bangladesh has more than 100,000 villages exposed to recurring food, climate, and income shocks, but no system currently monitors stress at village level before it becomes a humanitarian event. World Bank dashboards operate nationally and report retrospectively, typically six to twelve months after the fact. UNICEF's child-welfare monitoring tracks health and nutrition independently of economic and financial indicators, limiting its ability to catch cascading effects. FEWS NET is food-focused and does not account for an estimated 60% of crisis drivers originating in other sectors. None of the three treats the absence or delay of data as informative in its own right, even though transparency is often the first thing to erode when institutions come under pressure.

How the System Works

SilentGuard-Rural combines two types of signals that are not currently monitored together: the values of standard socioeconomic indicators, and the reliability of their reporting. Public data across six sectors is first checked for signs of suppressed or degraded reporting, then passed through an intelligence layer that learns normal reporting behaviour, forecasts risk, and traces how a shock in one sector spreads into others. The output reaches two audiences: a decision-support dashboard for district officials, and a plain-language mobile alert for residents.

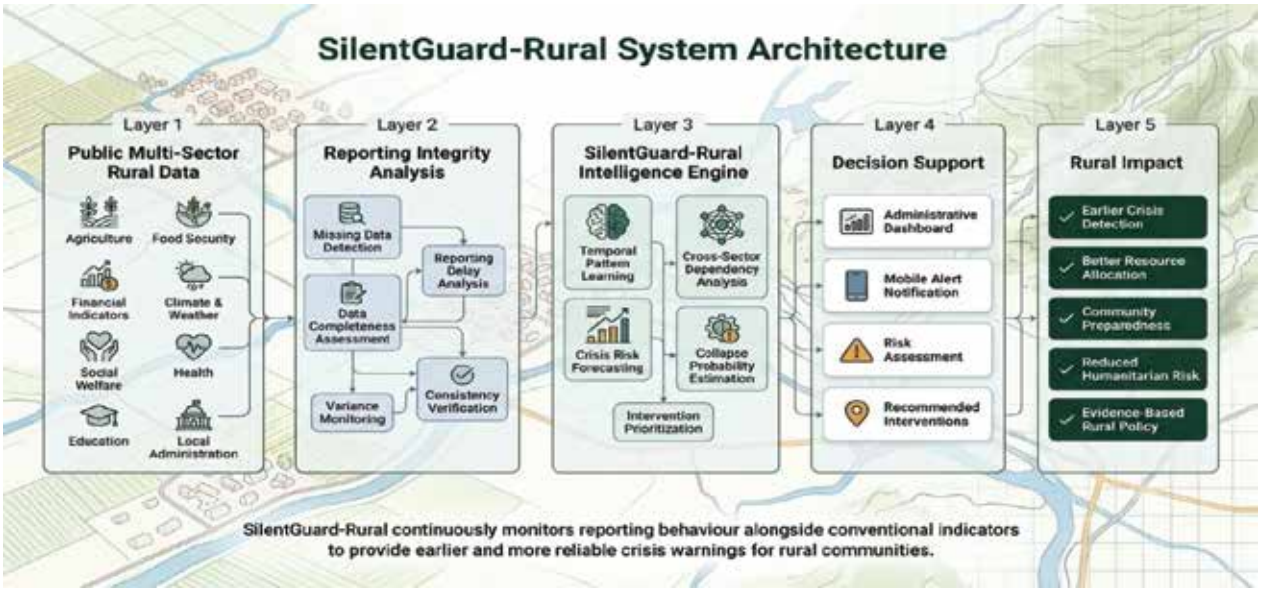


Figure 1. SilentGuard-Rural's five-layer architecture, from raw public data to rural impact.

Evidence: Reporting Gaps as a Leading Indicator

Across the 25-year study period, the seven years later confirmed as crisis years-including 2007-2008, 2011, and 2022-2023-showed an average silence score of 0.85, compared with 0.52 in stable years, a difference that is statistically significant ($p < 0.001$) and tends to appear two to four months ahead of conventional indicators. All seven crisis years scored at or above 0.70 on this measure; the score reached 0.9 during the 2022-2023 inflation crisis, before standard economic indicators had fully reflected it.



Figure 2. Silence score against modelled collapse probability, 2000-2024 (back tested data).

Cost-Effectiveness

Candidate interventions are ranked by cost per point of reduction in modelled collapse probability, using impact parameters drawn from published randomized-trial evidence adapted to the

Bangladeshi context. School feeding programs achieve roughly $22.8 million per point, compared with about $194.8 million per point for large-scale employment programs, despite the latter's larger absolute effect. A modest package combining school feeding with cash transfers, at an estimated cost of $473 million, produces a 31% reduction in modelled collapse probability at the most efficient point on the cost curve.

Results Summary

- 92% accuracy in predicting child-welfare crises approximately six months in advance, based on 25-year historical back-testing.
- 72% accuracy in predicting overall village-level collapse, including early detection of the 2022–2023 inflation crisis.
- Runs on existing district-level computing infrastructure, without additional hardware or specialized staff.
- Produces two coordinated outputs- a technical dashboard and a plain-language SMS alert-so officials and residents can act on the same forecast.

Adapting the System for Other Contexts

The framework was built with replication in mind rather than as a Bangladesh-specific tool. Its core indicators correspond to categories already collected by most national statistical bodies in the region, so a member state adopting the system would generally substitute local data sources and existing government infrastructure rather than redesign the framework. Alerts can be localized into the target language, and the system can begin with a limited pilot in one or two districts before wider rollout. Applied across CIRDAP's member countries, this approach could extend early warning coverage to a substantial share of the region's rural population, though this reflects potential coverage rather than a claim about current operational readiness at that scale.

Next Steps

The immediate priorities are a pilot in one or two rural districts, a short capacity-building session for member-country statistical and district officials, and an open-source release of the underlying code so that national agencies can adapt it directly rather than depend on the original development team. Feedback from a live pilot, particularly on data availability and alert usability at the village level, will likely shape the next version of the system more than further modelling refinements would.



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MALAYSIA

Integrated Molecular Surveillance to Livestock Diseases

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The Innovation

Livestock play an important role in supporting the livelihoods of rural communities across the Asia-Pacific region. They provide food, income, and employment for millions of people. However, infectious livestock diseases, especially transboundary animal diseases such as African Swine Fever (ASF), continue to threaten livestock production and rural economies. Early disease detection is essential for effective disease control. Delays in laboratory confirmation can slow response efforts, allowing diseases to spread further and increasing losses for farmers. Strengthening disease surveillance with rapid molecular diagnostics helps veterinary authorities respond more quickly and improve outbreak preparedness. To address this challenge, the Department of Veterinary Services Malaysia developed an Integrated Molecular Surveillance approach that combines disease surveillance with molecular diagnostic testing. By linking surveillance, laboratory testing, and reporting, the approach supports earlier disease detection and timely veterinary response while helping protect rural livelihoods.

Why This Innovation Matters

- Integrates disease surveillance with molecular diagnostics.
- Supports early laboratory confirmation.
- Enables faster reporting and veterinary response.
- Uses existing laboratory facilities and expertise.
- Can be adapted for different livestock diseases.
- Helps protect livestock, food security, and rural livelihoods.

The Integrated Molecular Surveillance Framework

Integrated Molecular Surveillance combines field surveillance with molecular diagnostic testing to improve livestock disease detection and response. Rather than working separately, surveillance, laboratory testing, and reporting are linked through a coordinated workflow. Samples collected during surveillance or disease investigations are tested using validated Real-Time PCR methods. Laboratory results are interpreted and reported promptly to support veterinary decision-making and disease control activities. This approach allows molecular diagnostics to become part of the surveillance system, helping veterinary authorities detect diseases earlier and respond more effectively.

Implementation Approach

The Integrated Molecular Surveillance approach follows a structured workflow from sample collection to laboratory reporting. Samples from suspected disease cases are received, registered, and processed using validated laboratory procedures. Nucleic acids are extracted before analysis using Real-Time PCR assays. Results are interpreted and reported promptly to support disease investigation and veterinary response. This workflow improves coordination between field

surveillance and laboratory diagnostics, enabling faster disease detection and better outbreak preparedness.



Figure 1. Real-Time PCR analysis supporting rapid laboratory confirmation of suspected livestock diseases.

Cost-Effectiveness and Adaptability

The Integrated Molecular Surveillance approach uses existing laboratory infrastructure, trained personnel, and validated molecular diagnostic methods. As it builds on available resources, no major investment in new facilities or equipment is required. The approach is practical, cost-effective, and can be adapted by veterinary laboratories for different livestock diseases.

Impact on Rural Communities

Earlier laboratory confirmation supports faster disease investigation and timely response, helping reduce the impact of disease outbreaks. For rural communities, this means healthier livestock, lower production losses, improved food security, and stronger protection of farmers' livelihoods. By linking surveillance with molecular diagnostics, the approach strengthens disease preparedness and supports more resilient livestock production systems.

Regional Relevance

Although developed in Malaysia, the Integrated Molecular Surveillance approach can be adapted by veterinary laboratories across the Asia-Pacific region. By using existing molecular diagnostic capacity, countries can strengthen disease surveillance, improve outbreak preparedness, and enhance livestock health without major additional investment.

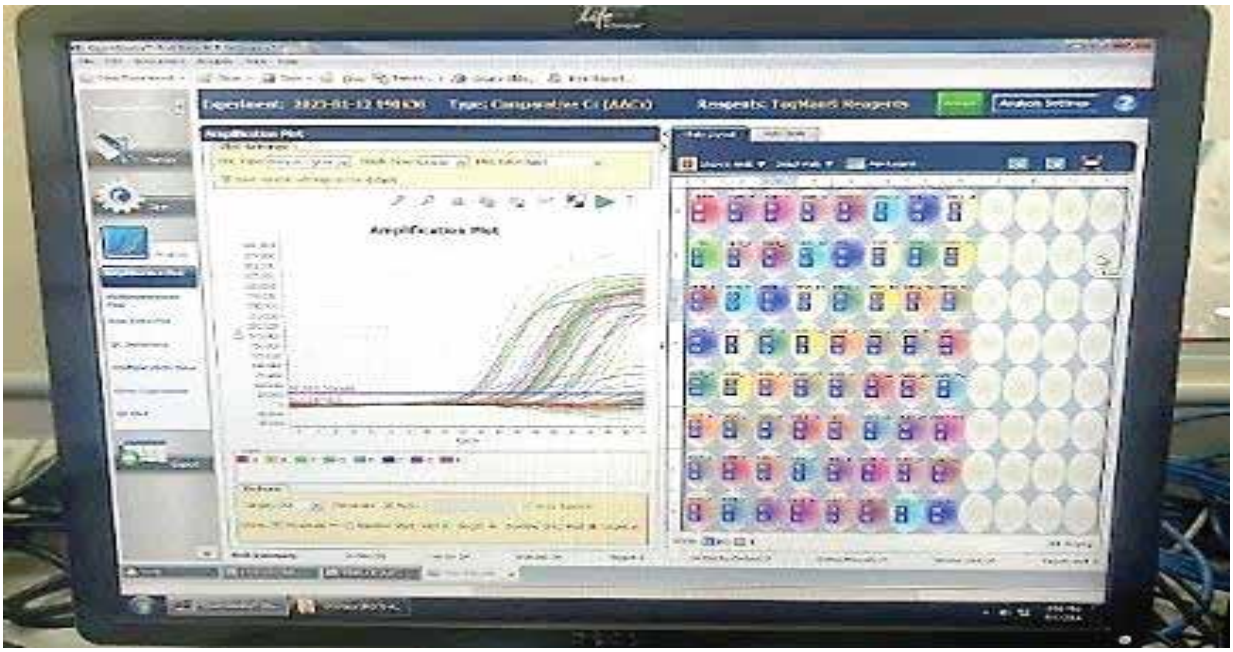


Figure 2. Interpretation of molecular diagnostic results to support timely disease surveillance and veterinary decision-making.

Conclusion

The Integrated Molecular Surveillance approach demonstrates how existing molecular diagnostic capabilities can be integrated with disease surveillance to support earlier disease detection and timely veterinary response. By linking surveillance, laboratory diagnostics, and reporting, the approach strengthens disease preparedness and contributes to healthier livestock, improved food security, and more resilient rural communities. It provides a practical and adaptable model that can support livestock disease surveillance across the Asia-Pacific region.



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SRI LANKA

Strengthening Mangrove Conservation and Fisher Livelihoods

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1. Background

Karainagar is a coastal island community in Northern Sri Lanka where rural fisher families rely heavily on mangrove ecosystems for coastal protection, fish breeding grounds, and crab habitats. Despite their ecological and economic value, these habitats face severe degradation due to overexploitation, limited community stewardship, and uncoordinated restoration practices. A major bottleneck in regional coastal restoration is the complete absence of organized local mangrove nurseries in Northern Sri Lanka. Past restoration programs frequently imported seedlings from other regions of the country, which increased transport costs, lowered seedling survival due to eco-climatic stress, and introduced significant risks of genetic mismatches.

This innovation directly builds upon a previously field-tested community restoration initiative in Karainagar managed by the author. Despite being struck by the severe Cyclonic Storm Ditwah, that project achieved an average 70% seedling survival rate after seven months, proving that strong community ownership and post-planting maintenance significantly enhance ecological resilience. To solve the supply chain vulnerability identified during that effort, this project shifts restoration away from external reliance and toward a locally embedded, conservation-linked livelihood model.

2. Objectives

The project aims to improve mangrove conservation by developing local capacity for managing native mangrove seed nurseries, as well as improving fisher livelihoods.

Specific Objectives are:

1. Train fisher families on mangrove conservation and nursery management.
2. Enhance community awareness on protecting the ecosystem.
3. Encourage conservation-linked income-generating activities.

2. The Innovation

The innovation establishes a decentralized, household-level mangrove nursery system owned and operated by local fishing families, including direct participation from women and youth members. The operational model merges practical ecological training with micro-entrepreneurship. Participating families undergo a hands-on training structure consisting of 70% field practicals and 30% theory, covering native species identification, ethical wild seed collection, low-cost nursery bed setup, soil mixing, and survival monitoring.

Following training, each family is equipped to establish a micro-nursery unit and propagate native, site-adapted mangrove seedlings, production. Beyond seedling production, participating fishers act as "Mangrove Ambassadors" within the village, promoting peer-to-peer conservation awareness and curbing localized habitat destruction.

3. Implementation Strategy

Community Awareness
↓
Selection of Fisher Families
↓
Field-Based Practical Training (70%)
↓
Household-Level Nursery Establishment
↓
Local Seedling Production
↓
Conservation Action & Community Ambassadors

4. Results Framework

By decentralizing seedling production, this model mitigates ecological risks, preserves local genetic adaptability, and creates supplementary income pathways during non-fishing seasons. The project's impact is tracked through clear milestone indicators. In the short term (0–6 months), output targets will be monitored. Between 6 and 12 months, monitoring will focus on short-term outcome targets on maintaining a seedling survival rate and supplementary income generation of the trained households through seedling sales, and demonstrating a measurable reduction in externally sourced seedlings for regional projects. Over the medium term (12–24 months), the initiative aims to enhance the protection of nearby mangrove patches, establish a sustained local seedling supply chain, and foster a positive community shift regarding the link between healthy mangroves and fishery yields.

5. Cost-Effectiveness

The project relies on low-cost, locally available materials such as polybags, shading nets, simple frames, and local soil mixtures combined with community labour. This drastically reduces overhead costs compared to centralized nurseries. At an exceptionally low unit cost of approximately LKR 10,266 per household (around USD 33), this initiative offers a highly cost-effective and scalable intervention. It provides an adaptable rural development model that can easily be replicated across coastal regions throughout Sri Lanka and the broader Asia-Pacific region.



Know the Innovator

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BANGLADESH

Employment Generation and Poverty Alleviation through Voluntary Organizations

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1.Executive Summary

The overall goal of the project is to promote sustainable and inclusive socio-economic development in rural Bangladesh by strengthening the institutional capacity of Bangladesh National Social Welfare Council (BNSWC)-trained registered voluntary organizations and empowering 2,000 unemployed women and men, widows, persons with disabilities, and other marginalized people across 10 poverty-prone districts in the country's eight divisions. Through market-oriented skills development, employment generation, entrepreneurship promotion, access to income-generating opportunities, and improved market linkages, the project will enhance beneficiaries' income, economic resilience, and social inclusion, thereby contributing to sustainable livelihood improvement and the reduction of extreme poverty.

In parallel, the project will strengthen the institutional infrastructure, organizational governance, administrative systems, financial management, and technical capacity of registered voluntary organizations, enabling them to serve as effective and accountable local development institutions. As strategic partners of the Government of Bangladesh, these organizations will be better equipped to deliver community-based social welfare and livelihood development services, expand outreach to vulnerable populations, and sustain development interventions beyond the project period. By reinforcing local ownership, participatory governance, and institutional sustainability, the project will contribute to building resilient, inclusive, and self-reliant rural communities.

2. Problem Statement

Rural marginalized communities in Bangladesh continue to face persistent socio-economic challenges, including income insecurity, irregular employment, limited access to quality education, market-oriented skills, technology, startup capital, market linkages, and digital literacy, which severely restrict sustainable livelihood opportunities. Women, widows, persons with disabilities, and unemployed youth are disproportionately affected due to inadequate institutional and financial support. Although registered voluntary organizations have strong community networks and the potential to deliver cost-effective, community-based development services, their institutional and technical capacities remain weak. Existing development initiatives rarely invest in strengthening these organizations as local development actors or utilize them to implement integrated livelihood programs. Consequently, the full potential of voluntary organizations to promote employment, entrepreneurship, social inclusion, and economic empowerment remains largely untapped. Addressing these institutional gaps is essential to achieving sustainable poverty reduction and resilient rural socio-economic development in Bangladesh.

3. Research Findings

The project focuses on 10 poverty-prone districts affected by river erosion, char vulnerability, unemployment, and limited livelihood opportunities. Its rationale is supported by the 2024 study,

"Evaluation of Grant Activities Provided to Voluntary Organizations by the Bangladesh National Social Welfare Council," led by Professor Dr. Md. Nurul Islam, University of Dhaka.

The study revealed that 93.75% of respondents recommended increased financial support for voluntary organizations, 93.75% emphasized employment-oriented training for beneficiaries, 85.42% supported staff capacity building, 83.33% favoured grants for qualified organizations, and 81.25% stressed effective monitoring and auditing.

The findings confirm that strengthening voluntary organizations is a practical and effective strategy for creating employment, increasing income, and reducing poverty among marginalized rural communities.

4. Socio- Economic Plan: Innovation Highlights

This initiative represents a community-based inclusive economic development model for Bangladesh, using registered voluntary organizations as the primary drivers of rural socio-economic transformation. Aligned with Amartya Sen's Human Development Theory, the Community-Based Development Model, and the Sustainable Livelihoods Framework, it promotes inclusive growth through local participation and institutional capacity building. In line with Section 5(J) of the Bangladesh National Social Welfare Council Act, 2019, the model provides a cost-effective and sustainable approach to employment generation, poverty reduction, and long-term rural development.

4.1 Target Population

- A total of 2,000 rural marginalized people be provided with employment opportunities through initial investment and livelihood support.
- The managerial and organizational capacity of 100 local voluntary organizations will be strengthened and enhanced.
- Approximately 2,000 beneficiary families will achieve socio-economic development and improved living standards through sustainable income-generating activities.
- The activities of these 2,000 entrepreneurs will create employment opportunities for at least 2,000 more disadvantaged rural unemployed people, and the process will continue to grow in the future.

4.2 Why

The initiative promotes "Endless Change" by empowering marginalized communities through sustainable employment, skills development, and income-generating opportunities rather than providing short-term assistance. By strengthening BNSWC-trained voluntary organizations, it creates lasting self-reliance, institutional capacity, and inclusive socio-economic transformation.

4.3 How

- In each project district, a group will be formed with 10 voluntary organizations. From each organization, 2 members will be included and provided with continuous capacity-building training (Training of Trainers).
- At the field level of the project, all training and related activities for the beneficiaries will be implemented through two trainers from the voluntary organizations.
- Trained members of voluntary organizations will select 2,000 beneficiaries (200 per district) and implement the project by providing field-level training, initial capital support, and ongoing socio-economic supervision to ensure their sustainable development.

Capacity Building of Voluntary Organizations

The project will strengthen the institutional capacity of 100 active voluntary organizations in 10 poverty-prone districts to promote integrated rural development and poverty reduction. A total of 200 members will receive professional training and a BDT 10,000 monthly apprenticeship allowance. The organizations will also receive essential institutional support, including ICT equipment, internet connectivity, and management support to improve their long-term effectiveness.

5. Outcomes

5.1 Medium-Term Outcomes

- Improved organizational and managerial capacity of rural voluntary organizations.
- Increased participation of marginalized rural people in income-generating and self-employment activities.
- Enhanced rural skills development, local entrepreneurship, and community-based economic activities.
- Strengthened local service delivery and community engagement in rural development initiatives.

5.2 Long-Term Outcomes

- Sustainable reduction of rural poverty and unemployment.
- Increased rural economic stability and self-reliance.
- Establishment of community-led and locally sustainable rural development structures.
- Reduced rural-urban migration through local employment opportunities.
- Development of resilient, inclusive, and economically empowered rural communities aligned with the United Nations Sustainable Development Goals (SDGs)

6. Conclusion:

By strengthening BNSWC-trained voluntary organizations as community-based development partners, the project will empower marginalized rural people through sustainable livelihoods, employment, and entrepreneurship. This innovative, participatory model combines institutional capacity building with local ownership to deliver cost-effective and lasting socio-economic transformation. Ultimately, the initiative will contribute to poverty reduction, resilient rural communities, and the achievement of the Sustainable Development Goals (SDGs) in Bangladesh.



Low-cost, High Impact solutions for Rural Communities Model



Know the Innovators



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INDIA

MISSION MARKET MIRCHI

A Low-Cost AI-Enabled Rural Market Linkage & Digital Empowerment Model

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1. The Innovation: Mission Marketmirchi

Mission MarketMirchi is an ultra-low-cost rural innovation initiative designed to bridge the structural gap between rural producers and organized markets through simple to use Marketmirchi Portal as well as the App. The initiative empowers Farmers, Farmer Producer Organizations (FPOs), Self-Help Groups (SHGs), Rural Startups to create direct B2B, B2C and institutional market linkages using their own mobile phones at absolutely no charges.

Unlike traditional e-commerce platforms, MarketMirchi does not sell products on behalf of producers. Instead, it builds digital capacity, enabling rural entrepreneurs to digitally advertise their products professionally, identify buyers, and negotiate with them directly. The Marketmirchi platform integrates AI-enabled buyer discovery tools for frontend linkages. It creates backend linkages through onboarding of rural stakeholders via grassroots trainings under the mission 'My Mobile My Marketing.'The approach is scalable, affordable, women-inclusive, and adaptable across developing countries. Interest in replicating the model has already emerged from Asia-Pacific rural livelihood professionals during training sessions conducted at MANAGE, Hyderabad. This initiative is Featured in NITI Aayog list of 75 Best Agri- & Rural Innovations and has won many awards including Global woman of Worth Award by the Global World Women Leadership Congress.

2. Problem Statement

Rural producers often remain excluded from organized markets due to dependency on intermediaries, lack of digital marketing skills, limited price discovery. Even when production quality is high, market access remains a major constraint. Across developing countries, rural producers remain invisible to formal markets. They depend on intermediaries, face weak price discovery, lack branding power, and possess limited digital marketing capability. Existing digital platforms frequently create new forms of dependency rather than building entrepreneurial capability. A capacity-driven, empowerment-based and a Commission or Subscription Charges Free solution is required. Although mobile penetration is rising, rural stakeholders are rarely trained to use their own devices as structured marketing tools. The gap is not connectivity — it is capability.

3. The Mission MarketMirchi Solution

A. My Mobile, My Marketing – Digital Empowerment

Through structured training, rural producers learn to use smartphones for professional product presentation, digital catalogue creation, buyer communication, pricing negotiation, and market research. Using Marketmirchi App or Portal every mobile phone becomes a marketing tool. Training Videos in every Indian language are prepared on how to use Marketmirchi effectively

and disseminated in online, offline trainings pan India. Recently we have developed simple online course on How to do Free Online Agro Rural Marketing explaining basic concepts of digital marketing in context to Marketmirchi and it is well received by Rural Stakeholders all over India MarketMirchi operates an educational YouTube channel to support continuous rural digital empowerment (https://youtube.com/@marketmirchi2161?si=ZzOA2pT7CH3LGHn2).

B. AI-Enabled B2B Market Discovery

MarketMirchi leverages Artificial Intelligence tools to identify potential B2B buyers, generates institutional buyer databases, analyses demand trends, and maps geographic market opportunities. AI ensures intelligent and targeted market outreach.

4. Innovation Highlights

- Ultra-low operational cost model
- Much needed Capacity-building of Rural stakeholders for using their own mobiles for their own marketing –My Mobile My Marketing, via a very user-friendly App Marketmirchi, giving instant list of Buyers at no Charges.
- Targeting Inclusive growth by bridging Digital Divide.
- Strengthening Collective Marketing by Self-help Groups, Farmer Producer Organizations for better market returns.
- AI-enabled rural market intelligence
- Replicable across Asia-Pacific developing countries

5. Measurable Impact

- 1,00,000+ rural sellers and buyers connected
- 5000+ online and offline capacity-building sessions conducted
- Multilingual video-based digital training ecosystem

6. Sustainability, Scalability & Replicability

The initiative operates through a structured Hub & Spoke institutional model. The central hub provides digital infrastructure and AI systems, while partner NGOs, government departments and rural institutions act as spokes for grassroots onboarding as a part of their mandate for Rural Empowerment The model is sustainable due to minimal operational cost, institutional partnerships, capacity-building integration, and community-led adoption. Minimal infrastructure requirements on cloud ensure easy replication across regions.

7. Conclusion

Mission MarketMirchi represents innovation without exclusion, technology without complexity, and empowerment without dependency. It transforms rural producers into digitally confident, market-ready entrepreneurs and offers a scalable model for rural economic transformation.



Know the Innovator

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INDONESIA

SACRED SOIL

Rekindling Children's Relationship with Land and Agriculture in the Formative Years

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The innovation

Most programmes that try to draw young people back to agriculture begin too late. In Indonesia, as in much of the world, they focus on teenagers aged 15 to 19 who have already decided that farming is neither profitable nor prestigious, and then spend heavily trying to reverse that judgement. Sacred Soil takes the opposite approach. It works with children while they are still in primary school, roughly ages 6 to 12, before the disconnection sets in, and it does so inside the school system itself, through teachers the children already know and trust. Three design choices make it different from a typical school garden project: starting during the formative years, so that children grow up familiar with food and land rather than having to be persuaded of their value later; structuring the programme as an arc that follows children as they advance through primary school, not a single garden visit; and using a train-the-trainer model that equips existing teachers to carry it on, keeping costs low and making handover straightforward.

Why it matters

Young people are leaving agriculture quickly. Globally, the share of working youth employed in agrifood systems fell from 54% in 2005 to 44% in 2021, a decline driven mainly by fewer young people going into farming. Income is the usual explanation, but it is only part of the story. In many rural areas, formal schooling has quietly cut the tie between a child's education and the land they live on: agricultural content has disappeared from classrooms or grown outdated, so children grow up with little meaningful connection to where their food comes from. Studies of how people come to choose farming careers point to early, positive, hands-on experiences with growing food as a precondition for even considering agriculture later in life. Sacred Soil is designed to create those experiences during the years when they are most likely to stick, which is a cheaper and more realistic strategy than recruitment programmes aimed at teenagers who have already made up their minds.

How it works

The pilot runs at Madrasah Ibtidaiyah (MI) Al Mansur, a small Islamic primary school in Bojonegoro, East Java. The school groups its youngest pupils under a shared environmental theme, so the module, pitched at a Grade 3 level, is delivered to its Grade 1 to 3 children together. It begins with a Training of Trainers, in which the TAU team introduces its learning module to the school's teachers and practises it together with them, so that the teachers, not outside facilitators, lead the classroom. The module opens with simple questions: what did you have for breakfast, which vegetables do you eat, and where do those vegetables come from? From there the class moves outdoors. The school sets aside a raised bed where each child plants seeds, and every two weeks the children return to observe their plants, record their growth, and write short reflections in a field journal provided by TAU. They keep this up until harvest, when they share what they have grown and observe with their families and community. Over the course of the programme, children begin

to understand food as something that has to be grown, cared for, and waited on, not something that simply shows up at home.

Impact and the road ahead

Between January and June 2026, the pilot completed its first full cycle at MI Al Mansur, reaching 52 people in all: 38 children and 14 teachers, 7 of whom led the sessions directly. Across the sessions the children planted, tended, observed, and journaled their crops, and the cycle closed with a community showcase where they presented and shared their results.

The change was most visible in the children's behaviour. Pupils who had never had such responsibilities began arriving early to check and water their plants, took ownership of problems like weeding and wilting, and proudly showed parents and visitors their harvest. Teachers noticed even the youngest students grasping cause and effect, understanding, for instance, why no pesticides were needed because natural predators did the work. One student with autism, who usually struggled to settle in class, engaged deeply and took initiative working outdoors with real plants.

The pilot also shifted outside perceptions. At the showcase, officials from the local agriculture and education offices were at first sceptical that the produce had really been grown by the children, until the video record of the full planting-to-harvest process convinced them. That credibility helped start conversations about doing more together. The economics support that: the whole pilot ran on a modest seed grant, with about USD 769 spent against a USD 1,000 award, and because the school, its teachers, and the raised bed are already in place, extending the programme to the next grade or another school costs only a fraction of the first year.

Indonesia has 26,826 Madrasah Ibtidaiyah nationwide, most of them in the rural areas where the disconnection between youth and agriculture is sharpest, and the district Religious Affairs Office has shown interest in the approach, while noting that a broad rollout would need more resources. TAU's next steps are to extend the module to Grade 4 with the same cohort, to develop a simpler, more game-based version for Grade 1, and to keep building the field journals into a cumulative record so the programme follows children from year to year rather than ending after a single term.



Know the Innovator

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39 Bioremediation of Village Wastewater Using Floating Wetlands

PAKISTAN

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Introduction

Water scarcity and deteriorating water quality are among the most pressing challenges facing rural communities in Pakistan. As freshwater resources become increasingly constrained, many villages rely on untreated wastewater for irrigation and other productive uses. While wastewater can supplement limited water supplies, its direct use poses serious environmental and public health risks, including contamination of soils, crops, and water sources.To address this challenge, the International Water Management Institute (IWMI) introduced a nature-based solution in Chak 13/1-L, District Okara, Punjab: *Bioremediation of Wastewater Using Floating Wetlands*.

The innovation harnesses natural biological processes to treat wastewater in village ponds, turning a pollution problem into a valuable resource for agriculture and rural livelihoods. Similar untreated ponds are common across water-stressed rural areas of Pakistan and the wider Asia-Pacific region, giving the model clear relevance as a low-cost, low-technology pathway for safe wastewater reuse, without the capital or energy demands of conventional treatment plants.

The Innovation

Floating Wetlands (FWs) are floating platforms planted with carefully selected wetland vegetation that naturally cleans wastewater. The platforms float on the surface of ponds while plant roots extend into the water below. These roots provide a large surface area where beneficial microorganisms thrive and break down pollutants. The pilot was installed on a 1.25-acre pond in Chak 13/1-L, a village of roughly 600–700 households generating about 1,000 cubic meters of wastewater daily, of which the pond receives approximately 200 cubic meters. What makes this innovation unique is the combination of wetland plants with selected beneficial bacteria introduced to the plant roots. Together, the plants and microbes remove organic pollutants, absorb excess nutrients, reduce suspended solids, and improve overall water quality through a natural bioremediation process. The system is particularly suitable for rural settings because it requires minimal infrastructure, consumes no external energy, and can be installed directly in existing wastewater ponds.



Fig 1: Floating wetland platforms of Common Reed and Canna indica on the wastewater pond

How it works

The floating wetland system follows a simple process: first, wastewater quality is assessed to understand the level and type of contamination. Suitable plants and beneficial bacteria are then selected based on local conditions. Floating platforms are constructed using locally available materials such as floating sheets, bamboo, pipes, and anchoring materials. Plant roots are inoculated with bacteria and inserted into the floating platforms and deployed in the pond. Once installed, the roots hang freely in the wastewater, where plant uptake, microbial activity, and natural filtration gradually break down pollutants, remove nutrients, and water becomes cleaner over time. The system adapts to changing water levels and requires only routine maintenance by community members.

Why it is cost-effective

Floating wetlands are affordable by design. Unlike conventional treatment plants, which demand substantial capital, energy, and skilled operation, FWs rely on natural processes, inexpensive local materials, and native plant species. Maintenance is minimal and can be managed by trained community members, keeping operating costs very low. The modular design allows the technology to be scaled up or adapted to different pond sizes and environmental conditions.

Impact

The floating wetland intervention in Chak 13/1-L has demonstrated significant environmental, social, and livelihood benefits. The pond, previously characterized by poor water quality and unpleasant conditions, became visibly clearer, odorless, and safer for agricultural reuse, reducing exposure to contaminated wastewater. The intervention also created habitat for birds and aquatic organisms, improving local biodiversity and ecological conditions.

Community participation was a key component of the initiative. Local residents, including women, youth, and farmers, were actively involved in installation and maintenance of the wetlands, building local knowledge and a strong sense of ownership. This success has generated interest among neighboring communities, demonstrating strong potential for replication across rural Pakistan and the wider Asia-Pacific region.



Fig 2: The wastewater pond in Chak 13/1-L prior to intervention, showing solid waste accumulation and poor water quality typical of untreated village ponds.

Conclusion

Bioremediation through floating wetlands shows how a simple, low-cost, and community-driven innovation can address multiple rural development challenges simultaneously by improving water quality, supporting safer agriculture, strengthening environmental health, and empowering local communities toward more sustainable water management. The experience from Chak 13/1-L confirms that nature-based solutions can deliver significant impact without expensive infrastructure. With its affordability, adaptability, and strong community ownership, the floating wetland model offers a scalable solution for rural communities across Pakistan and the wider Asia-Pacific region.

Know the Innovators



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INDIA

Empowering Coastal Women through Seaweed Cultivation

A Proven Low-Cost Livelihood Innovation

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Innovation Summary

Seaweed farming has become a low-cost and women-friendly livelihood activity in the coastal communities of Ramanathapuram district, Tamil Nadu, India. A survey was conducted with 187 women seaweed cultivators during 2024–2025, indicating how women's Self-Help Groups (SHGs) endorse sustainable income and women's economic empowerment. This cultivation reduces the seasonal unemployment, supports livelihoods during fishing bans, and conserves marine resources. Women earn between Rs. 10,000 and Rs. 35,000 per cultivation cycle within 20–60 working days. The income is used for household expenses, children's education, savings, and acquiring assets. As a cost-effective and eco-friendly method of seaweed cultivation, it is spreading across coastal regions of the Asia-Pacific.

The Significance of the Innovation

Seaweed cultivation has emerged as a sustainable livelihood innovation for coastal women in Ramanathapuram district, Tamil Nadu. Declining fish stocks, climate change, and seasonal fishing bans have reduced household earnings and increased livelihood insecurity. Women are mostly vulnerable due to inadequate access to productive assets, income-generating opportunities, and financial resources. To tackle these problems, women involved in Self-Help Groups (SHGs) have been given simple instructions on seaweed cultivation with limited cost. During the fishing ban periods, the women through the SHGs get themselves involved in seaweed production, financial affairs, and marketing. Women will. Such support activities will empower women and enhance their decision-making power at the household level, and their decision-making power at the household level will be enhanced through such support activities. This program helps them to grow their leadership ability and entrepreneurial spirit. Furthermore, seaweed farming encourages the women to get involved and helps preserve the sea resources without exhausting the natural ecosystem. The initiative also helps reduce poverty, empower women, boost households' capacity to cope with climate-related shocks, and promote the sustainable management of coastal resources.

How the Innovation Works

One such development is initiated hand-in-hand with women's self-help groups (SHGs), where women are skilfully trained in sowing the seeds; maintaining and harvesting; and drying, grading, and marketing their produce. Environmentally sustainable raft and monoline cultivation methods are implemented with minimum environmental impact by using bamboo poles, ropes, floats, and good-quality seedlings that are naturally available; sometimes they are purchased from their neighbour farmers. Seaweed women farmers are just like farmers; they are dividing the shore of the sea and cultivating it, with the cultivation cycle being a minimum of 45 to a maximum of 60 days. This practice helps women to get more production from the small seabed. Besides, SHGs play an enormous role in empowering women by collectively buying and managing inputs, procuring bank loans, providing technical advice, and arranging marketing connections.

Cost-Effectiveness of the Innovation

Seaweed production is a way of life that requires very little investment that depends only on common local materials. Women in this business can earn between Rs. 10,000 and Rs. 35,000 per

cycle because of the quick harvesting time. the women are collectively purchase the materials, working in jointly, and marketing at a gross roots level (e.g., through SHGs) the low level of production cost and marginally increase the income levels of coastal communities.

Impact of the Innovation

The invention led us to increase household income because it brought about employment, mostly in the fishing ban seasons, thereby giving the women's economic status a much stronger base. Being in a self-help group has allowed the women to be financially autonomous, to develop leadership qualities, and to be active in the making of household decisions. Also, the project has encouraged community involvement so that the improvement of the people's way of life has been possible in the face of climate-related challenges.

Scalability and Future Potential

Such a low-cost production model could work really well in those coastal areas where there have been declining fishing activities and climate hazards, as well as limited livelihood options. It is characterised by low investment needs, easy technology, quick returns and strong support from institutions, which would make it quite suitable for replication in South and Southeast Asia. It can also be an instrument for rural development in a more inclusive manner, empowerment of women, diversification of livelihoods, building resilience to climate change, and the creation of a green and sustainable blue economy.

Conclusion

Women's seaweed farming shows that a basic alternative livelihood to coastal women, low-cost and nature-friendly innovation can change the lives of coastal communities. It can create a real-life and widespread strategy of inclusive and climate-adapted rural development and empowering the women in near future.

Know the Innovators



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Climate-Informed Seasonal Flood Forecasting

BANGLADESH

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1. Background

Flooding is a defining feature of rural Bangladesh, bringing both benefits and challenges. While regular seasonal floods replenish soils and support fisheries, severe and unpredictable floods can destroy crops, damage homes and infrastructure, disrupt local markets, and threaten food security and livelihoods. Rural communities, particularly poor farming households, are among the most affected. The current flood forecasting system provides warnings up to five days in advance, which is valuable for emergency response but too short for farmers to make important decisions about cropping, planting, livestock management, or other livelihood activities. More time is needed for communities to prepare and reduce potential losses. Advances in climate science now offer an opportunity to predict seasonal flood risk months. Large-scale climate patterns such as the El Niño–Southern Oscillation (ENSO), together with the Indian Ocean Dipole (IOD) and Madden–Julian Oscillation (MJO), influence Bangladesh's monsoon and flooding. However, their effects vary from year to year. This project will use these climate signals to develop practical seasonal flood risk information that helps farmers, communities, and decision-makers improve agricultural planning, strengthen preparedness, and reduce disaster risk.

2. Problem Statement

Despite strong flood monitoring systems, Bangladesh faces three key challenges: (i) short forecast lead times that limit agricultural and community preparedness; (ii) oversimplified climate assumptions that overlook the varying impacts of El Niño, La Niña, and neutral conditions; and (iii) limited use of seasonal climate information in agricultural planning and disaster preparedness. As a result, rural communities remain highly vulnerable to avoidable climate-related losses.

3. Objectives

This project aims at strengthening rural livelihoods and flood preparedness in Bangladesh through climate-informed seasonal flood-risk assessment. Specifically, (i) assessing how different ENSO types influence seasonal flooding, (ii) evaluating the combined effects of ENSO, the Indian Ocean Dipole (IOD), and intraseasonal climate variability on flood risk, and (iii) developing a seasonal flood-risk framework to support agriculture, rural development, and disaster risk reduction.

4. Methodological Approach

The project uses a climate–hydrology–livelihoods lens, combining long-term flood records with large-scale climate indicators.

Data Sources

- Flood-Affected Area (FAA): Annual national flood extent data (1954–2024) from BWDB/FFWC and partner institutions.
- Climate Data and Indices: Sea Surface Temperature (SST) and wind data from NOAA and NCEP/NCAR reanalysis, along with key climate indices including ENSO (Niño 3, Niño 3.4, and Niño 4), the Oceanic Niño Index (ONI), and the Dipole Mode Index

Analytical Tools

Flood Frequency Analysis to classify flood severity and recurrence, Composite Climate Analysis to identify climate patterns linked to major floods, Principal Component Analysis (PCA) to extract dominant climate signals, Regression Analysis to explain flood extent using climate indicators and

Wavelet Coherence Analysis to assess changes in climate–flood relationships over time. The focus is on identifying consistent and interpretable climate signals, rather than building a fully operational forecast model at this stage.

6. Expected Results and Development Outcomes

Scientific and Technical Outcomes

- Clear differentiation of flood risk associated with Eastern Pacific, Central Pacific (Modoki), and Mixed ENSO events.
- Evidence that La Niña events pose the highest flood risk for rural Bangladesh, while some El Niño variants can still produce damaging floods.
- Identification of the Indian Ocean Dipole as a critical modifier of seasonal flood risk.

Rural Development Outcomes

- Improved flood-risk awareness to guide cropping, planting, and input decisions.
- Enhanced institutional capacity for food security, preparedness, and relief planning.
- Better integration of climate information into disaster management and rural planning.

7. Relevance to Rural Livelihoods and Poverty Reduction

Seasonal flood information is particularly valuable for:

- Smallholder farmers, Fisheries and aquaculture and poor and landless households.
- Rural roads, markets, and embankments.

By shifting from reactive response to anticipatory action, this work supports more efficient use of development resources and reduces vulnerability among rural populations.

8. Policy and Institutional Relevance

The proposed work aligns with the Bangladesh's Climate Change Strategy and Action Plan, national priorities on disaster risk reduction and agricultural resilience, and development partners' emphasis on anticipatory action and climate services for development. The results can complement existing FFWC systems by adding a seasonal planning layer, rather than replacing operational flood forecasts.

10. Conclusion

This project empowers rural communities by providing seasonal flood-risk information months in advance, enabling farmers and local institutions to make informed decisions on agriculture, livestock, fisheries, and preparedness. It supports sustainable livelihoods by reducing flood-related losses, protecting livelihood assets, and improving agricultural planning and income stability. By integrating ENSO diversity, the Indian Ocean Dipole, and other climate drivers into seasonal flood forecasting, the project strengthens climate resilience through anticipatory action and climate-informed rural development. Although flooding is an inevitable part of Bangladesh's landscape, better use of seasonal climate information can help communities adapt, reduce risks, and build more resilient livelihoods.



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MALAYSIA

Future Skills for All (FS4A) Sarawak Scale Up

A District-by-District STEM & Digital Innovation Model for Rural Youth

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The Innovation

Future Skills for All (FS4A) is a rural STEM and digital-empowerment model that carries in-person training directly into every education district of Sarawak, deliberately targeting secondary school students (ages 13–16) and teachers who have never taken part in any formal STEM programme. Its true innovation is not the coding syllabus but the delivery model: each school sends a team of one teacher and three students; students learn just enough coding to grasp what technology can do, then move into a structured problem-discovery process rooted in their own community. They identify a real local problem, connect it to a technology solution, and build a working prototype — while teachers take part as co-learning coaches rather than subject-matter experts. Trained teams then return home as peer mentors, cascading the experience to thousands more students.

Why it Matters

Sarawak's rugged geography, rainforests and riverine settlements leave hundreds of rural villages and longhouses beyond the reach of quality STEM education. This traps rural youth in a self-reinforcing loop:

poor connectivity and no local computer labs → no prior STEM exposure and low teacher confidence → youth migrate to cities for low-skilled work, draining the very talent needed to modernise rural agriculture, markets and climate resilience.

FS4A breaks this loop by building digital and problem-solving capacity in place, so that rural talent can develop and stay in the communities that need it most

How it Works

- ***Reach every district:*** training is delivered in all 21 districts, not only in urban centres, removing the geographic barrier.
- ***Team-based transfer:*** 1 teacher + 3 students per school learn together, then carry the knowledge back to the classroom.
- ***Learn by doing:*** minimal coding exposure → community problem-discovery aligned to the state's PCDS 2030 vision → rapid prototyping of a real solution.
- ***Ownership drives learning:*** students solve problems for their own community, giving them a genuine reason to deepen new skills.
- ***Teachers as coaches:*** educators facilitate with questions and prompts instead of answers, gaining confidence and new pedagogy.
- ***Cascade & sustain:*** a shared learning portal and RM500 kickstart micro-grants let teams scale projects and mentor peers back home.

Cost-Effectiveness

FS4A is engineered for high impact at low cost. A lean team of one teacher and three students per school becomes the seed for peer-training over 3,000 additional students — a large multiplier on every training place funded. The model reuses existing school facilities and devices loaned through

partners (e.g. SDEC), and relies on low-tech and offline activities so that learning does not depend on reliable connectivity. A single shared digital portal extends reach at near-zero marginal cost, while community projects are scaled through modest RM500 micro-grants rather than costly infrastructure — making the model highly replicable across other rural regions.

Evidence of Impact

Scale: all 21 education districts and 185 secondary schools engaged; 807 students and 269 teacher–student teams trained directly, cascading to 3,000+ more.

Output: 128 proposals submitted, 80 community projects developed, 212 formal grant applications, and 60 projects funded (RM500 each) with 10 excellence awards.

Performance: 83% completion rate, 91% submission rate, and over 80% positive participant sentiment in 2025.

Reach: the FS4A learning portal recorded 38,000 page views and 8,229 new registered users from Sarawak.

Alignment: every funded project advances a pillar of Sarawak's Post Covid Development Strategy 2030 — economic prosperity (Bario e-Harvest, TaTamu market directory), social inclusivity (SafeSteps panic-button app), and environmental sustainability (JOTANI smart agriculture, AirSifu route optimisation)



Bario e-Harvest — farmers sell fresh produce and Bario rice online, opening new markets.



Jom Kerja Baram — a local job portal that helps retain talent and curb youth migration.



Know the Innovator

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BANGLADESH

GreenLoop

A Framework for Climate-Resilient Circular Agriculture and Sustainable Rural Development

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Executive Summary

Rural communities across Asia and the Pacific are facing increasingly interconnected challenges-declining soil fertility, inefficient use of agricultural inputs, climate variability, water scarcity, agricultural waste accumulation, and limited access to timely advisory services. These issues are often addressed through isolated interventions, reducing their long-term effectiveness. GreenLoop 3.0 is an integrated rural development innovation that combines circular agriculture, climate-smart farming, digital extension services, environmental intelligence, and renewable energy into a single, scalable framework. By promoting waste-to-wealth approaches, precision resource management, and data-informed extension, GreenLoop strengthens farming systems, livelihoods, and the natural resource base. The framework is designed for gradual adoption through existing extension systems and can be adapted across diverse agro-ecological conditions in Bangladesh and other Asia-Pacific countries.

The Rural Development Challenge

Agriculture remains the backbone of rural livelihoods across much of Asia and the Pacific, yet smallholder farmers face multiple, interconnected problems. Continuous cultivation, excessive dependence on chemical inputs, inefficient irrigation, climate-induced weather variability, and poor management of agricultural residues have degraded soils, raised production costs, and increased environmental pressure. Fragmented extension support makes it difficult to adopt integrated solutions that simultaneously raise productivity, conserve natural resources, and build climate resilience. Agricultural waste remains underutilized despite its potential to enhance soil fertility and generate additional value, while digital technologies and scientific innovations are not yet fully integrated into routine extension services. These challenges call for a practical, scalable rural development framework that unites scientific knowledge, community participation, and digital innovation.

The GreenLoop Innovation

GreenLoop is built on five complementary pillars that work together to create resilient, resource-efficient rural communities. Together, these five pillars form a unified framework that integrates people, technology, and natural resources rather than addressing agricultural challenges through isolated interventions.

Pillar	Core Mechanism
Circular Agriculture	Organic crop residues and livestock waste are transformed into compost and bio-based soil amendments, raising soil organic matter and reducing dependence on external inputs.
Climate-Smart Agriculture	Alternate Wetting and Drying (AWD), precision nutrient management, and improved water strategies raise productivity while reducing greenhouse-gas emissions and water use.
Digital Decision-Support	Mobile-based advisories, farmer information systems, and AI-assisted alerts timely, location-specific guidance to farmers and extension staff.

Environmental Intelligence	Soil sensors, geospatial data, and environmental monitoring generate evidence-based insights for irrigation, nutrient management, and sustainable land use.
Renewable Rural Systems	Solar-powered irrigation, biogas, and waste-to-energy technologies lower operating costs and decarbonise rural production systems.

Cost-Effectiveness and Practical Implementation

GreenLoop is designed for practical implementation using existing institutional structures and locally available resources. The framework strengthens—rather than replaces—agricultural extension systems, enabling gradual adoption through demonstration plots, farmer field schools, and digital advisory services. Its circular agriculture approach reduces input costs by encouraging on-farm resource recycling and improving nutrient-use efficiency. Mobile-based information services, digital farmer records, and environmental monitoring raise extension productivity without extensive new infrastructure. The modular design allows communities to implement priority components according to local needs, financial capacity, and institutional readiness, making GreenLoop suitable for phased public- and donor-supported expansion. Pilot deployments consistently show a benefit–cost ratio above 3.0, with a 40% reduction in operational costs through in-house energy and bio-fertiliser production.

Expected Impact

GreenLoop is expected to deliver broad economic, environmental, institutional, and social benefits.

Economically, improved nutrient-use efficiency, better water management, and resource recycling lower production costs and raise farm profitability, with early pilots indicating a 30% increase in net income for smallholders.

Environmentally, circular resource use, AWD irrigation, improved soil health, and renewable energy integration reduce greenhouse-gas emissions, cut water consumption by 57%, and lower arsenic uptake in rice by 21%.

Institutionally, GreenLoop strengthens evidence-based planning by improving farmer information management and supporting more efficient extension services, and aligns directly with FAO's Four Betters-Better Production, Better Nutrition, Better Environment, and Better Life.

Socially, the framework promotes inclusive rural development by creating opportunities for smallholder farmers, rural youth, women entrepreneurs, and community organisations to participate in sustainable value chains.

Sustainability and Replicability

GreenLoop is designed as a flexible framework adaptable to diverse agro-ecological and socio-economic contexts. By combining locally applicable agricultural practices with scalable digital technologies, the innovation supports long-term sustainability while remaining accessible to farming communities with varying levels of resources. It aligns with national agricultural development priorities and contributes to climate resilience, sustainable resource management, and inclusive rural development. Its modular architecture makes it suitable for replication across Bangladesh and other Asia-Pacific countries facing similar agricultural and environmental challenges.

Conclusion

GreenLoop demonstrates that sustainable rural development is achieved not through isolated technologies but through the integration of circular-economy principles, climate-smart agriculture, digital decision-support systems, renewable energy, and community participation into a single

practical framework. By strengthening agricultural productivity while conserving natural resources and improving rural livelihoods, GreenLoop provides a scalable model for resilient rural development in Bangladesh and across the Asia Pacific region.

Figure 1. GreenLoop- Integrated Framework for Climate-Resilient Circular Agriculture

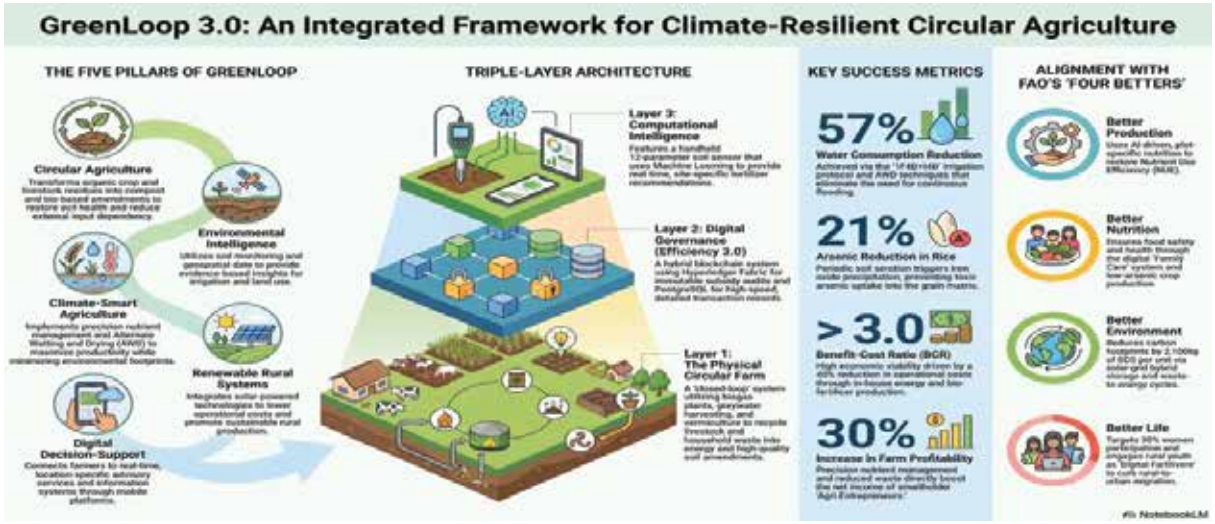


Figure 2. GreenLoop Field Demonstration — Climate-Resilient Rural Communities





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PAKISTAN

From Home-Based Work to Digital Enterprise

An Ecosystem Model for Women's Market Integration in Pakistan

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The Challenge

Across Pakistan, millions of women engage in home-based economic production, stitching garments, crafting handicrafts, processing food, and managing agri-livestock. Despite possessing strong vocational skills and entrepreneurial drive, female labor force participation remains below 23% nationwide.

The primary barrier to their economic advancement is structural isolation. Deep-seated social norms, mobility restrictions, time poverty from unpaid care responsibilities, and geographical distance restrict these women to informal, hyper-local markets. Operating without formal credit histories, bank accounts, or digital identities, they remain reliant on local intermediaries who capture the majority of profit margins. Traditional interventions have historically focused on standalone vocational training. However, isolated skill-building fails to generate sustainable livelihoods without concurrent access to digital tools, financial services, and broader consumer markets.

Novelty and Significance of Innovation

PPAF addresses this gap through an Ecosystem Integration Model. Rather than viewing women's economic exclusion merely as a skills deficiency, this innovation reframes it as a system-access challenge.

PPAF acts as a strategic platform integrator connecting grassroots women with telecommunications, financial institutions, and e-commerce platforms. The innovation bridges the digital divide for home-based producers by providing a synchronized, four-pillar framework that transitions them into formal digital entrepreneurs:

- ***Market-Aligned Skills Enhancement:*** Upgrading traditional artisanal, tailoring, and agricultural skills while integrating practical digital literacy, product pricing, branding, and online store management.
- ***Digital Infrastructure & Connectivity:*** Equipping micro-entrepreneurs with smartphones and subsidized data packages to operate digital stores directly from their homes.
- ***Financial Inclusion*:** Establishing mobile wallets and digital bank accounts to create formal credit histories, streamline transparent non-cash transactions, and promote financial independence.
- ***Structured Market Linkages:*** Onboarding women onto established digital marketplaces and collective e-commerce platforms, bypassing local middlemen and granting direct access to national consumers.

Additionally, the model addresses time poverty by integrating local infrastructure solutions such as localized Water, Sanitation, and Hygiene (WASH) facilities in flood-affected districts to reduce domestic care burdens, directly unlocking time for enterprise development.



Implementation and Operational Mechanism

The model operates through a scalable, decentralized operational network:

- **District-Level Digital Enterprise Hubs:** Established in partnership with local civil society organizations, these hubs serve as physical centers for hands-on digital onboarding, quality assurance, product aggregation, and professional photography.
- **Collective Digital Storefronts:** To lower entry barriers and individual commercial risk, PPAF aggregates individual micro-producers into collective online brand storefronts, providing unified marketing and bulk shipping arrangements.
- **Matching Capital Injections:** Small, targeted seed-capital grants are provided upon the successful completion of digital and financial literacy modules, allowing participants to procure quality raw materials or machinery.
- **Climate-Smart Integration:** Production methodologies incorporate sustainable practices, particularly within agri-livestock and artisanal processing, ensuring products meet market safety and environmental standards.

Cost-Effectiveness, Scalability, and Sustainability

- **Cost-Effectiveness:** By converting existing home spaces into productive digital micro-enterprises, the model eliminates traditional overhead costs associated with physical retail spaces or central workshops.
- **Scalability:** The model utilizes PPAF's established network of 164 partner civil society organizations across 150+ districts. This existing infrastructure enables rapid replication across diverse geographical regions without incurring significant institutional overhead.

- **Sustainability:** Long-term sustainability relies on commercial viability rather than ongoing grant dependency. By embedding micro-entrepreneurs directly into commercial fintech, telecom, and e-commerce supply chains, businesses sustain themselves through recurring market revenue.

Demonstrated and Potential Impact

The operational efficacy of this ecosystem approach is validated through PPAF's recent initiatives across Pakistan:

- **Women Strivers (Ba-Ikhtiar) Program:** A pilot in Haripur enabled 70% of semi-skilled participants to launch digital businesses, with 60% achieving a minimum 30% increase in baseline income. The framework has since expanded across 21 districts, reaching 2,100 women.
- **Growth for Rural Advancement and Sustainable Progress (GRASP) Initiative:** Supported 145 women-led enterprises with growth grants, resulting in an 88% increase in profitability, a 66% increase in overall sales, a 61% growth in business investment, and the direct creation of 737 new jobs. Over 17,700 micro-enterprises adopted climate-resilient production methods.

Scaling Target

Building on these proven outcomes, PPAF aims to scale this ecosystem model to formally onboard 5,000 additional home-based women workers into digital marketplaces, integrating at least 3,000 into formal financial systems, and establishing sustainable, climate-resilient pathways for female-led rural micro-enterprises across the region.



Know the Innovator

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INDIA

Wokha SAATHI

Smart AI-Based Assistant for Timely Help & Interface

Anuranjan Singh
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1. The Challenge: Geography as Destiny

Wokha District sits in the rugged Naga Hills of Northeast India, where Lotha Naga communities are scattered across mountain villages cut off by roads that wash out every monsoon. Before Wokha SAATHI, geography determined access to government: a single office visit meant a 40–60 km journey and ₹800–1,200 in transport, lodging and lost wages, and one scheme application often required trips to several departments over several weeks. App-based e-governance failed on the district's low bandwidth, leaving most of rural Wokha digitally excluded, while citizens had no reliable way to learn which schemes existed or what documents they needed. During floods and landslides, disaster-relief forms required a physical visit to the Deputy Commissioner's office - precisely when travel was least possible. The citizens who needed government most- the poorest, the most remote, pregnant women, the elderly, daily-wage labourers- faced the barriers to reaching.

2. The Innovation: Government in Your Pocket

Launched on 19 May 2023 by Shri A. Narayanaswamy, Hon'ble Union Minister of State for Social Justice & Empowerment, Government of India, Wokha SAATHI's design principle is disarmingly simple: meet citizens on the platform already in their hand — WhatsApp. No app download, no website, no digital-literacy prerequisite. A citizen types 'Hi' to +91-7005577231 and a conversational AI, built on natural-language processing, guides them step by step through more than 40 government services spanning health and maternity benefits, entrepreneurship and credit, agriculture, disaster relief, certificates, elections and grievance redressal — all through one number, working around the clock, through monsoon, landslide or curfew alike The system is engineered for the terrain it serves, not for an urban assumption: it runs on low 2G bandwidth, stores and syncs without requiring an app, and auto-tickets every grievance with a unique ID that is routed to the responsible department and tracked in real time, cutting resolution time by more than 60 percent. During disasters, SDRF relief applications submitted on WhatsApp are returned as processed forms within 24 hours — support delivered to a citizen's village without a single kilometre of travel.



Launch of Wokha SAATHI by Union Minister of State A. Narayanaswamy, Wokha, 19 May 2023.

3. Cost-Effectiveness: One Chatbot Replaces a Thousand Journeys

SAATHI's economics are built on substitution, not addition. It does not create new government services; it removes the cost of reaching the services that already exist. Built on WhatsApp's free-to-use consumer infrastructure, it required no citizen-side investment in devices, data plans, or training, and its marginal cost per additional citizen served is close to zero. Measured purely in travel avoided, the district has saved its citizens more than ₹4 crore over three years and restored over 1.65 lakh hours of productive rural time — savings that dwarf the administrative cost of running the platform. For a resource-constrained hill district, this is the most cost-efficient form of last-mile governance available: digital infrastructure that citizens already own, wrapped around services government already funds.

4. Impact: Three Years, Documented and Growing

Year 1 figures (to May 2024) are fully documented by the District Administration; growth in Years 2 and 3 reflects the district's sustained digital-adoption trajectory. By May 2026, Wokha SAATHI has served over 32,000 unique citizens across more than 42,000 sessions, exchanged over 2,13,000 messages, processed over 6,200 service requests, saved citizens more than ₹4 crore in avoided travel, restored 1.65 lakh hours of productive time, and integrated 40-plus government departments and schemes at 98.7 percent chatbot accuracy.

Metric	Year 1	Year 3 (2026)	Growth
Sessions	10,311	18,096	×1.75
Unique users	8,000+	14,040	×1.75
Annual cost savings	₹1.03 Cr	₹1.81 Cr	×1.75
Annual time saved	41,244 hrs	72,383 hrs	×1.75
Depts./schemes integrated	40	50+	1.25×

Behind the numbers are individual lives changed: disaster-affected families who filed SDRF claims from their villages during the 2023 monsoon landslides and received relief forms within 24 hours; a pregnant woman in a mountain village who received her Pradhan Mantri Matru Vandana Yojana maternity benefit of ₹5,000 without a single office visit; and a local artisan who discovered the PM Vishwakarma scheme through SAATHI's proactive outreach and secured a collateral-free loan. SAATHI has also inspired direct replication: Tuensang Police District built its 'Complaint Connect' citizen chatbot on the same architecture — the first AI chatbot of any kind in Nagaland's law-enforcement system.

5. Recognition and Replicability

Wokha SAATHI's ministerial launch was followed by the Wokha District Administration's CIPS Innovation Award (Rural Development Category, ASCI Hyderabad, January 2024), and, most notably, the Gold Award in the National Awards for e-Governance 2023–24, presented at the 27th National Conference on e-Governance in Mumbai on 3 September 2024 by Shri Devendra Fadnavis, Deputy Chief Minister of Maharashtra — the first Gold Award for e-governance ever won by an initiative from Nagaland. Because SAATHI runs on WhatsApp infrastructure that already reaches rural households across Asia and the Pacific, it offers CIRDAP member states a low-cost, high-impact blueprint for closing the last-mile governance gap, directly advancing SDG

1 (No Poverty), SDG 3 (Good Health), SDG 5 (Gender Equality), SDG 10 (Reduced Inequalities), SDG 11 (Resilient Communities) and SDG 16 (Strong Institutions).



Wokha SAATHI's WhatsApp interface guiding a citizen through the PMMVY maternity-benefit application.

"Geography is not destiny. A message is."



Know the Innovator

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BANGLADESH

SCRAP VENTURE

Digital Circular Economy Platform for Rural Waste Management and Livelihood Creation

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Problem

Bangladesh generates thousands of tons of household and industrial waste every day, but a large portion of recyclable materials—such as plastic, paper, cardboard and metal remains uncollected with general waste. Rural communities in Bangladesh face serious challenges related to plastic and solid waste management. This improper waste management leads to environmental pollution, blocked drainage systems, health hazards and loss of valuable recyclable resourcesDue to the absence of organized collection systems, plastic waste accumulates in villages, pollutes land and water bodies and creates health and environmental risks. At the same time, rural youth and low-income households have limited income opportunities, leading to unemployment and migration to urban areas. Despite plastic having economic value, rural people often lack access to buyers, price transparency, logistics and digital tools to convert waste into income. This gap results in both environmental degradation and missed livelihood opportunities.

Proposed Solution

Scrap Venture is a rural-focused, technology-enabled waste collection and recycling platform that transforms plastic waste into income while promoting environmental sustainability.



The platform connects rural households, waste collectors and recycling companies through a simple digital system. Community members can request waste pickup using mobile or web-based tools, while local collectors are engaged to collect and aggregate plastic waste and deliver it to recycling partners. We create a **Plastic bottles Collector Vending Machine.** This is a smart, incentive-based machine that allows rural users to deposit plastic bottles and receive instant rewards such as cash credits, points or community incentives.



The model creates a win–win ecosystem by enabling **rural households** to generate additional income from recyclable waste, while unemployed youth gain sustainable employment opportunities as waste collectors and coordinators. At the same time, recycling industries receive a consistent supply of properly sorted plastic and other recyclable materials, improving the efficiency of their operations. Overall, the initiative contributes to cleaner, healthier rural communities by reducing waste pollution, promoting environmental sustainability and strengthening the circular economy.

Innovation and Uniqueness

Scrap Venture combines digital technology with grassroots rural engagement, making it innovative and scalable:

- Low-cost, community-based waste collection model
- Digital pickup requests with location-based coordination
- Future-ready design for expansion using logistics optimization and emerging technologies
- A circular economy approach where waste becomes a resource

Target Beneficiaries

Our primary target beneficiaries are rural households and communities, who can conveniently dispose of recyclable waste while contributing to a cleaner environment. We also empower unemployed rural youth and informal waste collectors by creating sustainable income and employment opportunities through organized waste collection.

Additionally, women and low-income groups can earn supplementary income by participating in waste segregation and collection activities. Local recycling industries benefit from a reliable supply of quality recyclable materials, while rural local governments and environmental initiatives gain support in improving waste management systems, reducing pollution and promoting a circular economy.

Impact

Scrap Venture is expected to generate significant social, environmental and economic impact by increasing rural income through waste-based livelihoods**,** reducing plastic pollution in villages**,** creating sustainable green jobs for rural youth**,** improving public health and environmental conditions and strengthening the rural circular economy.

Cost-Effectiveness

Scrap Venture is a cost-effective solution because it leverages existing local waste collectors and recycling infrastructure instead of requiring expensive waste management facilities. The digital platform optimizes collection routes, reduces transportation costs and minimizes operational inefficiencies. Revenue generated from selling recyclable materials helps sustain operations,

making the model financially viable while delivering environmental and social benefits at a relatively low cost.

Scalability and Replicability

The Scrap Venture model is highly scalable and can be replicated across Bangladesh and other CIRDAP member countries. The solution is cost-effective, technology-light and adaptable to different rural settings. By partnering with local governments, NGOs and recycling companies. Scrap Venture can expand regionally and contribute to sustainable rural development across South and Southeast Asia.

Long Term Scalability Plan

Scrap Venture aims to expand its impact by collecting plastic waste and multi-layer plastic wrappers from landfills, rivers, canals and other polluted water bodies across Bangladesh. Instead of allowing these materials to contaminate the environment, they will be cleaned, processed and transformed into durable, eco-friendly recycled products**,** including outdoor furniture such as benches, tables, chairs and public park installations.

Conclusion

Scrap Venture offers a practical, inclusive, and environmentally sustainable solution to rural development challenges. By converting waste into economic opportunity, the initiative directly addresses rural poverty, unemployment and environmental degradation. Support from the Rural Development Innovation Challenge will enable Scrap Venture to scale its impact and contribute meaningfully to sustainable and inclusive rural development.

Know the Innovators



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INDIA

Rakshanetra

Autonomous Pest Detection and Crop-Stress Monitoring for Indian Farms

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Introduction

Rakshanetra is a field-deployed system designed to autonomously monitor a standing crop for the two most consequential and time-sensitive threats to its yield — insect and pest infestation, and the early stress produced by water deficiency, nutrient imbalance, or environmental strain — and to alert the farmer, in plain language and in the local language, before the damage becomes irreversible. The system combines low-cost environmental sensing with on-device computer vision, fuses the two streams into a single continuous assessment of crop health, and acts on that assessment by triggering irrigation and issuing graded advisories without requiring the farmer to be present in the field. Unlike existing tools, which typically perform one function in isolation — a soil probe, a pest trap, or a timer-driven pump Rakshanetra integrates sensing, inference, actuation, and communication into one unit, so that the same continuous vigilance available to large industrial farms is delivered to the small and medium holding at a fraction of the cost. The name, from raksha (protection) and netra (eye), reflects the design intent: an unblinking protective eye over the field.

Motivation

The motivation for Rakshanetra arose from a recurring limitation of existing agricultural technology: each available tool addresses only part of the problem. A soil-moisture sensor reports dryness but says nothing about pests; an image classifier can name an insect but is blind to the water stress that invited it; a timer-driven controller waters on a fixed schedule regardless of what the soil or the crop actually requires. The farmer is left to reconcile these fragments manually, and can do so only while physically present an impossibility on land that is large, dispersed, or worked by a single household. The difficulty is therefore not an absence of sensors but the absence of an integrated system that senses, decides, and acts on its own. Rakshanetra was conceived to be that system rather than another single-function device.

Problem Statement

Agriculture remains the livelihood of a large share of India's population, and the greater part of that population works small and medium holdings that cannot justify the cost of continuous professional monitoring. For this group the decisive failure in the crop-protection pathway is not the absence of remedies but the interval that elapses before a problem is recognised. Pest infestations and crop stress are frequently detected only after visible damage has appeared — by which time yield has already been lost, water has been spent on stressed plants, and pesticide has been applied broadly and late rather than early and precisely. Existing solutions do not close this gap: single-purpose sensors monitor one variable, image tools require the farmer to notice and photograph a problem that is already advanced, and full precision-agriculture platforms are priced far beyond the reach of the medium farm. The consequence is a broadly distributed loss — of

yield, of water, and of soil health through pesticide over-application whose severity is greatest wherever continuous human supervision cannot be assumed.

Objectives

To design and implement a single field unit that autonomously detects insect and pest species and the early onset of crop stress through the fusion of computer vision and low-cost environmental sensing, overcoming the fragmentation of tools that each address only part of the crop-protection pathway. To generate an autonomous response: condition-based irrigation together with real-time, plain-language advisories delivered to the farmer that require no continuous presence or technical expertise on the part of the user.

To operate reliably at the edge, so that a temporary loss of network connectivity delays only the synchronisation of records and never the local decision to irrigate or to raise an alert.To achieve this at a cost accessible to the small and medium farm, using commercially available modules and open-source software, so that continuous crop intelligence is not reserved for those who can pay most.

Methodology and Implementation

Rakshanetra is organised as four layers that operate continuously, from the field to the farmer's phone. The data-acquisition layer gathers the physical state of the crop and its environment. Low-cost IoT sensors measure soil moisture, ambient temperature, humidity, and light intensity, while a camera captures periodic images of the canopy. Together these establish, at all hours, a quantitative picture of conditions in the field.

The control layer performs inference locally on a solar-powered ESP32 or Raspberry Pi controller. Computer-vision models process the camera feed to identify pest species and harmful insects and to flag leaf damage, and these visual findings are evaluated jointly with the sensor readings so that early stress — from water deficiency, nutrient imbalance, or environmental strain — can be distinguished from healthy variation. On the basis of this combined assessment the controller drives a relay to actuate the irrigation pump directly.

The cloud-and-communication layer forwards sensor data and inference results to a hosted database such as Firebase, AWS, or ThingSpeak, allowing the farmer to review current conditions and historical trends from any location and preserving a longitudinal record of the field. The user-interface layer presents this information through a mobile application that reports detected problems, irrigation activity, and recommended actions in the farmer's own language and in plain terms, so that the system's findings translate directly into action.

In the field these layers are consolidated into a single low-power deployment unit: a solar-powered ESP32/Raspberry Pi controller with an attached camera and relay module, mounted on a pole above the soil probes, connected wirelessly to the cloud and wired to a nearby irrigation pump.

The unit is built entirely from commercially available components and open-source software, which keeps cost low and removes any dependence on custom fabrication. The hardware comprises the controller board; soil-moisture, temperature, humidity, and light sensors; a camera; a relay module and water pump; a battery-and-solar power supply; a Wi-Fi module; and local SD-card storage. The software stack is built in Python, using OpenCV and TensorFlow/Keras for image processing and model inference, the Arduino IDE for controller programming, and Firebase, AWS, or ThingSpeak for cloud storage and remote monitoring.

Because inference and the irrigation decision are performed on the controller itself, a temporary loss of connectivity does not impair the system: it continues to sense, decide, and irrigate autonomously, and synchronises its records to the cloud once the connection is restored.

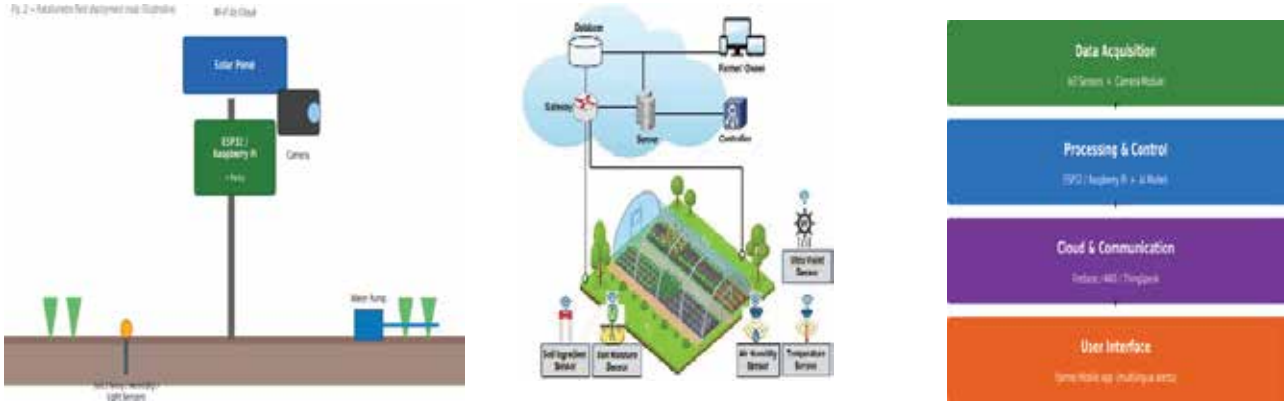


Figure 2: *The consolidated field unit — pole-mounted controller, camera, and relay above the sensor probes, drawing power from a solar panel and driving a nearby irrigation pump.*

Working, Cost-Effectiveness and Impact

Because the unit is assembled from off-the-shelf modules and free, open-source software, both the component cost and the cost to build remain low; almost the entire software stack Python, OpenCV, TensorFlow, and the Arduino IDE carries no licence fee, and the cloud tiers begin free of charge. The complete one-time hardware-and-deployment cost is on the order of ₹80,000 per field unit, covering the controller board, all sensors, the camera, the relay and pump, the power supply, connectivity, and the mobile application, against a usable service life of five years or more. This is a small fraction of the recurring losses — pesticide over-application, wasted water, and manual scouting labour — that a medium farm currently absorbs every season. Development is staged across a twenty-one-month cycle, moving from research through to a fully demonstrated system.

Social Impact

Beyond its immediate agronomic function, Rakshanetra is intended to place the kind of continuous, data-driven crop intelligence normally available only to large industrial farms within reach of the small and medium holding. Because its findings are delivered in plain language and in the farmer's own language, and because it acts on its own rather than expecting the farmer to interpret raw measurements, it is usable by those with limited technological familiarity. By irrigating according to real soil conditions rather than a fixed schedule it conserves water, and by enabling early, targeted intervention it reduces the broad and late application of pesticide that degrades soil health and inflates cost. In aggregate the system supports rural livelihoods, protects yield, and lightens the environmental burden of cultivation.

Conclusion

Rakshanetra is more than a monitoring device: it integrates continuous environmental sensing, on-device computer vision, autonomous irrigation, and plain-language regional advisories into a single low-cost unit that watches a field without interruption and acts on the farmer's behalf. Rather

than requiring farmers to acquire new expertise or to remain constantly present, it works through hardware and software that already exist and at a cost accessible to the medium farm. The system is presently a prototype rather than a validated product, and its reported performance figures are design targets pending field trials; a successful trial would support scaling to a wider range of crops, pests, and deployment conditions, broaden the range of recognised pest species and extend detection to plant diseases, so that a single unit covers a larger share of the threats to yield. Applying predictive analytics over the accumulated longitudinal record, moving from the detection of present problems to the forecasting of likely ones. Add aerial and drone-based imaging for large or dispersed holdings, complementing the fixed pole-mounted camera. Link the advisory layer to market-price and government-scheme information, so that alerts are accompanied by actionable economic guidance in the farmer's language.

Know the Innovators



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BANGLADESH

EcoLoop Rewards

An AI-Powered Decentralized Circular Economy Model for Rural Tourist Zones

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Abstract

Plastic pollution and rural unemployment represent intersecting crises across the Asia-Pacific region's tourist destinations. This paper presents EcoLoop Rewards, an innovative AI-powered circular economy model designed specifically for rural tourist zones where seasonal plastic waste surges overwhelm inadequate waste management infrastructure. The model establishes locally owned Plastic Collection Stores operated by rural youth, utilizing smartphone-based AI recognition technology to accurately measure and reward plastic bottle returns. Tourists participate by returning beverage containers in exchange for digital coins redeemable for local tourism experiences, creating a closed-loop system that transforms waste into economic opportunity. Drawing on successful precedents from Indonesia, Bangladesh, Thailand, and Zanzibar, this model demonstrates how EcoLoop Rewards addresses three interconnected rural challenges: environmental degradation from open plastic burning, chronic youth unemployment, and climate vulnerability. The model projects creation of 30-45 green livelihoods per tourist destination, diversion of approximately 60 tons of plastic annually, and measurable reduction in open burning emissions. By aligning environmental protection with economic incentives, EcoLoop Rewards offers a scalable, locally adaptable infrastructure for sustainable rural development in the Asia-Pacific's most vulnerable tourism-dependent communities.

Background

Tourism is a key source of income for many rural communities across the Asia-Pacific, but it also increases plastic waste and environmental degradation. Unlike urban areas, rural tourist destinations often lack adequate waste management systems to handle seasonal waste, resulting in plastic accumulation and open burning. Studies show that tourists generate significantly more plastic waste than local residents, while open burning releases harmful pollutants that threaten public health, biodiversity, and climate. At the same time, tourism-dependent rural communities experience seasonal unemployment, unstable incomes, and youth migration. Circular economy approaches that combine environmental protection with livelihood creation provide a sustainable solution. **EcoLoop Rewards** addresses these interconnected challenges through an AI-enabled, community-based model that converts plastic waste into economic value. By supporting rural youth-led Plastic Collection Stores and rewarding responsible waste disposal, the model promotes cleaner tourism, green employment, and sustainable rural development in line with SDGs 1, 8, 12, and 13.



Problem Statement

Rural tourist zones in Asia-Pacific experience:

- High seasonal plastic waste generation.
- Limited or non-existent formal waste collection systems.
- Prevalence of open burning and informal disposal.
- Youth unemployment and seasonal income instability.
- Climate vulnerability, including flooding due to blocked drainage and degraded ecosystems.

The absence of integrated waste-to-value systems perpetuates a poverty-environment nexus, where environmental degradation both results from and reinforces rural poverty.

The Innovation

EcoLoop Rewards establishes a decentralized, AI-enabled circular economy infrastructure for rural tourist zones with the following primary objectives:

- To establish decentralized plastic collection micro-enterprises in rural tourist zones.
- To generate stable, year-round employment for rural youth and women.
- To reduce open burning and plastic leakage into ecosystems.
- To create a local circular economy through a digital rewards system.
- To strengthen climate resilience and community health.

EcoLoop Rewards integrates some core concepts into a unified system designed specifically for rural tourism contexts.

- The system utilizes a smartphone-based AI application that enables accurate measurement of returned plastic bottles without requiring sophisticated infrastructure.
- The digital reward mechanism creates immediate tangible value for waste recovery. The tourism-focused redemption creates a virtuous cycle:
  more bottles returned → more coins earned → more local experiences enjoyed →

happier tourists → cleaner destination → more tourists visit.

- The PCS (Plastic Collection Store) owner collects and stores waste bottles during peak season and send them for recycling during off season of tourism. By doing this, it reduces the seasonal unemployment and ensures the income stability year-round. It also prevents plastic burning by ensuring the economic value of waste plastic bottles.
- Impact dashboard, generating verified environmental and social data for ESG and EPR funding. This innovation converts plastic waste into a traceable economic asset while fostering digital inclusion and entrepreneurship.

Implementation Strategy

- *Baseline Assessment:* conducting waste audits and socio-economic mapping.
- *Community Mobilization:* engaging local leaders, tourism operators, and youth groups
- *Training and Capacity Building:* providing technical, digital, and entrepreneurial training.
- *Infrastructure Setup:* establishing collection centres with weighing and sorting equipment.
- *Digital Platform Deployment:* launching EcoLoop mobile application.
- *Partnership Development:* linking with recycling firms and corporate sponsors.
- *Monitoring and Evaluation:* continuous impact measurement using digital dashboards.



Expected Impact

Community-based waste management initiatives in rural tourist zones demonstrate employment generation and environmental improvement at scale. Similarly, tourism-linked plastic reduction initiatives show that integrating sustainability into tourism enhances destination competitiveness.

Scalability & Sustainability

EcoLoop Rewards is designed for systematic replication across the Asia-Pacific's thousands of rural tourist destinations. EcoLoop is scalable due to:

- Low capital infrastructure requirements
- Community ownership model

- Revenue streams from recyclables, sponsorships and EPR credits
- Alignment with regional circular economy policies

Conclusion

EcoLoop Rewards addresses one of the most pressing yet overlooked challenges in Asia-Pacific development: the intersection of plastic pollution, rural unemployment, and climate vulnerability in tourist-dependent communities. The model transforms plastic from an environmental liability into an economic asset, creating dignified livelihoods while eliminating the practice of open burning that damages both human health and global climate.



Know the Innovator

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INDIA

Vayuśuddhi

A Combined Framework and Ozone Oxidation System for Rural Air Purification

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1. The Problem

Air pollution policies predominantly target major cities, yet the worst health and environmental burdens fall on rural and industrial-fringe communities across India and the Asia-Pacific villages within just 5 km of thermal power plants, brick kilns, and freight corridors are among the most critically affected, often breathing air at 16 to 240 times above WHO safe limits. Yet these communities have no monitoring infrastructure, no clean-air systems, and no meaningful policy representation to address the problem. The sources are well-documented: thermal power plants alone drive 60–65% of India's industrial SO_2 emissions, vehicular exhaust accounts for roughly 40% of PM2.5 (particulate matter) pollution spanning both urban and rural areas, and brick kilns combined with biomass burning contribute another 25–30% of fine particulate matter in peri-rural zones. The human toll reflects this neglect. India records 1.67 million air-pollution deaths every year, and rural communities, despite being among the hardest hit, remain largely invisible in both the data and the policy response. Existing technologies fail these communities in three ways. Activated-carbon filters (₹8,000–₹50,000, plus ₹1,500–₹5,000 monthly cartridges) treat only indoor particulates. Wet scrubbers need large footprints, continuous water, and generate secondary liquid waste. Catalytic converters only fit new petrol/diesel vehicles and ignore SO_2 (sulphur dioxide)/$PM_{2.5}$. Electrostatic precipitators handle only particulates and need permanent installation. None combines multi-pollutant treatment with portability, zero maintenance, and rural affordability.

2. The Innovation

This gap motivates Vayuśuddhi- a single, compact, maintenance-free, and affordable unit engineered to simultaneously neutralise $PM_{2.5}$, SO_2 (sulphur dioxide), NO_x (nitrogen oxides), CO (carbon monoxide), and VOCs (volatile organic compound) in one pass, integrate directly into rural infrastructure or vehicles without consumables, and upcycle captured pollutants into useful agricultural inputs for the very communities it protects. Where conventional pollution-control systems are designed for stationary, high-resource urban settings often requiring constant filter replacement, skilled maintenance, and stable power, Vayuśuddhi reimagines the entire approach from first principles, built specifically for the constraints of rural and peri-industrial life: intermittent power, extreme dust, high humidity, and the complete absence of technical support infrastructure. As no existing technology unifies these processes into one compact pass, Vayuśuddhi bridges that gap, transitioning lab-scale innovation into the world's first integrated, portable, maintenance-free outdoor unit built for the humidity and dust of rural and peri-industrial zones. Its innovation lies not in any single mechanism but in the convergence of several: a multi-pollutant capture system that would traditionally require five separate devices, a self-sustaining design that eliminates the recurring cost and complexity of consumables, and a circular-economy output that turns a liability, captured pollutants into a tangible asset for farmers. This combination of affordability, portability, and pollutant-to-resource conversion positions Vayuśuddhi not just as

an emissions-control device, but as a piece of infrastructure that pays for itself in the communities that need it most.

3. How It Works

Polluted air is drawn in through a 360° wraparound intake positioned at mid-body height, so it pulls in air from every direction rather than just one side. This air first passes through a special nanofibre membrane- a very fine mesh-like filter, that physically traps tiny particles (PM2.5) and harmful gases (VOCs) with 99.3% efficiency, meaning almost none of it gets through. Next, the air moves into a chamber where ozone is used to chemically break down and neutralize three more harmful gases SO_2, NO_x, and CO turning them into safer substances. While this is happening, a built-in sensor continuously checks the air quality in real time, so the system always knows how well it's working. At the same time, a UV light inside the unit automatically cleans and refreshes the filter using a self-cleaning chemical reaction (called photocatalysis) which means the filter never needs to be manually replaced or maintained. Once, the air has been fully cleaned, it exits through an outlet facing forward at breathing height, so people nearby get a direct flow of fresh air.The unit is designed to work in two ways: it can be connected directly to the exhaust of a vehicle or generator to clean pollution right at the source, or it can be used as a standalone, wheeled unit that can be moved around — making it easy to place in health centres, village schools, or homes located near major sources of pollution.



4. Cost-Overview

Stage	Activity	Duration	Estimated Cost
Proof of Concept	University lab bench testing against target pollutants	15–18 weeks	₹10–12 lakhs
Design for Manufacture	Compact low-cost unit for rural deployment, engineering iterations	6–8 months	₹18–22 lakhs
Field Trial	Pilot at rural industrial cluster or peri-urban settlement	3–4 months	₹25–30 lakhs
Scale-up	Community-level rollout with NGO/govt. partner	3–4 months	₹15–18 lakhs

Total estimated investment across all four stages is ₹68–82 lakhs. Since the design relies entirely on commercially procurable components-MOF membranes, off-the-shelf ozone generators,

standard UV modules, and solar panels, there is no dependence on custom fabrication, keeping costs down. The unit is built for a minimum lifespan of 8–10 years of continuous outdoor use; UV self-regeneration extends MOF membrane life to 5–7 years, and the ozone generator/biosensor array are rated for 10,000+ hours. Maintenance is minimal a visual check every 6 months and a component check every 2 years with no consumables, cartridges, or service technicians required.

5. Impact on Rural Development

- **Environmental Impact:** Validates 99%+ $PM_{2.5}$ filtration in real rural conditions while reducing SO_2, NO_x, and CO to CPCB-compliant levels in a single pass.
- **Public Health:** Brings clean-air infrastructure to vulnerable peri-industrial and rural communities near thermal plants, freight corridors, and stubble-burning zones that currently have no monitoring or protection.
- **Circular Resource Use:** Captures toxic SO_2 and converts it into sulfuric acid for local fertilizer blending, turning a pollutant into a useful agricultural input.
- **Zero-Maintenance Deployment:** UV self-regeneration eliminates filter replacements, and the supply-chain-free design circumvents the lack of rural service technicians.
- **Sustainability (SDGs-Sustainable Development Goals):** Advances SDG 2 (Zero Hunger), SDG 3 (Good Health), SDG 9 (Industry & Innovation), SDG 11 (Sustainable Communities), SDG 13 (Climate Action), and SDG 15 (Life on Land).

6. Conclusion

Vayuśuddhi is a first-of-its-kind, self-sustaining air purification system built for rural families living in the shadow of thermal plants, brick kilns, and industrial corridors across India and the Asia-Pacific — currently served by no existing technology. No current solution simultaneously treats $PM_{2.5}$, SO_2, NO_x, CO, and VOCs in a unit compact, cheap, and maintenance-free enough for real rural deployment. The science is proven and Vayuśuddhi brings it from the laboratory into the village. Future scope includes fully off-grid solar-powered UV regeneration, an AI-assisted pollution dashboard in local languages, biosensor networks feeding a regional air-quality map, replication across CIRDAP member nations, and integration with rural health worker networks to track respiratory outcomes alongside pollution data. One innovation. Cleaner air for thousands of villages.

Know the Innovators



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IR IRAN

A Clustered Circular Economy Model for Desert and Arid Rural Areas

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The Innovation

Rural communities in arid and desert regions face persistent structural constraints: extreme heat, chronic water scarcity, low agricultural productivity, dispersed settlements, and limited access to energy and markets. These constraints reinforce poverty traps and limit the effectiveness of conventional rural development interventions. Most existing approaches rely on household-level, fragmented solutions (individual solar panels, small gardens, isolated digesters). While technically sound, such solutions often fail in arid contexts due to high maintenance burdens, lack of scale, and weak local institutions.

The Clustered Circular Economy Model (CCEM) is designed specifically for arid rural villages of approximately 100 households, with particular relevance to the Middle East and North Africa (MENA) region. The model builds on empirical lessons from desert settlements such as Dehsalm (South Khorasan, Iran) and selected villages in Kashan County (Isfahan, Iran), where concentrated economic activities, eco-tourism, and resource recycling have demonstrated resilience and income potential. The core innovation lies in **spatial concentration and functional integration**: instead of dispersing small-scale systems across households, key productive and service activities are organized into functional hubs. This approach maximizes resource efficiency, reduces costs, enables professional management, and creates visible, scalable impact, criteria strongly aligned with international innovation challenges.

Conceptual Framework: From Fragmentation to Functional Hubs

In hot and water-scarce environments, physical distance directly translates into resource loss. Long pipelines increase evaporation, dispersed waste management creates hygiene risks, and isolated energy systems suffer from poor maintenance. The **CCEM** replaces fragmentation with **four interconnected functional hubs**, each designed to operate efficiently at a small communal scale while remaining technically simple. Together, these hubs form a closed-loop system in which energy, water, nutrients, and economic value circulate within the village.
This framework allows even small villages to achieve economies of scale, professional oversight, and learning-by-doing—without requiring large external investments.

The Four-Hub Circular Model

Hub 1: Energy & Organic Waste Hub (Biogas and Fertilizer):

Functions: Centralized anaerobic digestion using livestock manure and organic household waste - Production of biogas for communal kitchens and selected households - Generation of digestate (liquid and solid bio-fertilizer)

Key Advantages: Economies of scale compared to household digesters - Improved hygiene and odor control - Reliable daily gas production

Income & Impact: Reduced household energy costs - Sale or distribution of bio-fertilizer to the agricultural hub - Job creation in waste collection and plant operation

Hub 2: Solar Energy Micro-Hub:

Functions: Ground-mounted photovoltaic units in a fenced, managed area - Power supply for water pumping, Cold storage and solar dryers, village lighting and charging stations.

Key Advantages: Optimal panel orientation and maintenance - Reduced theft and damage - Shared storage and inverters.

Income & Impact: Lower energy expenditures, potential sale of surplus electricity (where regulations allow), and enabling infrastructure for other hubs.

Hub 3: Low-Water Agricultural Production Hub

Functions: Small shared greenhouses and shaded cultivation units for production of drought resilient crops and high-value products, medicinal and aromatic plants, selected vegetables under drip irrigation by using treated greywater and bio-fertilizer.

Key Advantages: Controlled water use and reduced evaporation, professional crop management, demonstration and training sites.

Income & Impact: Fast cash flow from high-value crops, reduced risk compared to rain-fed farming, and skill development opportunity for women and youth.

Hub 4: Processing, Value Addition & Eco-Tourism Hub:

Functions**:** Solar drying and basic processing of agricultural products, packaging and branding of village products, eco-tourism services (guided desert and cultural tours, local food and handicraft sales, educational visits focused on sustainability)

Key Advantages**:** Significant value addition with minimal energy input, creation of a unified village brand, strong visibility for donors, visitors, and evaluators.

Income & Impact**:** Higher and more stable household incomes, employment for women in processing and services and income diversification beyond agriculture.

Economic Feasibility and Speed of Impact

Initial investment: Moderate and modular; hubs can be phased

Fast income streams:

- Solar drying (weeks)
- Biogas energy savings (immediate)
- High-value crops (2–4 months)
- Eco-tourism (seasonal but high-margin)

Operational model: Cooperative or village enterprise

The clustered approach reduces per-unit costs and enables professional oversight even in small villages.

Key Strategic Advantages:

The CCEM is built around following **two core innovations** that distinguish it from conventional rural development projects and directly address the realities of arid and desert environments:

a. Spatial Concentration of Economic Activities:

Instead of dispersing small, inefficient systems across households, the model deliberately **concentrates production, energy generation, processing, and services into clearly defined hubs**. In arid regions, distance equals loss. The clustered layout directly converts physical proximity into economic and environmental efficiency.

Thus, the spatial concentration:

- Minimizes water loss, energy dissipation, and material leakage
- Reduces capital duplication and maintenance costs
- Enables professional operation and collective ownership
- Creates visible and manageable intervention points for monitoring and scaling

b. A Closed-Loop Productive System

The model operates as a **closed-loop circular system**, where waste streams are transformed into productive inputs:

- Organic waste becomes biogas and bio-fertilizer
- Bio-fertilizer enhances low-water agriculture
- Agricultural outputs feed processing and tourism
- Residues return to the biogas hub
- Solar energy powers all stages without fossil fuel dependency

This design ensures near-zero waste, prevents capital leakage, and maximizes value extraction from every unit of water, biomass, and energy, an essential principle for desert economies.

Conclusion:

The Clustered Circular Economy Model (**CCEM**) offers a robust, low-cost, and high-impact pathway for sustainable livelihood creation in desert and arid rural areas. By prioritizing spatial concentration and closed-loop resource flows, the model eliminates inefficiencies that typically undermine desert development projects.

More than a collection of technologies, this proposal represents a **system-level innovation,** one that transforms environmental constraints into structural advantages. Its clarity, scalability, and proven contextual relevance make it a strong candidate for international recognition and replication across the drylands of the world.





Know the Innovator

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INDIA

Community-Led Tribal Bio-Resource Enterprise for Sustainable Pest Management

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The Innovation

Tribal regions possess valuable biodiversity, traditional ecological knowledge and a workforce capable of building nature-positive rural enterprises. Yet seasonal employment, weak market access, unscientific harvesting, poor primary processing and the absence of assured quality systems prevent local communities from receiving fair value. This initiative is a community-led enterprise model in which trained tribal collectors, women's self-help groups, Gram Sabha-linked institutions and producer organisations sustainably collect selected, legally permitted and locally abundant plant biomass—such as Gliricidia sepium and Vitex negundo (Nirgundi)—and undertake primary processing under a traceable quality protocol. BareFooter School Foundation provides community education, mobilisation and incubation; Pestosys LLP provides technical specifications, product development, quality assurance and market linkage for eligible plant-based pest-management products. The model combines livelihood generation with biodiversity stewardship, local value addition, scientific validation and responsible procurement. It is designed as a pilot-first, replicable framework and does not presume unrestricted forest collection, automatic certification coverage or guaranteed procurement without written commercial agreements.

Development Context

Tribal and forest-fringe communities often live close to renewable biological resources but remain at the lowest-value end of the supply chain. The principal challenges are:

- Seasonal and uncertain employment, particularly for women and youth.
- Sale of unprocessed biomass at low prices and through informal intermediaries.
- Limited knowledge of species identification permitted collection and quality standards.
- Loss of active ingredients because of delayed drying, moisture, contamination or poor storage.
- Absence of lot-level traceability and credible links with laboratories, start-ups and buyers.
- Risk of ecological damage when collection is driven by volume rather than a resource-management plan.

Purpose and Objectives

- Create dignified, supplementary income from locally available and legally harvestable plant biomass.
- Train communities in identification, non-destructive harvesting, first-stage processing, safety and record keeping.
- Build village-level aggregation and quality-control systems linked with transparent pricing.
- Develop reliable raw-material supply chains for scientifically validated plant-based pest-management products.
- Conserve biodiversity through community resource mapping, seasonal limits and regeneration monitoring.

- Incubate tribal youth and women as collectors, processors, service providers and rural entrepreneurs.

3. The Proposed Model

The model is built on four connected pillars:

Pillar	Village-level activity	Enterprise result
1. Resource stewardship	Participatory mapping, legal screening, harvest calendar and regeneration checks	Reliable supply without damaging the resource base
2. Skills and organisation	Collector groups/SHGs, field training, safety, weighing and record keeping	Local capability and fair participation
3. Primary value addition	Sorting, cleaning where appropriate, shade/controlled drying, cutting, grading, packing and storage	Higher quality and higher value per kilogram
4. Technology and market	Specification, testing, formulation, compliant manufacture, branding and buyer linkage	Market-ready products and repeat demand

4. Indicative Bio-Resource Basket

The resource basket must be finalised village by village. Inclusion requires correct botanical identification, abundance assessment, lawful access, buyer specification and suitability within the applicable organic-input/certification scope.

Illustrative resource	Possible source	Primary operation	Essential caution
Gliricidia sepium	Farm boundaries, hedgerows or permitted community sites	Leaf/soft biomass segregation and drying	Pruning plan; do not damage live fences or ownership rights
Vitex negundo (Nirgundi)	Cultivated or lawfully accessible local stands	Species verification, leaf grading and drying	Avoid uprooting; retain reproductive and regenerative material
Neem and other approved botanicals	Farm/community sources as specifically approved	Part-specific sorting and contamination control	Use only authorised parts and quantities
Other locally abundant weeds/biomass	Mapped agricultural or community locations	Pilot testing before procurement	Not all weeds are safe, effective, legal or covered by certification

Certification note: The Pestosys NPOP-related certificate and its annexed product/scope details should be attached and verified for each proposed product. Certification does not replace Forest,

Biodiversity, Pollution Control, product-registration, labelling or local permissions that may separately apply.

5. End-to-End Operating Process

- Select a pilot geography and convene Gram Sabha/community institutions, landholders and relevant departments.
- Map species, quantity, ownership/tenure, collection season, ecological sensitivity and applicable permissions.
- Issue a written raw-material specification: botanical name, plant part, maturity, moisture, contamination limits, packing and rejection criteria.
- Train and register collectors; provide identification cards, safety guidance and simple field records.
- Collect only approved quantities using non-destructive methods and a seasonal harvest calendar.
- Weigh at a transparent collection point; record collector, village, date, species, source category, quantity and lot code.
- Undertake primary processing in a hygienic village facility and test representative lots.
- Dispatch accepted lots to the authorised manufacturing unit against purchase order and receipt.
- Manufacture and market compliant products; return performance and rejection data to the producer group.
- Review income, quality, regeneration and market demand before expansion.

6. Institutional Architecture

Institution	Proposed role
Gram Sabha / recognised community institution	Consent, lawful access, local oversight, equitable collector selection and grievance mechanism.
Collector groups, SHGs, FPOs or tribal enterprises	Collection, aggregation, primary processing, records, quality discipline and local payments.
BareFooter School Foundation	Mobilisation, practical education, training-of-trainers, youth/women incubation, monitoring and documentation.
Pestosys LLP	Raw-material specifications, formulation/technology, quality assurance, compliant manufacture or licensing, branding and market linkage under written terms.
University / accredited laboratory	Botanical authentication, quality testing, efficacy/safety studies and protocol improvement.
Government departments and local bodies	Scheme convergence, permissions, infrastructure support, training and regulatory facilitation within their mandates.
Anchor buyer / distributor	Demand forecast, purchase order, territory plan, market feedback and timely payment.

7. Livelihood and Revenue Model

Income should arise from several transparent layers rather than a single speculative promise:

- Collector payment per accepted kilogram, with rate, grade and deductions displayed publicly.
- Additional processing wage or margin for drying, cutting, grading, packing and aggregation.
- Village enterprise/service margin for managing the center, records and storage.

- Manufacturing margin for the authorized producer meeting quality and compliance requirements.
- Technology license or royalty to Pestosys when its protected know-how, formulation, trademark or validated product package is used.
- Distribution/marketing margin linked to actual sales, territory and performance.

Commercial rule: No group should invest in large-scale collection, machinery or production only on verbal assurances. Procurement volume, quality, price formula, rejection, payment time, intellectual property, territory and exit conditions must be documented before scale-up.

8. Quality Assurance and Traceability

Control point	Minimum record	Decision
Species and source	Botanical/local name, photograph, village, ownership/source category	Approve or quarantine
Harvest	Date, collector, plant part, method and quantity	Check calendar and quota
Processing	Drying dates, facility, moisture/visual condition and contaminants	Grade or reject
Lot movement	Unique lot code, weights, invoices, transporter and receiver	Full chain of custody
Testing	Sampling record and laboratory/internal results	Release for manufacture
Finished product	Batch, label, permitted claims, market and complaint record	Release and post-market review

9. Environmental and Social Safeguards

- Obtain prior community consent and all permissions required under land, forest, biodiversity and local rules.
- Do not collect protected, threatened or unidentified species; do not uproot plants unless specifically permitted and scientifically justified.
- Fix species-wise quotas and rest periods; retain seed-bearing material and monitor regeneration.
- Prohibit child labor, unsafe transport and exposure to dust or plant irritants without suitable protection.
- Use calibrated weighing, receipts, published rates, timely digital/bank payment and a grievance register.
- Respect traditional knowledge and determine benefit-sharing/IP treatment before commercial use where applicable.
- Avoid claims such as ‘organic’, ‘non-toxic’ or ‘pest-control efficacy’ unless supported by the relevant certification, validation and regulatory pathway.

10. Suggested Pilot: One District, Five Villages

The following is an indicative 6–12-month learning pilot and should be adapted after a baseline study.

Phase	Duration	Core action	Go/no-go evidence
Feasibility	Month 1–2	Resource, legal, community and buyer assessment	Approved species, permissions route and buyer specification
Demonstration	Month 3–4	Train 50–100 collectors; produce trial lots	Acceptable quality, yield, safety and cost
Market validation	Month 5–7	Limited manufacture and buyer/user trials	Documented demand and repeat order potential
Enterprise pilot	Month 8–10	Operate aggregation/processing with real payments	Positive unit economics and payment discipline
Scale decision	Month 11–12	Independent review and expansion plan	Ecological, social, quality and commercial thresholds met

11. Monitoring Indicators

- Number and share of women/youth/tribal households trained and earning income.
- Accepted biomass quantity, rejection rate, moisture compliance and traceable lots.
- Collector income, processing margin, payment time and enterprise operating surplus.
- Area/resource patches mapped; quota compliance and evidence of regeneration.
- Number of validated formulations/products, trial customers and repeat orders.
- Safety incidents, grievances, corrective actions and compliance observations.

12. Expected Outcomes

- Supplementary and dignified livelihoods with increased participation of women and youth.
- Reduced waste of plant biomass through safe, lawful and planned value addition.
- A traceable raw-material base for plant-derived pest-management innovation.
- Stronger collaboration among communities, NGOs, start-ups, researchers, government and markets.
- Improved biodiversity stewardship through community monitoring and non-destructive harvest practice.
- A documented model that can be replicated only after local ecological, legal and market adaptation.

13. Risks and Mitigation

Key risk	Mitigation
Overharvesting or conflict over access	Consent, ownership verification, quotas, harvest calendar and independent regeneration checks.
Wrong species or contaminated material	Field identification aids, trainer verification, lot segregation, testing and rejection protocol.
No buyer or price collapse	Pilot against written demand; diversify products/buyers; avoid debt-funded scale before repeat orders.
Certification/regulatory mismatch	Product-wise legal and certification review; use only permitted claims and licensed facilities.
IP or traditional-knowledge dispute	Prior written agreements covering ownership, licence, attribution and benefit sharing.
Payment delay or elite capture	Transparent rates, receipts, bank payments, audit trail and community grievance committee.

14. Replication Strategy

Replication should follow a modular approach: one verified resource basket, one trained cluster, one quality protocol, one compliant product pathway and one documented market channel at a time. A district-level hub may subsequently support several village collection and processing centres. Expansion to another state or country requires a fresh legal, ecological, certification and market assessment; the original pilot results cannot automatically be transferred.

15. Conclusion

The proposed model reframes tribal communities not as suppliers of cheap raw biomass, but as knowledgeable partners in a science-led, biodiversity-responsible value chain. Its strength lies in connecting community institutions and traditional ecological understanding with transparent enterprise systems, research, quality assurance and actual market demand. The model should begin with a controlled pilot, written roles and purchase terms, measurable ecological safeguards and independent review. If these conditions are met, it can create local income while supporting safer, sustainable plant-based pest-management innovation.



Know the Innovator

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VIETNAM

Community Seed Bank for Climate-Resilient Rural Livelihoods

A Low-Cost Innovation to Support Farmers in Disaster-Prone Areas

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The Innovation

Climate change is increasing the frequency and intensity of floods, droughts, storms, and other natural disasters across Vietnam. While emergency relief often provides food and basic necessities, one essential resource is frequently overlooked: seeds. For smallholder farmers, especially those living in remote and disaster-prone areas, the loss of seeds and breeding materials means the loss of the next production season. Without access to quality planting materials, many households are forced to purchase expensive commercial seeds, rely on external aid, or delay cultivation, making recovery slower and increasing their vulnerability to future disasters.

The Community Seed Bank is a locally managed system that stores, conserves, and distributes seeds, seedlings, and small livestock breeding materials before and after disasters. The innovation enables communities to secure their own agricultural resources, helping farmers quickly restart production while protecting local crop varieties that are naturally adapted to local conditions. Rather than depending solely on external assistance, communities develop their own capacity to respond to climate shocks, creating a more resilient and sustainable agricultural system.

How the Innovation Works

The Community Seed Bank is built on a simple but effective principle: "Borrow today - return after harvest". Farmers receive seeds immediately after disasters and return an agreed quantity following a successful harvest, allowing the seed bank to continuously replenish its stock and remain sustainable over time.

The model is managed by local farmer groups or cooperatives through transparent community regulations that ensure fair access, particularly for vulnerable households. In addition to maintaining seed reserves, the system provides training on seed selection, preservation, regeneration, and climate-resilient farming practices. Local climate-adapted crop varieties are prioritized because they perform better under changing environmental conditions and help preserve agricultural biodiversity. The seed bank also serves as an emergency response mechanism, enabling rapid seed distribution so that farmers can resume cultivation without unnecessary delays.

Cost-Effectiveness

One of the strongest advantages of this innovation is its low implementation cost. Unlike infrastructure-intensive agricultural projects, the Community Seed Bank requires only basic storage facilities, simple preservation equipment, and community participation. Existing farmer organizations, cooperatives, and local institutions can manage most activities without creating complex administrative systems or requiring significant financial investment.

Because farmers replenish the seed stock after harvest, the model gradually becomes self-sustaining and requires only limited external support. It also reduces dependence on commercial seed markets, lowers post-disaster production costs, and decreases the need for repeated emergency seed distribution programs. As a result, the Community Seed Bank offers a highly cost-

effective solution that delivers long-term benefits while remaining affordable for local governments and rural communities.

Impact

The Community Seed Bank generates economic, social, and environmental benefits simultaneously. Economically, it shortens recovery time after disasters, reduces production costs, and stabilizes agricultural output by ensuring that farmers have immediate access to planting materials. Faster recovery also helps protect household incomes and reduces long-term economic losses caused by climate-related disruptions.

Socially, the innovation strengthens cooperation among community members and promotes mutual support through shared management of agricultural resources. Vulnerable households receive priority access to seeds, while local participation increases community ownership and self-reliance instead of long-term dependence on external aid. Environmentally, the model conserves indigenous crop varieties, protects agricultural biodiversity, and promotes farming systems that are better adapted to changing climate conditions. Together, these outcomes contribute to stronger resilience and more sustainable rural development.

Scalability and Sustainability

The Community Seed Bank has strong potential for replication because it is low-cost, community-based, and adaptable to different crops, farming systems, and ecological conditions. The model can be integrated into existing agricultural extension services, disaster risk reduction programmes, climate adaptation initiatives, and rural development plans. Its simple management mechanism allows local communities to operate and maintain the seed bank without requiring complex infrastructure or substantial long-term funding.

With the support of local authorities, businesses, organizations, and individuals, the model can mobilize financial resources, technical expertise, facilities, and management capacity to expand its implementation and ensure long-term sustainability. The participation of multiple stakeholders can also strengthen farmer training, improve seed preservation techniques, support the conservation of indigenous varieties, and enhance the community's ability to respond to climate-related disasters.

This collaborative approach creates favourable conditions for the Community Seed Bank to be replicated in disaster-prone areas across Vietnam and adapted to other climate-vulnerable countries in the Asia-Pacific region. By combining community ownership with external support, the model can develop into a sustainable local mechanism for protecting agricultural production, food security, and rural livelihoods.



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INDIA

AI-Powered Indoor Climate Control System for Cattle Sheds

A Low-Cost, Sensor-Driven Innovation for Livestock Farm Productivity

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1. The Problem

Heat stress has emerged as one of the most significant environmental challenges affecting dairy cattle, particularly in tropical and subtropical regions such as India. Elevated ambient temperature, excessive humidity, and inadequate ventilation create an unfavourable microclimate within cattle sheds, resulting in reduced feed intake, lower milk production, weakened immunity, reproductive disorders, and increased susceptibility to infectious diseases. These adverse conditions directly impact farm productivity and economic sustainability, especially for small- and medium-scale dairy farmers.

Existing climate management approaches predominantly rely on conventional cooling equipment such as continuously operated fans, evaporative cooling systems, or air-conditioning units. Although effective under certain conditions, these solutions are characterized by high installation costs, substantial energy consumption, and limited accessibility for resource-constrained farmers. Furthermore, most commercially available systems operate using fixed schedules or manual intervention, lacking the capability to dynamically adapt to changing environmental conditions. Consequently, they often lead to unnecessary power consumption, inconsistent thermal regulation, and inefficient resource utilization. Recent IoT-based livestock monitoring systems primarily focus on environmental sensing and data visualization without incorporating intelligent closed-loop control capable of autonomously maintaining optimal shed conditions. Therefore, there exists a critical need for an affordable, intelligent, and energy-efficient environmental control system that continuously monitors climatic parameters, performs adaptive decision-making, and autonomously regulates the shed environment while minimizing operational costs and human intervention.

2.The Innovation

The proposed AI-Powered Indoor Climate Control System for Cattle Sheds introduces an integrated intelligent control framework that combines IoT-based environmental sensing, adaptive decision-making, and automated actuator coordination to establish and maintain an optimal livestock microclimate. Unlike conventional systems that independently address ventilation, cooling, or monitoring, the proposed architecture unifies these functionalities into a single embedded platform capable of autonomous environmental regulation. The system continuously acquires real-time temperature, humidity, and ambient light data using distributed sensors connected to an ESP32/Arduino-class embedded controller. Instead of employing fixed timer-based operation, an intelligent control algorithm evaluates environmental conditions against predefined thermal comfort thresholds and dynamically determines the optimal activation sequence and duration of multiple actuators, including evaporative misting nozzles, HVAC circulation fans, industrial blowers, and exhaust ventilation units. This adaptive cyclic control strategy ensures efficient heat dissipation while minimizing unnecessary energy consumption and preventing excessive moisture accumulation within the shed.

A key technical contribution of the proposed system is the implementation of sensor-driven closed-loop environmental control, enabling real-time feedback, adaptive actuator scheduling, and energy-aware operation. The architecture further integrates automated hygiene management through scheduled UV insect-trapping mechanisms and incorporates a motion-triggered worker assistance module that activates calming audio during milking operations, thereby simultaneously improving animal comfort, workplace conditions, and operational efficiency. The proposed solution emphasizes affordability, modularity, and scalability by utilizing commercially available low-cost embedded hardware and IoT components. Its modular architecture allows deployment in small prototype installations as well as large commercial dairy farms without requiring significant redesign, thereby facilitating practical adoption across diverse agricultural environments.

Collectively, the integration of intelligent sensing, adaptive environmental control, energy optimization, and multifunctional automation distinguishes the proposed system from existing livestock climate management technologies and represents a technically robust, economically viable, and scalable smart farming solution.

2.1 How It Works

Three sensors form the system's eyes: a temperature sensor, a humidity sensor, and a light-intensity sensor. Their readings feed a microcontroller-based AI controller, which runs a continuous cyclic control loop while shed conditions exceed comfort thresholds:The controller processes sensor data every few seconds and determines the optimum sequence of cooling actions based on temperature, humidity, and environmental conditions. Once the desired comfort range is achieved, all actuators automatically return to standby mode, conserving energy.

Step 1: Misting nozzles activate for 15 seconds, releasing a fine evaporative cooling mist.

Step 2: HVAC fans and industrial blowers run for 5 seconds, circulating cooled, humidified air uniformly through the shed.

Step 3: Exhaust fans run for 5 seconds, clearing stale air and excess heat.

This cycle repeats automatically for as long as conditions demand it, then pauses once temperature and humidity return to the target range, removing the need for a farmer to switch anything on or off manually.

In parallel, the light sensor adjusts internal ventilation to match natural lighting conditions, a motion sensor switches on calming music whenever a worker is present during milking, and a timer operates the UV insect-trapping light on a fixed hygiene schedule.

2.2 Cost-Effectiveness

The complete prototype- sensors, controller, HVAC fans, blowers, exhaust fans, misting line, UV light, audio system, and structural frame is estimated at ₹40,000 to ₹45,000, a fraction of the cost of installing and running conventional air-conditioning in a shed of comparable size. Because the system runs in short, timed cycles rather than continuously, it consumes significantly less electricity than always-on cooling equipment, keeping recurring operating costs low. Its modular design also means a farmer can start with the 3-cattle prototype and scale the same architecture up to a larger shed without redesigning the core system, spreading costs further as the farm grows.



Fig.: Prototype layout of the AI-powered climate control system (3-cattle model)

2.3 Impact on Rural Development

- Economic: Lowers both installation and running costs for small and medium dairy farmers, directly improving farm profitability and household income.
- Animal Welfare & Productivity: Reduces chronic heat stress in cattle, supporting better health and more consistent milk yields a direct income benefit for rural dairy households.
- Labour & Wellbeing: Automates repetitive environmental monitoring and cooling tasks, freeing farm labour for other work, while the music system eases stress during milking.
- Hygiene & Sustainability: The UV insect-control system improves shed cleanliness, and the cyclic, energy-efficient design lowers the carbon footprint of livestock cooling compared to conventional AC-based methods.
- Scalability: A low-cost, modular architecture that is deployable across farms of all sizes, making the innovation broadly accessible to rural and semi-urban farming communities rather than only large commercial operations.

3. Conclusion

By combining low-cost IoT sensing with AI-driven cyclic automation, this system offers a practical, affordable path to better cattle comfort, higher milk productivity, and reduced manual labour for rural dairy farms. Its modular design and accessible price point make it a realistic near-term deployment for small and medium farms, with a clear roadmap toward future enhancements such as waste-to-biogas integration and cloud-based monitoring.

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MALAYSIA

Transforming Rural Child Nutrition Through redmunch™:

A Food-Based Innovation to Combat Hidden Hunger in Malaysia

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Introduction

Vitamin A deficiency (VAD) remains one of the most significant hidden hunger problems worldwide, particularly among children in developing nations and underserved rural communities. The consequences of VAD are severe and far-reaching, including impaired vision, weakened immunity, increased susceptibility to infections, stunted growth, anaemia, respiratory illnesses, reduced cognitive development, and higher mortality rates among children. Despite Malaysia's tropical climate and abundance of fruits and vegetables rich in natural nutrients, vitamin A deficiency continues to persist among vulnerable populations, especially undernourished children living in rural and indigenous communities. This situation highlights an urgent need for practical, sustainable, and culturally acceptable food-based nutritional interventions to address micronutrient deficiencies in high-risk populations.

The inspiration for this innovation began when reports from the Ministry of Health Malaysia (MOH) and findings from the Southeast Asian Nutrition Surveys (SEANUTS) revealed that vitamin A deficiency persisted among Malaysian children, particularly in rural communities. The coexistence of malnutrition, poverty, poor hygiene, parasitic infections, and limited dietary diversity further compounds the problem in deeper regions. Recognizing this critical public health gap, we embarked on developing a sustainable food-based intervention using red palm oil (RPO). Red palm oil is widely recognized as one of the richest natural plant sources of provitamin A carotenoids, particularly α-carotene and β-carotene, which are responsible for its distinctive orange-red color. By integrating RPO into a convenient biscuit form, we transform a familiar snack into a potent nutritional vehicle that aligns with Malaysian Dietary Guidelines. A critical technical hurdle, preserving carotenoid stability during baking and storage, was successfully addressed through optimized processing, and packaging conditions, ensuring nutrient retention until the product's expiry.

The effectiveness of this innovation was validated through our double-blinded, randomised controlled clinical trial conducted in collaboration with Universiti Malaya among rural primary schoolchildren with VAD. Ten rural primary schools across Peninsular Malaysia and East Malaysia were selected with assistance from the Ministry of Education Malaysia and the Department of Orang Asli Development (JAKOA). A total of 1,164 schoolchildren aged between 7 and 11 years were screened, and 651 children with confirmed or marginal vitamin A deficiency were recruited into the intervention programme. 93% of the children came from households earning less than RM500 per month, reflecting the severe socioeconomic vulnerability of the study population. The intervention involved daily supervised consumption of either RPO-enriched biscuits or control palm oil biscuits four days per week over six months.

Following six months of supplementation, children consuming RPO-enriched biscuits demonstrated significant improvements in multiple health and nutritional indicators. Serum retinol and retinol binding protein (RBP4) concentrations improved substantially in both groups, confirming enhanced vitamin A status. Plasma α-carotene and β-carotene concentrations increased markedly in the RPO group, providing strong evidence that the carotenoids naturally present in red palm oil are highly bioavailable and effectively absorbed by children. In addition to improving vitamin A status, RPO-enriched biscuits also produced important improvements in iron metabolism and blood health. Children receiving the RPO-enriched biscuits showed significantly greater increases in serum iron concentrations than the control group. Improvements were also observed in haemoglobin levels, haematocrit, mean corpuscular volume, and other haematological parameters. The prevalence of microcytic anaemia declined significantly among children receiving. The intervention also demonstrated promising effects on inflammation, parasitic reinfection, and gut health. One of the most impactful findings from the study involved improvements in ocular health and prevention of xerophthalmia among vitamin A-deficient children. Beyond clinical outcomes, the study fostered better hygiene practices and nutritional awareness among families, and directly addressed educational barriers by providing spectacles for children with visual impairments.

The success of this supplementation programme extended beyond scientific research, entering the realm of national public health implementation. Throughout the study, we worked closely with the Ministry of Health Malaysia (MOH) and are proud that MOH recognised our efforts and continued the RPO biscuit supplementation program after our study as part of its community nutrition initiatives, reaching thousands of malnourished children nationwide. The biscuit formulation is protected and sold under the trademark redmunch™, ensuring that the proven health benefits extend beyond research settings to the broader population. Most importantly, this innovation has already influenced national policy discussions. In September 2025, the proposal titled "Implementation of Red Palm Oil Supplementation to Improve the Nutritional Status of Children in Malaysia" was presented during the 18th National Food Safety and Nutrition Council Meeting, chaired by the Minister of Health. The proposal was endorsed as a priority national nutrition strategy, recommending integration of red palm oil into institutional menus and wider distribution of these RPO biscuits through schools, hospitals, preschools, and community feeding programmes by ministries and relevant agencies involved in providing food or nutritional assistance to children.



Through scientific validation, community implementation, and demonstrated health impact, redmunch™ offers a practical, evidence-based model capable of transforming child nutrition and improving quality of life among rural communities. redmunch™ thus constitutes a scalable rural-development innovation that

simultaneously advances food security, child health and sustainable palm-oil value addition directly addressing SDG 2 (Zero Hunger), SDG 3 (Good Health) and SDG 10 (Reduced Inequalities). By addressing hidden hunger through an affordable, culturally acceptable, and clinically validated intervention, redmunch™ has the potential to become a transformative rural nutrition solution that empowers healthier futures for vulnerable children across the region.

Scan here to know more:

Know the Innovator



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INDIA

EquiVolt

An Online Cloud-Synchronized Rural Electrification System

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Introduction

Energy scarcity remains one of the most structurally entrenched challenges facing rural communities in the developing countries. Electrification has expanded considerably in recent years, yet a significant proportion of rural households, health clinics, and schools continue to experience frequent outages, unstable voltage, or no dependable grid connection at all. This unreliable access suppresses agricultural productivity, restricts evening education, and leaves local health clinics unable to power critical vaccine refrigeration.

Lower-cost solar photovoltaic (PV) hardware, high-density Lithium Iron Phosphate (LiFePO4) batteries, and low-cost Edge-Artificial Intelligence (Edge-AI) microcontrollers have made decentralized micro-grids increasingly feasible, but most existing systems remain rigid rather than adaptive: they rely on fixed-threshold charge controllers that cannot forecast weather anomalies, offer no automated load-prioritization to protect critical infrastructure during generation deficits, and depend entirely on cloud connectivity that freezes or drops into an unmanaged state whenever monsoon weather or rugged terrain disrupts fragile last-mile internet networks. As a result, many rural micro-grid deployments today function only for as long as their internet connection holds, leaving communities exposed to extended blackouts at precisely the moments storms, equipment faults, or missed payments when intelligent, automated intervention matters most. For a family in one of these regions, a single unplanned outage can mean a batch of spoiled vaccines at the local clinic, an evening lost to studying without light, or an irrigation pump that fails to run during a critical planting window. Addressing this gap calls for a system that is resilient by design rather than by exception: one that keeps functioning correctly and fairly whether or not connectivity is available, and that treats offline operation as a normal, fully-supported mode rather than a failure state.

Motivation

The motivation for EquiVolt stems from the observation that the underlying hardware for reliable rural electrification already exists solar generation, battery storage, and embedded compute have all become dramatically cheaper and more capable in recent years but the control logic layered on top of that hardware has not kept pace. Most commercial micro-grid systems are designed around an assumption of constant connectivity, and simply degrade, freeze, or fall back to manual operation the moment that assumption breaks down, which is often exactly when rural communities need them most. EquiVolt is motivated by the goal of closing this gap: building a control system that keeps working, keeps prioritising critical loads such as clinics and schools, and keeps its payment system running whether it is online or offline, so that the communities who most need dependable power are not the ones left waiting for a signal to return.

The Innovation

EquiVolt is a fully online, cloud-synchronized smart mini-grid that maintains operational resilience through local Edge-Artificial Intelligence (Edge-AI) whenever network connectivity is

compromised. It runs on a continuous cloud pipeline during normal operation, and shifts to a local Long Range Wide Area Network (LoRaWAN) mesh network during outages, streaming consumer telemetry directly to an on-site Edge-AI microchip. This on-site engine autonomously performs 48-hour predictive weather and load forecasting, enforces a priority-based Load Allocation Plan that guarantees uninterrupted power to High-Priority loads such as medical clinics and schools, smart-schedules Medium-Priority loads such as agricultural mills during peak sun hours, and applies gentle wattage-shaving to Low-Priority household loads, resolves short-circuit faults within milliseconds, and validates prepaid utility top-ups through an offline cryptographic token ledger. Few existing platforms combine equity-constrained Multi-Objective Reinforcement Learning (MORL) dispatch, on-chip weather forecasting, a dual-mode online/offline dashboard, and a cryptographic offline pay-as-you-go engine into a single deployable system, which is the gap this project aims to close.

How the Innovation Works

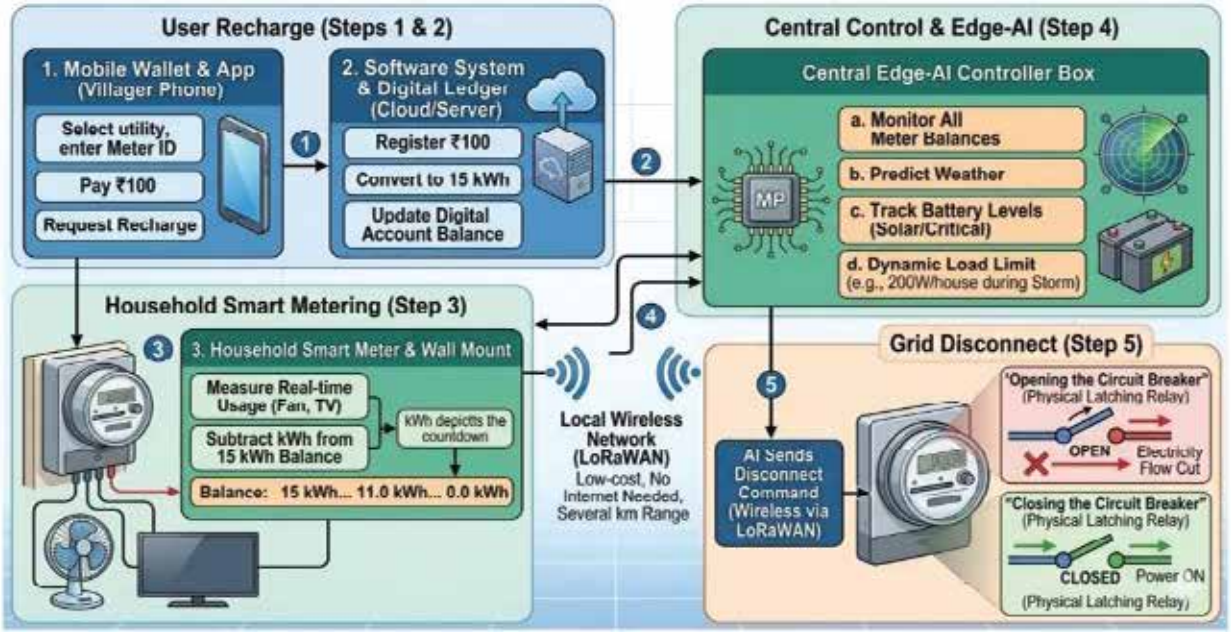
EquiVolt's principle is built around two complementary modes of operation that share the same underlying logic. Under normal conditions, the system runs in an online, cloud-synchronized mode: consumption data, account balances, and weather forecasts are processed through a central cloud pipeline, and both users and administrators can monitor the grid in real time through a web-based dashboard accessible from any browser. The moment internet connectivity is lost, control shifts automatically to the on-site Edge-AI Controller Box, which takes over balance tracking, weather-based load management, and fault response using only the local wireless network with no interruption in service and no action required from the user. The same core recharge-to-disconnect workflow described below runs identically in both modes; only the location of the decision-making, cloud or edge, changes. Illustrating a methodology, a user opens a Unified Payments Interface (UPI) application, selects the “Village Power” utility, enters their Meter ID, and pays ₹X. The system converts this payment into Y units of electricity at the village rate and credits it to the household's digital balance, which is immediately reflected on both the household meter display and the online dashboard.

Step 1: The smart prepaid meter on the wall continuously tracks real-time usage, counting the balance down as appliances draw power and logging consumption locally so that no data is lost if connectivity drops mid-cycle.

Step 2: The central Edge-AI Controller Box communicates with every household meter over the Long-Range Wide Area Network (LoRaWAN), a low-cost local wireless network that operates over several kilometres without requiring internet access. It continuously monitors balances across all connected households, ingests short-range weather signals, and runs a 48-hour forecasting model to anticipate periods of reduced solar generation.

Step 3: If a storm is approaching and battery levels are critical, the Edge-AI temporarily lowers the per-house power limit (for example, to Z watts for a few hours), prioritising High-Priority loads such as clinics and schools first, Medium-Priority loads such as agricultural mills second, and Low-Priority household loads last, to prevent a full blackout.

Step 4: The moment a balance reaches 0.00 units, the Edge-AI Controller transmits a wireless disconnect command over the LoRaWAN network, which mechanically triggers a latching relay inside the meter, thereby interrupting the electricity supply to the household until the balance is topped up again.



Step 5: As soon as the user's recharge is received, the Edge-AI Controller detects the payment and closes the relay again, restoring power within moments with no manual intervention needed at any step.In areas with no internet access at the time of recharge, the same top-up can be completed through a locally-generated, cryptographic HMAC-SHA256-based token issued by a vendor's offline application. The Edge-AI Controller validates this token entirely on-device before restoring supply, so the payment-to-power cycle works identically whether or not the internet is available at that moment.

Impact on Rural Development

Economic and Affordable: A cryptographic pay-as-you-go structure keeps electricity access affordable for low-income households while keeping the grid financially self-sustaining. The turnkey micro-grid platform is designed so that the Edge-AI handles forecasting, load-shaving, and fault isolation locally, reducing the recurring cost of manual monitoring and diesel back-up generation. Its modular, containerized design allows the same architecture to start with a single-village pilot and scale to additional villages without re-engineering the core platform, spreading capital costs further as the network grows.

Healthcare: Guaranteed High-Priority uptime for clinics reduces the vaccine-spoilage risk caused by temperature spikes in traditional off-grid facilities.

Education: Reliable evening lighting adds extra hours of study time for students each day.

Agriculture: Smart-scheduling of grain milling and irrigation pumps during peak sun hours reduces post-harvest losses.

Environment: The system is estimated to avoid a meaningful share of carbon dioxide (CO_2) emissions per village annually compared with diesel generators.

Conclusion

EquiVolt offers a practical, deeply engineered solution to the power failures that disrupt rural electrification, pairing a standard online, cloud-synchronized dashboard with a resilient on-site Edge-AI engine so that a village grid never freezes when the internet goes down. The pilot is

designed to keep power running for critical health and education needs, eliminate unplanned blackouts, protect life-saving vaccines, extend study hours for students, and operate an internet-independent prepaid payment system all while building long-term community ownership through hands-on technician training. Building on a successful pilot, the platform can be extended into a multi-source hybrid grid that integrates micro-hydro and wind generation for added resilience during monsoon seasons and low-solar periods. Additional planned enhancements include inter-village electricity trading over the LoRaWAN network, electric vehicle charging points for farm vehicles, carbon-credit tracking aligned with international climate frameworks, and predictive maintenance alerts that flag inverter or battery issues before they cause down.

Know the Innovators



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BANGLADESH

A Low-Cost Portable Device for Detecting Food Adulteration in Rural Markets

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Introduction

Food adulteration is a persistent and dangerous problem in Bangladesh, particularly in rural and semi-urban markets where regulatory testing is limited. Chemicals such as formalin, calcium carbide, and sulfur dioxide are commonly used to preserve fish and fruit or to force premature ripening, extending shelf life and appearance at the cost of serious long-term health risks. Peer-reviewed toxicology studies have linked repeated formalin exposure in food to measurable liver and kidney tissue damage, and separate public-health reviews have tied calcium carbide residue to elevated cancer risk from its arsenic content. Because these effects build up silently over years rather than appearing immediately, most consumers have no way to connect a specific illness to a specific adulterated meal- and rural markets in particular are exposed with almost no way to screen food before purchase. Having grown up in a small city in Bangladesh where these practices are a daily reality, and after watching friends and relatives cope with long-term illnesses whose causes are rarely investigated, I set out to build a handheld device that ordinary people could use to screen food on the spot- not as a replacement for laboratory analysis, but as a fast, low-cost early warning that tells a shopper or vendor when a sample deserves closer scrutiny.

The Innovation

The device is a portable, battery-powered gas-vapor detector weighing approximately 350 grams, with an outer shell built from biodegradable material to keep it lightweight and low-cost. It uses an Arduino Uno microcontroller connected to an MQ-135 gas sensor, a 0.96-inch OLED display, and a buzzer. The user simply points the device toward a food sample- no contact with the food is required. The MQ-135 sensor measures the concentration of volatile organic compounds (VOCs) in the surrounding air, including vapours associated with formalin, sulphur dioxide, and calcium carbide, and returns a reading in roughly 3 to 8 seconds depending on ambient conditions. The Arduino compares the sensor's analog output against a calibrated threshold (Figure 2). If the reading exceeds the threshold, the OLED display shows a warning with an estimated adulteration level and the buzzer sounds; if the reading stays within the normal range, the display shows a safe reading. The full circuit is mounted in a compact handheld enclosure with a USB-rechargeable battery, so it can be operated with a single button and requires no technical training to use.



Figure 1 — The Food Adulteration Detector prototype

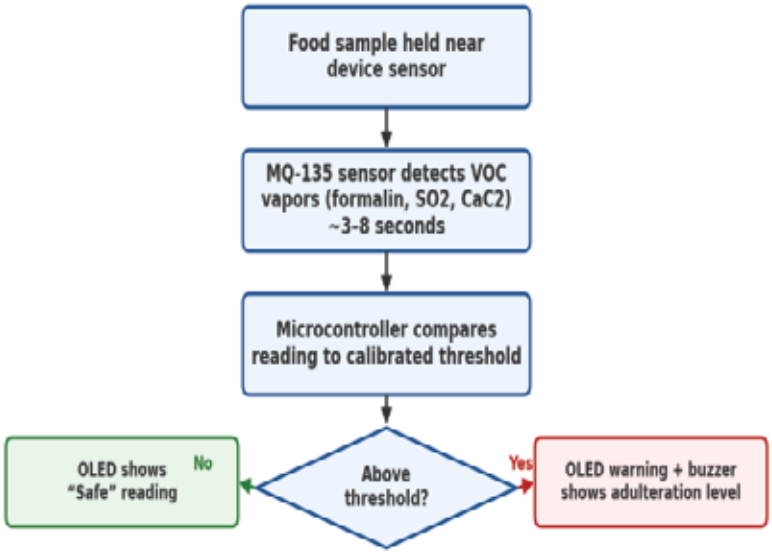


Figure 2 — Detection logic: from sample to alert

Field Testing and Community Response

The prototype has been tested with more than 50 food samples, primarily soft-shell produce such as oranges, mangoes, and bananas, using formalin, sulphur dioxide, and calcium carbide as reference adulterants. Treated samples consistently produced a clear, repeatable rise in sensor output compared with untreated controls. Separately, an independent community survey of 92 residents- including teachers, students, and general shoppers- conducted in Muktarpara, Netrakona, found that 97% would use the device if it became available; the remaining 3% felt that direct government enforcement against dishonest vendors was a more effective solution. This project was also selected among the top three at the 3Zero Leadership Challenge 2025, an international youth innovation competition.

Cost-Effectiveness

Affordability is central to the device's design. The current handheld prototype- Arduino Uno, MQ-135 gas sensor, OLED display, buzzer, battery, and enclosure- costs approximately $10 to build. With optimized, scaled manufacturing (custom PCB, bulk component sourcing, injection-molded casing), the per-unit cost could fall to roughly $4. This is a fraction of the cost of a single laboratory formalin assay or commercial test kit, making the device realistic for individual consumers, market vendors, small NGOs, and community health workers, not just institutions.

Potential Impact

The device's potential impact spans several fronts. For consumers, it offers a way to screen produce before purchase rather than relying on guesswork or smell. For markets, wider availability of quick testing could discourage vendors from using harmful preservatives, strengthening accountability. For public health systems, even modest reductions in everyday adulterant exposure could ease the long-term burden of chronic disease. And for local food economies, vendors and farmers who can

demonstrate safer produce stand to build stronger trust with their communities. Beyond individual households, the device could be deployed by community health and agriculture workers on field visits, used in school STEM and health-education programs, and loaned out by village cooperatives during food-safety awareness campaigns.

Future Development

Planned next steps include shrinking the enclosure to roughly the size of a handheld infrared thermometer, improving sensor sensitivity, and adding dedicated sensors for additional adulterants. Later, higher-connectivity versions may move to a Wi-Fi/Bluetooth-enabled microcontroller such as the ESP32 to support smartphone pairing and regional data logging. Field partnerships with local NGOs or universities are planned to pilot the device at larger scale.

Conclusion

This project demonstrates that a genuinely low-cost, portable device can give rural consumers and vendors a practical first line of defence against food adulteration- closing part of the gap between laboratory-grade detection and everyday market life. I welcome the opportunity to continue refining and field-testing this device, and to collaborate with health agencies, NGOs, and researchers interested in scaling accessible food-safety tools for underserved communities.



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IR IRAN

Rangeland Mentor Program in Golestan Province, Iran

A community-based extension and governance model to strengthen rangeland management, livelihoods, and ecosystem services

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Executive Summary

Golestan Province hosts extensive rangelands that underpin rural livelihoods and provide key ecosystem services. Rangelands in Golestan cover approximately 860,000 hectares; about 756,000 hectares are winter rangelands and the remainder are summer rangelands. Rangeland quality varies, with roughly 20% classified as grade 1, slightly over 20% as grade 2, and close to 60% as grade 3. This proposal introduces a low-cost, high-impact institutional innovation: training and organizing experienced volunteer rangeland users as "Rangeland Mentors". Mentors serve as trusted local reference points and as practical bridges between communities and the Natural Resources Administration, enabling peer learning, smoother program implementation, and faster feedback for local problem-solving. The Mentor program has not been implemented nationally to date and can be pioneered in Golestan.

Background and Rationale

Rangelands are globally significant, covering about 40% of the world's surface and supporting the livelihoods of more than half a billion people across over 100 countries. In Golestan, they contribute to soil and water conservation, biodiversity and wildlife habitat, carbon cycling, and forage production. Two practical needs motivate this innovation: (1) strengthening relationships and trust between the Natural Resources Administration and local rangeland users, and (2) providing local-level guidance for rangeland-related programs where formal extension capacity may be limited.

Innovation and Objectives

What is a Rangeland Mentor?

A Rangeland Mentor is an experienced, respected rangeland user who is trained, recognized, and supported to guide peers in rangeland-related practices and programs. Mentors provide practical advice, help interpret and implement local rangeland plans, and facilitate communication between communities and government agencies.

Objectives

- Strengthen relationships and trust between the Natural Resources Administration and rangeland users.
- Increase knowledge and adoption of sustainable rangeland practices through peer learning.
- Improve local planning and implementation of rangeland-related programs, reducing delays and administrative burdens.
- Contribute to improved rangeland condition and productivity over time.

Implementation Plan

Step	Core Activities	Key Outputs
1. Selection	Transparent selection of experienced volunteer rangeland users; community validation.	Shortlist of mentor candidates.
2. Workshops	Introduce the model; clarify roles; co-design local rules and expectations.	Shared understanding and local buy-in.
3. Training	Short, practical training (classroom + field) on rangeland management, facilitation, conflict resolution, simple monitoring.	Trained mentors with toolkits.
4. Networking	Create mentor network, coordination meetings, code of conduct, and reporting channels.	Operational mentor network.
5. Mentoring	Start mentoring; routine supervision; refresher training; capture lessons for scale-up.	Active mentoring + evidence for scale-up.

Training (illustrative modules)

- Sustainable grazing and rangeland condition basics (field-oriented).
- Participatory facilitation and communication skills for peer learning.
- Conflict management and negotiation for local problem-solving.
- Understanding local rangeland plans/procedures; implementation support.
- Simple monitoring and record keeping; basic reporting.
- Use of ICT where feasible (e.g., messaging groups, simple digital forms).

Pilot Timeline (6 months)

Month 1: alignment and pilot selection; Month 2: mentor selection and community workshops; Month 3: core training; Months 4–5: deployment and supervision; Month 6: evaluation and scale-up toolkit.

Monitoring, Learning and Evidence

Evidence will combine simple quantitative tracking with qualitative testimonies to demonstrate feasibility and local impact.

Suggested indicators

- Mentors selected/trained; participation in workshops and field sessions.
- Mentoring activities delivered (visits, peer-learning sessions, facilitation events).
- User satisfaction and perceived trust/communication quality (short surveys/interviews).
- Program implementation signals (timeliness, reduced back-and-forth).
- Simple ecological signals (rangeland condition scorecards; erosion-risk observations).

Expected Outcomes and Impact

- Improved relationships, trust, and communication between rangeland users and the Natural Resources Administration.
- Higher knowledge and adoption of sustainable practices among rangeland users.
- More effective and locally grounded planning and implementation of rangeland-related programs.
- Reduced conflicts and faster resolution of local issues; over time, improved rangeland condition and productivity supporting more stable rural livelihoods.

Sustainability, Scalability, and Partnerships

Sustainability will be supported through formal recognition of mentors, clear roles and accountability, periodic refresher training, and a peer network. The model is designed for collaboration between the Golestan Natural Resources and Watershed Management Administration and academic support from the Gorgan University of Agricultural Sciences and Natural Resources.

Key Risks and Mitigation

Key risks include selection bias, volunteer fatigue, role confusion, and weak monitoring. Mitigation will rely on transparent criteria and community validation, recognition and peer support, clear coordination protocols with assigned focal points, and simple tools with periodic supervision.





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INDIA

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GRAMSETU

An AI-Assisted Rural Commerce and Livelihood Ecosystem

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The Innovation

India is known for its agriculture, dairy production, and a huge amount of small-scale rural producers. Still, most producers remain outside markets, a farmer with surplus stock, a self-help group with unsold goods, and an idle tractor nearby often don't have ways to connect with one another. Gramsetu is built exactly to fill this gap. It combines four main components which usually are offered as separate platforms, supply aggregation, verified market access, employment generation and renting of rural assets such as land tractors and equipment into a single platform. What sets Gramsetu apart from the existing tools is that employment is not treated as a separate feature but it is generated directly whenever packing storage and delivery task is created through the platform.

Motivation

The inspiration for Gramsetu came from the direct observation in the research of rural commerce platforms, where the existing tools focus on tackling only parts of the problem. Marketplace applications help to execute transactions between buyers and sellers without providing aggregation of supply. Advisory platforms provide information which does not create jobs or market access. There are job portals that list available jobs without providing direct employment through local transactions. Patterns revealed by rural users' abandoning several of these platforms after a few uses, typically due to complicated and nonintuitive interfaces, suggested that the problem is not a lack of tools, but a lack of coordination between the tools. Gramsetu was therefore planned to be integrated into one comprehensive system, not an additional one-off project in this disjointed world.

Problem Statement

Producers, buyers, workers and idle assets just stay in that same rural area unused. There is no efficient means of contact between a farmer with a large producer surplus and a buyer other than a certain radius; a tractor is left unused next to a buyer who requires one; a self-help group produces goods of genuine quality but has no reliable market beyond its own locality. From producer to aggregator, aggregator to logistics, logistics to buyers, value is lost and information about the price is not passed to the producer or the actual maker of the product. Not many platforms already attempt to help but they only do part of the job.

eNAM is an enabling tool for linking all the registered mandis, but not for self-help groups. DeHaat offers advisory and input supply but no employment opportunities or asset sharing. Ninjacart has a good B2B chain for urban retail, but omits the rural workers. AgroStar remains limited to a single category and Open Network for Digital Commerce (ONDC) remains an open network to which no rural user is onboarded. Individual producers are too small to meet bulk buyers' needs as a result of fragmented markets.

How it Works

Price data is updated locally, which means that it remains available even if there is no signal available and it will be synced as soon as the signal is restored.



Figure 1: GRAMSETU ecosystem architecture, from participation to rural economic impact.

That aggregation service enters the market layer, and links the producer with verified buyers. Each verified order generates local employment, someone picks up the order, packages and moves it, and the jobs are directly linked to the order – work and employment grow in line with transactions. A village asset layer allows for unused land, tractors, equipment, and storage space for short term or rent, allowing landowners to make money off idle resources. A voice assisted AI assistant built on Bhashini API, helps users to navigate through the platform in Malayalam, Tamil, Kannada, Hindi or English and support layer is provided for help that can't be resolved by the assistant. The platform is built using React Native, Node.js, PostgreSQL, Firebase and SQLite in few tier AWS (or GCP) which allows the pilot to scale without the cost of scaling up.

Working, Cost-Effectiveness and Impact

Gramsetu aims to create and implement one integrated platform that pulls rural producers, buyers and idle assets together, and that overcomes the fragmentation caused by the tools currently available that work with only parts of this chain. It helps create jobs at the local level from activities within the platform instead of jobs as a separate feature, to coordinate, pack, prepare, store and onboard. The production process is interwoven into the transaction flow of the produce. Further, it creates a platform experience that is friendly to first time digital users, since most of the rural platforms' failure is because of interface complexity, not lack of functionality.

Once the available produce is posted on the site, then the platform searches for a listing until an order is big enough to meet the buyer's requirements. After order is confirmed, some roles are created to execute transportation and delivery. It is also built to stay upfront costs to a minimum as services are available on a free or per transaction basis. They accept payments via Razorpay and UPI services and their location service is powered by Google Maps with its free tier and supports multiple languages via Bhashini, which is free for academic projects. Based on these, it is expected that there will be a cost of Rs.42000- Rs.62000 for the three-month pilot for two or three rural clusters. The platform can have positive impacts on various segments of the rural community if it is successfully put in place. Gramsetu seeks to promote more involvement in the rural economy, beyond its income-generating ability. This platform can be utilized by self-help groups and

women-led companies to display and sell their products without getting to know complicated digital instruments. The AI navigation assistant simplifies the navigation and leads the user step by step in the language of his preference. Moreover, with the placement of orders, other occupations like coordinator, packing assistant, digital agent are given to local community members, which also provides employment in the village and can minimize the migration of young people from villages to urban areas for employment.

Conclusion

Gramsetu is not just a marketplace, it is more. It integrates supply consolidation, access to markets, job creation, and the sharing of resources. It offers a comprehensive suite of mostly free services, and operates on a low-cost pilot model, which is feasible in rural settings. Rather than expecting people to change the way they work, invest in resources, Gramsetu focuses on being the better of resources which already exist. The successful piloting can be scaled up to additional villages and different products.

Future Scope

- Implement AI powered advisory within the existing AI navigation assistant, enabling farmers to get weather-based crop/livestock recommendations and guidance all in one place.
- Enable linkage with eNAM and ONDC to facilitate the producers to access larger market.
- Make a completely offline version of the platform to use by poor internet connectivity villages.
- Install an analytic dashboard on the platform for farmers, self-help groups and local administrators to monitor sales, usage of resources and income generation.

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NEPAL

Village-Based Integrated Dairy Feed and Service Enterprise (IDFSE)

A Youth-Led One-Door Innovation for Transforming Smallholder Dairy Farming in Nepal

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1. The Problem

Smallholder dairy farming remains a major source of food, nutrition, and income for rural households in Nepal. However, the sector is increasingly threatened by labor shortages, youth migration, fragmented landholdings, rising feed costs, low productivity, weak market linkages, and limited mechanization and digitalization. These challenges are causing many rural families to reduce or abandon livestock farming, undermining rural livelihoods, national milk production and long-term food security. The uploaded concept note identifies the need for a business-oriented, youth-led service delivery model that reduces labor burdens, improves feed efficiency, increases profitability and strengthens the sustainability of smallholder dairy systems.

2. Novelty and Significance of the Innovation

The Village-Based Integrated Dairy Feed and Service Enterprise (IDFSE) is an innovative one-door rural livestock service model designed specifically for smallholder dairy farmers. Unlike conventional projects that focus on a single intervention, IDFSE integrates:

- Feed and Total Mixed Ration (TMR) services
- Artificial insemination and breeding support
- Vaccination, deworming, and veterinary coordination
- Milk collection and quality testing
- Custom hiring of farm machinery
- Digital livestock data management
- Manure collection and organic fertilizer production

A unique feature is that 5 to10 rural youth form a registered enterprise that serves 100 to 150 dairy households and 400 to 600 dairy animals, functioning as a professional Livestock Service Contractor. This creates local employment while allowing farmers to focus on productive livestock management.

3. How the Innovation Works

The enterprise operates through six integrated service components:

a. Feed and TMR Services

The enterprise collectively leases fodder land, produces green fodder and silage, procures feed ingredients in bulk and formulates balanced TMR using local agricultural by-products. Ready-to-feed rations are delivered directly to farmers, reducing labor requirements and improving milk productivity.

b. Livestock Management Services

Seasonal labor support is provided for fodder harvesting, silage preparation, emergency milking assistance, disinfection, tick control and digital record keeping, particularly benefiting women-headed and elderly households.

c. Milk Collection and Marketing

Milk is collected from member households, tested for quality, transported in bulk and linked directly with dairy industries, improving bargaining power and milk prices.

d. Animal Health and Breed Improvement

The enterprise coordinates artificial insemination, heat detection, vaccination campaigns, deworming, veterinary referrals and digital livestock records to improve herd productivity and profitability.

e. Custom Hiring Centre

Farmers gain affordable access to machinery such as chaff cutters, mini feed mixers, silage balers, grass cutters, milking machines, mini tractors and fodder shredders without making large individual investments.

f. Circular Agriculture Component

Livestock manure is systematically collected and converted into compost, vermicompost, biogas slurry and other organic fertilizers, creating additional income opportunities while improving environmental management. Digital tools support all components through mobile-based livestock management systems, digital payments, milk recording applications, online veterinary consultation, weather advisories and QR-based milk traceability.

4. Cost-Effectiveness, Scalability, and Sustainability

The innovation is highly cost-effective because expensive machinery, feed processing equipment, and marketing infrastructure are shared collectively rather than purchased by individual farmers. Bulk procurement of feed ingredients and utilization of local agricultural residues further reduce production costs.

The model is scalable because each enterprise can be replicated in additional villages or dairy clusters with relatively low startup investment. The pilot is proposed for Dudhauli Municipality, Sindhuli District, where existing dairy cooperatives, milk collection networks and road connectivity provide a favorable environment for expansion.

Financial sustainability is strengthened through diversified revenue streams, including:

- TMR and feed sales
- Service charges for livestock management
- Milk collection commissions
- Equipment rental fees
- Veterinary support services
- Organic fertilizer sales
- Digital advisory services

The integration of manure recycling, local feed resources, and digital management also makes the model environmentally sustainable and climate-smart.

5. Potential Impact on Rural Development

The IDFSE model has strong potential to transform rural dairy systems by:

- Reducing labor burdens for farm households, especially women and elderly farmers
- Improving feed efficiency and milk productivity through balanced TMR feeding
- Increasing farm income through collective marketing and better milk prices

- Improving animal health and reproductive performance through timely preventive services
- Creating employment and entrepreneurship opportunities for rural youth and women
- Reducing youth migration and encouraging local economic development
- Promoting circular agriculture through manure-based organic fertilizer production
- Enhancing food and nutrition security through increased domestic milk production

By integrating feed transformation, animal health, mechanization, digitalization and market linkages under a single service platform, the innovation converts smallholder dairy farming from a labor-intensive subsistence activity into a modern, commercially viable and climate-smart rural enterprise. The model is suitable not only for Nepal but also for other South Asian countries facing similar smallholder dairy challenges.





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IR IRAN

Pistachio Farm, Festival & Future

A Multifunctional Rural Innovation Model

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The Innovation

In Qohab-e Rastaq, a pistachio-growing village of 4,000 people in Semnan Province, northern Iran, farming families have built- without external funding or outside design; a Multifunctional Rural System that turns the pistachio orchard from a single commodity source into a self-reinforcing engine of agritourism, cultural identity, and knowledge-based marketing. Three interconnected innovations, developed organically by the community in partnership with the Damghan Pistachio Association and Damghan University, make up the system: (1) Pistachio Agritourism and Living Farm Tours, (2) the annual Damghan Pistachio Festival, and (3) a University-Community Marketing Model that converts university students into a zero-cost distribution and brand-ambassador network.

Importance

Rural Damghan faces pressures common across Asia-Pacific: water scarcity and climate stress on ancient qanat irrigation, income volatility from raw-commodity pricing, low local value addition, youth outmigration, weak market linkages, and cultural erosion. In September 2023, severe drought cut regional pistachio yields by 25–35%. Families who had diversified their income through this model absorbed the loss without debt or household breakup — an unplanned, real-world test of the model's value as a climate-resilience mechanism.

How It Works

- ***Agritourism:*** Visitors join the harvest cycle directly — traditional qanat irrigation, indigenous pruning and pest-management practices, harvesting and sorting, and shared meals prepared by village women — generating income, youth employment as orchard guides, and economic roles for women as hosts and cooks.
- ***Festival:*** An annual, community-owned event combines a direct producer-to-consumer market, a culinary and craft showcase, and an inter-generational knowledge forum where elder farmers formally pass on indigenous agronomy. It is also building the evidence base for Geographical Indication (GI) and FAO GIAHS heritage recognition.
- ***University-Community Marketing:*** Damghan University's large non-local student population, plus roughly 1,000 international students, carry pistachio home, take orders from family and neighbours, and — through student-designed packaging and social media — extend the brand to 31 Iranian provinces and 5+ countries, entirely without an advertising budget.

Cost-Effectiveness

The model required no external capital or imported expertise: it activates assets the community already had — orchards, a nearby university, a harvest calendar, and cultural identity. The student distribution network delivers province- and country-spanning market reach at zero marketing cost, while festival-direct sales let producers keep 20–35% more of the sale price by eliminating intermediaries.

Impact

Community surveys of 60 participating families (Damghan Pistachio Association, October 2024) recorded: 60+ farm families earning supplementary agritourism income; 40+ producers selling festival-direct at 20–35% above intermediary prices; 35 young people (18–32) in roles that did not exist before 2019, including 8 returnee migrants; 30+ women in new income-generating roles; and 12 elder farmers engaged as formal knowledge-holders, reaching 200+ visitors annually. During the 2023 drought, participating families fully absorbed a 25–35% yield loss without debt — in contrast to neighbouring single-commodity households.



Farmer-guide sharing orchard knowledge with agritourism visitors



Producer-direct market day at the annual Damghan Pistachio Festival



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INDIA

Eco-Friendly Broad-Spectrum Herbal Nematicide

Galla Chandrasekhar
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Introduction

Nematodes pose a significant threat to farmers, causing substantial yield losses: 30-90% in vegetables, up to 50% in field crops like paddy, wheat, and corn, and 20-21% in horticultural crops. These microscopic parasites damage plant roots, leading to stunted growth, and are often mistaken for drought or nutrient deficiencies, resulting in delayed action. The damage creates entry points for other pathogens, further compromising plant health, yield, and quality. This leads to financial losses for farmers due to reduced market prices. Once established, nematodes are challenging to eradicate, and chemical controls can increase costs and contribute to pesticide resistance, exacerbating the issue. Effective management strategies are crucial to mitigate the devastating impact on farmers' livelihoods. Our eco-friendly, plant-based nematicide is broad-spectrum and effective on various crops (Taiwan guava, pomegranate, tomato, chilly, tobacco, lemon, mango etc.). It rejuvenates roots in 20-25 days after application, visible recovery of plants observed in 20 days, and boosts yield by 40%. Affordable and easy to use. Mix herbal nematicide with soil/sand, apply near roots, followed by water supply. Dosage: 2L/acre (vegetables), 3L/acre (fruits). Can be applied for 10 days post-planting.

Problem Statement

Plant parasitic nematodes inflict significant economic losses, exceeding $150 billion annually worldwide, with India alone facing losses of over ₹21,000 crores. This represents a substantial 15% reduction in global food production. Nematode infestations lead to a range of symptoms, including decreased water and nutrient uptake, wilting, yellowing of leaves, stunted growth, chlorosis, and necrosis, ultimately resulting in poor yields and plant death. The use of chemical nematicides poses significant environmental and health risks, including groundwater contamination, ozone depletion, and toxicity to non-target species, including humans. These chemicals have been linked to sterility in men, bird deaths, and other adverse effects, leading to bans by regulatory agencies like the Environmental Protection Agency (EPA). Furthermore, existing eco-friendly nematicides often fall short in terms of efficacy, consistency, and cost-effectiveness, while also acting slower than chemical alternatives. Additionally, methods like soil solarization are impractical for ongoing crops and large trees, such as fruit crops.

Background of the Innovation

As a grassroots innovator, I've researched the challenges faced by my village, Karakollu, in South Andhra Pradesh, India. Our area was once renowned for lemon cultivation, with a history spanning 80 years. However, over the past 20 years, the lemon trees began to decline, exhibiting symptoms like yellowing leaves, reduced fruit size, wilting, and eventual tree death within six months. Despite trying various treatments, the cause remained unknown, and the crop vanished within three years, devastating our farmers financially. The loss of the primary income source led to debts, delayed marriages, and educational setbacks for our children. While removing the affected trees, we noticed unusual root damage, unlike typical root rot. Inspired by my research on herbal antimicrobial properties, I applied a herbal mixture to the roots of 75% withered lemon trees, suspected to be damaged by plant parasitic nematodes. Remarkably, new buds and small leaves appeared within 15 days, indicating a potential solution.

Uniqueness of Innovation

Our herbal nematicide boasts a unique herbal technology, making it an environmentally safe and human-friendly solution. It is particularly suited for polyhouses, lawns, and golf courses due to its non-toxic nature. It enhances soil fertility and has a remarkable plant recovery rate, with 80% of damaged plants reverting to health post-application. Safety is paramount; it's non-carcinogenic and harmless to earthworms and snails, posing no risk to applicators. The fruits of herbal plants are even consumed by children and cattle, underscoring its safety. Typically, a single application suffices for annual crops, while a second application is recommended after two years for perennials.

Recognition for this innovation

Galla Chandrasekhar- the Innovator, received President award for Herbal Nematicide preparation in Seventh National Grassroots Technological Innovations &Traditional Knowledge Awards (2013). In 2018, received prestigious Raithu Nestam award from former Vice President Venkayya Naidu Garu. In 2020, Patent (No. 334008) was granted for 'Herbal Compositions for Control and Elimination of Plant Pests'.

Market Vision

Over the past decade, we've built trust with farmers across various crops in Andhra pradesh and Telangana through product samples, earning loyal customers. We've marketed Nemato-C for five months, achieving ₹4 lakh sales in Andhra Pradesh and Telangana in the first month, with 10-15% monthly growth. We're expanding across South India and India, leveraging our **Bhooamrit** website, YouTube channel, and positive farmer reviews. With our eco-friendly, fast-acting product, we aim to make **Nemato-C** a top choice for organic and conventional farmers. Our goal is ₹50-100 crore sales in the next decade, promoting chemical-free farming.

Conclusion

Our herbal nematicide, Nemato-C, offers a breakthrough solution for farmers grappling with nematode infestations, a persistent threat to agricultural productivity. With its eco-friendly, non-toxic, and effective formula, Nemato-C has demonstrated its potential to revive even severely damaged crops, as seen in our village's lemon trees. By harnessing the power of nature, we aim to empower farmers to reclaim their lands, boost yields, and secure their livelihoods, paving the way for a sustainable and chemical-free farming future.



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BANGLADESH

Gender-responsive 3A Framework

Strengthening Rice Seed Systems and Improving Livelihoods in Climate-Vulnerable Areas

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International Rice Research Institute (IRRI)

Introduction

Rice is the backbone of Bangladesh's food system, cultivated on 11.6 million hectares, produced 56.5 million tons paddy, and provided 70% of daily calorie intake in 2025-26. Despite considerable investments in rice research and breeding, many farmers still lack access to quality seeds of improved, climate-resilient varieties. As a result, the adoption of climate-smart rice varieties stays low; productivity gains are unrealized, and farming communities remain vulnerable to climate shocks. The challenge is severe in the Haor Region, where seasonal flooding, remoteness, weak market linkages, and limited local seed availability restrict farmers' access to quality seeds. Usual approaches, such as one-time demonstrations and seed distribution campaigns, often fail to build trust, create sustained demand, or establish a reliable local seed supply system. To confront these challenges, the International Rice Research Institute (IRRI), through the HSBC-funded Climate-Smart Rice Value Chain (CS-RVC) Project, developed a gender-responsive **3A Implementation Framework: Awareness, Accessibility, and Affordability**. The framework delivers a practical, market-based and scalable solution that strengthens rice seed systems, accelerates the adoption of climate-smart inbred rice varieties, and creates livelihood opportunities for rural communities including women and youth.

The Innovation: The 3A Framework

The 3A Framework is an integrated seed system transformation model designed to ensure that farmers:

- Know about quality seeds (Awareness);
- Can access quality seeds locally (Accessibility); and
- Can afford quality seeds when needed (Affordability).

Unlike conventional seed promotion approaches that focus primarily on farmers and seed suppliers, the 3A Framework engages the entire rice value chain actors, including farmers, community seed banks, seed growers, seed dealers, millers, extension agents, local government representatives, and research institutions. This creates a viable ecosystem where demand generation, seed production, and market development occur simultaneously.

Awareness

The first pillar builds knowledge, trust, and demand for locally suitable improved rice varieties through:

- Farmer training on climate-smart rice cultivation.
- Quality seed production and processing training.
- Pest and disease management advisory services.
- Head-to-head varietal demonstrations.
- Innovation platforms like Crop **Cafeterias**, where farmers and value chain actors jointly compare new varieties against existing local and older varieties.
- Networking among farmers, seed dealers, millers, researchers, and extension services.

This participatory approach lets stakeholders observe varietal performance under local conditions, thereby increasing interest, confidence, and accelerating adoption.

Accessibility

The second pillar ensures that quality seed is available locally, on time, and in sufficient quantities through:

- Establishment and strengthening of Community Seed Banks.
- Capacity building of local seed growers including women and youth.
- Seed certification, quality assurance support, and marketing.
- Seed preservation technologies and storage solutions.
- Mechanization supports seed production and processing. By strengthening local seed enterprises, farmers can access quality seeds closer to home, decreasing dependency on distant markets and improving resilience during climatic disruptions.

Affordability

The third pillar focuses on assuring sustainable access to quality seeds through:

- Strengthened local seed businesses.
- Improved market linkages between producers and buyers.
- Reduced transportation and transaction costs.
- Market-driven seed multiplication and distribution systems.
- Community-led seed enterprise development with focus on women and youth.

Together, these interventions help stabilize seed supply and make improved varieties economically accessible to smallholder farmers.

What Makes Innovation Unique?

The 3A Framework goes beyond traditional seed distribution models by focusing on the root causes of low technology adoption. Its primary innovations include:

- Integrating awareness of creation, seed access, and market affordability within one framework.
- Mobilizing the entire value chain rather than targeting farmers and seed suppliers only.
- Creating trust through participatory Crop Cafeteria demonstrations.
- Transforming Community Seed Banks into successful rural enterprises.
- Strengthening both formal and informal seed sectors simultaneously.
- Promoting climate-resilient varieties suited to vulnerable ecosystems.
- Providing a scalable model that can be applied across crops and regions.

Gender Inclusion and Women's Empowerment

Gender inclusion is a core component of the 3A Framework. Women play an important role in seed selection, preservation, storage, and post-harvest activities but often have limited access to training, markets, and business opportunities.

The framework promotes women's participation through:

- Active involvement of women in Community Seed Banks.
- Equal access of men and women to technical and entrepreneurial training.
- Engagement of women in seed production, processing, packaging, and marketing.
- Participation of women in Crop Cafeterias and varietal selection processes.
- Creation of women-led seed enterprises and income-generating opportunities. By supporting women as seed entrepreneurs rather than merely beneficiaries, the framework strengthens their income, leadership, decision-making power, and contribution to household food security and community resilience.

Results and Impact

The CS-RVC Project implemented in the Haor Region of Bangladesh over the past two years is adopting this 3A framework and has exhibited considerable results:

- More than **3,000 rice farming households** reached directly by this initiative.
- Approximately **10,000 farmers** adopted newly released climate-smart rice varieties.
- Successful promotion of BRRI dhan96, BRRI dhan101, BRRI dhan104, BRRI dhan105, BRRI dhan94, and BRRI dhan103.
- BRRI dhan96 and BRRI dhan103 emerged as the most preferred varieties through stakeholder evaluations.
- For other crops, like mustard, BINA shorisha-11 and BARI shorisha-20, and for Groundnut, BARI badam-6, showed higher yields relative to the local and older varieties cultivated earlier in this region.
- Five Community Seed Banks generated more than **BDT 290,000 in profit**, creating new livelihood opportunities.
- Strengthened local seed supply systems and enhanced access to quality seeds.
- Enhanced farmer resilience to climate-related production risks.

Cost Effectiveness and Sustainability

The 3A Framework is highly cost-effective because it leverages existing community institutions, local entrepreneurs, and market actors instead of establishing parallel delivery systems.

The model reduces costs by:

- Promoting local seed production, distribution, and availability.
- Lowering transportation and transaction expenses.
- Reducing dependence on external seed suppliers.
- Strengthening community-based seed enterprises that continue functioning beyond project support.
- Creating self-sustaining business incentives for local seed producers and seed banks. As awareness increases and local seed businesses become profitable, the framework sustains itself through market demand rather than continued donor investment.

Scalability and Future Potential

The 3A Framework delivers strong potential for replication across Bangladesh and other rice-growing countries confronting similar challenges. The approach corresponds with national priorities on food security, climate resilience, seed system strengthening, and rural livelihood development. Because it utilizes locally available institutions, community organizations, and existing market actors, it can be scaled with relatively modest investment. The model can also be adapted beyond rice to support seed systems for inbred varieties of mustard, groundnut, and other climate-resilient crops.

Conclusion

The wider adoption of climate-smart technologies requires a seed system approach, going beyond mere distributing seeds. By concurrently addressing **Awareness, Accessibility, and Affordability**, the 3A Framework creates an enabling ecosystem where farmers can confidently obtain and use quality seeds, local enterprises can thrive, women can participate as business leaders, and communities can build resilience to climate change. With proven early results in Bangladesh's Haor Region, the 3A Framework delivers a practical, inclusive, cost-effective, and scalable pathway to transform seed systems, enhance climate resilience, and improve rural livelihoods.

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INDIA

AGRI SUPER

Real-Time Soil Intelligence and Decision Support System for Smallholder Farmers

Anup Kumar Sahu
Agri Super, India

Executive Summary

Agri Super has developed a Soil Intelligence System that integrates real-time soil sensing, an in-house data logger, and a digital decision support platform to deliver field-specific soil analysis, fertilizer recommendations, and crop advisory for precision and sustainable agriculture.

Problem/Challenge Addressed

Agriculture today faces major challenges due to the lack of real-time soil intelligence and scientific decision-making. Most farmers rely on traditional practices or infrequent soil testing, leading to imbalanced fertilizer application, declining soil health, low crop productivity, and increased input costs.

Our Solution:

Existing soil testing methods are often time-consuming, laboratory-dependent, and do not provide timely recommendations during the crop cycle. Agri Super addresses this gap through a Soil Intelligence System that integrates real-time soil sensing, an in-house developed data logger, and a digital decision support platform. The solution provides field-specific soil analysis, fertilizer recommendations, and crop advisory, enabling farmers to make data-driven decisions for sustainable, climate-resilient, and profitable agriculture.

The novelty and significance of the innovation

Agri Super's innovation lies in integrating **real-time soil sensing**, an **in-house developed data logger**, and an **Decision Support System (DSS)** into a single precision agriculture platform. Unlike conventional soil testing, which is laboratory-based and provides delayed results, our solution enables rapid field-level soil data collection and delivers location-specific recommendations through a mobile and web application. The platform analyzes key soil parameters and generates scientific fertilizer recommendations, soil health insights, and crop advisory to support informed farm decisions. The system is designed to be affordable, scalable, and easy to deploy for farmers, FPOs, government agencies, and development organizations. By combining hardware, software, and agronomic intelligence, Agri Super offers a comprehensive digital agriculture solution rather than a standalone device or advisory service. This innovation promotes efficient input use, improves soil health, enhances crop productivity, reduces cultivation costs, and supports sustainable, climate-resilient agriculture, contributing to higher farmer incomes and long-term agricultural. This does not replace the lab value although for fast decision it has been made.

How it works

Agri Super's solution integrates **smart sensing hardware, data logger, and a digital platform** to provide real-time soil intelligence and decision support. The system begins with field-deployed soil sensors that measure key soil parameters. The sensor data is collected by Agri Super's

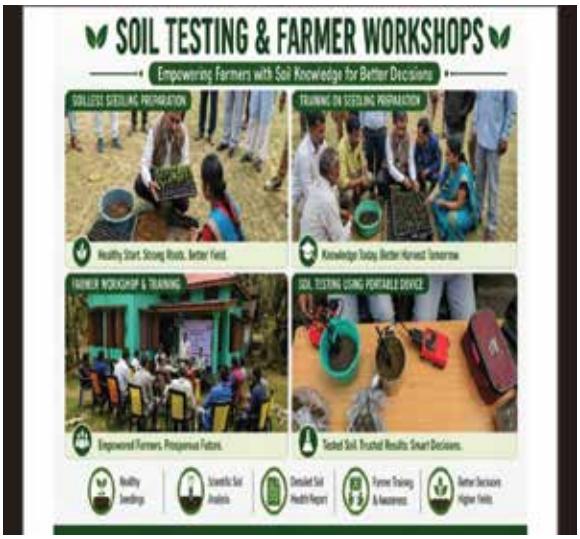
proprietary **Data Logger**, which processes and securely transmits the information to the cloud through a mobile or internet network. The collected data is analyzed using Agri Super's **Decision Support System (DSS)**, which combines soil data, crop requirements, agronomic principles, and location-specific information to generate actionable recommendations. Farmers and field professionals can access these insights through a user-friendly **mobile and web application**, which provides digital soil health reports, field-specific fertilizer recommendations, nutrient management guidance, and crop advisory. The platform also enables field monitoring, data storage, and historical analysis, allowing users to track soil health over time and make better management decisions. Agri Super works closely with farmers, FPOs, government departments, and NGOs to deploy the technology, provide training, and ensure effective adoption. By combining hardware, software, data analytics, and agronomic expertise, the solution delivers a scalable, data-driven precision agriculture ecosystem that improves productivity, optimizes input use, enhances soil health, and supports sustainable, climate-resilient farming.

Cost-Effectiveness, Scalability, and Sustainability

Agri Super's solution is designed to be **affordable, scalable, and sustainable** for farmers and agricultural institutions. By combining commercially available sensors with an and proprietary digital platform, the system reduces development and deployment costs while maintaining high functionality. Real-time soil intelligence and field-specific recommendations help farmers optimize fertilizer use, reduce unnecessary input costs, improve nutrient-use efficiency, and increase crop productivity, resulting in better economic returns. The platform follows a **modular and scalable architecture**, enabling easy deployment across individual farms, Farmer Producer Organizations (FPOs), government programs, NGOs, and agribusinesses. As more users adopt the platform, new sensors, AI models, and advisory services can be integrated without significant infrastructure changes, making it suitable for expansion across different regions and cropping systems.

Potential Impact on Rural Development

Agri Super's innovation has the potential to significantly improve rural livelihoods by enabling farmers to adopt **data-driven, precision agriculture practices**. Through real-time soil intelligence and decision support, farmers can make informed decisions on nutrient management, leading to improved crop productivity, reduced input costs, and higher farm income. The solution also promotes balanced fertilizer use, better soil health, and efficient utilization of natural resources, contributing to long-term agricultural sustainability. The platform is designed to support not only individual farmers but also **Farmer Producer Organizations (FPOs), government departments, NGOs, and agricultural institutions**, enabling large-scale adoption across rural communities. By reducing dependence on traditional, experience-based farming practices and providing scientific, field-specific recommendations, the technology enhances resilience to climate variability and resource constraints. In addition, Agri Super's expansion will create employment opportunities in rural areas through field operations, technical support, sales, and advisory services. The solution strengthens digital agriculture adoption, improves access to modern farming technologies, and contributes to sustainable rural development by enhancing productivity, protecting soil resources, increasing farmer incomes, and building more resilient agricultural ecosystems.











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BANGLADESH

Nutrition Club: A Youth-Led Initiative for Combating Malnutrition

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Background

Malnutrition among children and adolescents remains one of the most pressing public health challenges in Bangladesh. Poor dietary habits, limited nutrition knowledge, unhealthy food environments, and inadequate life skills contribute to undernutrition, micronutrient deficiencies, overweight, and obesity. Although schools are ideal platforms for promoting healthy behaviours, opportunities for meaningful youth participation in nutrition education remain limited.

To address this gap, BIID Foundation established the Nutrition Club in 2015 as a youth-led, school-based innovation that empowers adolescents to become nutrition champions within their schools, families, and communities.

The Innovation

The Nutrition Club is an innovative, low-cost, and sustainable model that promotes nutrition awareness, healthy lifestyles, leadership, and community engagement through student-led action. Operating within schools, colleges, and universities, the clubs are managed by students under the guidance of trained teachers, with BIID Foundation serving as the technical facilitator.

The model addresses nutrition through practical learning and peer-to-peer education rather than conventional classroom instruction. Club members organize nutrition campaigns, healthy tiffin initiatives, school nutrition gardens, food safety awareness, menstrual hygiene management (MHM), physical activity programmes, debates, quizzes, cooking demonstrations, and community outreach.

Since its inception, the initiative has expanded to over 2,000 educational institutions, engaging more than 85,000 adolescents and youth across Bangladesh. The Nutrition Club has also been recognized in the National Food and Nutrition Security Policy (NFNSP) as an important platform for youth engagement in nutrition.

How the Innovation Works

The Nutrition Club follows a simple implementation model:

- Partnership with school management
- Formation of Nutrition Clubs (minimum 30 members)
- Training of student leaders and teacher mentors
- Provision of club manuals and activity toolkits
- Student-led implementation of monthly activities
- Periodic mentoring by BIID Foundation
- Participation in the International Nutrition Olympiad (INO) for knowledge sharing and innovation exchange.

Cost-effectiveness and Sustainability

The Nutrition Club is designed as a low-cost and self-sustaining model. After initial orientation and capacity building, schools independently manage club activities using existing school facilities and student volunteers. This significantly reduces operational costs while ensuring long-term sustainability beyond project funding.

Unlike many project-based interventions, Nutrition Clubs remain active because they are institutionalized within schools and owned by students and teachers. BIID Foundation continues to provide technical guidance, learning resources, networking opportunities, and quality assurance while maintaining minimal recurring costs.

Impact

The Nutrition Club has demonstrated measurable impacts in nutrition awareness, leadership development, and healthy behaviour promotion.

Key achievements include:

- More than 85,000 adolescents and youth engaged since 2015.
- Nutrition Clubs established in over 2,000 educational institutions.
- Increased nutrition literacy and healthier dietary practices.
- School nutrition gardens promoting practical learning.
- Improved awareness of food safety and menstrual hygiene management.
- Strengthened student leadership, teamwork, and communication skills.
- Enhanced parent and community participation in nutrition promotion.
- Development of a scalable youth-led model with replication potential across CIRDAP member countries.

Future Potential

BIID Foundation aims to expand the Nutrition Club network to 10,000 schools by 2030 and introduce the model in other developing countries through regional collaboration. By integrating nutrition education, youth leadership, digital learning, and community engagement, the Nutrition Club offers a practical and sustainable solution for improving adolescent nutrition and achieving the Sustainable Development Goals.



Students participating in physical activities and games



Nutrition Club members conducting peer education on Menstrual Hygiene Management (MHM) awareness activities.



Nutrition Club members gathered at the annual conclave International Nutrition Olympiad (INO)



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IR IRAN

Community Disaster Resilience Measurement Toolkit (CDRMT)

A Community-Led Tool for Rural Disaster Resilience

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1. The Challenge: Beyond Measuring Resilience

Rural communities throughout the Asia-Pacific region are increasingly vulnerable to climate change, natural disasters, and socioeconomic challenges that jeopardize livelihoods, food security, and sustainable development. Therefore, enhancing disaster resilience has become a key priority for governments and development organizations. However, despite this urgent need, the methods used to assess resilience have changed little. Most current resilience evaluations are costly, consultant-driven, and conducted as one-off projects. They yield valuable reports yet seldom create mechanisms for continuous oversight, local learning, or adaptive decision-making. Community members often serve only as respondents, while assessment findings typically remain disconnected from daily governance and local development efforts. The true challenge lies not in the absence of assessment tools but in the lack of a practical framework that enables communities to continuously understand, monitor, and enhance their own resilience. Transitioning from sporadic evaluations to community-led resilience governance requires a new methodology—one that turns resilience measurement into a continual process of shared learning, evidence-driven planning, and local action.

2. The Innovation: Resilience Assessment to Community-Owned Governance

The Community Disaster Resilience Measurement Toolkit (CDRMT) tackles this issue by converting disaster resilience assessments from a one-time review into a dynamic, community-managed system for ongoing monitoring, collective learning, and adaptable local governance. Instead of generating a report that quickly becomes irrelevant, CDRMT establishes a continuous process through which communities consistently evaluate their resilience, analyse evolving risks, set priorities, and turn evidence into actionable steps. In this manner, resilience assessment is integrated into local governance rather than being treated as a separate technical task.

The innovation is not merely in the Toolkit itself, but rather in the transformational concept it introduces. Traditional resilience assessments generally evaluate conditions at a specific moment and are mostly conducted by external specialists. CDRMT reconceptualizes resilience assessment as an ongoing, participatory governance process where communities take on active roles as co-creators of knowledge and decision-makers. Community members are no longer regarded solely as sources of information; they work alongside facilitators, local authorities, and technical entities to produce evidence, interpret outcomes, prioritize actions, and track progress over time. This method enhances local ownership and forges stronger connections between community needs and formal disaster risk management frameworks. To implement this novel approach, CDRMT incorporates four interrelated elements into a unified framework:

First, it utilizes a participatory mixed-method assessment that merges quantitative community profiling with qualitative dialogue-based evaluation. Quantitative data pinpoint local hazards,

vulnerabilities, and capacities, while facilitated discussions allow community members to interpret these results, affirm local realities, and develop a collective comprehension of resilience-related challenges.

Second, the Toolkit introduces continuous digital monitoring through the Living Community Resilience Monitoring Dashboard. Similar to environmental monitoring systems that continuously showcase changing conditions, the dashboard allows communities to periodically refresh resilience indicators, visualize trends, compare progress over time, and recognize emerging risks before they escalate into crises.

Third, CDRMT integrates community decision-making directly into the assessment procedure. After every assessment cycle, community members collaboratively review the findings, determine priority issues, and suggest locally suitable solutions. Local governments and development organizations leverage these community-generated priorities to bolster planning, investment, and disaster risk reduction initiatives, thus strengthening the linkage between grassroots knowledge and institutional action.

Lastly, the Toolkit promotes continuous learning and adaptive governance. Instead of concluding when data collection is finished, resilience monitoring evolves into an ongoing cycle of observation, reflection, planning, execution, and reassessment. Communities glean insights from past experiences, assess the effectiveness of their actions, and modify their strategies as environmental, social, and economic conditions change. This continuous feedback loop transforms resilience from a static metric into a dynamic ability that intensifies over time.

By amalgamating participatory assessment, digital monitoring, local decision-making, and continuous updating within a unified framework, CDRMT transcends the conventional notion of a disaster assessment toolkit. It establishes a practical model of community-owned resilience governance that empowers rural communities to grasp their shifting risks, bolster local capacities, and navigate their own path toward safer and more resilient development.

3. Why CDRMT Stands Out

CDRMT is not just a disaster resilience assessment tool; it is an effective system designed to enhance community resilience through ongoing involvement and learning. Unlike traditional assessments that produce reports and recommendations, CDRMT establishes a continuous process where communities consistently monitor resilience, assess their progress, and modify their strategies to address evolving risks.

This innovation fills the gap between technical evaluations and local governance. It merges scientific data with local knowledge, allowing rural communities to take an active role in recognizing risks, prioritizing issues, and developing resilience initiatives. At the same time, its standardized yet adaptable framework enables the comparison of results across different communities while being mindful of local circumstances. This blend of community involvement, adaptability, and practical decision-making support positions CDRMT as a scalable innovation for rural disaster risk reduction throughout the Asia-Pacific region.

4. Affordable and Simple to Scale

CDRMT is specifically crafted for rural communities with limited resources. The system necessitates only a small facilitation team, readily available data, and inexpensive digital tools that function both online and offline. By equipping local volunteers and institutions to refresh resilience indicators, the reliance on repeated external consultancy is greatly diminished, thus reducing long-

term implementation expenses. Its flexible design allows governments, NGOs, and development organizations to adopt the Toolkit without substantial investments in technology or specialized infrastructure. As it seamlessly integrates into current planning and disaster risk management processes, CDRMT presents a sustainable and cost-effective strategy for monitoring resilience throughout villages, districts, and regions.

5. Effects and Future Possibilities

The initial implementation in a rural community in northern Iran showed that CDRMT is more than just a data collection tool—it's a driver for dialogue, trust, and collective action. This process allowed community members to uncover hidden vulnerabilities, acknowledge local strengths, enhance collaboration with local authorities, and transition their focus from emergency response to long-term resilience planning.

Beyond the pilot phase, CDRMT provides a novel framework for rural resilience governance that can be tailored for different CIRDAP member countries. By turning resilience assessment into an ongoing, community-driven effort, it facilitates evidence-based decision-making, strengthens local institutions, and aids rural communities in becoming better prepared, more adaptive, and resilient to an increasingly uncertain future.

6. Impact

The trial implementation of CDRMT in a rural community in northern Iran illustrated that the Toolkit is much more than just a technical evaluation tool. It acted as a venue for dialogue, learning, and collaborative decision-making. Through the participatory assessment approach, community members engaged in open discussions about local risks, identified vulnerabilities that had previously gone unnoticed, acknowledged existing strengths, and collectively sought practical solutions. The pilot also highlighted an increase in community involvement, heightened volunteer engagement, improved communication between residents and local authorities, and a enhanced sense of ownership concerning disaster risk reduction initiatives. This experience demonstrated that resilience assessment itself can serve as a capacity-building process. By integrating local knowledge, scientific research, and institutional viewpoints, CDRMT fosters trust, encourages shared responsibility, and facilitates a shift from reactive disaster response to proactive resilience planning. At the regional level, CDRMT has the capability to assist governments and development partners throughout the Asia-Pacific region by offering a practical mechanism for evidence-driven rural resilience governance. The Toolkit can aid in prioritizing investments by pinpointing community-specific vulnerabilities and strengths, tracking progress towards the Sustainable Development Goals, supporting the application of the Sendai Framework for Disaster Risk Reduction, and enhancing decentralized disaster risk reduction through effective community involvement. In this way, it equips decision-makers with dependable local evidence while enabling communities to become active collaborators in building safer and more resilient futures.

7. Scalability

CDRMT is crafted for wide applicability within the diverse rural environments of CIRDAP member nations. Its modular design incorporates a standardized core framework alongside flexible indicators that can be customized for various environmental, social, and institutional circumstances without risking comparability. The Toolkit utilizes cost-effective, low-tech digital solutions, allowing it to operate effectively even in areas with limited resources and data availability. Crucially, its focus on community ownership empowers local stakeholders to maintain resilience

monitoring long after external funding has ended. Since CDRMT enhances rather than replaces existing disaster risk management frameworks, it can be seamlessly incorporated into both national and local planning systems, making it a viable and scalable solution for reinforcing rural resilience across the Asia-Pacific region.

8. Conclusion

The Community Disaster Resilience Measurement Toolkit (CDRMT) signifies a crucial transition from merely assessing resilience to actively building it. Instead of treating assessment as a singular technical task, it frames resilience as an ongoing process of community education, data-informed decision-making, and flexible local governance. By merging participatory assessment, digital tracking, and collaborative planning into one cohesive framework, CDRMT enables rural communities to better comprehend their evolving risks, enhance local capabilities, and assume control of their resilience journey. As a practical, cost-effective, and scalable innovation, CDRMT provides governments and development partners with a fresh approach to promoting disaster risk reduction and sustainable rural development throughout Asia and the Pacific.



Know the Innovator

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BANGLADESH

The Reinterpretation of Bengal Nakshi Kantha for International Market

Reviving Rural Crafting, Redefining Sustainability

Mohammad Azim

Impact Entrepreneur, Bangladesh

Background

The term Nakshi Kantha comes from two Bengali words: *nakshi*, meaning artistic or decorative patterns, and *kantha*, meaning quilt. Traditionally, Nakshi Kantha quilts are made from several layers of old or discarded clothing and decorated with intricate designs that often depict everyday life, folklore, cultural traditions, and personal memories. Cotton fabric and cotton thread are the primary materials used. The craft is mainly practised by rural women in Bangladesh, including widows, students, and homemakers. Produced in different sizes and for various purposes, Nakshi Kantha has long held both practical and cultural significance. Nakshi Kantha is one of the most important forms of domestic folk art practiced by women in Bangladesh. Its motifs reflect influences from different ethnic and religious traditions (Islam, M. T., 2022). Sewing Kantha is traditionally carried out by rural Bengali women, often during leisure time and in the company of others. Traditionally, rural Bengali women stitch Nakshi Kantha during their leisure time, often in the company of other women. In this context, stitching is more than a technical or creative activity; it is also a social and knowledge-sharing practice through which skills, meanings, stories, and memories are passed from one generation to another. The making of Nakshi Kantha can therefore be understood as a form of situated knowledge production, in which relationships between people, materials, culture, and the environment are continuously expressed and interpreted through the act of stitching.

Challenges

The original purpose of Nakshi Kantha was to repurpose worn saris and other cotton fabrics. However, rapid urbanization, rural-to-urban migration, and the dominance of fast fashion and mass-produced textiles have increasingly overshadowed such handcrafted traditions (Chowdhury, 2025). As inexpensive products have become more widely available, both the recycling function and the artistic authenticity of Nakshi Kantha have gradually declined. Artisans frequently face economic insecurity, and younger generations often leave traditional crafts for urban employment. At the same time, the expansion of fast fashion contributes to significant environmental harm, including soil and water pollution.

Opportunity

There is growing demand for handcrafted products in many developed countries, driven in part by increasing awareness of sustainability. Concerns about climate change and environmental degradation have encouraged consumers to seek ethical and heritage-based alternatives that emphasize quality, durability, and cultural meaning. However, one of the key challenges is adapting traditional designs to suit the cultural preferences and aesthetic expectations of different markets. For example, consumers in Scandinavian countries often tend to prefer minimalist designs, subtle colours, and less visually elaborate fashion and interior products.

This context invites renewed attention to the Bengali cultural heritage of Nakshi Kantha within contemporary sustainable fashion and design. This project explores how product storytelling, grounded in the craft's cosmovision, can deepen ecological sustainability, strengthen emotional

connections with materials, and encourage more responsible consumption. To achieve this, the project will foster collaboration between rural Nakshi Kantha artisans in Bangladesh and designers, entrepreneurs, and consumers in developed countries. Through these collaborations, the cultural meanings, traditional practices, and sustainability dimensions of Nakshi Kantha will be reinterpreted and communicated to international audiences while creating new opportunities for rural women artisans.

Action Plan

As an initial step, we are developing a range of prototype crafts inspired by the Nakshi Kantha tradition. For example, we developed a quilt titled "Last Ones Left," which depicts a bee and a daisy as the only remaining elements, conveying the consequences of environmental degradation associated with deforestation, pollution, and overconsumption (Figure 1). We have also developed a table mat that highlights biodiversity through motifs inspired by native Bengali medicinal plants. This design creates a visual connection to local ecological knowledge while emphasizing the importance of preserving biodiversity and natural resources (Figure 2). Building on these early prototypes, we aim to develop a diverse collection of products, including rugs, quilts, wall hangings, pillow covers, bedspreads, and table mats. All products will be inspired by Nakshi Kantha and made using sustainable materials. We plan to present and promote these products through an online platform and reach international audiences through a sustainable business model. By connecting traditional craftsmanship with contemporary sustainable design and global markets, the project aims to generate sustainable income for rural Nakshi Kantha artisans and contribute to the economic empowerment of them and their families in Bangladesh.



Figure1: A quilt termed 'Last Ones Left'



Figure 2: The table Mat

Conclusion:

The initiative will create opportunities for artisans to collaborate with designers from developed countries to produce crafts with ecological and cultural value using low-impact materials, while connecting their work with global audiences. An online platform will support the promotion and sale of these products. Beyond generating income, the platform will raise environmental awareness and highlight the importance of preserving traditional crafts as cultural heritage. Through meaningful engagement among people, materials, and local contexts, the initiative seeks to demonstrate how traditional craftsmanship can contribute to both cultural preservation and a more sustainable future



Know the Innovator

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MALAYSIA

Perat Binuang @ Binuang Sachet

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Introduction

Perat Binuang @ Binuang Sachet is a community-led innovation developed by KRT Baginda to modernize the traditional consumption of the Binuang (*Octomeles sumatrana*) medicinal tree while creating sustainable livelihood opportunities for the rural community. In the local Dusun language, *Perat* means "sachet" or "pouch," while *Binuang* refers to a forest tree traditionally used by the indigenous community for its medicinal properties. For generations, the bark of the Binuang tree has been prepared by scraping, cleaning, and boiling it for several hours before consumption. Although this traditional practice is believed to promote recovery after childbirth, relieve body aches, and improve general well-being, the preparation process is time-consuming, labor-intensive, and increasingly unattractive to younger generations.

Recognizing these challenges, KRT Baginda transformed this traditional herbal remedy into an easy-to-use tea sachet without compromising its traditional value. The Binuang bark is sustainably harvested, thoroughly cleaned, dried under controlled conditions, finely processed, and packed into hygienic tea sachets, allowing users to prepare the herbal drink simply by adding hot water. This innovation successfully combines indigenous knowledge with simple processing technology to produce a safe, convenient, and marketable community product.

The innovation was developed in response to three major community challenges. First, limited employment and income-generating opportunities among rural households, particularly women, single mothers, senior citizens, and B40 families. Second, the gradual loss of indigenous knowledge as younger generations becomes less familiar with traditional medicinal plants and their cultural significance. Third, the limited availability of locally produced herbal products that are hygienic, standardized, and convenient for modern consumers.

By transforming a traditional practice into an innovative community enterprise, Perat Binuang not only preserves cultural heritage but also creates economic opportunities, promotes community participation, and demonstrates how local resources can be transformed into sustainable rural innovations.

Objectives

The primary objective of Perat Binuang is to empower rural communities by improving economic resilience, strengthening social cohesion, preserving indigenous knowledge, and enhancing the overall well-being of community members through a sustainable community-based enterprise. The project demonstrates how local natural resources can be transformed into value-added products that generate income while maintaining environmental sustainability and cultural identity.

Specifically, the innovation seeks to create additional livelihood opportunities for rural households by engaging community members in the harvesting, processing, packaging, branding, and marketing of Perat Binuang sachets. It also aims to preserve and promote traditional herbal knowledge by documenting and commercializing indigenous practices in a form that is relevant and accessible to younger generations and wider markets.

Beyond its economic value, the project strengthens community participation by involving different demographic groups according to their strengths and capacities. Youth participate in raw material collection and logistics, women and single mothers lead product processing and packaging, while the KRT committee oversees financial management, quality assurance, product branding, and strategic partnerships with government agencies and community organizations.

The innovation further contributes to holistic community development by supporting eight strategic pillars of KRT: *Economic Empowerment and Livelihoods, Community Safety and Resilience, Leadership Development, Community Well-being, Lifelong Learning, Environmental Sustainability, Heritage and Cultural Preservation, and Creativity and Innovation*. Through these integrated pillars, Perat Binuang creates a community ecosystem that encourages self-reliance, strengthens local leadership, promotes environmental stewardship through sustainable harvesting practices, and inspires continuous innovation for rural development.

Impact to the community

Since its implementation, Perat Binuang has generated significant economic, social, cultural, and health benefits for the local community. Economically, the project has created additional income opportunities for women, single mothers, youth, and low-income families by involving them in every stage of production. Revenue generated from product sales is also reinvested into KRT community programmes, creating a sustainable community financing mechanism that benefits all residents.

Socially, the project has strengthened community cohesion through collective participation in production activities, volunteerism, and shared decision-making. The initiative has increased community ownership and strengthened collaboration among residents, government agencies, and strategic partners, reinforcing the role of KRT as a catalyst for sustainable rural development.

The innovation has also played a vital role in preserving indigenous knowledge by documenting and promoting the traditional medicinal use of the Binuang tree. Rather than allowing this valuable heritage to disappear, the project has transformed it into an innovative product with commercial value while maintaining respect for local customs and traditional practices. Sustainable harvesting methods ensure that natural resources are protected for future generations.

From a health perspective, Perat Binuang has received encouraging acceptance among consumers, particularly postpartum mothers and individuals seeking traditional herbal alternatives for general wellness. Community feedback indicates positive experiences in improving energy levels, reducing body aches, and supporting postnatal recovery. The innovation demonstrates that traditional knowledge, when combined with appropriate quality control and hygienic processing, can produce practical, safe, and consumer-friendly health products.

The project's simplicity, affordability, and scalability make it highly replicable in other rural communities. The production model requires minimal investment, utilizes locally available resources, and can be adapted using different indigenous herbs according to local biodiversity. Furthermore, its lightweight sachet packaging makes the product suitable for digital marketing and e-commerce platforms, creating opportunities to reach national and international markets. As a result, Perat Binuang serves as a successful model of community innovation that simultaneously strengthens rural livelihoods, preserves cultural heritage, promotes environmental sustainability, and improves community well-being.









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BANGLADESH

Community-Based Integrated Care Model

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The Innovation

A low-cost, community-driven care model has been developed by BARD that integrates family caregiver training, professional caregiver development with hospital attachment, community support groups, affordable healthcare, assistive services, and institutional partnerships to improve the quality of life of rural elderly and differently abled people.

Importance

Bangladesh's ageing population and limited rural healthcare leave many elderly and differently abled people without adequate care. The model addresses fragmented services by creating a coordinated ecosystem that combines families, communities, local government, hospitals, NGOs, and social protection services. It reduces isolation, improves access to healthcare, and strengthens dignity and inclusion.

How the Innovation Works

The model organizes beneficiaries into community groups, trains family caregivers in home-based care (blood pressure, diabetes monitoring, hygiene, nutrition, physiotherapy, and basic nursing), and develops semi-professional caregivers through a one-month hospital-attached training program. Beneficiaries receive health cards for discounted services, reduced-cost ambulance support, assistive devices, and referrals through institutional partnerships. Community volunteers and trained caregivers provide continuous home-based monitoring and follow-up.

Cost-effectiveness

The innovation builds on existing community resources instead of expensive institutional care. It uses trained family members, volunteers, and partnerships with hospitals and government agencies, minimizing operational costs while expanding coverage. By preventing unnecessary hospital visits, promoting home-based care, and leveraging existing local institutions, the model delivers high social value with relatively low financial investment.

Impact

Implemented in selected villages of Comilla, the model currently supports 205 vulnerable families. It has strengthened family caregiving capacity, improved home-based healthcare, increased access to affordable medical services, enhanced mobility through assistive devices, and reduced social isolation. The professional caregiver training program has also created employment opportunities for rural women and youth. The model contributes to SDGs 1, 3, 10, 11, and 17 and has strong potential for replication across Bangladesh and other low-resource settings.

Case Studies: Evidence of Impact

Case Study 1: Mahfuza Akhter– Empowering Family Caregiving

Mahfuza Akhter from Deghoulgao village cares for her husband and brother-in-law, both suffering from thalassemia requiring regular blood transfusions. Before receiving caregiver training, repeated hospital visits disrupted her livelihood and created severe emotional and financial pressure. After participating in BARD's caregiver training, she learned Patient care techniques, post-transfusion management, Hygiene and nutrition support. She now confidently provides home-based care while continuing her livelihood activities. Her story

demonstrates how caregiver training empowers rural women and strengthens family resilience.

Case Study 2: Mohammad Ali– Restoring Mobility and Dignity

Mohammad Ali, a 68-year-old beneficiary, suffered from diabetes, hypertension, and kidney complications. Due to poor mobility and financial hardship, he struggled to continue daily activities. Through the project, he received regular healthcare check-ups, medical consultation and medicines and a wheelchair free of cost. His physical mobility, confidence, and psychological well-being improved significantly. This case highlights the importance of accessible healthcare and assistive support for vulnerable elderly people.

Case Study 3: Yousuf and Younus– Institutional Linkage for Sustainable Livelihoods

Md. Yousuf and Md. Younus, two brothers living with thalassemia, lost their tea business due to prolonged illness. Through project-supported linkage with the Department of Social Welfare, they received BDT 50,000 each as financial support. Using the funds, the family purchased cows for income generation, managed part of their treatment expenses. This case demonstrates how institutional networking can strengthen both healthcare and livelihoods.

Case Study 4: Nazma Akter– Community Leadership Through Care giving

Nazma Akter from Ujirpur village has visual impairment in one eye but actively leads elderly support activities in her community. After caregiver training, she began using Glucometers, Blood pressure machines, Pulse oximeters and First-aid kits. She now provides regular health monitoring and support to family and community members. Her story demonstrates how vulnerable individuals themselves can become agents of community transformation.

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INDIA

The Bal Panchayat

A Micro-Level Intervention to Combat Learning Poverty in Rural Government Schools

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1. Innovation and Strategic Rationale

The global crisis of learning poverty threatens the developmental trajectory of low- and middle-income nations. According to a World Bank report, nearly 70 percent of ten-year-olds in these countries cannot read and comprehend a basic story, a deficit that constitutes a structural obstacle to national advancement rather than a mere pedagogical shortcoming. This crisis manifests along gendered lines: boys are drawn into hazardous child labour, with research indicating dropout rates among working children are approximately 11.57 percent higher than their non-working peers, while girls are frequently pushed into early marriage, terminating their educational trajectories altogether. The resulting rural labour trap perpetuates a low-skill, low-productivity equilibrium that constrains household income and national prosperity.

Conventional responses to this crisis rely on top-down national curriculum reforms and policy shifts, which are slow-moving and often take decades to yield measurable results. The Bal Panchayat model offers a strategic pivot: a cost-free, micro-level intervention that establishes village-level student councils within each local high school. By transforming passive students into self-motivated "Educational Scouts," the model creates a decentralized, internally governed structure controlled entirely by students, operating on an obligatory 1:1 gender parity ratio. This framework directly addresses hyper-local systemic leakages child labour, early marriage, and infrastructure deficiencies turning underfunded government schools into functioning laboratories of civic leadership and holistic student development.

2. Operational Framework and Mechanics

The Bal Panchayat replicates the dual-tier structure of adult representative governance, adapted to the rural school ecosystem. The Bal Sabha (General Assembly) automatically includes every child in the village aged 5 to 18, functioning as the foundational voting collective. The Bal Panchayat (Executive Council) is a compact body of 11 elected representatives aged 10 to 14, mobilised to handle specialized portfolios and advocate for child rights. Both tiers enforce a strict 50 percent girls–50 percent boys representation quota from nomination through to the final executive cabinet.

Elections unfold over a structured five-day cycle designed to balance democratic rigor with minimal disruption to the school calendar. On Day 1, the election steering committee comprising teachers, neutral adult facilitators, and school management members releases the call for the 11 executive seats, with wards drawn to preserve the gender quota. Day 2 involves scrutiny of applications to confirm age eligibility, ensure representation of marginalized hamlets, and exclude coercive adult interference. Day 3 is the campaign phase, in which gender-balanced candidate units canvass classroom to classroom on hyper-local manifestos identifying children engaged in labour, broken hand pumps, or the absence of separate girls' restrooms. Day 4 features secret ballot voting using simplified visual symbols such as books, trees, and suns, enabling younger students to vote confidently, followed by public counting. Day 5 completes the cycle with portfolio allocation and a formal oath ceremony witnessed by adult community elders.

The elected council divides responsibility across five specialized portfolios. The Bal Sarpanch (Child Head) serves as chief executive and the primary channel to adult governance structures. The Up-Sarpanch (Deputy Child Head) manages documentation, coordinates ministers, and assumes presidential duties in the Sarpanch's absence. The Shiksha Mantri (Education Minister) tracks students absent more than five consecutive days through a real-time peer attendance roster and conducts home visits to dissuade parents from withdrawing children for labour. The Swasthya evam Swachhta Mantri (Health and Sanitation Minister) enforces WASH standards, verifies mid-day meal compliance, and inspects hand-washing and sanitation infrastructure. The Bal Suraksha Mantri (Gender Justice and Child Protection Minister) maps unsafe routes and establishes confidential grievance boxes addressing menstrual hygiene, early marriage pressure, and domestic violence. Institutional accountability is sustained through a bi-monthly Joint Action Committee, in which the 11 elected members meet with parents, the school principal, and adult village representatives to convert findings into documented, actionable outcomes ensuring that deficits such as a broken girls' toilet are formally logged and escalated to adult authorities.

3. Cost-Effectiveness and Multiplier Outcomes

The model's principal advantage is its cost-free, self-sustaining design: it leverages existing student agency as a community asset rather than requiring new administrative machinery or external funding. Structural gap sheets and quantitative attendance rosters build students' data management, evidentiary reasoning, and analytical problem-solving skills, enabling them to function as regional Educational Scouts who close institutional tracking gaps. Direct negotiation and mediation with school principals and Gram Panchayat leaders cultivate self-efficacy, public speaking, and conflict-resolution abilities, producing a legally literate electorate capable of holding public institutions accountable and structurally reducing generational corruption. By entrusting female students with institutional control, the model breaks the culture of silence around early marriage and menstrual hygiene, accelerating progress toward "Child Marriage Free Villages," while safety mapping and WASH inspections generate accurate data that reduces health-related absenteeism. Cumulatively, by delaying premature economic engagement until children enter the workforce as literate, trained adults, the model interrupts the rural labour trap and functions as a wealth multiplier for household income, community output, and national prosperity.

4. Empirical Validation: A Case Study from Srinagar Block

Purnia district in Bihar is characterised by a low literacy rate of 51.08 percent (District Administration Purnea, 2011). While serving as a Gandhi Fellow with the Piramal Foundation under the Aspirational District Collaboration (ADC) programme, the author implemented the Bal Panchayat initiative in Srinagar Block, one of the district's most marginalised administrative units, in response to critically high student dropout rates.

At the Upgraded High School, Jhunni Kala, prior to implementation, students were routinely redirected from classrooms into seasonal agricultural labour, reinforcing a localized low-productivity equilibrium. The newly formed Bal Panchayat functioned as a decentralized, peer-led data pipeline: through a thorough village-mapping exercise, the council identified 46 students who had evaded official administrative tracking. The diagnostic process further revealed a hyper-local barrier to re-enrollment, a student excluded from Class 9 after his father's death because his mother could not afford the government registration fee, including a late fee, totalling INR 450.

On submission of this student-led data to adult governing structures, the village mukhiya personally paid the student's registration fees, while adult Gram Sabha members organised focused

family counselling for the remaining 46 dropouts. Within six months, Jhunni Kala was formally designated a zero-dropout Panchayat. When scaled horizontally across all nine panchayats of Srinagar Block, the model achieved absolute zero-dropout status in five panchayats and reduced historic dropout rates by 50 percent in the remaining four highly marginalised panchayats demonstrating that student agency can overcome micro-financial bottlenecks and durably break the rural labour trap.



Bal Panchayat student council members with facilitators



Portfolio Allocation and Oath Taking Ceremony of students,



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MYANMAR

The Rural Resilience Academy (TRRA)

Strategic Rural Innovation for Myanmar's "Generation on Hold"

Aung Htet Oo
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1. Executive Summary

The Rural Resilience Academy (TRRA) is a vocational intervention for youth (16+) in Myanmar whose education was paralyzed by the COVID-19 pandemic and 2021 crisis. This initiative introduces a circular economic model where youth convert village waste into value-added products. Income from these enterprises' funds Environmental Stewardship, Ag-Tech, Job Readiness training, and Psycho-social Support (PSS). The project's physical hub—the Resource Recovery Center (RRC)—is built with Eco-Adobe to serve as both a waste facility and a community Heat Shelter, providing a low-cost, high-impact solution to rural climate vulnerabilities.

2. Problem Statement

Rural Myanmar faces intersecting challenges that deepen regional disparities:

- **Education & Connectivity Gap**: Youth lack access to formal schooling and internet connectivity, leading to limited job opportunities and migration.
- **Climate & Energy Crisis**: Central Myanmar suffers from extreme heat and electricity shortages, forcing a reliance on unmaintained solar systems.
- **The Waste Crisis**: A case study in a village of Taungthar Township, central Myanmar revealed- a single village generates **0.4 tons (344.08 kg) of waste daily**, comprising **72.74% Organic** and **19.36% Plastic** matter.
- **Psychological Distress:** Interrupted education and economic instability have left youth (the "Generation on Hold") facing high levels of stress, loss of agency, and social isolation.

3. Core Innovation: The Circular Livelihood Model

The project empowers youth to lead a "story of change" by transforming waste into resources.

A. Waste-to-Asset Production Plus Solar Repair Training (Income Generators)

- Eco-Adobe Bricks: Youth are trained to shred non-recyclable plastic waste (comprising 19.36% of the rural waste stream, excluding sellable PET bottles) and integrate it into a matrix of straw and clay. These bricks effectively sequester plastic pollutants while providing low-cost, durable building materials for community infrastructure such as waste infrastructure and community hub.
- **Bio-Fertilizer**: Leveraging the 72.74% organic waste proportion, youth produce high-grade fertilizer to improve agricultural productivity and food security.
- **Solar Maintenance**: Youth are also trained to repair and install off-grid solar systems, ensuring reliable power for the community and the project's digital hub.



*AI Generated Infographic

B. The Dual-Purpose "Cooling Hub" (Infrastructure)

The **Resource Recovery Center (RRC)** built by the youth serves two vital roles:

- **Waste Management Hub:** A central facility to manage village waste streams.
- **Community Heat Shelter:** Due to the high thermal mass of Eco-Adobe (clay and straw), the interior remains significantly cooler than the outside temperature. In the extreme heat of Central Myanmar, this facility provides a life-saving, climate-resilient space, training centre for vulnerable community members.

4. Ag-Tech, Stewardship & Job Readiness

Income from fertilizer sales and solar repair fees funds a comprehensive curriculum:

- **Ag-Tech & Stewardship**: Training in solar-powered irrigation, digital crop-monitoring, and climate-vulnerability awareness.
- **Smartphone-Based Offline Library**: A micro-server broadcasts a local Wi-Fi signal, allowing youth to browse vocational manuals on their phones with **zero data costs**.
- **Job Readiness**: Professional skills (communication, micro-enterprise management) to prepare youth for the workforce.

5. Clear Evidence of Potential Impact

This project delivers "Endless Change" through tangible outcomes:

- **Climate Resilience**: Providing a functional heat shelter in a region with rising temperatures.
- **Information Sovereignty**: 24/7 access to education, unaffected by internet shutdowns.
- **Waste Diversion**: Turning 0.4 tons of daily waste into building materials and organic fertilizer.
- **Financial Sustainability**: Fertilizer income covers the cost of Ag-Tech training and library maintenance.

6. Potential Deliverables

- **Eco-Adobe Heat Shelter & RRC**: A physical facility serving as a model for climate-resilient rural construction.
- **Increased Household Income**: Documented savings for farmers switching to local bio-fertilizer.
- **Digital Learning Hub**: A functioning offline campus that empowers and inspires rural communities.

7. Future Outlooks: Transition to a Sustainable Community Centre

While the project begins as a vocational hub, the **Resource Recovery Centre (RRC)** is designed to evolve into a permanent pillar of village life.

- **The "Green Hub" for All**: As the "Generation on Hold" completes their training, they will manage the facility as a community-owned centre, transitioning from students to "Rural Champions".
- **Climate Sanctuary**: The Eco-Adobe structure will continue to serve as the primary
- **Community Heat Shelter**, providing a dignified space for elders and children during the increasing heatwaves of Central Myanmar.
- **Digital Access Point**: The **Offline Digital Library** will remain a permanent public resource, allowing all villagers—not just youth—to access health information, market prices for crops, and literacy tools via their own **smartphones**.
- **Circular Marketplace**: The centre will become a permanent site for farmers to purchase bio-fertilizer and for households to bring plastic waste, cementing the "Circular Economy" as a lifelong village practice.



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BANGLADESH

ASTHA: A Journey of Service, Hope, and Social Change

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The Innovation

Project Astha is a youth-led grassroots social initiative established on 21 February 2023 to improve the lives of disadvantaged children, women, and vulnerable people in rural Bangladesh. The word "***Astha"*** means **trust and hope**, reflecting the project's commitment to creating opportunities through education, community participation, and women's economic empowerment. The initiative was founded by me, **Astha Mahmud**, a student of the Foundation Course in Human Sciences at the International Islamic University Malaysia (IIUM). Inspired by humanitarian values and the Sustainable Development Goals (SDGs), I invested my personal savings to initiate sustainable community development activities in rural Bangladesh.

Importance of the Initiative

Many rural communities in Bangladesh face limited access to educational resources, livelihood opportunities, health awareness, and community-based development initiatives. Project Astha addresses these challenges through a simple, community-driven approach that mobilizes local volunteers and existing community resources instead of relying on expensive infrastructure.

The initiative focuses on:

- Promoting reading habits and creative learning among rural children.
- Raising awareness of health, hygiene, and environmental protection.
- Preserving traditional cultural heritage.
- Creating sustainable livelihood opportunities for disadvantaged women.
- Building inclusive and caring rural communities.

How the Initiative Works

Project Astha combines education, awareness, and livelihood development into one integrated community model.

Its major activities include:

- Distribution of storybooks, drawing books, color pencils, and educational materials for rural children.
- Storytelling sessions, reading programs, and art competitions that encourage creativity and confidence.
- Health and hygiene awareness programs promoting handwashing and healthy practices.
- Environmental campaigns, including tree plantation and climate awareness activities.
- *Aparajita Nakshi Kathar Math Initiative,* where disadvantaged women receive financial support, sewing machines, cloth, thread, and other materials to produce traditional Nakshi Katha products for income generation.

The project is implemented with support from family members, local volunteers, community organizations, and local stakeholders, ensuring strong community ownership and sustainability.

Cost-Effectiveness

Project Astha demonstrates that meaningful rural development can be achieved with limited financial resources. Key features include:

- More than **BDT 100,000** invested from the founder's personal savings.
- **BDT 50,000** invested in the women's livelihood program.
- Strong reliance on volunteers and community participation.
- Utilization of local knowledge, traditional skills, and locally available resources.
- Minimal administrative costs with maximum direct community benefit.

By using existing community capacity rather than expensive infrastructure, the project delivers sustainable results at a relatively low cost.

Impact

Since its establishment, Project Astha has achieved meaningful social impact:

- More than **40 rural children** have participated in reading, storytelling, and educational activities.
- **20 disadvantaged women** have received livelihood support through the Nakshi Katha initiative and now earn income using their traditional skills.
- Increased awareness among children and families regarding personal hygiene and healthy practices.
- Greater environmental awareness through tree plantation and climate education.
- Enhanced confidence, creativity, and community participation among children and women.

The project demonstrates that a small youth-led initiative can create sustainable improvements in education, women's empowerment, environmental awareness, and rural livelihoods







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Dr. P. Chandra Shekara has more than 35 years of experiences towards integrated rural development especially in the areas of Agricultural Extension Management, Agri-Entrepreneurship Development, Agricultural Marketing Management and Public-Private-Partnership. He is one of the leading professionals in the field of agricultural and rural development and headed three premier National Institutions under the Ministry of Agriculture and Farmers Welfare, Government of India during his more than three and a half decade long professional carrier: Director General of CCS National Institute of Agricultural Marketing (CCS NIAM), Director General of National Institute of Plant Health Management (Incharge) (NIPHM) and Director General of National Institute of Agricultural Extension Management (MANAGE). Currently serving as the Director General of the Centre on Integrated Rural Development for Asia and the Pacific (CIRDAP), an international organization based in Dhaka, Bangladesh.



Dr. Ganga Dutta Acharya is an accomplished development professional with more than 30 years experience working with rural communities and policy stakeholders in Nepal and South Asia. With a Ph.D. in Rural Development from Australia, and a strong foundation in socio-economic policy research, he has published over 30 research outputs, including papers in national/international journals, reports, policy documents, and book chapters. He worked as the editor of the SAARC Journal of Agriculture during 2022-2024, and currently holds editorial responsibility for the Asia-Pacific Journal of Rural Development- a biannual academic journal- which is a flagship publication of CIRDAP and published by SAGE Publication. Dr. Acharya is currently working as Director Research at the CIRDAP Secretariat.

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