Scaling Climate-Resilient Rice Production through Mechanised Planting in Battambang

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Purpose:
This case study was developed as part of the Nurture Project's interim evaluation to document key achievements and lessons learned from the implementation phase.

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1. Introduction

Nurture Project Overview

Nurturing Climate Resilience in Cambodia (Nurture) is a four-year collaborative initiative among HEKS/EPER, Caritas Switzerland, the Ministry of Water Resources and Meteorology (MOWRAM), and the General Directorate of Agriculture (GDA). Co-financed by the Swiss Agency for Development and Cooperation (SDC), the project strengthens the climate resilience of smallholder farmers (SHFs) through three interventions: local water governance; policy and planning on climate adaptation; and climate-resilient agriculture and market development. By enabling private-sector actors and farmer organizations to adopt and scale commercially viable, climate-resilient practices, Nurture facilitates improved decision-making, productivity, and market access for vulnerable rural households.

Intervention Scope

In the rainfed southern region of Battambang Province, Nurture and Agricultural Systems Research (Cambodia) Co., Ltd. (ASR Crop Care) targeted nine climate-vulnerable communes that lacked irrigation infrastructure and were highly exposed to weather variability. The intervention addressed systemic barriers faced by rice and maize farmers in agro-ecological zones where traditional broadcasting often leads to crop failure amid shifting climate patterns. By focusing on these high-risk areas, the partnership aimed to replace subsistence-based broadcasting with mechanized, climate-resilient planting techniques, ensuring that even households without significant capital could access modern agricultural advancements.

Monitoring of Fall Armyworm infestation on maize crops in Prey Totueng Village, Chhnal Moan Commune, Koas Krala District, Battambang Province.

2. The Context: Vulnerability of Rainfed Systems

ASR conducting a Farmer Field School (FFS) session in Ruong Village, Rukhakiri District, Battambang Province, 2024
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Rice field visit during Farmer Field School (FFS) training, Ruong Village, Rukhakiri District, Battambang Province, 2024.
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The southern region of Battambang is a high-risk agroecological zone, entirely dependent on increasingly erratic rainfall and lacking irrigation infrastructure. Climate change has shifted the onset and duration of the wet season, leaving the early period (February to June) increasingly hot and dry. These altered patterns make initial crop establishment difficult and often lead to severe production losses or complete crop failure.

In response to these conditions, households across nine rainfed communes traditionally relied on manual broadcasting. This method requires excessive seed rates, approximately 300 kg per hectare, and results in uneven plant spacing, high weed and pest pressure, and increased labor costs. Baseline surveys of 180 households confirmed the severity of this systemic vulnerability, reporting average yields of only one to two tons per hectare. Without access to formal agronomic advice, farmers relied exclusively on informal networks and chemical-intensive practices, leaving them with minimal adaptive capacity to withstand a changing climate.

Box 1: Key Challenges

- Climate Shift: A delayed wet season and extreme heat during the early planting window (February–June) shortened the viable growing season, forcing farmers to delay planting and increasing the risk of late-season crop failure.
- Inefficient Practices: Traditional manual broadcasting required excessive seed rates (approximately 300 kg/ha), resulting in overcrowded crops highly susceptible to pests, weeds, and water stress.
- Knowledge & Service Gaps: A baseline survey revealed a total absence of public extension services. Farmers relied solely on peer-to-peer advice, leading to heavy reliance on chemical fertilizers and a lack of awareness of conservation agriculture.
- Economic Risk: In drought years, broadcast crops often failed entirely, resulting in 100% loss of investment for vulnerable households.

3. The Intervention: A one-stop distribution model

To institutionalise this transition, the partnership deployed a private-sector-led service model centered on a "one-stop" Crop Care shop in Koas Krala District. This facility serves as a strategic hub, integrating agronomic advisory services, technical demonstrations, and machinery contracting to lower the barrier to entry for SHFs. Central to this model was the establishment of a Farmer Field School (FFS) in Roung Muoy Village, where farmers engaged in experiential learning to observe the efficiency and yield advantages of machine-planted rice throughout the entire crop cycle. By offering mechanised planting as a contract service rather than requiring farmers to invest in expensive equipment, ASR Crop Care bridged the gap between technical knowledge and field-level adoption, creating a commercially viable pathway for sustainable agricultural modernisation.

Partners and Roles

The intervention involved multiple actors, including ASR Crop Care as the lead private actor; machinery operators and bio-pesticide suppliers; Farmer Field School facilitators; local farmer groups; and the Provincial Department of Agriculture, Forestry, and Fisheries (PDAFF).

A demonstration of maize cultivation using direct machine planting to bolster climate resilience, 2024 ©*Nurture Project*

Monitoring of maize crop progress by the Nurture team at a participant's farm in Prey Totueng Village, Koas Krala District, 2024. ©*Nurture Project*

Box 2: Intervention Core Components

- **Farmer Field Schools (FFS):** Established in Roung Muoy Village, the FFS served as a localised R&D and demonstration hub, allowing farmers to compare machine-planted and broadcast rice side by side throughout the full crop cycle.
- **The "One-Stop Shop" Model:** ASR operated as a service hub in Koas Krala District, providing machinery contracting, high-quality inputs (bio-pesticides), and agronomic advisory services.
- **Technology Access:** By facilitating machinery contracting, the project removed the high barrier to equipment ownership, enabling smallholder farmers to pay for planting services on a per-hectare basis.
- **Multi-Stakeholder Engagement:** The intervention connected machinery operators, bio-pesticide suppliers, and the Provincial Department of Agriculture, Forestry, and Fisheries (PDAFF) to strengthen coordination and ongoing service delivery.

4. Results and Systemic Impact: The Resilience Premium

Farmer in their rice field in Ruong Village, Rukhakiri District, Battambang Province, 2024 © Nurture Project

A farmer checking the health of rice crop using a Leaf Color Chart (LCC) to determine nitrogen requirements. © Nurture Project

The intervention's results provided strong proof of concept across farm performance, household resilience, and behavioral change. Data from demonstration plots showed that machine-planted rice consistently outperformed broadcast fields. By reducing seed requirements from 300 kg/ha to 80 kg/ha, farmers significantly lowered input costs while achieving superior yields. On average, machine planting yielded 3,629 kg/ha, compared with 2,624 kg/ha for broadcasting, resulting in over one ton/ha more than broadcasting. This technical efficiency translated into substantial economic gains, with net incomes increasing by USD 252 per hectare (from USD 548/ha for broadcasting to USD 800/ha for machine planting).

Table 1: Comparative Performance

Metric	Traditional Broadcasting	Machine-Planted	Change
Seed Requirement	300 kg/ha	80 kg/ha	-73%
Average Yield	2,624 kg/ha	3,629 kg/ha	38%
Net Income (USD)	548/ha	800/ha	46%

Additionally, the intervention prompted a shift in farmers' behavior. Participants reported that machine planting made fertilizer application easier, reduced pest and disease pressure, and accelerated harvesting. Most importantly, the intervention sparked an early market response: households have begun planning to adopt these services commercially, signaling the emergence of a self-sustaining service market.

Box 3: Qualitative Gains

- **Resource Efficiency:** Lower labour requirements and easier application of fertilizers/pesticides.
- **Crop Health:** Improved plant spacing reduced disease pressure and accelerated harvesting.
- **Behavioural Change:** Farmers transitioned from "observers" to "customers," and local entrepreneurs began offering machine-planting services commercially.

A Household Spotlight

The most profound impact was observed during periods of acute climate stress. In a standout case from Roung Muoy Village, a farming household (Veasna and Lim) experienced a severe drought that devastated their traditional crops. While 5.5 hectares of their broadcasted rice failed completely, their one-hectare machine-planted field survived, yielding 4.4 tons. In a season of potential catastrophe, the mechanised plot became the family's sole source of agricultural income, doubling their per-hectare earnings from the previous year to USD 1,027. This "resilience premium" demonstrated that machine planting is not just a productivity tool; it is an essential safeguard against total crop failure in drought-prone environments.

5. Lessons Learnt

The success of machine-planted rice as a climate-resilient alternative to traditional broadcasting offers several critical lessons for the Nurture project and its partners. First, demonstration alone cannot drive systemic change; success requires "follow-through" support, including reliable machinery contracting and advisory services. Second, machinery adoption is a household-level decision in which women play a central financial role. Future outreach must therefore continue to target the entire household rather than only male operators. Third, the intervention demonstrated that the private sector can fill the extension gap through commercially viable models that prioritise climate resilience.

Box 4: Strategic Lessons Learnt

- **Resilience Drives Adoption:** Farmers are more likely to invest in technologies that protect yields in bad years than those that simply increase yields in good years.
- "Follow-through" Support is Essential: Demonstrations fail without a support ecosystem. Adoption requires the simultaneous availability of machinery, contractors, advisory services, and quality inputs.
- Gender-Inclusive Decision-Making: Financial decisions about mechanization are made at the household level, where women play a primary role. Marketing and outreach must target the whole household, not just male machinery operators.
- Filling the Extension Vacuum: In the absence of public services, private-sector actors such as ASR Crop Care can provide "embedded" extension services if the model is commercially viable.

6. Sustainability and Ways Forward

The model indicates that national-level adoption of mechanised planting could increase Cambodia's paddy production by up to three million tons annually, generating between USD 400 and 800 million in economic value. Sustainability is anchored in expanding the network of private service providers and engaging in policy dialogue to incentivise mechanisation. As more service providers are incentivised to enter the market, reliance on project support will decline. By rebuilding value chains for rotation crops and supporting distribution networks, the Nurture project will continue to strengthen smallholders' adaptive capacity and climate resilience.

Box 5: Recommendations for Scale

- Incentivise Service Providers: Support low-interest financing for local entrepreneurs to purchase planting machinery.
- Diversification: To further improve soil health, the focus must shift toward developing value chains for rotation crops (mung bean, maize) to complement mechanised rice systems.
- Policy Integration: Use data from this case study and other research to inform the Ministry of Agriculture, Forestry, and Fisheries (MAFF) and MOWRAM about the cost-effectiveness of mechanisation as a primary climate adaptation strategy.

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