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Interim Evaluation Report

This report presents the Interim Evaluation of the Green Climate Fund (GCF)-funded project “Climate-Friendly Agribusiness Value Chains Sector Project”. The evaluation was independently commissioned by the Accredited Entity (AE), Asian Development Bank, and submitted to GCF. GCF assumes no responsibility for the accuracy of the information in this report.

Interim Evaluation Report

Climate-Friendly Agribusiness Value Chains (CFAVC) Project Kingdom of Cambodia

Project No. SC 124288-CAM







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Acronyms

AC	Agricultural Cooperative
ADB	Asian Development Bank
AIMS	Accelerating Inclusive Markets for Smallholders – Information Management System
AMIS	Agricultural Management Information System
ARDB	Agricultural and Rural Development Bank
ASPIRE	Accelerating Inclusive Markets for Smallholders (ASPIRE) Programme
AWD	Alternate Wetting and Drying
BCR	Benefit–Cost Ratio
BCA	Benefit–Cost Analysis
CARDI	Cambodian Agricultural Research and Development Institute
CDM	Clean Development Mechanism
CFAVC	Climate-Friendly Agribusiness Value Chains
CO_2e	Carbon Dioxide Equivalent
CS1	Consulting Services Package 1 – Project Implementation Consulta
CS5	Consulting Services Package 5 – Feasibility Study and Detailed Engineering Design
CSA	Climate-Smart Agriculture
DMF	Design and Monitoring Framework
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
FPIC	Free, Prior, and Informed Consent
FWUC	Farmer Water User Committee
FWUG	Farmer Water User Group
GAP	Good Agricultural Practices
GCF	Green Climate Fund
GHG	Greenhouse Gas
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
IRMF	Integrated Results Management Framework
KII	Key Informant Interview
MAFF	Ministry of Agriculture, Forestry and Fisheries
MEF	Ministry of Economy and Finance
MoE	Ministry of Environment
MOWRAM	Ministry of Water Resources and Meteorology
MRD	Ministry of Rural Development
NAL	National Agricultural Laboratory
NDWI	Normalized Difference Water Index
NGO	Non-Governmental Organization
NDC	Nationally Determined Contribution
PADC	Provincial Agricultural Development Center
$PM_{2.5}$ and PM_{10}	Particulate Matter ≤2.5 and ≤10 micrometers
PMU	Project Management Unit
PPP	Public–Private Partnership
PPIU	Provincial Project Implementation Unit
RUA	Royal University of Agriculture
SDG	Sustainable Development Goal
SPSS	Statistical Package for the Social Sciences
TOC	Theory of Change

Executive summary

The CFAVC Project, financed by ADB, GCF, and the Royal Government of Cambodia, reduces agricultural vulnerability to climate change by strengthening rice, maize, cassava, and mango value chains across four provinces. Implemented by MAFF with MOWRAM, MRD, and CARDI (2018–2025), it integrates climate-resilient infrastructure, renewable energy, climate-smart agriculture, and policy reforms to boost productivity and rural livelihoods. The Interim Evaluation used mixed methods—surveys, KIIs, FGDs, GIS, scorecards, and cost-benefit analysis—to assess relevance, effectiveness, efficiency, gender equity, country ownership, innovation, coherence, and impact. Findings show strong progress in climate resilience, agrifood system performance, and the foundations for low-emission, climate-adaptive agribusiness transformation.

Description of respondent groups
Respondents were diverse and gender-balanced, mainly working-age farmers from the four target provinces, with moderate household sizes and limited formal education. Women comprised at least 50% of survey and FGD participants, ensuring equitable representation. Agriculture was the main livelihood, supplemented by livestock, wage labor, and small enterprises, with monthly incomes of USD 150–375. Livestock ownership was common—averaging 6 cattle, 10 pigs, and 62 poultry—supporting diversified, climate-smart production. About two-thirds were members of cooperatives or FWUCs, promoting peer learning and adoption of composting, biodigesters, and improved water management. Women were active in these groups, though youth participation remained very low (0.7%).

Relevance
CFAVC is strongly aligned with Cambodia's agricultural and climate priorities and the mandates of MAFF, MOWRAM, MRD, and CARDI. Infrastructure and training interventions met local needs, with 94.4% confirming relevance and 95.5% reporting skill improvements. The Theory of Change validation showed widespread uptake: 89.2% adopted improved practices and 76% reported better quality of life. Women's participation and income gains further underscore inclusivity. Remaining challenges include incomplete irrigation systems and limited peer-learning structures, requiring continued support to fully achieve climate-resilient agribusiness outcomes.

Impacts
The project produced strong socioeconomic and environmental impacts, advancing Cambodia's shift to climate-resilient, market-oriented agriculture. Value-chain progress reached 66%, and 52% of farmers reported productivity gains. Improved roads cut maize transport time from 14 hours to 15 minutes and reduced rice transport costs by 63%, boosting market access. Cooperative membership rose to 69%, and 7.6% co-financed biodigesters. Yet resilience gains (27.8%) and sustained practice adoption (14.2%) were hindered by water shortages and high input costs. Environmental benefits included reduced dust and lower $PM_{2.5}$/PM_{10} exposure from road upgrades and biodigester use. Overall, CFAVC strengthened productivity, energy security, and community resilience, providing a scalable model for low-emission agribusiness.

Outcome

Increase in Crop Yield. The project delivered strong productivity gains through improved irrigation, land leveling, and climate-smart practices. Rice yields rose 34.8% (2.70→3.64 t/ha), maize 55.8% (4.00→6.23 t/ha), and mango 16.7% (15.0→17.5 t/ha), while cassava remained stable (+0.7%). Farmers adopted laser land leveling mainly for better water management (29.9%) and higher yields (28.1%), enabling double cropping and

diversification. Despite price fluctuations, incomes and food security improved, with women actively contributing to production, training, and cooperative leadership. Overall, CFAVC combined technical innovation and inclusive participation to significantly enhance climate-resilient productivity.

GHG Emission Reduction. The project achieved 359,209 tCO_2e in GHG reductions—150% of target—through climate-smart rice management, biodigesters, and efficient rural roads. AWD and organic soil practices cut methane by over 90% (383,688 t→26,030 t CH_4), even with a 79% increase in rice area, and 79% of farmers practiced drying cycles informally. 412 biodigesters generated ~1,111 tCO_2e/year in savings and reduced firewood use, while 250 km of rehabilitated roads lowered emissions by 30% (~386 tCO_2e/year). Using IPCC Tier 1 and AR6 factors with GIS validation, total cross-sector reductions exceeded 1,500 tCO_2e/year, directly supporting Cambodia's NDC and providing a scalable low-emission model.

Resource-Efficient Agribusinesses. Progress toward resource-efficient value chains was mixed. Water-saving targets were mostly irrelevant for enterprises like rice mills, but energy efficiency reached 25 agribusinesses (30.8%), achieving 20% savings—50% of the target—via better roads, solar systems, and equipment upgrades. Post-harvest loss reduction was strongest: 40 enterprises (50%) cut losses by 21.1%, achieving 80% of the target through improved roads, storage, and handling. To meet 2026 goals, the project must expand renewable energy uptake, refine efficiency benchmarks, and maintain technical support.

Outputs

Output 1. Output 1 delivered major gains in climate-resilient agribusiness infrastructure. Farm roads and cooperative upgrades were fully completed (100%), and 19 of 27 irrigation systems (70%) restored 15,759 ha (105%) of irrigated land, benefiting 20,500 households, including 49,898 women, and enabling 2–3 cropping cycles. Water access improved through 278 ponds (56%) and preparations for solar drip systems. Post-harvest capacity strengthened with 80 solar warehouses (100%) and 31.46 km of resilient roads, with 97% of households reporting reduced transport costs. The National Agricultural Laboratory reached 54% of testing and 86% of income targets, expanding advanced testing and gender-inclusive training (52% women). Renewable energy investments benefited 63,972 farmers, though biodigesters and compost huts remained low (4.6%) and drip irrigation at 0%. Overall, Output 1 established strong, gender-responsive foundations for climate-resilient, low-emission value chains.

Output 2. Output 2 advanced climate-smart agriculture through varietal innovation, large-scale training, and improved water governance. All resilient varietal targets were achieved (100%) for rice, maize, and cassava. CSA training reached 29,709 farmers (74%), including 13,854 women (87%). Water-user governance improved through 17 FWUCs (63%) and 75% of PADCs and workshops becoming operational centers. Fertilizer efficiency increased by 53 points, organic input use by 20 points, and residue burning declined by 11 points. Laser land leveling on 3,000 ha boosted yields by up to 30%, benefiting 5,727 households (30% female-headed), with demo plots reaching 3.9–6.9 t/ha. FWUC training covered 6,299 members (28% women). Although SRP compliance remains moderate (43%), Output 2 built a strong base for scalable, gender-responsive, low-emission agriculture.

Output 3. Output 3 achieved major policy and institutional milestones, completing 95.5% of targets for a climate-friendly, gender-responsive enabling environment. Key outputs included Cambodia's first Climate-Smart and Gender-Responsive Agribusiness Policy, a sector-specific PPP Framework, and CamGAP standards, with women participating in nearly half of consultations. Green-finance training exceeded expectations, reaching 64 bank staff and 41 agribusinesses, while national financing partnerships supported 19,368 households (97%)

and market linkage of 20,000 tons of produce. However, digital components lagged: the ICT-based Climate Risk Management System and CamGAP endorsement both remained at 0%, limiting access to climate and market information. Despite these gaps, Output 3 significantly strengthened policy, institutional, and financing systems for climate-responsive agribusiness.

Coherence

The project demonstrated strong policy and institutional coherence by aligning closely with Cambodia's Agricultural Strategic Development Plan, Climate Change Strategic Plan, and NDC commitments, while coordinating delivery across MAFF, MOWRAM, MRD, and MEF to integrate irrigation, roads, renewable energy, and agribusiness into a unified climate-resilient model. At the subnational level, PPIUs worked collaboratively with local authorities, cooperatives, NGOs, and development partners—such as AIMS, ASPIRE, CARDI, and CEDAC—to expand training, seed access, and value-chain support, reducing operational overlap and strengthening local ownership. More than 50% of farmers adopted climate-smart practices, demonstrating effective translation of national policies into field-level change. Although private-sector participation remains limited, CFAVC established a coherent implementation framework that harmonizes national strategy, donor investments, and community-based action, advancing Cambodia's transition toward sustainable, low-emission agribusiness.

Efficiency

The project demonstrated strong operational and economic efficiency, with adaptive management and participatory coordination improving service delivery, scheduling, and accountability across provinces. Productivity-enhancing interventions—such as laser land leveling and improved irrigation—generated substantial economic returns, contributing to $76.2 million in total benefits against $54.5 million in expenditures. This resulted in Benefit–Cost Ratios of 1.29–1.36 and positive Net Present Values ranging from $13–19 million, supported by yield gains in rice, maize, and cassava, reductions in fertilizer and transport costs, fuel savings, and $4.36 million in GHG mitigation benefits. Although overall disbursement utilization stood at 51.8%, efficiency remained high due to prioritization of high-impact activities, with civil works accounting for approximately 80% of spending and administrative costs kept below 10%. Overall, CFAVC delivered strong value for money, achieving significant productivity, climate, and livelihood outcomes despite implementation delays.

Gender Equity

The project significantly advanced gender equity, moving women into leadership roles in climate-smart agriculture and water governance. Women made up 44% of 57,000 trainees and 28.6% of 556,980 paid workdays under equal-wage conditions. Gender mainstreaming strengthened through ministry Gender Working Groups and 123 focal points, embedding equity in planning and monitoring. Women also influenced major policies, including CamGAP standards. While their participation was strong, youth and ethnic minority involvement remained limited. Overall, CFAVC positioned women as central actors in climate-resilient agricultural development.

Country Ownership

Country ownership was strong, with CFAVC fully aligned with national climate and development priorities. MAFF, MOWRAM, MRD, and MEF coordinated effectively, while FWUCs and cooperatives contributed labor, cost-sharing, and governance. Implementation through MAFF and PPIUs ensured accountability and integration into public systems. Key policies—the 2024 Climate-Smart Agribusiness Policy, PPP Framework, and CamGAP standards—reinforced national commitment, complemented by green finance and risk-management training. The project firmly embedded climate-smart agriculture within Cambodia's institutional and community structures for long-term sustainability.

Innovation
CFAVC introduced impactful innovations that improved productivity and resilience. Laser land leveling and water-smart irrigation increased efficiency, reduced fuel and water use, and stabilized yields. Farmers adopted low-emission practices—composting, biodigester slurry use, and integrated soil management—reducing fertilizer dependence and producing renewable biogas. Post-harvest improvements in drying, residue handling, and storage boosted quality and market access. Limited access to green finance constrained SME and cooperative investment, underscoring the need for expanded climate-finance mechanisms to sustain innovation.

Sustainability, Replication, and Scalability
The project showed strong sustainability potential through durable infrastructure, active cooperatives, and high farmer ownership. About 75% of beneficiaries intend to continue using technologies such as irrigation systems, biodigesters, and compost huts, with only 17% needing limited support. Cost-sharing and cooperative models enhanced maintenance, supported by NGOs (71%), local authorities (59%), and cooperatives (54%). Scaling remains constrained by limited finance (66%), technical capacity (55%), and market access (51%). Expanding green credit and embedding co-management in MAFF and commune systems will be essential for national replication.

Unexpected Results
Several positive unintended outcomes emerged, including stronger FWUC governance and increased digital engagement, though some cooperatives struggled with fee collection. High interest in biodigesters, composting, and CSA practices persisted despite construction delays. Farmers' adoption of social media for marketing improved logistics and visibility. Infrastructure upgrades reduced costs and expanded market access, though mango value chains still faced unstable prices. Survey findings showed 33% gained new market access, 21% received external support, and 27% shifted from traditional crops toward project-promoted commodities. Minor negatives included higher input costs (8%) and localized disputes (4%).

Scorecard-Based Assessment of Paradigm Shift Contribution
The project achieved a GCF score of 3.4 (Substantial Progress), indicating strong movement toward transformational change. Key drivers included land leveling, efficient irrigation, composting, and biodigesters, which reduced GHG intensity while raising productivity and resilience. Resilience was rated 4 (Significant), with farmers reporting higher yields and reduced drought risk. Emission reduction achieved a 3 (Substantial) rating, and gender/SDG co-benefits scored 4, reflecting women's leadership and contributions to SDGs 2, 5, and 13. Institutional coordination among MAFF, MOWRAM, MRD, and MEF strengthened policy coherence. Remaining gaps—ICT and PADC delays—prevent full transformation but the project is well-positioned to reach Level 5 (Transformational) upon completion.

Lessons Learned
The project showed that technical innovation, market linkage, and institutional strengthening must advance together to achieve climate-resilient transformation. Laser land leveling proved highly scalable, while biodigesters and compost huts improved soil health but required continued mentoring. Water systems boosted productivity but remained limited by dry-season shortages and incomplete canals, emphasizing the need for synchronized construction. Operational delays from weather and maintenance gaps highlighted the need for contingency planning. Training was widely valued, but stronger buyer networks are needed for sustained income gains. FWUCs and cooperatives improved governance and market participation, though follow-up support is essential. Overall, combining technology

adoption, inclusive governance, and continuous capacity building is key to sustaining low-emission agribusiness growth.

Conclusion

The interim evaluation confirms that CFAVC is performing strongly at the outcome level, achieving 97–100% of targets for crop yield improvement and GHG reduction, with overall output performance at 73% despite earlier delays in renewable energy, laboratory upgrades, and policy work. Activity-level progress averaged 77–79%, with solid delivery in irrigation, roads, green finance, and ICT, though biodigester and energy components lagged. With pending infrastructure contracts now approved, remaining activities are expected to be completed within the next year. Under the GCF IRMF, the project scored 3.4, indicating substantial progress toward transformational change. With strengthened implementation oversight, full achievement of transformational targets by 2026 remains feasible, positioning CFAVC as a key model for low-emission, climate-resilient agribusiness in Cambodia.

Recommendations

In order to sustain CFAVC's strong outcome performance and address remaining implementation gaps, the evaluation recommends a compressed set of six priority actions for 2025–2026:

1. Fast-track remaining infrastructure and systems including biodigesters, PADCs, workshops, and the ICT Climate Risk System, enforcing contractor timelines and establishing FWUC- and commune-led maintenance.
2. Enhance private-sector and green finance engagement through PPPs, contract farming, and blended credit, prioritizing women-led and CamGAP/organic agribusinesses.
3. Institutionalize policy and monitoring tools by integrating the Climate-Smart Agribusiness and PPP Framework into ministry work plans and embedding CFAVC indicators and GHG tools in AMIS.
4. Advance gender-responsive CSA adoption by ensuring 40% women in FWUC/AC leadership and expanding their access to ICT, training, and enterprise opportunities.
5. Strengthen monitoring and adaptive learning using digital M&E, participatory scorecards, and midline–endline validation aligned with GCF indicators.
6. Ensure sustainability and replication by integrating FWUCs/PPIUs into national systems, aligning financing with ASDP/NDC goals, and scaling proven models such as laser land leveling, composting, and cooperative contracting.

1.0 Introduction

The Climate-Friendly Agribusiness Value Chains (CFAVC) Sector Project (SC 124288-CAM) combines infrastructure rehabilitation, renewable energy deployment, climate-smart agriculture, institutional strengthening, and policy innovation to enhance productivity, resilience, and rural incomes. The interim evaluation applied a mixed-methods and participatory approach to assess the project's relevance, effectiveness, efficiency, coherence, gender responsiveness, innovation, and sustainability. Overall, findings indicate that the project remains well aligned with national priorities and development partner strategies, is demonstrating early results in productivity and climate resilience, and provides valuable lessons for scaling climate-smart agribusiness models in Cambodia.

1.1 Project overview

The Climate-Friendly Agribusiness Value Chains (CFAVC) Sector Project (SC 124288-CAM) aims to reduce the vulnerability of Cambodia's agriculture sector to climate change while lowering greenhouse gas (GHG) emissions. It promotes climate-resilient agribusiness development across four key value chains: rice, maize, cassava, and mango, in the provinces of Kampong Cham, Tboung Khmum, Kampot, and Takeo. Aligned with Cambodia's national priorities to modernize and commercialize agriculture, CFAVC supports the Agriculture Sector Strategic Development Plan (2014–2018) and the Industrial Development Policy (2015–2025).

Project implementation began in 2018 and is expected to be completed by 2024–2025. Through investments in irrigation, farm-to-market connectivity, renewable energy, and value chain infrastructure, CFAVC enhances agricultural competitiveness, strengthens climate resilience, and improves livelihoods along the Greater Mekong Subregion's Southern Economic Corridor and South-Coastal Corridor.

The project is funded through:

- a concessional loan from the Asian Development Bank's (ADB) Ordinary Capital Resources (OCR) for $90 million
- a loan from the Green Climate Fund (GCF) for $10 million
- a grant from the GCF for $30 million, in addition to estimated contributions of $3.66 million from beneficiaries and $7.38 million from the Royal Government of Cambodia

The Ministry of Agriculture, Forestry and Fisheries (MAFF) serves as the executing agency, working closely with the Ministry of Water Resources and Meteorology (MOWRAM) and the Ministry of Rural Development (MRD) to oversee project coordination and implementation. The implementing agencies include the General Directorate of Agriculture (GDA), General Directorate of Animal Health and Production (GDAHP), General Department of Technical Affairs of MOWRAM and MRD, and the Cambodian Agricultural Research and Development Institute (CARDI). Together, these agencies ensure the effective delivery of project activities related to climate-smart infrastructure, agricultural innovation, and value chain development. Technical assistance packages, such as CS1 (Project Implementation Consultancy) and CS5 (Feasibility Studies and Detailed Engineering Design), provide specialized support in infrastructure design, institutional development, and performance monitoring to achieve efficient and sustainable project outcomes.

1.2 Expected results

The CFAVC Project aims to enhance Cambodia's agricultural competitiveness and resilience to climate change by improving productivity, quality, and value addition across key crop value chains, supporting climate-resilient and low-carbon growth, and contributing to higher

rural incomes and more inclusive economic development. Its intended outcome is the creation of productive and resource-efficient agribusiness value chains across Kampong Cham, Tboung Khmum, Kampot, and Takeo. The project delivers this through three outputs: (1) improving and climate-proofing critical agribusiness infrastructure, including irrigation systems, farm-to-market roads, and renewable energy facilities; (2) promoting climate-smart agriculture through resilient crop varieties, farmer capacity building, and mechanization support; and strengthening the enabling environment for climate-friendly agribusiness through green finance, agribusiness standards, and digital risk management tools.

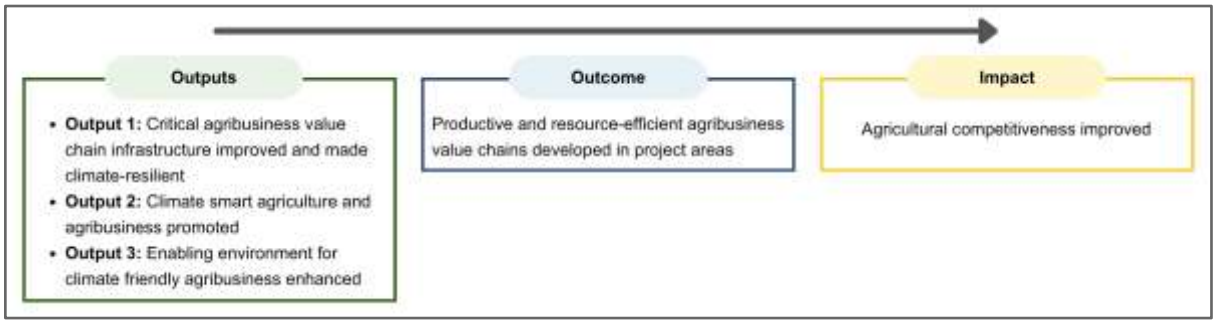


Figure 1. Project outputs, outcome, and impact.

1.3 Key project interventions

Key CFAVC interventions integrate infrastructure rehabilitation, renewable energy deployment, climate-smart technologies, capacity building, institutional strengthening, policy innovation, and digital solutions to support farmers, cooperatives, and agribusinesses. These activities are organized across three outputs: Output 1 includes measures to improve irrigation systems, farm-to-market roads, and renewable energy facilities for rice, maize, cassava, and mango production, integrating resilient designs and sustainable technologies. Output 2 comprises initiatives that promote the adoption of resilient crop varieties, efficient land and water management practices, and capacity building for farmer institutions. Output 3 covers actions to strengthen institutional frameworks, develop green financing mechanisms, and reinforce policy and regulatory environments to support sustainable agribusiness growth.

Box 1. *Key project interventions.*

Output 1: Climate-resilient agribusiness infrastructure
- Activity 1.1: Rehabilitating water management infrastructure
- Activity 1.2: Upgrading agricultural cooperative value chain infrastructure
- Activity 1.3: Improving connectivity to cooperatives and market through climate-resilient farm road networks
- Activity 1.4: Strengthening infrastructure for agricultural quality and safety testing at the National Agricultural Laboratory (NAL)
- Activity 1.5: Promoting renewable energy for value chain improvement

Output 2: Promotion of climate-smart agriculture and agribusiness
- Activity 2.1: Deploying climate-resilient varieties
- Activity 2.2: Strengthening capacity in climate-friendly production practices and technologies
- Activity 2.3: Promoting farm mechanization and extension

Output 3: Enabling environment for climate-friendly agribusiness
- Activity 3.1: Formulating climate-friendly agribusiness policies and standards
- Activity 3.2: Promoting green finance and risk-sharing mechanisms
- Activity 3.3: Supporting climate risk management through information and communication technologies (ICT)

1.4 Evaluation objectives

The CFAVC Project Interim Evaluation provided an independent, evidence-based assessment of the project's progress, performance, and results at the midpoint of its implementation. It examined the project's relevance, effectiveness, efficiency, coherence, gender equity, country ownership, innovation, scalability, and impact, in alignment with the GCF evaluation criteria and ADB evaluation guidelines. The purpose of the evaluation was to generate evidence-based insights to guide project steering, strengthen adaptive management, and inform the design of future climate-smart agribusiness initiatives in Cambodia. It specifically aimed to:

- Assess the project's implementation progress, efficiency, and alignment with its theory of change and logical framework.
- Evaluate the effectiveness of interventions in achieving intended outcomes, particularly on adaptation beneficiaries, GHG reduction, and resilience of agrifood systems.
- Examine institutional, financial, and policy coherence across implementing partners, including linkages with national climate and agricultural strategies.
- Analyze cross-cutting themes, such as gender equality, social inclusion, and country ownership in the project's design and delivery.
- Identify innovations, lessons, and opportunities for scaling, replication, and long-term sustainability.
- Provide actionable recommendations to strengthen project implementation, monitoring, and impact tracking for the remaining project period.

The evaluation applied a mixed-methods approach that combined quantitative data analysis with qualitative tools (e.g. key informant interviews, focus group discussions, field verification, and document review). It was guided by a structured analytical framework aligned with the GCF evaluation criteria, ensuring coherence with international standards for assessing climate-related investments. Each criterion was operationalized through key evaluation questions, data sources, analytical methods, and measurement tools, guiding the systematic collection and triangulation of qualitative and quantitative evidence across project components. The framework also ensured that the analysis captured both intended and unintended outcomes, integrating dimensions of gender equity, country ownership, innovation, and scalability. The evaluation process was participatory and inclusive, engaging government counterparts, project beneficiaries, private sector stakeholders, and development partners to produce a comprehensive, credible, and balanced assessment.

In order to ensure quality, transparency, and usability, the evaluation produced a series of key deliverables:

- Quality Assurance Plan with an outline of methods, roles, and validation mechanisms
- Inception Report that details the methodology, data sources, and analytical framework
- Draft Evaluation Report and Presentation that summarizes key findings, evidence, and emerging recommendations
- Final Evaluation Report with stakeholder feedback, as well as 10 strategic and actionable recommendations to strengthen project performance and sustainability

Evaluation matrix

The Evaluation Matrix served as the core instrument that connected the evaluation criteria with corresponding research questions, indicators, and data collection methods. It outlined how specific tools (e.g. KIIs, FGDs, scorecards, and GIS analyses) were used to assess project performance against the logical framework and Theory of Change (TOC). Integrating desk-based document reviews with participatory field methods and digital monitoring platforms (e.g. as Kobo Toolbox and online project monitoring system) enabled a robust mixed-methods design. Guided by the Evaluation Matrix (**Table 1**), this approach ensured that quantitative indicators (absorption rates, GHG reductions, and beneficiary reach) were

complemented by qualitative insights on stakeholder perspectives, gendered experiences, and institutional coherence.

Table 1. CFAVC interim evaluation matrix.

Evaluation criterion	Key evaluation questions	Data sources	Methods	Tools	Indicators
Relevance	Are the project objectives and outcomes relevant and realistic to the local context?	Project documents, stakeholder interviews, national development plans	Desk review, KIIs	Document review, Online project monitoring tool	Alignment with national plans; stakeholder perceptions of relevance
Efficiency	Are resources utilized economically, effectively, and equitably?	Financial reports, project progress reports, interviews with project staff	Benefit-Cost Analysis, KIIs, document review	Kobo Toolbox, Budget analysis templates	Absorption rate, cost per beneficiary, timeliness of delivery
Effectiveness	What progress has been made toward outcomes such as GHG reduction and adaptation beneficiaries?	Progress reports, survey data, CDM verifications	Surveys, Scorecard assessment, TOC validation	Scorecard, GIS, Kobo Toolbox	Tons of CO2e reduced, % of beneficiaries adopting climate-smart practices
Coherence	To what extent has the project complemented other local initiatives?	Stakeholder interviews, project documents	KIIs, desk review	KII guide, Partnership analysis checklist	Evidence of coordination; stakeholder feedback on complementarity
Gender equity	Are project benefits equitably distributed among women, youth, and marginalized groups?	FGDs, survey data, project activity records	FGDs, surveys, gender-disaggregated analysis	Gender-sensitive FGD guide, Kobo Toolbox	% of women/youth/marginalized beneficiaries; gender-aware activities
Country ownership	Is the project aligned with national and sub-national climate strategies?	Project governance records, national climate strategies	Desk review, KIIs	Policy alignment checklist, KII guide	Use of national systems; inclusion in national development plans
Innovation	Has the project provided innovation or unlocked climate finance?	Project reports, stakeholder feedback	KIIs, document review	Innovation tracker, KII template	Evidence of new practices or leveraged finance
Replication & scalability	What are the lessons learned and how replicable are the outcomes?	Project reports, interviews, case studies	SWOT analysis, KIIs	SWOT worksheet, Lessons log	Documented lessons; scalability potential
Impact	Has the project contributed to a paradigm shift?	Scorecards, GIS data, CDM verifications	Scorecard assessment, GIS analysis	Scorecard, GIS maps	GHG reduction metrics; changes in resilience indicators
Unexpected results	Are there unintended positive or negative outcomes?	Interviews, FGDs, field observations	KIIs, FGDs, observation	Field notes template, Observation log	Unplanned outcomes reported and verified

Evaluation questions

Each criterion within the evaluation matrix corresponds directly to a core analytical question that guided the inquiry (**Table 2**).

Table 2. Research questions.

Evaluation criterion	Questions
Relevance	• To what extent did the CFAVC Project respond to Cambodia's agricultural

Evaluation criterion	Questions
	needs, climate priorities, and socio-economic context? ● Were the project objectives, theory of change, and strategies coherent, realistic, and aligned with national policies and GCF paradigm shift goals?
Efficiency	● How efficiently were resources, partnerships, and institutional mechanisms utilized? ● Were implementation arrangements, financial management, and governance systems effective in delivering outputs on time and within budget? ● How well did adaptive management address emerging risks?
Effectiveness	● To what degree had the project's outputs and outcomes have been achieved by the time of evaluation? ● What progress was evident in improving climate resilience, increasing adaptation beneficiaries, and reducing GHG emissions? ● How robust was the evidence base for measuring results against the baseline?
Coherence	● How well did CFAVC align and coordinate with other national and subnational initiatives on climate change, agriculture, and rural development? ● Were synergies with development partners, NGOs, and government agencies effectively leveraged?
Gender equity	● To what extent did the project contribute to gender-responsive and inclusive outcomes? ● How effectively did it address barriers faced by women, youth, and marginalized groups? ● Were gender considerations embedded in decision-making, benefit distribution, and monitoring?
Country ownership	● To what extent did the project reflect national ownership and institutional leadership? ● Were country systems, policies, and governance structures utilized in implementation and monitoring? ● Did project outcomes strengthen local capacities and sustainability?
Innovation	● What innovative technologies, practices, or financing models were introduced that demonstrated transformative potential or attracted additional climate finance?
Replication & scalability	● What lessons emerged for replicating or scaling up successful interventions? ● Which enabling conditions or contextual factors supported or constrained replication in other provinces or sectors?
Impact	● What measurable effects were observed on GHG reduction, adaptation capacity, and climate-resilient livelihoods? ● To what extent did CFAVC contribute to the intended paradigm shift toward low-emission, climate-resilient agribusiness?
Unexpected results	● What unanticipated outcomes—positive or negative—emerged during implementation? ● How did the project adapt to lessons learned or contextual changes?

1.5 Methodology

The evaluation adopted a mixed-methods approach, combining qualitative and quantitative techniques to ensure triangulation and the robustness of findings. It was participatory in nature, engaging a wide range of stakeholders and beneficiaries, and was conducted in alignment with the GCF Evaluation Policy and Guidelines. The evaluation assessed the project's TOC, progress toward intended outcomes, and examined its alignment with the GCF evaluation criteria.

Core data-collection instruments and a summary of fieldwork timing and geographic coverage are provided in Appendix 14 and 15.

1.5.1 Sampling design

The sampling design ensured broad geographic, demographic, and sectoral coverage across the four provinces and value chains, aligning with the TOR's emphasis on inclusivity, representativeness, and gender equity. A stratified purposive sampling approach was applied using beneficiary lists, stakeholder registries, and community profiles, with surveys distributed proportionally across Kampong Cham, Tboung Khmum, Kampot, and Takeo (n=288), and further stratified by value chain and gender (50% women, 50% men). KIIs were purposively selected to include project staff, government officials, agribusiness actors, development partners, GCF focal points, and NGOs, while FGDs in each province comprised 8–10 participants representing farmers, processors, women, youth, and marginalized groups, with at least half being women. Field observations were conducted at purposively chosen project sites to validate climate-resilient infrastructure, training centers, and other interventions. This multi-method approach—combining surveys, KIIs, FGDs, and site visits—reduced selection bias through stratification and clear selection criteria, while triangulation strengthened the reliability and validity of findings.

Representativeness and interpretation of survey findings. The household survey (n = 288) was designed using stratification by province and intervention exposure to ensure coverage of key program contexts rather than to generate statistically representative provincial estimates. As such, reported provincial adoption rates and commodity-level transport cost changes should be interpreted as descriptive patterns within the sampled population, not as population-level estimates with known margins of error. Confidence intervals and sampling weights were not applied because the survey was not powered for province-level inference. Findings are therefore presented to illustrate direction, relative differences, and consistency across data sources, and are triangulated with KIIs, FGDs, and secondary data where possible.

1.5.2 Data collection

The evaluation's data collection process was grounded in strong ethical standards to protect participants and ensure integrity, supported by secure data management and archiving practices. Data were collected using a combination of desk review, quantitative methods, qualitative tools, field observations, and mapping, with digital tools applied to enhance efficiency, accuracy, and reliability.

1.5.2.1 Ethical considerations

A strong emphasis was placed on upholding ethical principles throughout the evaluation. The measures below were applied to protect participants and ensure the integrity of the process.

Free, Prior, and Informed Consent (FPIC). All participants were engaged based on the principle of Free, Prior, and Informed Consent (FPIC). Evaluators clearly explained the purpose of the evaluation, the voluntary nature of participation, and the confidentiality measures in place before obtaining consent. This ensured participants were fully aware of and agreeable to their involvement.

Confidentiality and data anonymization. Strict measures were taken to safeguard the identities of participants. All sensitive data was anonymized and securely stored, ensuring that no personally identifiable information was disclosed in any reports or communications resulting from the evaluation.

Cultural sensitivity and inclusivity. The evaluation approach was adapted to the local cultural context. This included respecting community traditions, gender norms, and the specific needs of marginalized or vulnerable groups. Tools and methods were reviewed to ensure they were gender-sensitive and inclusive.

"Do No Harm" principle. Evaluators applied the "Do No Harm" approach throughout the evaluation process. This involved careful consideration to avoid reinforcing existing power imbalances, social tensions, or marginalization within the communities involved. Adherence to ethical standards. The evaluation complied with ADB's Standards of Conduct and GCF's Evaluation Policy. This included upholding high standards of integrity, professionalism, and respect throughout all evaluation activities.

Compliance with integrity protocols. The entire evaluation process aligned with ADB's integrity standards, reinforcing transparency, accountability, and ethical conduct in the handling of information and interactions with stakeholders.

Box 2. *Ethical considerations in the evaluation.*

- Free, Prior, and Informed Consent (FPIC)
- Compliance with integrity protocols
- Confidentiality and data anonymization
- Cultural sensitivity and inclusivity
- "Do No Harm" Principle

1.5.2.2 Data management and archiving

A centralized database was developed using Microsoft Access and Baserow to efficiently store, retrieve, and process quantitative data collected from individual surveys. These relational database management systems provided a user-friendly platform for managing large volumes of structured data, supporting data validation, form-based data entry, and complex queries. The database design enabled the evaluation team to link multiple tables, including household characteristics, adoption of climate-smart practices, and income changes, while maintaining data integrity and traceability. This structure facilitated efficient data cleaning, cross-tabulation, and export of datasets for further statistical analysis in SPSS or Excel. Regular backups and security measures were implemented to ensure ethical handling, data protection, and long-term archiving of all evaluation records.

1.5.2.3 Desk review

A comprehensive review was carried out on key project documents, including progress and mission reports, online materials, stakeholder maps, the Theory of Change (TOC), and the logical framework (logframe). The analysis also covered relevant policies from the GCF and ADB, along with national development plans and climate strategies. Additionally, secondary data sources (government records, GIS datasets, and Clean Development Mechanism verification reports) were examined to evaluate the resilience of project-supported infrastructure and estimate reductions in GHG emissions.

1.5.2.4 Quantitative approach

The quantitative approach involved administering surveys to a representative sample of project beneficiaries to validate reported outcomes (e.g. changes in income levels and the adoption of climate-smart agricultural practices). Additionally, the evaluation included an analysis of secondary data sources (e.g. government records, GIS datasets, and CDM verification reports) to assess the resilience of project-supported infrastructure and quantify reductions in GHG emissions.

Individual beneficiary interviews
Individual interviews were conducted to capture detailed personal experiences from beneficiaries and stakeholders. These semi-structured interviews followed a similar guide to the KIIs but focused more on individual perspectives, particularly how climate-smart practices influenced their farming activities. The interviews involved beneficiaries from the rice, maize, cassava, and mango sectors and were conducted in local languages, each lasting approximately 30 to 45 minutes. A total of 288 individuals participated in these interviews. This method provided in-depth insights into project outcomes, especially among marginalized or underrepresented groups, and reinforced the evaluation's focus on gender equity and social inclusion.

Survey questionnaire
A structured survey questionnaire was used to quantify beneficiary outcomes and validate the project's reported results. The survey was administered to 288 respondents and primarily consisted of closed-ended questions, such as "Have you adopted climate-smart practices?" or "By what percentage has your income increased?", along with a limited number of open-ended questions to capture additional qualitative insights. Surveys were conducted either in person or via mobile devices, in local languages, with trained enumerators ensuring data consistency and reliability. Informed consent was obtained, and all responses were anonymized to protect participant privacy. The survey sample was stratified by value chain and gender, covering beneficiaries across four provinces. This method generated measurable data on key outcomes (e.g. income changes and adoption of climate-smart practices) and supported the evaluation's focus on effectiveness, impact, and disaggregated analysis by gender and location.

Digital data collection using KoboToolbox
Computer-Assisted Personal Interviewing (CAPI) was used to conduct Community Perception and Awareness Interviews (CPAI) with individual households, ensuring efficient data collection and storage. Kobo Toolbox, an open-source digital platform widely used in humanitarian and development contexts, served as the primary tool for survey administration. Enumerators collected data using mobile devices, allowing real-time validation, geo-tagging, and automatic syncing to a centralized server. This digital approach minimized data entry errors, enhanced data quality and reliability, and expedited data processing for timely analysis and reporting.

1.5.2.5 Qualitative approach

The qualitative approach included semi-structured KIIs with a diverse range of stakeholders, including ADB and project staff, government officials, agribusiness enterprises, development partners, GCF focal points, and NGOs. Focus Group Discussions (FGDs) were also conducted with beneficiaries (farmers, processors, women, youth, community-based organizations, and marginalized groups) in each province to capture diverse experiences and perspectives. Additionally, participatory methods (e.g. community mapping) were employed to explore and visualize local insights on project implementation, challenges, and impacts.

Key informant interviews

KIIs were conducted to gather in-depth insights from stakeholders with specialized knowledge of the project's design, implementation, and outcomes. These semi-structured interviews followed a tailored guide with open-ended questions aligned with key evaluation criteria (relevance, efficiency, effectiveness, coherence, and innovation). Discussions explored topics, such as how the project addressed local climate risks and the challenges encountered during implementation. Each interview lasted approximately 45 to 60 minutes and was conducted either in person or virtually, with informed consent and confidentiality strictly maintained. Respondents included ADB and project staff, government officials, agribusiness enterprises, development partners, GCF focal points, and NGOs. The KIIs provided valuable expert perspectives on project governance, policy alignment, and strategic outcomes, particularly regarding country ownership and paradigm shift potential.



Figure 2. Interview with the staff of Royal University of Agriculture (RUA).

Focus Group Discussions

FGDs were conducted to explore collective perspectives and assess the community-level impacts of the project. Each session involved 8 to 10 participants (**Figure 3**) and followed a participatory discussion guide with open-ended questions, such as "How have project interventions impacted your community's farming practices?" and "Are you aware of your rights as beneficiaries?". Sessions lasted between 60 to 90 minutes and were conducted in local languages with translation support as needed. Participatory techniques (ranking exercises and community mapping) were used to encourage engagement and capture diverse viewpoints. Consent and confidentiality were ensured throughout the process. The FGDs engaged a wide range of participants, including farmers, processors, women, youth, community-based organizations, and marginalized groups, providing valuable insights into project effectiveness, beneficiary satisfaction, and gender equity in line with the participatory evaluation approach outlined in the Terms of Reference.



Figure 3. Focus group discussion with a farmer water user group.

1.5.2.6 Field observations

Field visits were carried out in selected project sites across Kampong Cham, Tboung Khmum, Kampot, and Takeo provinces to directly observe the condition of project-supported infrastructure and the implementation of agricultural practices on the ground. These visits provided an opportunity to validate reported results and assess the tangible impacts of project interventions (**Figure 4**).



Figure 4. Field observation at Ratanak Pulrath Samaki Agricultural Cooperative.

A structured observation checklist guided evaluators in systematically verifying physical outputs and outcomes, documenting the condition of infrastructure (e.g. climate-resilient roads and irrigation systems) and the application of climate-smart agricultural practices, including crop diversification and water-saving techniques. Observations also captured evidence of community engagement and participation. Photos and field notes were collected with prior consent, ensuring that no sensitive or personally identifiable information was recorded. The checklist was applied across 16 villages in the four provinces (**Table 3**), providing direct evidence of project achievements and strengthening the evaluation's

assessment of effectiveness, infrastructure resilience, and the validity of findings through triangulation with other data sources.

Table 3. Project sites visited.

Province Name	District Name	Commune Name	Village Name
Kampong Cham	Cheung Prey	Trapeang Kor	Sa Ang
	Kampong Siem	Hanchey	Hanchey
		Hanchey	Lvea Ter
	Kang Meas	Peamchikong	Damnak Chrey
Kampot	Chhuk	Baniev	Trapeang Ta Sek
		Tramaeng	Trapeang Boeng
	Dorng Tong	Damnak Sokram	Khcheay Khang Lech
		Mean Rith	Trapeang Chhouk
Takeo	Koh Andet	Krapum Chhuok	Beng
		Krapum Chhuok	Krapum Chhuok
	Tram Kak	Trapeang Kranhoung	Prey Kduoch
		Trapeang Kranhoung	Trapeang Trasom
Tboung Khum	Dambae	Chong Cheach	Cheach Koeut
		Chong Cheach	Kouk Sralao
	Tboung Khmum	Beung Pruol	Beungkambau
		Lngeang	Smounh

Box. Overall Evaluation Limitations, Mitigation Measures, and Confidence in Findings

In addition to the sampling and representativeness considerations outlined above, several non-sampling limitations should be considered when interpreting the results of this interim evaluation.

Attribution and counterfactual limitations: As an interim evaluation conducted during ongoing implementation, it is not possible to fully attribute observed changes in practices, productivity, or resilience solely to project interventions, nor to establish a robust counterfactual. External factors such as market dynamics, climatic variability, and parallel development initiatives may also influence outcomes. This limitation was mitigated through contribution analysis and triangulation across multiple qualitative and quantitative data sources.

Potential respondent and recall bias: Some findings rely on self-reported data from beneficiaries and stakeholders, which may be subject to recall bias or social desirability bias. To mitigate this, data were cross-checked through focus group discussions, key informant interviews, field observations, and review of secondary documentation where available.

Baseline and MRV data limitations: Limitations in available baseline data and monitoring, reporting, and verification (MRV) systems—particularly for greenhouse gas mitigation outcomes—constrain the ability to quantify early impacts or verify emissions reductions at this stage. Consequently, mitigation-related findings focus on enabling conditions, adoption of practices, and intermediate outcomes rather than verified emissions impacts.

Implementation-stage constraints: Delays or partial rollout of selected project components (e.g., ICT systems and full operationalization of service centers) limit assessment of systemic transformation and longer-term impacts at this stage of implementation.

Confidence in findings: Overall confidence in findings is **high** where evidence converges across multiple data sources (e.g., adoption of climate-resilient practices, beneficiary engagement, institutional arrangements); **moderate** where results are emerging but implementation is ongoing (e.g., value-chain integration and service delivery performance); and **lower** for outcomes requiring longer time horizons or more mature MRV systems (e.g., quantified GHG mitigation impacts).

Table 4. Summary of Evaluation Limitations and Confidence in Findings

Outcome area	Confidence level	Rationale
Adoption of climate-resilient practices	High	Consistent survey, FGD, and field observation evidence
Institutional coordination & service delivery	Medium	Progress observed; some components still being rolled out
Value-chain integration outcomes	Medium	Early results; market effects still evolving
Quantified GHG mitigation impacts	Low	MRV systems and baselines not yet fully operational

1.5.3 Analytical tools

The evaluation employed a comprehensive set of analytical tools and approaches designed to assess project progress, verify the credibility of results, and evaluate alignment with GCF criteria. Each tool was carefully chosen for its relevance to the evaluation objectives, ensuring robust, evidence-based findings that inform project improvements and support long-term sustainability.

1.5.3.1 Descriptive statistics

Quantitative survey data were analyzed using statistical softwares (JASP and Excel) to generate descriptive statistics, including means, percentages, and frequencies. This analysis quantified key beneficiary outcomes, such as the proportion of farmers adopting climate-smart practices or reporting changes in household income. Results provided measurable evidence of the project's effectiveness and impact, addressing evaluation questions related to adaptation progress, GHG reductions, and overall beneficiary reach. In line with the GCF Evaluation Policy's emphasis on evidence-based assessment, data from 288 survey respondents were examined to determine the percentage of farmers reporting increased climate resilience, with results disaggregated by gender and province to enable deeper and more contextual interpretation.

1.5.3.2 Theory of change validation

The TOC was evaluated for its coherence, realism, and alignment with the project's stated outputs, outcomes, and long-term paradigm shift objectives. This process included mapping reported outputs (e.g. infrastructure improvements) to their corresponding outcomes (e.g. increased agricultural productivity) and validating these causal relationships using stakeholder insights and project data. The validation served as a key step in assessing the relevance and effectiveness of the intervention, confirming whether the project's underlying logic remained sound or required adjustment. This analysis directly addressed the TOR's requirement to examine the TOC's consistency with the GCF objectives. For example, the evaluation verified whether infrastructure investments (outputs) effectively contributed to improved market access (outcomes), supported by evidence from progress reports and beneficiary survey findings.

1.5.3.3 Scorecard assessment

The evaluation used a scorecard assessment aligned with GCF investment criteria to systematically rate the strength and credibility of evidence for project outcomes and impacts. Scores were based on data quality, methodological rigor, and alignment with the Theory of Change, drawing from project reports, surveys, verifications, and GIS datasets, with each indicator assessed for completeness, reliability, and verifiability. Results were validated through triangulation with KIIs, FGDs, and field observations, and a draft scorecard was shared with ADB for review before final ratings and narrative justifications were incorporated into the report. This standardized and transparent approach ensured consistency with GCF Evaluation Guidelines and was particularly useful for evaluating effectiveness and impact—such as assessing GHG reductions through independently verified CDM reports and spatial analysis.

1.5.3.4 LogFrame target vs. Achievement analysis

The analysis compared LogFrame targets with actual achievements for key indicators such as farmers trained, CO_2e reduced, and climate-resilient infrastructure completed, using data from progress reports, surveys, CDM records, GIS datasets, and field observations. Achievement rates were calculated as percentages and rated using a four-level scale (1 = <70%, 2 = 70–80%, 3 = 81–90%, 4 = >90%). Timeliness was also assessed by comparing actual completion dates with LogFrame schedules, classifying delays as Minor (≤3 months), Moderate (3–6 months), or Significant (>6 months). Qualitative insights from KIIs and FGDs helped explain delays, including weather, procurement, and logistical issues. All performance and timeliness data were compiled into tables disaggregated by province, value chain, and gender, with gaps analyzed to understand underlying causes. This approach addressed evaluation questions on effectiveness, efficiency, and impact. The combined rating system ensured consistent assessment—for example, achieving 90% of a farmer-training target would be rated "Good," though a three-month delay would still register as a minor implementation issue. Results were summarized in the main report and supporting annexes.

1.5.3.6 Efficiency analysis

The efficiency of the project was evaluated using three complementary methods designed to assess resource utilization, cost-effectiveness, and the timeliness of outcome delivery.

Benefit-cost analysis with sensitivity analysis
The benefit-cost analysis (BCA) assessed the economic efficiency of the project by comparing total costs (e.g. expenditures on infrastructure, training, and operational activities) with quantified monetary benefits (e.g. increased farmer incomes, reduced climate-related losses, and the value of GHG emission reductions). Cost data were obtained from project financial reports, while benefits were estimated using survey results on income gains, secondary sources (e.g. crop market prices, and standard valuation approaches). The analysis produced a benefit-cost ratio (BCR) by dividing total benefits by total costs, where a BCR greater than 1 indicated that the project generated positive economic returns.

A sensitivity analysis was also conducted to test the robustness of results by varying key assumptions, including discount rates, benefit estimates, and cost projections. This helped to capture potential uncertainties and present a range of BCR outcomes under different scenarios, providing a more nuanced understanding of the project's economic performance and risk exposure.

The findings were summarized in a comparative table showing BCR results across multiple scenarios, complemented by qualitative insights from KIIs and FGDs. These perspectives enriched the analysis by illustrating beneficiaries' views on economic benefits and implementation challenges. Overall, the BCA provided a transparent measure of value for money and resource utilization, supporting the evaluation's efficiency criterion and guiding future investment decisions on scalability and sustainability.

Timeliness of achieving targets
The assessment of timeliness in achieving LogFrame targets was integrated into the broader LogFrame Target versus Achievement Analysis. For each indicator, actual completion dates were compared with the planned timelines specified in the LogFrame to determine whether implementation occurred as scheduled. This enabled the evaluation team to identify deviations from the original plan and assess the extent to which project activities were completed on time.

A summary table was developed to present timeliness alongside achievement rates and performance ratings, offering a consolidated view of implementation progress. Delays were analyzed using qualitative data from KIIS, including feedback from project staff on procurement and logistical constraints, and quantitative data from progress reports. The analysis also examined how delays influenced project efficiency, such as by increasing costs or reducing the timeliness of benefits delivered to beneficiaries. Key data sources for this assessment included the LogFrame, progress reports, KIIs, FGDs, and beneficiary surveys.

1.5.3.7 Mapping

Delineating rice production areas was a critical step in estimating the project's GHG emissions, as these areas (**Figure 5**) defined the spatial boundaries for clipping data generated from Google Earth Engine (GEE), including GHG emission estimates and Normalized Difference Water Index (NDWI) values. The delineation process used Sentinel-2 imagery accessed through GEE, where a clustering algorithm classified land cover types based on spectral signatures derived from Sentinel-2 and MODIS datasets. This classification was further refined in QGIS using training points obtained from geotagged field photos and visual interpretation of high-resolution imagery from Google Earth Pro. These reference points guided the assignment of Digital Numbers (DN) to spectral bands represented as pseudocolors in QGIS. Rice production areas were then extracted using the Raster Calculator in QGIS by isolating DN values corresponding to rice fields, resulting in a raster map that served as the analytical base layer for subsequent GHG and NDWI analyses.

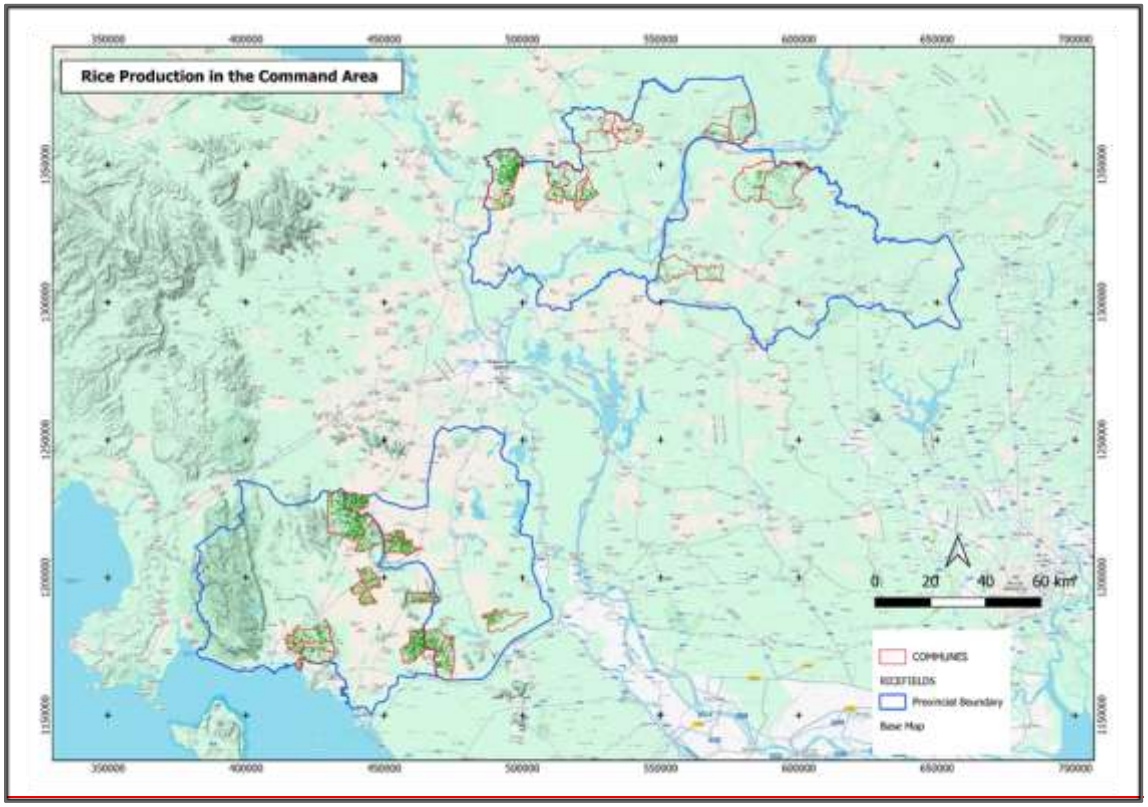


Figure 5. Raster map of identified rice production areas derived from cluster analysis and training points.

1.5.4 Evaluation Limitations and Implications for Findings

This interim evaluation applied a mixed-methods approach designed to balance rigor with feasibility during project implementation. While the methodology is appropriate for an interim assessment, several limitations should be noted when interpreting the findings.

First, as noted in Section 1.5.1, quantitative survey results are intended to identify descriptive patterns and trends among sampled beneficiaries and should not be interpreted as statistically representative at the provincial or national level. No confidence intervals or weighting were applied. To mitigate this limitation, findings were systematically triangulated with qualitative evidence from key informant interviews, focus group discussions, field observations, and secondary sources.

Second, limitations in available baseline and monitoring data—particularly related to greenhouse gas (GHG) mitigation and MRV systems—constrain the ability to quantify early mitigation outcomes or attribute observed changes directly to project interventions. As a result, findings related to climate mitigation focus on progress toward enabling conditions, adoption of practices, and intermediate outcomes rather than verified emissions reductions.

Third, as an interim evaluation conducted during ongoing implementation, the analysis is subject to attribution and counterfactual limitations. Observed changes in practices, productivity, or resilience may be influenced by external factors such as market conditions, weather variability, or parallel development initiatives. The evaluation therefore emphasizes contribution analysis rather than causal attribution.

Fourth, implementation-stage constraints, including delayed rollout of selected components (e.g., ICT systems and full operationalization of service centers), limit assessment of systemic transformation and longer-term impacts at this stage. Conclusions related to paradigm shift potential should therefore be interpreted as preliminary.

Overall, confidence in findings is highest where multiple data sources converge (e.g., adoption of agricultural practices, beneficiary engagement, institutional arrangements), moderate where evidence is emerging but incomplete (e.g., value-chain integration outcomes), and lower for outcomes requiring longer time horizons or more reliable MRV systems (e.g., quantified GHG impacts).

2.0 Description of the respondent groups

The evaluation engaged key stakeholder groups involved in or affected by the CFAVC Project. These included project beneficiaries, implementing agencies, local authorities, development partners, and private sector actors across the four target provinces. Respondent selection covered different value chains, institutional roles, and community contexts within the project areas.

Fieldwork was conducted in selected districts, communes, and villages through surveys, interviews, and focus group discussions. Individual farmer interviews represented the four priority value chains, with an average of five to eight respondents per village. Both male and female farmers were included, ensuring at least 50% female participation in accordance with the project's gender inclusion targets.

Box 3. *Key respondent groups.*

Agribusinesses, traders, and processors. Respondents included corporate and community-based agri-traders, cooperatives, and processors engaged in the four value chains. These interviews helped assess value chain linkages, market access, and private sector participation in climate-friendly agribusiness models.

Community-based groups. Farmer Water User Communities (FWUCs) and Agricultural Cooperatives participated in FGDs to discuss collective management practices, benefits from infrastructure investments, and challenges in sustaining operations.

Development partners and NGOs. Representatives from FAO, IFAD, and GIZ were interviewed to provide an external perspective on coordination, technical support, and complementarity with other donor programs. National NGOs shared their experiences in community mobilization, training, and extension support.

Farmer beneficiaries. The largest respondent group consisted of direct project beneficiaries across multiple intervention types, including irrigation schemes, rainwater harvesting ponds, drip irrigation demonstrations, land leveling, biodigesters, compost huts, and model demonstration farms. Farmers were categorized by value chain (rice, maize, cassava, mango) to capture differentiated livelihood outcomes and technology adoption levels.

Government agencies and research institutions. Officials from MAFF, MRD, and MOWRAM provided policy and implementation perspectives. Technical experts from CARDI and the Royal University of Agriculture (RUA) contributed insights on research, innovation, and capacity development under the project.

Local authorities. Commune and village chiefs participated in interviews and focus group discussions to validate project impacts at the local level and provide feedback on governance, community participation, and sustainability mechanisms.

Logistics and transport operators. Logistics providers and transport operators were consulted to understand constraints in the farm-to-market chain, transport efficiency, and potential low-carbon transport solutions supporting agricultural trade.

Model farmers. Selected case studies highlighted individual model farmers and cooperatives that demonstrated successful adoption of climate-smart technologies across the four value chains. These cases provided deeper insights into adaptive capacity, knowledge transfer, and sustainability outcomes.

Project staff and implementing partners. Respondents comprised representatives from the Project Management Unit (PMU), Implementing Agencies (IA) under MAFF, MRD, and MOWRAM, as well as Provincial Project Implementation Units (PPIUs) in Takeo, Kampot, Kampong Cham, and Tboung Khmum. Project finance officers, and the Program Advisor also participated in the evaluation.

2.1 Socioeconomic profile of beneficiaries

Understanding the socioeconomic characteristics of project beneficiaries provides insight into whether project strategies, training modules, and livelihood activities were suited to the local population. Most participants were older adults, underscoring the importance of designing activities that are practical and accessible. Household leadership patterns showed that men held more decision-making roles, suggesting a need for gender-sensitive measures to ensure equitable participation and benefit-sharing. Education levels were generally low, reinforcing the need for simple, skills-based training approaches. The average household size and composition further reflect typical rural family structures, with responsibilities often shared among multiple family members. Among the 288 households surveyed, gender representation was relatively balanced, with 151 females (52.4%) and 137 males (47.6%) (**Table 5**).

Table 5. Demographic and Household Characteristics of Survey Respondents

	Female	Male	Total
Age Category			
• <40 years (Younger adults)	7.3%	6.9%	14.2%
• 40 - 51 years (Early middle-aged)	20.1%	15.6%	35.8%
• 52 - 63 years (Late middle-aged)	17.7%	14.2%	31.9%
• >63 (Older adults / seniors)	7.3%	10.8%	18.1%
Position in the HH			
• HH Head	15.3%	46.2%	61.5%
• HH Member	37.2%	1.4%	38.5%
Education of Respondents			
• No formal education	11.1%	4.2%	15.3%
• Primary school	27.8%	22.6%	50.3%
• Lower secondary	10.8%	16.0%	26.7%
• Upper secondary	2.1%	4.2%	6.3%
• Post-secondary / Vocational	0.3%	0.3%	0.7%
• University or higher	0.3%	0.3%	0.7%
HH Size			
• 1–2 members (Single / Couple)	5.2%	3.8%	9.0%
• 3–4 members (Small household)	20.1%	20.1%	40.3%
• 5–6 members (Medium household)	18.8%	16.7%	35.4%
• 7+ members (Large household)	8.3%	6.9%	15.3%
Total	N=151	N=137	N=288

Source: HH survey

Age. Respondents are predominantly in the working-age bracket, with early middle-aged adults (40–51 years) forming the largest group (35.8%), followed by late middle-aged (52–63 years) at 31.9%. Younger adults (<40 years) account for 14.2%, while older adults/seniors (>63 years) represent 18.1%. This indicates a mature respondent base, suggesting

accumulated livelihood experience but also potential vulnerability to age-related livelihood constraints.

Household role. Household heads make up 61.5% of respondents, disproportionately male (46.2% of total respondents). Women more often participated as household members (37.2%), which may reflect traditional gender roles in household decision-making and could influence access to project benefits.

Education. Educational attainment is concentrated at the primary level (50.3%), with 26.7% reaching lower secondary. Only 7.7% have attained upper secondary or higher education. A notable 15.3% reported no formal schooling, which may limit engagement in technical training or participation in complex project activities unless tailored support is provided.

Household size. Most respondents live in small (3–4 members, 40.3%) or medium-sized (5–6 members, 35.4%) households. Large households (7+ members) comprise 15.3%, while single/couple households are least common at 9.0%. Household size may affect resource needs, participation in livelihood interventions, and the ability to adopt new technologies.

2.2 Economic livelihood structure and income distribution of project beneficiaries

The analysis of beneficiaries' livelihood structures and income distribution was crucial for assessing the socioeconomic context of the CFAVC Project. Most households depended primarily on farming as their main source of income, indicating the need for agricultural interventions that are both climate-resilient and effectively connected to value chains to improve income growth. Non-farm income among higher-earning households showed the value of livelihood diversification in enhancing resilience and reducing exposure to climate risks. Gender-disaggregated data revealed that women were largely engaged in lower-income activities such as livestock rearing and farm labor, highlighting the need for targeted measures to improve women's access to resources, participation in value-added activities, and overall economic empowerment.

2.2.1 Household livelihood composition

Households adopted mixed livelihood strategies focused on rice cultivation, vegetable production, and livestock rearing, based on the KIIs with farmers. Rice served as both a staple food and a primary cash crop, typically grown twice a year with average yields of 5 to 7 tons per hectare. Farmers sold rice to local traders at about 800,000 riels ($200) per ton, ensuring steady cash flow while reducing marketing effort. Home gardens producing vegetables such as tomato, cucumber, pumpkin, and beans contributed to household consumption and small-scale income. Many farmers also planted cash crops including maize, cassava, mango, pepper, cashew, rubber, and watermelon, which helped diversify income and reduce vulnerability to production and market fluctuations.



Figure 6. Rice, corn, cassava, and mango farms under the CFAVC Project.

2.2.2 Household income distribution

The household survey shows marked income disparities across the 288 respondents, with 38.7% in the high-income bracket (>USD 200/month), 29.5% in the upper-middle bracket (USD 76–200), 19.8% in the lower-middle bracket (USD 31–75), and 12.0% in the low-income bracket (<USD 31), reflecting varied economic resilience (**Table 6**). Farming contributed nearly half of total income (48.5%), supplemented by livestock and poultry raising (15.8%), employment (12.0%), and smaller livelihood activities such as non-farm labor, remittances, trading, and aquaculture. KIIs confirmed that crop-based earnings vary widely—from USD 25–800/month for rice, up to USD 520 for mango, and smaller but important contributions from maize, pepper, cashew, rubber, vegetables, and watermelon—depending on land size, market access, and irrigation. Cooperative interviews highlighted the role of collective marketing and diversified production in stabilizing incomes: cooperatives in Kampong Cham and Takeo combined rice, vegetable production, and poultry to boost earnings, while those in Tboung Khmum achieved the highest household incomes (up to USD 375/month) through mixed crop–livestock systems and small trading. FGDs reinforced that livelihood diversification is essential for managing seasonal and climate-related shocks, as secondary income sources help smooth consumption, reduce vulnerability, and strengthen overall household economic resilience.

Table 6. Primary Household Income Sources by Income Bracket

Income Source	Low income(<31 USD)	Lower-middle income(31 – 75USD)	Upper-middle income(76 – 200USD)	High income(>200USD)	Total
Farming	5.0%	11.5%	15.4%	16.6%	48.5%

Income Source	Low income(<31 USD)	Lower-middle income(31 – 75USD)	Upper-middle income(76 – 200USD)	High income(>200USD)	Total
Livesotck & Poultry Raising	5.5%	5.7%	3.0%	1.5%	15.8%
Employment	0.3%	0.0%	3.5%	8.2%	12.0%
Business	0.0%	0.6%	1.6%	4.2%	6.4%
Non-Farm Labor	0.3%	0.3%	1.3%	4.3%	6.1%
Remittance	0.5%	0.6%	2.8%	1.1%	5.0%
Farm Labor	0.3%	0.6%	1.8%	1.9%	4.5%
Agri Processing	0.0%	0.0%	0.0%	0.5%	0.5%
Agri Trading	0.0%	0.0%	0.1%	0.4%	0.5%
Fishing & Aquaculture	0.1%	0.3%	0.0%	0.0%	0.4%
Others	0.0%	0.3%	0.0%	0.0%	0.3%
Total	12.0%	19.8%	29.5%	38.7%	100.0%

Source: HH survey

2.2.3 Livestock Raised

Livestock rearing—particularly cattle, pigs, and poultry—was reported through KIIs and household surveys as a widespread and essential livelihood activity across the four provinces, providing income, food, and organic fertilizer. Monthly livestock income ranged from USD 10 to 600, underscoring its role in household stability and resilience. Survey results further highlight significant variation by species and province: cattle ownership was relatively consistent at 5.6–6.7 heads per household, reflecting its traditional role, while pig holdings averaged 10.4 heads, with Tboung Khmum highest at 17.9 and Takeo lowest at 5.4. Poultry production showed the greatest disparity, averaging 62.5 birds per household but reaching 228.6 birds in Tboung Khmum compared with 30.6–48.3 in other provinces. These patterns (**Table 7**) indicate strong market potential—especially in Tboung Khmum—and emphasize the value of integrating climate-smart livestock practices with crop systems, using high-density provinces as demonstration sites for scaling and cross-provincial learning.

Table 7. *Average number of livestock and poultry raised per household by province.*

Animals	Kampong Cham	Kampot	Takeo	Tboung Khum	Average no. of heads
Cow	5.6	5.7	5.9	6.7	6.0
Pigs	10.0	7.5	5.4	17.9	10.4
Poultry	30.6	48.3	37.5	228.6	62.5

Source: Household survey

2.3 Participation in local organizations for collective and climate-resilient development

The household survey showed strong community participation and collective organization among respondents. Most households reported membership in at least one local organization, reflecting a high level of social engagement that supports collective action and community-led development. Agricultural cooperatives had the highest membership rate at 66.3 percent (34.7% women, 31.6% men) (**Table 8**), confirming their central role in promoting collective marketing and access to inputs. Farmer groups, involving 48.3 percent

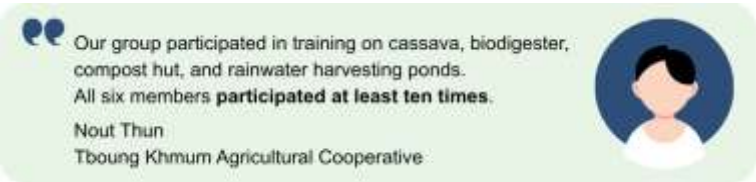
of respondents, provided essential platforms for peer learning and technology adoption, enabling coordinated farming practices across communities. Savings and credit groups, with 30.2 percent participation (19.1% women, 11.1% men), highlighted women's strong role in local financial systems and enterprise development. The prevalence of these cooperative and group affiliations underscores the project's coherence and effectiveness in leveraging existing local structures for coordinated and context-specific interventions. However, limited youth participation indicates a need for more targeted strategies to engage young people in climate-resilient agriculture, innovation, and cooperative leadership.

Table 8. *Household membership in community-based organizations by gender.*

Group membership	Female	Male	Total
Agricultural cooperative	34.7%	31.6%	66.3%
Farmer group	26.0%	22.2%	48.3%
Not a member of any group	5.2%	4.5%	9.7%
Saving group / Credit group	19.1%	11.1%	30.2%
Farmer water user group	8.0%	8.3%	16.3%
Women's group	2.8%	0.3%	3.1%
Youth group	0.3%	0.3%	0.7%
Total	52.4%	47.6%	100.0%

Source: Household survey

Key informant interviews with cooperative members provided deeper insight into how these organizations drive collective learning and capacity building. In Kampong Cham's Akphivath Kaksikor Cooperative, members received training on agricultural techniques, market research, and price negotiation, and organized collective rice purchasing and financial management through regular meetings. Similarly, members of Akphivat Samaky Phum 3 Cooperative in Takeo participated in training on compost production, agricultural techniques, and market access, including study visits that reinforced peer learning. In Kampot's Poloeu Kaksekor Srok Chhouk Agricultural Cooperative, members benefited from technical support from the Ministry of Agriculture on seed selection, soil preparation, water management, and business planning. In Tboung Khmum's Cooperative, all 6 members actively joined multiple training and demonstration sessions on cassava cultivation, biodigester use, compost huts, and rainwater harvesting, reflecting strong ownership and responsiveness to project activities. Together, these initiatives strengthened farmers' technical knowledge, promoted the adoption of climate-resilient practices, and fostered innovation through low-emission technologies that enhance productivity and sustainability.



3.0 Findings

The project has demonstrated strong relevance, effectiveness, and alignment with Cambodia's national strategies for agricultural modernization and climate resilience. Its interventions have enhanced productivity, infrastructure, and institutional capacity across four key value chains, resulting in significant gains in crop yields, farmer incomes, and GHG reductions that exceeded targets. The project has also advanced gender equality, with women achieving equal or greater livelihood benefits and assuming leadership roles in cooperatives and Farmer Water User Committees. Efficiency analysis confirmed sound fiscal

performance and high cost-effectiveness, while coherence among MAFF, MOWRAM, MRD, and MEF ensured policy and implementation synergy. Although some infrastructure and digital systems remain incomplete, CFAVC has catalyzed a clear shift toward low-emission, market-oriented, and inclusive agribusiness, establishing a scalable model for climate-smart rural transformation. Continued investment in renewable energy, green finance, and institutional capacity will be essential to sustain and expand these impacts beyond the current implementation period.

3.1 Relevance

The project demonstrated strong relevance to Cambodia's agricultural and climate adaptation priorities, effectively aligning its objectives with both local needs and national strategies for climate-resilient agribusiness. Its activities were widely regarded as contextually appropriate, practical, and transformative, with evidence of high awareness, training participation, and adoption of improved farming practices. Interventions such as irrigation, roads, and storage facilities addressed long-standing productivity and market constraints, while capacity-building initiatives strengthened knowledge and adaptation behaviors. Despite these gains, gaps remain in material support and equitable access to resources, particularly in areas with weaker water infrastructure and market connectivity, indicating opportunities for deeper targeting and sustained local ownership.

Stakeholder engagement in design. The overall project design was shaped through coordination among provincial departments (MAFF, MOWRAM, and MRD) in collaboration with CARDI, ensuring institutional alignment and consistency with national development goals. Findings from KIIs with agricultural cooperatives from Kampong Cham and Tboung Khmum indicated that climate-smart technologies (biodigesters and compost huts) were incorporated into design plans to promote sustainable resource use; however, early engagement gaps were observed, particularly the limited participation of beneficiaries during initial consultations. This limited participation resulted in limited early feedback. The experience highlights the need for participatory design processes that integrate both institutional and community perspectives to ensure greater inclusiveness. These insights underscore the importance of adopting participatory design processes that balance institutional planning with community input to enhance inclusiveness and responsiveness.

Participation and reach. Household engagement in the project was extensive, confirming strong outreach and visibility. Awareness reached 87.2%, participation 84.0%, and training attendance nearly universal at 95.8% (**Table 9**). However, only 35.4% of households reported receiving direct project support, revealing a gap between knowledge diffusion and tangible input delivery. Participation was particularly high in climate-smart agriculture training (83.0%), while technology adoption—including biodigester or compost hut use—stood at 35.4%, indicating potential to translate learning into broader uptake (**Table 10**). Provincial patterns highlight areas for further strengthening: participation exceeded 90% in Kampong Cham and Takeo but dropped to 77.3% in Tboung Khmum, where logistical and irrigation constraints limited engagement. Overall, the participation data confirm robust coverage but highlight a need to deepen support mechanisms that convert awareness into material benefits and long-term resilience outcomes.

Table 9. Beneficiary Awareness, Participation, and Perception of the CFAVC Project

	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
Respondents	84	48	46	110	288
HEARD CFAVC					
Not Heard About CFAVC	6.0%	12.5%	10.9%	19.1%	12.8%

	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
Heard About CFAVC	94.0%	87.5%	89.1%	80.9%	87.2%
HH MEMBERS PARTICIPATED THE PROJECT					
Did Not Participate	2.4%	4.2%	2.2%	3.6%	3.1%
Participated	91.7%	83.3%	87.0%	77.3%	84.0%
ATTENDED TRAINING					
Did Note Attend Any Training	0.0%	6.3%	2.2%	7.3%	4.2%
Attended Trainings	100.0%	93.8%	97.8%	92.7%	95.8%
RECEIVED PROJECT SUPPORT					
Did Not Receive Proj Support	67.9%	45.8%	56.5%	73.6%	64.6%
Received Proj Support	32.1%	54.2%	43.5%	26.4%	35.4%
INVOLVED IN DEMO FARM					
Not Involved in Demo Farm	57.1%	54.2%	50.0%	59.1%	56.3%
Involved in Demo Farm	42.9%	45.8%	50.0%	40.9%	43.8%
MEMBER OF FARMER GROUPS					
Non-Member	21.4%	27.1%	13.0%	24.5%	22.2%
Member	78.6%	72.9%	87.0%	75.5%	77.8%
PROJECT ADDRESSED HH NEED PERCEPTION					
Agree	77.4%	64.6%	65.2%	75.5%	72.6%
Disagree	0.0%	2.1%	0.0%	0.0%	0.3%
Neutral	7.1%	12.5%	10.9%	6.4%	8.3%
Strongly agree	11.9%	20.8%	19.6%	14.5%	15.6%
RELEVANCE OF PROJECT					
I don't know	0.0%	2.1%	2.2%	0.0%	0.7%
Somewhat relevant	78.6%	56.3%	50.0%	75.5%	69.1%
Very relevant	21.4%	41.7%	47.8%	24.5%	30.2%
PROJECT SUITED TO SOLVE FARMING PROBLEMS					
Agree	85.7%	64.6%	73.9%	81.8%	78.8%
Disagree	1.2%	0.0%	0.0%	0.9%	0.7%
Neutral	4.8%	12.5%	6.5%	10.9%	8.7%
Strongly agree	8.3%	22.9%	19.6%	6.4%	11.8%

Source: HH survey

Table 10. Types of Beneficiary Participation in CFAVC Project Activities

ACTIVITIES PARTICIPATED	Kampong Cham	Kampot	Takeo	Tboung Khum	TOTAL
Respondents	84	48	46	110	288
Climate-smart agriculture training	86.9%	72.9%	87.0%	82.7%	83.0%
Use of biodigester or compost hut	31.0%	35.4%	43.5%	35.5%	35.4%

ACTIVITIES PARTICIPATED	Kampong Cham	Kampot	Takeo	Tboung Khum	TOTAL
Participated in meetings or awareness events	21.4%	66.7%	30.4%	29.1%	33.3%
Land leveling or soil management demo	27.4%	31.3%	39.1%	30.9%	31.3%
Part of farmer groups or cooperatives	26.2%	22.9%	19.6%	22.7%	23.3%
Use of drip irrigation or rainwater harvesting	20.2%	14.6%	10.9%	25.5%	19.8%
Received financial or technical support	15.5%	16.7%	17.4%	10.9%	14.2%
Chicken raising training	1.2%	0.0%	0.0%	0.0%	0.3%
None	0.0%	2.1%	2.2%	6.4%	3.1%

Source: HH survey

Information channels and coherence. Information dissemination relied primarily on localized, interpersonal channels that reinforced trust and alignment with community structures. Community meetings (63.5%) and agricultural cooperatives or farmer groups (26.0%) were the dominant sources of project information, while only 0.7% of households cited radio and 0.3% posters as sources (**Table 11**). This pattern reflects an intentional focus on face-to-face engagement, which facilitated contextualized learning and credibility among farmers. Cooperative and focus group accounts confirmed that departmental staff and commune authorities regularly provided technical guidance, ensuring coherence with local governance and extension systems (FGD, Akphivat Samaky Phum 3; FGD, Tboung Khmum). However, the limited use of mass or digital media constrained outreach to remote or less networked households; diversifying communication methods could strengthen inclusivity without undermining local engagement.

Table 11. *Sources of information about CFAVC.*

Source	Kampong Cham	Kampot	Takeo	Tboung Khum	Average
Community meeting	72.60%	60.40%	65.20%	57.30%	63.50%
Agricultural cooperative or farmer group	23.80%	39.60%	17.40%	25.50%	26.00%
Project staff or government official	13.10%	33.30%	43.50%	17.30%	22.90%
Other farmers	21.40%	14.60%	6.50%	20.90%	17.70%
Village chief or commune official	8.30%	25.00%	19.60%	15.50%	15.60%
Radio or loudspeaker	0.00%	2.10%	2.20%	0.00%	0.70%
Posters or leaflets	0.00%	2.10%	0.00%	0.00%	0.30%

Source: Household survey

These results indicate strong awareness, participation, and positive perceptions of the CFAVC Project, underscoring its relevance to local agricultural and household needs. Nonetheless, disparities in support distribution and demo farm participation highlight the need for more inclusive and equitable implementation across target areas.

Appropriateness of activities and unmet needs. Project interventions were widely viewed as addressing key agricultural needs, particularly through improvements in roads, storage, and irrigation infrastructure. Findings from key informant interviews with agricultural cooperatives showed that communities prioritized continued investment in canals, reservoirs, and rainwater ponds to stabilize dry-season water supply and enable double-cropping. Training on agronomy, seed selection, and fertilizer and water management remained in high demand, along with broader dissemination of biodigesters and compost huts to reduce production costs. While many households shifted from scarcity to surplus through better storage and diversified production, land-poor and wage-dependent families continued to experience livelihood instability, highlighting the need for stronger market linkages and

access to affordable finance. In some areas, laser land leveling improved productivity but raised localized concerns about dam pressure and corridor stability, underscoring the importance of site-specific engineering solutions suited to local conditions.



Figure 7. Rehabilitated rural road under the CFAVC Project.

Irrigation relevance and system performance. Irrigation improvements were highly relevant, contributing to productivity and resilience gains. Key informant interviews with farmer beneficiaries indicated that rainwater ponds and canals enabled two to three cropping cycles per year and yield increases of four to five tons per hectare, while drip and hose systems reduced labor and improved water control. However, system coverage reached only 70-80% of needs in many areas due to shallow reservoirs and maintenance gaps. Communities prioritized secondary canals and deeper ponds to ensure equitable, year-round access. FWUC leaders reported that sites with complementary investments and operation and maintenance training has achieved fairer water distribution and stronger collective management. These findings highlight irrigation's central role in project relevance and the need for continued investment in water infrastructure and governance.



Figure 8. Irrigation infrastructure under the CFAVC Project.

Adoption of improved practices. Behavioral change is among a key indicator of project relevance. Overall, 89.2% of respondents reported adopting new farming practices, with the highest uptake in Kampong Cham (94.0%), followed by Kampot (91.7%) and Takeo (91.3%) (**Table 12**). Although Tboung Khmum recorded the lowest adoption rate (83.6%), its larger

respondent base significantly influenced the overall average. These patterns indicate broad behavioral shifts toward climate-smart agriculture, moderated by geographic variations linked to irrigation access and extension support. The findings affirm the project's relevance and effectiveness in promoting adaptive practices while identifying areas requiring stronger follow-up interventions.

Table 12. *Adoption of improved farming practices by province.*

Change in practices	Kampong Cham	Kampot	Takeo	Tboung Khum	Weighted Average
Changed farming practices	94.00%	91.70%	91.30%	83.60%	89.20%
No change in farming practices	6.00%	8.30%	8.70%	16.40%	10.80%
Total	84	48	46	110	288

Source: Household survey

Governance, monitoring, and adaptive management. Institutional arrangements at the cooperative level contributed to effective project coordination and strengthened community ownership of activities. Insights from FGDs in Tboung Khmum and KII with agricultural cooperatives showed clear role delineation, regular meetings, and structured problem-solving processes that enabled adaptive management and timely decision-making. Complementary findings from KIIs with agricultural cooperatives indicated that monitoring systems were in place across provinces, with baselines established and progress tracked quarterly, most consistently in Takeo, allowing for timely adjustments in response to implementation challenges. While these systems enhanced efficiency, delays in resource disbursement and inconsistent communication among agencies occasionally disrupted progress. Improving coordination and ensuring timely fund releases would help sustain performance and reinforce trust in project implementation.

3.1.1 Alignment with national priorities

The project demonstrated strong country ownership through close alignment with national priorities under the Agriculture Sector Strategic Development Plan (2014–2018) and collaboration with key government institutions (MAFF, MRD, and MOWRAM). The use of existing government systems for agricultural extension, irrigation management, and rural infrastructure delivery ensured institutional anchoring within Cambodia's public sector while contributing to frameworks such as Public–Private Partnerships (PPP) and Good Agricultural Practices (GAP) standards that support climate-resilient agribusiness and sustainable rural development. Capacity building and extension activities enhanced local skills and farmer ownership of climate-smart practices, with over 95% of respondents reporting improved farming skills, 52.4% slightly and 43.1% significantly (**Table 13**), indicating broad knowledge transfer. However, the shift to fully climate-smart systems remains gradual, as most farmers reported only moderate (42.7%) or small (27.8%) changes, and only 2.1% reported a full transition, highlighting the need for continued technical support. The most notable improvements were in post-harvest handling (23.6%), adoption of climate-resilient practices (22.2%), and market access (18.4%), with Tboung Khmum (38.2%) showing the strongest progress due to effective provincial coordination. Economically, 42% of respondents reported higher incomes, followed by 13.2% citing adoption of climate-friendly techniques and 9.7% improved market access, reflecting greater financial stability and reinvestment capacity. Local leadership and cooperative structures, particularly farmer groups, commune chiefs, and local authorities, played a central role in sustaining engagement, managing irrigation, and mobilizing resources. This collaborative model strengthened accountability and ensured that interventions were locally owned and managed. However, only 2.8% of respondents reported influencing others to adopt similar practices, suggesting that while individual ownership is strong, peer learning and replication remain limited. Expanding

cooperative-led training and exchange programs is recommended to strengthen community-wide adoption and sustain long-term impact.

3.1.2 Alignment with local needs

The project demonstrated a strong alignment with local needs and effectively leveraged community-based systems to deliver contextually relevant agricultural solutions. Cooperative networks, local authorities, and provincial departments played active roles in implementation, contributing to sustained community engagement and adaptive problem-solving. High levels of perceived relevance, skill improvement, and practice change suggest that interventions addressed most livelihood and productivity constraints. However, gaps persist in infrastructure, technology access, and input delivery, particularly in irrigation and market connectivity. Gender-disaggregated data further reveal that women benefited equally and in some cases, more than men. This underscores positive equity effects of inclusive outreach and training.

Country ownership and use of local systems. The project's integration with local governance and agricultural structures reflected strong institutional alignment and country ownership. Insights from an FGD with Poloeu Kaksekor Srok Chhouk in Kampot showed that when farmers faced production or marketing challenges, they could readily seek advice and solutions from within their communities, demonstrating how local systems facilitated effective problem-solving. Complementary findings from a KII with agricultural cooperatives indicated that the involvement of the Provincial Department of Agriculture, Forestry, and Fisheries (PDAFF) and CARDI strengthened provincial coordination and responsiveness to local priorities. This integration anchored the project within established institutional networks and enhanced the sustainability of project outcomes.

Alignment with community priorities. Most respondents viewed the project as well aligned with their priorities, with 46.5% reporting that it met most of their needs and 47.9% saying it did so partially, while only 1.0% felt it did not address their key challenges and 4.5% were unsure. Female respondents were slightly more likely to report partial alignment (27.4%) than males (20.5%), indicating some variation in perceived benefits. Perceptions of the project's contribution to long-term goals were also positive, with 77.8% rating its performance as "very well" (34.4%) or "somewhat well" (43.4%), while 17.7% were neutral and 4.5% uncertain—reflecting broad satisfaction with its sustainability and responsiveness. KIIs with agricultural cooperatives reinforced these findings, highlighting water access, irrigation for double-cropping, rural roads, and storage as high-value interventions. However, some cooperatives, such as Poloeu Kaksekor Srok Chhouk in Kampot, felt only about 70% of their needs were met due to gaps in access roads, biogas systems, and improved seed varieties, underscoring the need for deeper consultation and more targeted resource allocation in future phases.



Capacity and behavioral change. Training and extension activities led to widespread improvements in household farming skills and practices. Most households (95.5%) reported improved skills, with 43.1% noting significant gains and 52.4% slight gains (**Table 13**). Changes in farming practices were also reported by 95.5% of households, with moderate improvements most common (42.7%), followed by small changes (27.8%), major changes (22.9%), and complete transformation (2.1%). These shifts were accompanied by broader outcomes, including higher income for 42.0% of households, regular use of climate-friendly techniques by 13.2%, better market access for 9.7%, and 2.8% of households influencing others to adopt improved farming methods.

Table 13. Perceived Project Contribution to Long-Term Goals and Farming Practice Change

	Female	Male	Total
Respondents	151	137	288
Farming Skill Improvement Trend			
• No, no noticeable change	1.0%	2.4%	3.5%
• Not sure / Don't know	0.7%	0.3%	1.0%
• Yes, significantly	21.5%	21.5%	43.1%
• Yes, slightly	29.2%	23.3%	52.4%
How Project Changed Community Farming Methods			
• Complete transformation (farming is now very different and more climate-friendly)	1.4%	0.7%	2.1%
• Major change (clear shift in practices and outcomes)	12.8%	10.1%	22.9%
• Moderate change (several noticeable improvements)	23.3%	19.4%	42.7%
• No change at all	1.4%	3.1%	4.5%
• Small change (some minor improvements)	13.5%	14.2%	27.8%
Change Indicators			
• I earn more income now	23.6%	18.4%	42.0%
• I have better access to markets or buyers	5.9%	3.8%	9.7%
• I teach or influence others to change their farming methods	0.7%	2.1%	2.8%
• I use improved climate-friendly techniques regularly	7.3%	5.9%	13.2%

Source: HH survey

These findings indicate early success in driving first-generation adoption of climate-smart practices and productivity-enhancing methods. However, insights from KIIs with agricultural cooperatives indicated that sustaining and deepening these changes will require continued technical assistance, reliable irrigation, and improved market integration.

Gender outcomes. Gender analysis shows that women and men benefited similarly from the project, with women slightly outperforming men in some outcomes. Significant skill improvement was reported by 21.5% of both women and men, while slight skill gains were more frequently reported by women at 29.2% compared with 23.3% of men. Women also reported marginally higher shares of major or complete transformation in farming practices. A greater proportion of women experienced increased income, 23.6% compared with 18.4%

of men, and more women reported strong contributions to long-term goals, 20.5% compared with 13.9% of men. These results indicate progress in narrowing gender gaps in skills, farming practices, and economic outcomes.

Sustainability and market readiness. The strongest capacity gains were observed in areas directly supporting long-term sustainability and market participation. Households reported the greatest improvements in post-harvest handling and storage (23.6%), use of climate-resilient practices (22.2%), and market access or linkages (18.4%). Gains in the use of new equipment or technology (14.2%) and financial or record-keeping skills (13.5%) indicate enhanced operational readiness for commercial agriculture. Diffusion of knowledge remains limited, with only 2.8% of households reporting that they influenced others to adopt new methods. Scaling peer-to-peer extension and cooperative-led mentoring could transform early adopters into knowledge multipliers, supporting continuity and expansion of project impacts beyond direct beneficiaries.

Implementation signals from the field. Farmers consistently linked reservoirs, canals, and roads to lower production costs, improved water availability, and better market access. Insights from key informant interviews with agricultural cooperatives indicated that biodigesters and compost huts were important innovations that reduced input costs and supported health outcomes through cleaner environments. Persistent challenges included uneven irrigation coverage, seasonal water shortages, and market saturation during peak harvests. These gaps highlight the need for deeper reservoirs, secondary canals, shared operation and maintenance systems, and stronger buyer coordination to consolidate gains. Addressing these systemic constraints will be essential to transform incremental improvements into durable, market-anchored resilience for rural farming communities.

3.1.3 Project theory of change and intervention logic

The evidence indicates a credible causal chain from training and services to behavior change and early welfare gains, with strongest effects on knowledge, skills, and incremental income improvements. Households widely report practice change consistent with low-emission and adaptation goals, while irrigation and market outcomes are positive but more uneven. Mid-chain levers (post-harvest handling, diversification, and cooperative engagement) lag agronomic transitions, suggesting where the intervention logic should tilt next. Spatial variation, especially in Tboung Khmum, highlights the need for adaptive targeting to convert broad awareness into durable, market-anchored resilience.

Perceived benefits and TOC pathways. Capacity building was the most widely perceived benefit, with 93.1% of households reporting increased knowledge or skills in farming (**Table 14**), consistent with the TOC's focus on building human capital. Economic benefits followed, with 67.4% of households noting higher crop yields or income, led by Takeo at 78.3%. Infrastructure impacts were more limited, as 30.2% reported improved water access or irrigation, reflecting uneven performance across catchments. Only 3.1% of households reported no noticeable impact, while 17.0% highlighted stronger community cooperation, indicating potential to strengthen collective action.

Table 14. *Project impacts to households and communities.*

Impact	Kampong Cham	Kampot	Takeo	Tboung Khum	Weighted Average
More knowledge or skills in farming	94.00%	89.60%	97.80%	91.80%	93.10%
Increased crop yield or income	71.40%	62.50%	78.30%	61.80%	67.40%
Better water access or irrigation	25.00%	27.10%	28.30%	36.40%	30.20%
Stronger community cooperation	17.90%	22.90%	10.90%	16.40%	17.00%
No noticeable impact	0.00%	8.30%	2.20%	3.60%	3.10%

Source: Household survey

Livelihood and welfare outcomes. Most households experienced positive livelihood and welfare outcomes. Farm income increased for 75.3% slightly and 4.2% much (**Table 15)**, indicating that production gains are translating into earnings. Household expense management improved for 65.6%, reflecting growing financial stability. Market access rose for 60.8% of households, though 35.1% saw no change, highlighting remaining logistical or buyer constraints. Overall, quality of life improved for 73.6% of households, showing broadly positive effects on household well-being.

Table 15. Perceived Changes in Farm Income, Household Expenses, Market Access, and Quality of Life Since Project Implementation

	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
Respondents	84	48	46	110	288
FARM INCOME TREND					
Much Worse	0.0%	0.0%	0.0%	0.9%	0.3%
Slightly Worse	2.4%	0.0%	0.0%	0.9%	1.0%
No Change	17.9%	16.7%	13.0%	23.6%	19.1%
Slightly Improved	76.2%	79.2%	80.4%	70.9%	75.3%
Much Improved	3.6%	4.2%	6.5%	3.6%	4.2%
HH EXPENSES TREND					
Much Worse	0.0%	0.0%	2.2%	0.0%	0.3%
Slightly Worse	0.0%	0.0%	2.2%	2.7%	1.4%
No Change	38.1%	25.0%	26.1%	34.5%	32.6%
Slightly Improved	61.9%	75.0%	69.6%	62.7%	65.6%
Much Improved					
MARKET ACCESS					
Much Worse	0.0%	0.0%	2.2%	0.0%	0.3%
Slightly Worse	1.2%	0.0%	0.0%	0.9%	0.7%
No Change	28.6%	43.8%	28.3%	39.1%	35.1%
Slightly Improved	69.0%	52.1%	60.9%	58.2%	60.8%
Much Improved	1.2%	4.2%	8.7%	1.8%	3.1%
QUALITY OF LIFE TREND					
Much Worse					
Slightly Worse	0.0%	0.0%	0.0%	0.9%	0.3%
No Change	22.6%	16.7%	17.4%	30.0%	23.6%
Slightly Improved	76.2%	79.2%	78.3%	67.3%	73.6%
Much Improved	1.2%	4.2%	4.3%	1.8%	2.4%

Source: HH survey

Breadth and depth of farming practice adoption. Adoption of improved farming practices is widespread across households. Most of the households (89.2%) adopted at least one improved practice, while 10.8% reported no change (**Table 16**). The most common shifts align with the TOC's climate goals, with 56.9% adopting organic or low-chemical inputs and 51.4% using climate-resilient techniques. Water-saving methods were adopted where water stress is most pronounced, with 41.3% in Takeo and 32.7% in Tboung Khmum, demonstrating context-specific uptake. Tboung Khmum recorded the highest rate of no change at 16.4%, indicating a need for intensified extension, improved inputs, and more reliable water access.

Table 16. *Adoption of improved farming practices by households.*

Farming practice	**Kampong Cham**	**Kampot**	**Takeo**	**Tboung Khum**	**Weighted Average**
Shifted to organic or low-chemical input farming	51.20%	75.00%	73.90%	46.40%	56.90%
Applied climate-resilient farming techniques	44.00%	50.00%	63.00%	52.70%	51.40%

Farming practice	Kampong Cham	Kampot	Takeo	Tboung Khum	Weighted Average
(e.g., drought-tolerant seeds, mulching)					
Diversified crops or income sources	39.30%	52.10%	21.70%	30.90%	35.40%
Improved post-harvest handling (e.g., drying, storage)	36.90%	27.10%	23.90%	23.60%	28.10%
Adopted water-saving irrigation methods	19.00%	12.50%	41.30%	32.70%	26.70%
Joined or engaged more in a farming cooperative or group	20.20%	29.20%	32.60%	25.50%	25.70%
Accessed or used climate information for decision-making	23.80%	16.70%	17.40%	21.80%	20.80%
Practiced better waste or nutrient management	20.20%	25.00%	19.60%	14.50%	18.80%
No change in practices	6.00%	8.30%	8.70%	16.40%	10.80%

Source: Household survey

3.2 Impacts

CFAVC investments are driving structural transformation across Cambodia's rural economy, linking productivity gains with broader environmental and social benefits. Enhanced agribusiness competitiveness and improved infrastructure have strengthened value chains, market access, and rural livelihoods. At the same time, cleaner transport and renewable energy systems are contributing to measurable improvements in air quality and public health.

3.2.1 Achievement of the DMF Impact Indicators

3.2.1.1 Agribusiness transformation

The project catalyzed a clear shift from subsistence to market-oriented enterprise, with farmers increasingly trading through cooperatives, storage, and improved logistics that stabilize prices and expand reach. Reported improvements concentrate on value chain development and farm productivity, while climate resilience and sustainability lag, indicating where second-generation effort should deepen. Transport upgrades and on-farm pickup reduced time and per-unit costs across crops, translating production gains into market access and income. Cooperative participation is widespread and generally associated with better selling outcomes, though pricing gains are uneven. Field accounts confirm that training, irrigation, and input packages lifted yields, even as water reliability, O&M, and price volatility constrained full realization.

Market orientation and enterprise upgrading. Insights from KIIs with Kranh Sokrey and Akphivath Kaksikor, as well as FGDs with Akphivat Samaky Phum 3 and the Tboung Khmum cooperative, indicated that farmers are graduating into buying and selling roles linked to cooperatives, warehouses, and inter-provincial and some cross-border channels for rice, maize, cassava, mango, and sweet potato. KIIs with the Akphivath Kaksikor Agricultural Cooperative Leaders and Ses Saron from the Poloeu Kaksekor Srok Chhouk Agricultural Cooperative showed that community-backed mills and small processors, such as sweet-potato flour producers, generated profits and dividends and, in some cases, reached international buyers, demonstrating quality upgrading and expanded market access. FGDs with Akphivat Samaky Phum 3 and the Tboung Khmum Cooperative highlighted that organization, infrastructure, and business-skills training supported product and channel diversification, reducing seasonality and reliance on a single buyer. Key informant interviews with Ses Saron in Kampot reveal that continued reliance on middlemen in some chains indicates opportunities for stronger cooperative aggregation, financing, and contracting.

Value chain and productivity outcomes. Households rank value chain development as the strongest area of improvement at 66%, followed by farm productivity at 51.7% (**Table 17**), indicating that investments are translating into marketable output rather than isolated farm gains. The most cited skill improvements contributing to sustainability are post-harvest handling at 23.6% and climate-resilient practices at 22.2%, both of which help lower losses and improve product quality. Field informants confirm yield increases, with rice moving from approximately 3–4 to 4–6 t/ha and cropping expanding from one to two cycles per year, attributed to more reliable water, better varieties, and integrated nutrient management.

Table 17. *Perceived project contributions to household agriculture and livelihoods.*

Project contribution	Moderate improvement	Significant improvement	Slight improvement	Very significant improvement	Total
Value chain development (e.g., inputs, processing, storage)	35.80%	19.10%	9.40%	1.70%	66.00%
Improvement in farm productivity	29.90%	11.80%	9.40%	0.70%	51.70%
Efficiency in marketing our produce	14.60%	6.30%	9.70%	0.00%	30.60%
Climate resilience on your farm	15.60%	6.30%	5.60%	0.30%	27.80%
Sustainability of agricultural practices	10.80%	1.00%	2.40%	0.00%	14.20%
Access to and participation in agribusiness	7.30%	1.40%	3.50%	0.00%	12.20%
Overall resilience of your livelihood	3.80%	3.10%	0.30%	0.00%	7.30%

Source: Household survey

Market access and logistics efficiency. Marketing-related improvements are widely observed, with road and transport conditions (64.6%) and market or buyer access (54.5%) (**Table 18**) showing the strongest gains. Access to quality seeds or planting materials follows at 37.8%, supporting production efficiency and consistency. Improvements in farmgate prices (24.0%) and input access (21.5%) indicate modest progress in market integration. Lower but notable gains in extension services (20.5%), cooperative participation (19.8%), and credit access (13.2%) suggest continued need for institutional and financial linkages to sustain competitiveness.

Table 18. Reported Marketing Improvements by Province

MARKETING IMPROVEMENTS	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
Improved road or transport conditions	20.5%	9.7%	8.3%	26.0%	64.6%
Improved access to market or buyers	21.9%	5.6%	8.3%	18.8%	54.5%
Easier access to quality seeds or planting materials	10.4%	7.3%	7.3%	12.8%	37.8%
Higher farmgate prices for my products	6.6%	4.9%	6.6%	5.9%	24.0%
Better access to fertilizers or farm inputs	3.8%	4.9%	4.5%	8.3%	21.5%
Better access to farming advice or extension services	4.2%	5.6%	3.1%	7.6%	20.5%
More opportunities to join cooperatives or producer groups	5.6%	3.8%	3.1%	7.3%	19.8%
Easier access to credit or loans for farming	3.1%	2.4%	3.5%	4.2%	13.2%

Source: HH survey

Data on the transportation of crops show significant efficiency gains across most crops following project interventions. Cassava and maize recorded the largest reductions in travel time and costs per kilometer, with cassava transport costs dropping from 155,724 KHR/km to 65,732 KHR/km and maize from 84,604 KHR/km to 43,820 KHR/km, alongside faster travel speeds (**Table 19**). Rice transport also became more efficient, with lower total and per-kilogram costs and reduced losses. Mango transport shows mixed results. While distance and losses declined, total and per-kilometer costs increased, likely due to higher

handling or market access expenses. Overall, improved infrastructure and logistics systems have lowered transaction costs and increased transport efficiency for most commodities.

Table 19. *Changes in crop transport conditions and costs.*

Cassava		
Criteria	**Before the Project**	**At Present**
Quantity transported	31,478	39,371
Distance (kms.)	11.64	9.42
Minutes traveled	92.69	26.95
Speed (Ave. all types of transportation)	0.126	0.35
Total transport cost (KHR)	647,620	197,612
Transport cost (KHR/km)	155,724	65,732
Losses in transport (kgs.)	5.05	4.74
Transport cost/kg./km.	8.13	2.97
Maize		
Criteria	**Before the Project**	**At Present**
Quantity transported	6,629	6,821
Distance (kms.)	1.74	1.36
Minutes traveled	877.29	14.71
Speed (Ave. all types of transportation)	0.002	0.092
Total transport cost (KHR)	99,174	69,831
Transport cost (KHR/km)	84,604	43,820
Losses in transport (kgs.)	2.56	1.5
Transport cost/kg./km.	22.35	7.82
Mango		
Criteria	**Before the Project**	**At Present**
Quantity transported	17,709	15,260
Distance (kms.)	8.82	2
Minutes traveled	318.67	20
Speed (Ave. all types of transportation)	0.028	0.1
Total transport cost (KHR)	47,687	73,252
Transport cost (KHR/km)	48,197	64,860
Losses in transport (kgs.)	7.18	5.07
Transport cost/kg./km.	8.46	5.55
Rice		
Criteria	**Before the Project**	**At Present**
Quantity transported	3,787	4,388
Distance (kms.)	1.23	1.27
Minutes traveled	210.86	20.34
Speed (Ave. all types of transportation)	0.006	0.062
Total transport cost (KHR)	98,377	50,081
Transport cost (KHR/km)	131,116	57,504
Losses in transport (kgs.)	2.98	1.51
Transport cost/kg./km.	40.43	14.9

Source: Household survey

Most crops are sold locally, with 140 cases picked up directly at farms by buyers or middlemen and 125 cases at commune markets (**Table 20**). Rice dominates farmgate transactions, while cassava and mango show a more diverse mix of local and district marketing. Only cassava is exported, with 6 cases transported to Vietnam. Eight respondents reported no current market destination for their produce. These results suggest that while most sales remain localized, cassava has the greatest cross-border market reach.

Table 20. *Market destinations of crops.*

Destination	**Cassava**	**Maize**	**Mango**	**Rice**	**Total**
At the farm (picked up by buyer/middleman)	3	31	22	84	140
Local market (within the commune)	43	11	17	54	125
District market	6	0	3	0	9
Transported to Vietnam	6	0	0	0	6

Destination	Cassava	Maize	Mango	Rice	Total
None	0	0	0	8	8

Source: Household survey

Motor trailers ("kouyun") are the most common transport mode, used in 126 cases across all crops (**Table 21**). Buyer collection is also widespread, particularly for rice and maize, reported in 101 cases. Cargo trucks are used mainly for bulk crops like cassava and rice, while motorbikes and tuktuks are rarely used. Six respondents reported no crop transport. These patterns indicate strong reliance on local logistics and buyer collection systems, with limited use of larger-scale or specialized transport.

Table 21. *Transportation of crops from source to market destination.*

Transportation	Cassava	Maize	Mango	Rice	Total
"Kouyun" (motor trailer)	45	12	17	52	126
I do not transport. Buyers come to collect	0	25	18	58	101
Cargo truck	13	5	5	24	47
Motorbike	0	0	2	5	7
Tuktuk	0	0	0	1	1
None	0	0	0	6	6

Source: Household survey

Most households reported that selling crops has become easier, with 112 saying it is much easier and 50 slightly easier (**Table 22**). Only three respondents found it more difficult, while 20 observed no change. Improvements were most noted among rice and cassava farmers, suggesting better market access and trading conditions since the project.

Table 22. *Perception of households in selling crops.*

Selling process	Cassava	Maize	Mango	Rice	Total
Much easier now	34	6	18	54	112
Slightly easier	18	6	3	23	50
More difficult	0	0	1	2	3
No change	6	5	2	7	20
Don't know	0	0	0	2	2

Source: Household survey

Across provinces, 69.4% of households are members of agricultural cooperatives, with the highest participation observed in Takeo (78.3%) (**Table 23**). Among these members, 81.5% reported improved crop sales after joining, indicating clear marketing benefits from collective participation. Furthermore, 59.0% experienced better prices or trading terms, while 40.5% reported no change. Overall, cooperative membership has enhanced market access and price outcomes for most farmers, though gains remain uneven across provinces. Gender-disaggregated data were not available for these indicators. It is recommended for future monitoring to include this dimension to assess equity impacts.

Table 23. Agricultural Cooperative Membership and Its Impact on Market Access and Pricing

	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
Respondents	84	48	46	110	288
AGRICULTAL COOP MEMBERSHIP					
No	34.5%	31.3%	21.7%	30.9%	30.6%
Yes	65.5%	68.8%	78.3%	69.1%	69.4%
PRODUCT SELLING TREND AFTER AC MEMBERSHIP					
No change	3.6%	27.3%	25.0%	22.4%	18.5%
Yes, improved	96.4%	72.7%	75.0%	77.6%	81.5%
AC MEMEBRSHIP IMPACT TO BUYING PRICES					

	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
No change	41.8%	36.4%	27.8%	47.4%	40.5%
Not sure	0.0%	3.0%	0.0%	0.0%	0.5%
Yes, better prices or terms	58.2%	60.6%	72.2%	52.6%	59.0%
Respondents	29	15	10	34	88

Source: HH survey

Farming support, practices, and water use. Cooperatives described improved dissemination of agronomic advice and coordination, such as training on planting, care, harvesting, and marketing in Kampot, and easier participation in meetings and decision-making in Tboung Khmum, indicating timely delivery of outputs that support the TOC (FGDs with Poloeu Kaksekor Srok Chhouk Agricultural Cooperative and Tboung Khmum Agricultural Cooperative; KII with agricultural cooperatives). Insights from KIIs indicated that farming practices have shifted from heavy chemical use toward integrated regimes combining compost or manure with reduced chemical inputs, which helped lower costs and improve soil health. Moreover, irrigation investments enabled multiple rice cycles and adoption of water-saving practices, though shallow reservoirs, dry-season shortages, and O&M constraints continue to limit equitable access, consistent with moderate resilience (27.8%) and sustainability (14.2%) scores (please refer to **Table 17**).

Financial leverage and country ownership. Out of 288 households surveyed, 22 (7.6%) reported contributing to biodigester construction, while 266 (92.4%) did not (**Table 24**). Average contributions ranged from 225,000 KHR in Kampot to 875,000 KHR in Takeo, reflecting varied ability to pay. Contributions were made through cash (50%), labor (36.4%), and local materials (9.1%) (**Figure 9**). Although participation remains limited, these contributions demonstrate tangible local commitment that could be strengthened through more flexible financing models. Expanding incentives, credit access, and staged payment schemes could further deepen community ownership and participation.

Table 24. *Household contributions to biodigester construction.*

Contributed	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
Yes	4	4	5	9	22
No	80	44	41	101	266
Average contribution (KHR)	583,333	225,000	875,000	352,857	

Source: Household survey

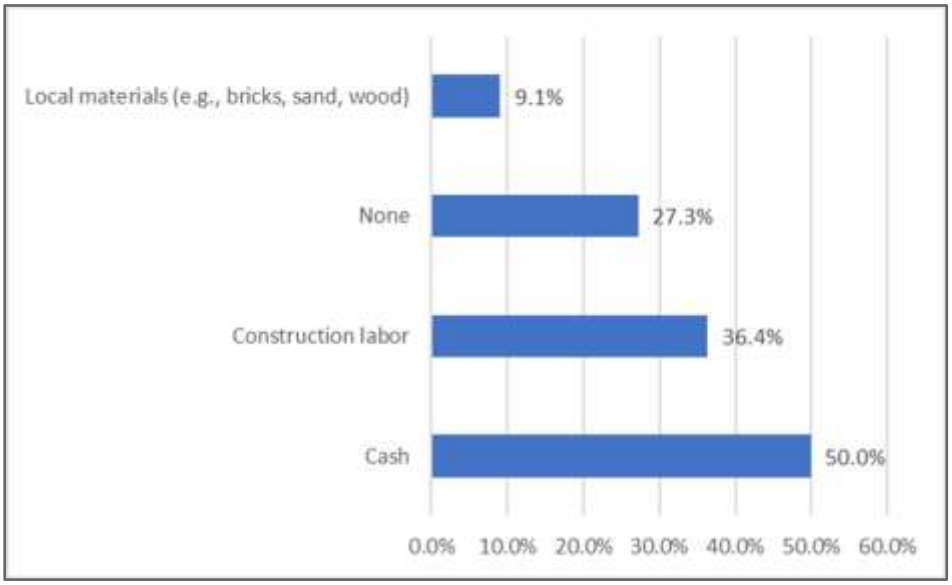


Figure 9. Contributions to biodigester construction. Source: Household survey.

Constraints and implications for scale. Binding constraints (e.g. dry-season water shortages, high input costs, labor gaps, uneven operation and maintenance of shared assets, and price volatility) continue to limit gains and help explain why resilience and sustainability lag behind value chain and productivity outcomes. Priority actions include reservoir deepening and construction of secondary canals, regular maintenance, and clearer water-sharing rules, along with post-harvest upgrades, market-risk management, and strengthened advisory services. In areas with strong transport and buyer access, the next opportunities likely lie in cooperative-led aggregation, forward contracting, and working-capital solutions to help communities capture a greater share of value locally.

3.2.1.2 Air quality improvement

Road improvements under the project produced measurable public health and environmental benefits by reducing dust emissions, which are a major source of respiratory and eye problems in rural areas. A spatial health impact assessment using WorldPop 2020 raster data (100 m resolution) estimated populations within 100 m, 300 m, and 500 m of upgraded road corridors. Analyses in GEE showed that many residents previously exposed to dust from unpaved roads now face lower exposure levels. Studies by the Asian Development Bank and the World Health Organization associate road dust with higher risks of chronic bronchitis, asthma, and eye irritation. By sealing road surfaces, the project is expected to reduce respiratory symptoms, lower healthcare costs, and improve living conditions. At the household level, the biogas component aims to replace wood-fueled cooking systems, reducing smoke exposure and methane emissions from livestock waste. As of the interim evaluation, biodigester contracts have been approved and implementation is underway. Once operational, these systems are expected to improve air quality, reduce particulate matter exposure ($PM_{2.5}$ and PM_{10}), and decrease respiratory and eye diseases. Together, road and biogas interventions demonstrate how CFAVC's infrastructure and clean energy investments deliver climate and health benefits while supporting resilient rural development.

3.2.2 Achievement of the GCF Impact Indicators

The CFAVC Project demonstrates mixed progress across GCF impact indicators, with strong gains in household-level climate-resilient livelihoods and infrastructure, but slower advancement in higher-level community and systemic resilience outcomes. Several GCF indicators are also captured within the project's DMF Outcome indicators—for example, crop yield improvement, adoption of climate-smart practices, irrigation reliability, and post-harvest system performance (**Table 25**)—resulting in aligned but differently timed measurements. Under Adaptation, the project achieved 87.1% accomplishment for the number of males and females adopting diversified, climate-resilient livelihood options; however, the overarching GCF indicator on increased resilience and enhanced livelihoods of vulnerable groups (A1.0) remains at 0%, as it is measured only at endline and requires long-term, system-level verification beyond household-level adoption already captured in the DMF. For Resilience outcomes, progress varies: health, food, and water security (A2.0) remains low at 18.4%, reflecting the gradual nature of climate-resilient crop uptake and irrigation expansion, whereas infrastructure resilience (A3.0) reached 69.9% due to significant rehabilitation of water management systems, post-harvest facilities, and rural roads—results also reflected in DMF Output and Outcome indicators. Under Mitigation (M1.0), the project achieved 50% of its target, demonstrating substantial GHG reductions through biodigesters, compost huts, improved irrigation efficiency, and climate-smart agronomic practices; this aligns with DMF indicators on emission reduction but will only reach full completion once all renewable energy systems and CSA adoption targets are finalized. Overall, the combined GCF and

DMF evidence shows that CFAVC is effectively strengthening household and infrastructure resilience and contributing to a low-emission agrifood system, while broader, systemic resilience outcomes will become fully measurable toward the end of the project when long-term behavioural and institutional changes have matured.

Table 25. ***GCF Impacts Summary***

RESULT ASPECT	RESULT	% ACCOMP
ADAPTATION	A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities, and regions	0.0%
	A1.2 Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options	87.1%
RESILIENCE	A2.0 Increased resilience of health and well-being, and food and water security (e.g. climate resilient crops, efficient irrigation systems, etc.)	18.4%
	A3.0 Increased resilience of infrastructure and the built environment to climate change threats	69.9%
MITIGATION	M1.0 Reduced emissions through waste management and increased low emission energy access and power eneration	50.0%

3.2.2.1 Adaptation

3.2.2.1.1 Increased resilience and enhanced livelihoods of the most vulnerable people, communities, and regions (A1.0)

Overall, the CFAVC Project shows meaningful but uneven progress toward its adaptation impact under Indicator A1.0, reaching a total of 1,106,423 beneficiaries and demonstrating significant community-level improvements in climate resilience through climate-smart agriculture, enhanced rural infrastructure, and strengthened producer organizations. While indirect beneficiaries reached 859,083 people (88.1% of target)—reflecting strong spillover benefits from CSA practices, improved market access, and institutional coordination—the project reached only 165,399 direct beneficiaries (42.4% of target) and 81,941 women (52.5% of the women's target). These shortfalls were primarily driven by COVID-19 disruptions, the phased rollout of CSA and cooperative strengthening, and the longer time needed for farm households—especially women—to adopt new technologies and participate in livelihood programs. Despite these delays, the breadth of indirect resilience gains and increasing engagement in CSA and postharvest activities indicate strong momentum, with potential for direct beneficiary numbers to rise as interventions continue to mature over the remaining implementation period.

3.2.2.1.2 Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options (A1.2)

The CFAVC Project demonstrates strong performance under Indicator A1.2, which measures the number of farmers—male and female—benefiting from diversified and climate-resilient livelihood options. The project supported 29,709 farmers, achieving 74.3% of the overall target of 40,000, reflecting significant progress in scaling climate-smart agriculture (CSA), livelihood grants, improved farming practices, and postharvest innovations. Notably, the project fully achieved its gender target, with 16,000 women beneficiaries, meeting 100% of the expected women's share (40%). This indicates that women were effectively engaged in the adoption of CSA technologies, value-addition activities, and cooperative-based livelihood programs. While the overall farmer target has not yet been fully met, the high proportion of women participants and the substantial uptake of diversified livelihood options underscore the project's positive contributions to household resilience and the empowerment

of vulnerable groups, with strong potential for full achievement by completion as CSA and value-chain interventions continue to expand.

3.2.2.2 Resilience

3.2.2.2.1 Increased resilience of health and well-being, and food and water security (e.g. climate resilient crops, efficient irrigation systems, etc.) (A2.0)

The CFAVC Project shows substantial progress in strengthening household food and water security in climate-vulnerable areas under Indicator A2.0, despite falling short of several direct beneficiary targets. The project supported 73,679 climate-vulnerable households to become more food-secure, achieving 92.1% of the household-level target (80,000), and reached 171,817 indirect households (90.4% of target), demonstrating broad improvements in resilience at the community level. However, it achieved only 42.4% of the direct beneficiary target (165,399 of 390,000) and 52.5% of the women's target (81,941 of 156,000), reflecting delays in scaling climate-resilient practices, COVID-19 interruptions, and the time needed for adoption of efficient irrigation, climate-resilient crops, and improved production systems. Despite these shortfalls, the high performance in household-level outcomes and indirect beneficiary reach indicates that the project is effectively improving food security, reducing climate vulnerability, and enhancing the well-being of rural communities. These gains directly support the project's overarching goals of building climate-resilient agrifood systems and strengthening adaptive capacity, suggesting that while full target achievement will require continued roll-out of CSA, irrigation, and resilience-building interventions, the foundational impacts on household resilience are already strongly evident and aligned with CFAVC's adaptation objectives.

3.2.2.2.2 Increased resilience of infrastructure and the built environment to climate change threats (A3.0)

The CFAVC Project demonstrates strong and strategically significant progress in enhancing the climate resilience of rural infrastructure under Indicator A3.0, which directly supports the project's goal of safeguarding agrifood systems against climate risks. The project upgraded 19 water management systems (70.4%), rehabilitated 185 km of climate-resilient rural roads (74%), established 3 of 4 Provincial Agricultural Development Centers (75%), and fully rehabilitated the National Agriculture Laboratory (100%), strengthening Cambodia's capacity for climate-resilient production, testing, and extension services. Most notably, the project exceeded expectations in postharvest infrastructure development, constructing 80 climate-resilient storage facilities, achieving 100% of target and significantly improving community-level food security and market access. Although water management and road infrastructure targets have not yet reached full completion, the substantial progress achieved—covering undetermined asset values but most like close to USD 111 million—provides critical resilience benefits by improving irrigation reliability, reducing transport disruptions during climate shocks, and protecting agricultural value chains from postharvest losses. Collectively, these investments substantially advance CFAVC's core objectives of strengthening adaptive capacity, stabilizing rural livelihoods, and promoting climate-resilient agricultural growth, with remaining gaps expected to close as infrastructure works are completed in the latter implementation period.

3.2.2.3 Mitigation: Reduced emissions through waste management and increased low emission energy access and power generation (M1.0)

Under Outcome M1.0, the project demonstrated very strong performance in greenhouse gas mitigation, achieving 359,209 tCO_2-eq, or 150% of the target, through climate-smart agronomic practices, biodigesters, compost huts, and improved irrigation and post-harvest systems—highlighting the project's significant contribution to Cambodia's mitigation goals and to CFAVC's objective of promoting low-emission agrifood systems. However, despite this strong technical achievement, the project did not meet its co-financing target, with 0% accomplishment against the expected USD 13.6 million in leveraged finance. This indicator, originating from the GCF Funding Proposal (FP076), reflects anticipated external investments mobilized by GCF support, yet no actual leveraged finance has been reported to date in the GCF Annual Performance Report (2024), which continues to show a cumulative value of USD 0, with revised targets of USD 2 million (mid-term) and USD 3 million (end-project). While the approved financing plan includes approximately USD 101 million in planned co-financing from ADB, government, and beneficiaries, these are commitments rather than leveraged finance, and no verified evidence of additional mobilized private-sector or institutional investment has been documented. The contrast between strong emissions-reduction performance and the absence of leveraged finance suggests that while CFAVC's mitigation interventions are effective and impactful, challenges remain in catalyzing market-based financing necessary for long-term sustainability, replication, and scale-up of low-emission technologies.

3.3 Outcome

3.3.1 Achievement of DMF Outcome Indicators

The CFAVC Project demonstrated strong overall progress toward its Development Objective, with two of the three DMF outcome indicators performing at high levels and closely aligning with progress recorded under the GCF Outcome indicators, given the overlap between the two frameworks. Several DMF outcomes—such as crop yield improvement, adoption of climate-smart practices, and GHG reductions—are also reflected in the corresponding GCF indicators on enhanced resilience (A1.0, A2.0) and reduced emissions (M1.0), providing a consistent picture of project performance across both systems. Productivity gains were particularly strong: average crop yields increased by 97%, far exceeding the ≥15% target, with rice (+59.3%), maize (+73.0%), cassava (+43.3%), and mango (+16.7%) all rated Excellent and surpassing 100% of their targets when compared to baseline levels. The project also fully achieved—and surpassed—its GHG mitigation target, generating 359,209 tCO_2e, equivalent to 149.7% of the planned 240,000 tCO_2e, which directly contributes to GCF Mitigation Outcome (M1.0). In contrast, progress on resource efficiency among agribusinesses was mixed: while 40 of 50 enterprises (80%) achieved reductions in post-harvest losses (rated Satisfactory), only 12 of 50 (24%) met energy-saving targets and 0 of 50 achieved water-saving targets, both rated Low. These results show that although the project delivered strong outcomes in productivity and emissions reduction—reinforced under both the DMF and GCF reporting frameworks—additional technical support, financing, and capacity-building will be required to accelerate adoption of resource-efficient technologies within agribusiness enterprises.

Box 4. *CFAVC outcome and outcome indicators.*

Outcome: Productive and resource-efficient agribusiness value chains developed in project areas.

Indicators:

1. At least 15% increase in yields (2017 baseline: rice 2.7 tons, maize 4 tons, cassava 20 tons and mango 15 tons/ha).
2. GHG emissions reduced (CO2)
3. At least 50 agribusinesses become more resource efficient in terms of water savings (5-10% efficiencies); energy savings (20%); and reduction in post-harvest losses (10%) (2017 baseline: 0).

3.3.1.1 Increase in crop yield

The project substantially improved agricultural productivity and household welfare by increasing crop yields, expanding irrigation coverage, and promoting diversified farming systems. Farmers who previously relied on a single rice crop per year began cultivating two rice cycles, complemented by vegetables and livestock, which improved both food security and income opportunities. Yields of rice, maize, and mango exceeded project targets by wide margins, demonstrating high agronomic effectiveness and strong local adoption of water-efficient and land-leveling technologies. These outcomes collectively confirm that the project interventions were well-aligned with community needs and successfully translated productivity gains into improved livelihoods and food resilience.

Yield performance across major crops. Yields increased significantly across major crops, surpassing the 15% target in three out of four crops. Rice increased from 2.7 (Baseline) to 3.64 (accomplishment) tons/ha (+59.3%; approximately 138% of target), maize from 4.00 to 7 tons/ha (+73.0%; approximately 150% of target), cassava from 20.00 to 28.65 tons/ha (+43.3%; approximately 125% of target), and mango from 15.00 to 17.51 tons/ha (+16.7%; approximately 102% of target) (**Table 26**). The high performance of the four target commodity crops reflects the success of irrigation investments and land leveling in improving water use efficiency and soil uniformity, complemented by the impacts of extensive training on climate-smart agriculture (CSA) that enhanced farmers' knowledge and adoption of improved practices. These results validate the project's technical soundness and relevance to smallholder productivity enhancement.

Changes in cropping patterns and income potential. The project helped shift farming from single-crop systems to more diversified production. FGDs with Trapeang Tros Agricultural Cooperative (Tboung Khmum) and Prey Kduoch Agricultural Cooperative (Takeo) revealed that farmers now grow two rice crops per year and integrate vegetables and livestock, improving both food security and income diversity. Meanwhile, Poutatres Agricultural Cooperative (Kampong Cham) reported that diversification into maize and vegetable cultivation increased household resilience to market and climate shocks. At the community level, higher productivity strengthened local economies by expanding marketable surpluses and reducing reliance on external food sources.

Yield and price dynamics. Although yields increased for most crops, falling market prices tempered income gains. Maize yields rose by 50.3% in the first cropping season and 35.6% in the second, but prices declined by 3.4–12.8% (**Table 26**). Mango yields grew by 29.4% and 7.9% across the two seasons, yet prices fell sharply by 25.6% and 15.8%, likely due to seasonal oversupply. Rice recorded moderate gains, with dry-season yields up 13.7% and wet-season yields up 8.7%, alongside stable prices (−1.8% to +3.1%).

For cassava, yield results varied depending on the data source. The household survey indicated a modest decline in yield (≈21 t/ha), whereas project progress reports and KII data showed a higher range of 21–28.7 t/ha, reflecting improvements from mechanization and soil management interventions. Taking the higher end of this range as the final project performance, cassava yields demonstrated modest gains overall, though farm-gate prices

declined by 36.7% due to market fluctuations. These variations underscore differences in measurement timing and reporting sources but collectively confirm that CFAVC's production interventions achieved strong technical outcomes, with remaining challenges in market access and post-harvest value addition needed to sustain profitability.

Table 26. Changes in crop production, yield, and price.

Season	Cassava							
	Before the Project				At Present			
	No. of Farmers	Area (Ha)	Yield (ton/Ha)	Price (USD/ton)	No. of Farmers	Area (Ha)	Yield (ton/Ha)	Price (USD/ton)
1st cropping	17.40%	2.23	24,981	353.2	19%	2.01	21,135	223.5
Season	**Maize**							
	Before the Project				At Present			
	No. of Farmers	Area	Yield	Price	No. of Farmers	Area	Yield	Price
1st Cropping	16.70%	1.36	4,360	833.3	16.00%	1.45	6,553	805
2nd Cropping	9.40%	1.49	4,285	819.3	12.80%	1.3	5,811	714.3
Season	**Mango**							
	Before the Project				At Present			
	No. of Farmers	Area	Yield	Price	No. of Farmers	Area	Yield	Price
1st Cropping	8.70%	1.54	10,276	798	14.60%	1.74	13,299	593.6
2nd Cropping	6.60%	1.65	12,684	592.1	10.40%	1.92	13,688	498.3
3rd Cropping	0.70%	1.75	7,100	550	0.70%	1.5	4,750	700
Season	**Rice**							
	Before the Project				At Present			
	No. of Farmers	Area	Yield	Price	No. of Farmers	Area	Yield	Price
Dry Season	19.80%	1.61	3,098	881.9	26.70%	1.62	3,522	865.6
Wet Season	76.40%	12.99	2,553	941.3	78.50%	1.61	2,775	970.8

Source: Household survey

Technology Adoption Drivers. Surveyed farmers identified better water management (30%) and higher crop yields (28%) as the main motivations for adopting laser land leveling, while cost reduction (11.1%) and precision leveling (3.5%) ranked lower (**Table 27**). The preference aligns with the project's adaptation goals to enhance resilience to irregular rainfall and improve water efficiency. Extension campaigns could further highlight both yield and cost benefits to increase adoption among resource-constrained farmers.

*Table 27. **Reported Reasons for Adopting Laser Land Leveling Technology***

Laser Land Leveling Adoption Reasons	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
Respondents	84	48	46	110	288
Better water management	10.4%	5.6%	8.7%	5.2%	29.9%
Higher crop yield	8.7%	6.6%	8.7%	4.2%	28.1%
Reduced labor costs	4.5%	2.1%	3.5%	1.0%	11.1%
To accurately level the land	1.7%	0.0%	0.7%	1.0%	3.5%
Don't Know	0.0%	0.3%	0.0%	0.0%	N=288

Source: HH survey

Livelihood and gender-responsive outcomes. Higher yields and reliable irrigation translated into tangible livelihood improvements, including better food availability and additional market income. Women's participation in production, training, and cooperative leadership expanded, enhancing their roles in household decision-making and community organization (KII with agricultural cooperatives). Reduced residue burning and increased use of organic fertilizers were noted as environmental co-benefits. However, localized constraints such as depressed mango prices and uneven participation limited benefits in some areas. Overall, the yield gains and gender-inclusive participation underscore the project's effectiveness in promoting both economic and social dimensions of agricultural resilience.

3.3.1.2 Greenhouse gas emission reduction

The project made a substantial contribution to greenhouse gas (GHG) reduction in Cambodia's agricultural and rural infrastructure sectors. By achieving an estimated 359,209 tons of CO_2 equivalent reduction—approximately 150% of the planned target of 240,000 tons—the project not only met but exceeded its mitigation goal. This accomplishment, rated "Excellent" in performance, reflects the effectiveness of integrated interventions that combined sustainable agricultural practices, infrastructure improvement, and renewable energy use. The achievement supports Cambodia's Nationally Determined Contributions (NDC) under the Paris Agreement, reinforcing the project's alignment with national climate strategies and the Green Climate Fund's dual objectives of adaptation and mitigation.

GHG reduction outcomes and key factors. Against a baseline of 0, the project has achieved a total reduction of 359,209 tons of CO_2, equivalent to 150 percent of its original target, although capped at 100 percent under the monitoring protocol (please see **Table 27**). This strong outcome reflects effective synergy between infrastructure and agricultural components. Improved irrigation systems and laser land leveling increased water-use efficiency and reduced energy intensity per hectare, while biodigesters and compost huts lowered methane emissions from livestock waste. Road quality upgrades further reduced fuel consumption per kilometer by replacing poor surfaces with smoother, energy-efficient routes. Together, these interventions demonstrate a coordinated and multi-channel approach to emission reduction across production and transport systems.

Methodological rigor and assumptions
GHG estimation followed the IPCC Tier 1 methodology to ensure transparency and comparability with international standards. The analysis applied standard emission factors and operational parameters appropriate to Cambodia's rural context (**Table 28**). For road improvements, emission reductions were calculated as the difference between pre- and post-improvement emission factors (0.27 kg CO_2e/km and 0.19 kg CO_2e/km, respectively), multiplied by travel distance, vehicle trip frequency, and annual operating days. The total length of rehabilitated rural roads was 250 km, with traffic activity assumed at 10 vehicle trips per day over 365 days, based on triangulated key informant inputs.

For livestock systems, avoided methane (CH_4) emissions were estimated for 209 biodigester and compost hut sites. Each site was assumed to manage three cows and five pigs, applying Tier 1 emission factors of 1.0 kg CH_4/head/year for cattle and 1.5 kg CH_4/head/year for pigs. With an assumed methane reduction efficiency of 85 percent and a global warming potential (GWP) of 27.2 for methane, these systems contributed substantially to total CO_2-equivalent mitigation. Overall, the methodology maintained internal consistency while accounting for limited availability of localized emission data.

Traffic activity assumption and sensitivity

In the absence of systematic traffic counts on rehabilitated rural road segments, daily traffic activity was estimated using triangulated key informant interviews (KIIs) with commune officials, road users, and project staff across the four provinces. Informants consistently indicated low to moderate rural traffic, with plausible daily use ranging from approximately 5 vehicle trips per day on lightly used segments to around 20 vehicle trips per day on more active segments, depending on seasonality and local market access. Based on this range, an assumption of 10 vehicle trips per day was adopted as a conservative network-wide average across the 250 km of rehabilitated roads, reflecting intermittent agricultural and service-related use rather than continuous commercial traffic. Because estimated emission reductions scale linearly with traffic volume, this assumption represents a mid-range estimate. Under a low-use scenario (5 trips/day), estimated reductions would be approximately 50 percent lower, while under a higher-use scenario (20 trips/day), reductions would be up to 200 percent higher. These bounds confirm that reported results are conservative and robust within plausible rural traffic conditions.

Table 28*. Key parameters and assumptions for GHG estimation*

Road Improvement			
Components and parameter	**Assumed value**	**Unit**	**Source / Reference**
Total road length	250	km	Measured from GEE asset
Average trips per day	10	trips/day	Key informant interviews
Operating days per year	365	days/year	Assumed continuous use
Emission factor (before)	0.27	kg CO_2/km	IPCC/ADB default for poor roads[1]
Emission factor (after)	0.19	kg CO_2/km	IPCC/ADB default for improved roads[1]
Vehicle type	Diesel light truck	–	Field validation
GHG calculation method	Distance × EF × Trips × Days	–	IPCC Tier 1 Transport Methodology
Biodigester / Compost Hut System			
Components and parameter	**Assumed value**	**Unit**	**Source / Reference**
Number of sites	209	sites	Project database
Average cows per site	3	head	Project assumption
Average pigs per site	5	head	Project assumption
CH_4 emission factor (cow)	1	kg CH_4/head/yr	IPCC 2006 Tier 1 (Asia)[2]
CH_4 emission factor (pig)	1.5	kg CH_4/head/yr	IPCC 2006 Tier 1[2]
CH_4 reduction efficiency	85	%	SNV, GIZ, FAO case studies
GWP ($CH_4 \rightarrow CO_2e$)	27.2	–	IPCC AR6 (2021)[3]
Population Exposure to Dust			
Components and parameter	**Assumed value**	**Unit**	**Source / Reference**
Buffer distance	100 / 300 / 500	meters	ADB, WHO guidelines
Population dataset	WorldPop 2020 (KHM)	raster	https://www.worldpop.org
Raster resolution	100	m	WorldPop spatial resolution

Co-benefits and monitoring gaps. Beyond numerical emission reductions, the project promoted environmental co-benefits such as reduced residue burning, enhanced soil carbon sequestration, and improved air quality from less dust and fuel use. The WorldPop 2020 dataset was used to estimate populations within 100–500 m buffers of improved roads,

[1] Asian Development Bank – *Guidelines for Estimating Greenhouse Gas Emissions of ADB Projects: Additional Guidance for Transport Projects* → https://www.adb.org/sites/default/files/institutional-document/219791/guidelines-estimating-ghg-emissions-transport.pdf Asian Development Bank+1

[2] Intergovernmental Panel on Climate Change (IPCC) – *2006 Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use – Chapter 10: Emissions from Livestock and Manure Management* → https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_10_Ch10_Livestock.pdf IPCC NGGIP+1

[3] For latest values: IPCC AR6 / GHG Protocol – "Methane – non-fossil GWP value of 27.0 (100-yr)". See: https://ghgprotocol.org/sites/default/files/2024-08/Global-Warming-Potential-Values%20(August%202024).pdf GHG Protocol+1

demonstrating reduced dust exposure for nearby communities. However, no local GHG monitoring system currently exists to track these gains in real time (KII with project staff). While modeled estimates using IPCC defaults provide a reliable proxy, the absence of in-country monitoring tools limits precision and the potential for adaptive management. Establishing such systems in future projects would improve accuracy, enable long-term tracking, and strengthen national GHG inventories.

Implications for climate-smart agribusiness. The project's overachievement in emission reduction underscores the viability of integrated, low-emission agribusiness systems. It illustrates how combining infrastructure efficiency, renewable energy adoption, and sustainable farming practices can generate both productivity and mitigation outcomes. Future replication should emphasize embedding Tier 2 data collection for country-specific emission factors, strengthening institutional capacity for Monitoring, Reporting, and Verification (MRV), and linking community-level innovations to national climate accounting frameworks. These steps would not only enhance accuracy but also sustain Cambodia's leadership in climate-smart agricultural transformation.

3.3.1.2.1 Greenhouse Gas mitigation assessment

The project has achieved significant GHG reductions across three key intervention areas: rice field management, household biodigesters, and road improvements. Together, these activities mitigated approximately 359,209 tons of CO_2 equivalent (tCO_2e), exceeding the LogFrame target of 240,000 tCO_2e by about 119,000 tons, or 150 percent of the planned goal. The largest share of reductions came from climate-smart agricultural practices, particularly the adoption of AWD in rice fields, which substantially lowered methane emissions per hectare. Biodigester systems further contributed by capturing methane and reducing reliance on fuelwood, while improved rural roads decreased fuel use and transport-related emissions. These combined measures also produced co-benefits such as reduced deforestation pressure, improved air quality, and lower household energy costs, demonstrating strong consistency with Cambodia's Nationally Determined Contribution (NDC) and IPCC-compliant mitigation standards.

GHG estimation followed the 2006 IPCC Guidelines (Tier 1) with refinements from the 2019 update, integrating remote sensing, GIS, and emission factor modeling to enhance spatial accuracy. Data sources included Sentinel-2 imagery processed in GEE, project shapefiles for road improvements, and livestock survey data for biodigester systems. Calculations applied AR6 Global Warming Potentials (CH_4 = 27.2; N_2O = 273). Emission factors of 0.27 $kgCO_2e$/km for unpaved roads and 0.19 $kgCO_2e$/km for improved roads were used, together with manure management factors of 3 kg CH_4/head/year for cows and 7.5 kg CH_4/head/year for pigs, consistent with ADB and IPCC methodologies. Integrating these datasets produced a transparent and reproducible framework that yielded a verified total mitigation impact exceeding expectations. When benchmarked internationally, the project's emission factors are conservative but credible, remaining below global averages for continuously flooded rice (7.9 tCO_2e/ha/year; Qian et al., 2023) and consistent with chamber-based studies in Cambodia's rainfed systems (<1 tCO_2e/ha; Dumas & Johansen, 2009). Overall, the CFAVC project illustrates how combining climate-smart agriculture, renewable energy, and infrastructure modernization can deliver measurable and scalable GHG reductions, providing a replicable model for low-emission, climate-resilient rural development (**Table 29**).

Table 29. *Estimated GHGs mitigated by the project*

	2017	2025	Change	Notes
I. Climate-smart agriculture intervention				
1.1 Agriculture production area (Has.)	80,242.00	143,945.65	63,703.65	Increase in agriculture production area

	2017	2025	Change	Notes
				The increase in agricultural production area has contributed to the higher total GHG emission in 2025 compared to 2017
1.2 Total GHG emission				
1.2.1 BAU scenario				
CH_4 (t)	179.1	383,688.16		
N_2O (t)	16,895.74	131.77		
Total CO_2e (t)	**17,074.84**	**383,819.93**		
1.2.2 CFAVC interventions scenario (total GHG emission from all agricultural areas)				
CH_4 (t)		26,030.18		
N_2O (t)		77.14		
Total CO_2e (t)		**26,107.32**		
1.2.3 Mitigated GHGs from CFAVC interventions				
1.2.3.1 2017 vs. 2025 CSA interventions scenario				
CH_4 (t)			-25,851	Difference between 2017 and 2025 CSA Scenario -25,851 = 179.1-26,030.18: no mitigation (2025 GHG is higher than in 2017) 16,818.60 = 16,895.74-77.14: mitigated qty -9,032.48 = 17,074.84-26,107.32: No mitigation (2025 GHG is higher than in 2017) 2017 GHG emission is higher than in 2017 is due to the increase of agricultural areas compared to 2017
N_2O (t)			16,818.60	
Total CO_2e (t)			-9,032.48	
1.2.3.2 2025 BAU vs. 2025 CSA interventions scenario				
CH_4 (t)			357,658	
N_2O (t)			55	
Total CO_2e (t)			**357,712.61**	
1.3 Mean tCO_2e/ha				Determining the GHG emission per hectare to normalize the GHG emission
1.3.1 BAU Scenario				
CH_4 (t)	0.002	2.666		
N_2O (t)	0.211	0.001		
Total CO_2e (t)	0.213	2.666		Under BAU Scenario, the $Co2_e$ per hectare is projected to increase on per hectare basis
1.3.2 CFAVC interventions scenario				
CH_4 (t)		0.181		All the GHG emission per hectare is lower compared
N_2O (t)		0.001		

	2017	2025	Change	Notes
Total CO_2e (t)		0.181		to the BAU scenario
1.3.3 Mitigated GHGs from CFAVC interventions				
1.3.3.1 2017 vs. 2025 CSA interventions scenario				
CH_4 (t)			-0.179	Difference between 2017 and 2025 CSA Scenario 0.031=0.213-0.181: (there is reduction of emission on per hectare basis from 2017 and 2025 CSA scenario)
N_2O (t)			0.21	
Total CO_2e (t)			0.031	
1.3.3.2 2025 BAU vs. 2025 CSA interventions scenario				
CH_4 (t)			2.485	Difference between 2025 BAU and 2025 CSA Scenario 2.485=2.666-0.181 (there is reduction on a per hectare basis between 2025 BAU and 2025 CSA scenario)
N_2O (t)			0	
Total CO_2e (t)			2.485	
II. Biodigester intervention				
	2017	**2025**	**Change**	**Notes**
1.0 Mitigated CH4 from manure emissions	0	959.93	959.93	
2.0 GHG from fuelwood mitigated by biogas substitution	0	910.927	910.927	
Total GHG mitigated by the biodigester project	0	1,110.96	1,110.96	
III. Road improvement				
	2,017	**2025**	**Change**	**Notes**
Total GHG Emission	1,302	916.438	385.87	
IV. Total GHG mitigated attributed to the project				
	2017	**2025**	**Change**	**Notes**
	0	359,209.44	359,209.44	Total GHGs mitigated by the project 359,209.44=357,712.61 (ricefields) + 1,110.96 (biodigesters) + 385.87 (road improvement)

*The assumptions of the emission is based in Table 28

While the mapping and modeling results provide strong evidence of the project's mitigation potential, the GHG estimates have not yet been verified through direct field measurements. No emission monitoring was conducted during implementation, and the PPIUs lacked the capacity for such activities. This gap reflects wider institutional and technical limitations in field-based GHG assessment. However, the RUA has begun establishing a national GHG monitoring framework for rice systems. The university has acquired closed static chambers for field sampling and operates a gas chromatography laboratory capable of analyzing methane and other gases. Although field monitoring is still pending, RUA plans to launch pilot sampling and measurement campaigns to strengthen national capacity for empirical GHG monitoring in agriculture.

3.3.1.2.1.1 Ricefield emissions

Rice cultivation emerged as both the largest source and the most significant mitigation pathway for GHG emissions, as shown in **Figure 10**, with emission reductions achieved despite a 79% expansion in rice area from 80,242 ha in 2017 to 143,946 ha in 2025. Through CSA practices—including AWD, mulching, and organic soil management—the project reduced BAU emissions from an estimated 383,820 tCO_2e (2.67 tCO_2e/ha) to about 26,107 tCO_2e (0.18 tCO_2e/ha), resulting in approximately 357,713 tCO_2e of mitigation. Methane declined from 383,688 to 26,030 tons and N_2O to 77 tons (please refer to **Table 29**), demonstrating that CSA interventions effectively offset emissions that would otherwise have surged with the 63,704-ha increase in production area. These estimates were derived using an integrated GEE–GIS workflow aligned with IPCC Tier 1 methods, incorporating Sentinel-2 NDVI/NDWI, irrigation command boundaries, and water-management adjustments. The per-hectare values align with reported ranges for Cambodia's rainfed rice systems and show that strategic AWD and soil management can transform rice cultivation into a scalable, low-emission pathway that enhances both productivity and climate resilience.

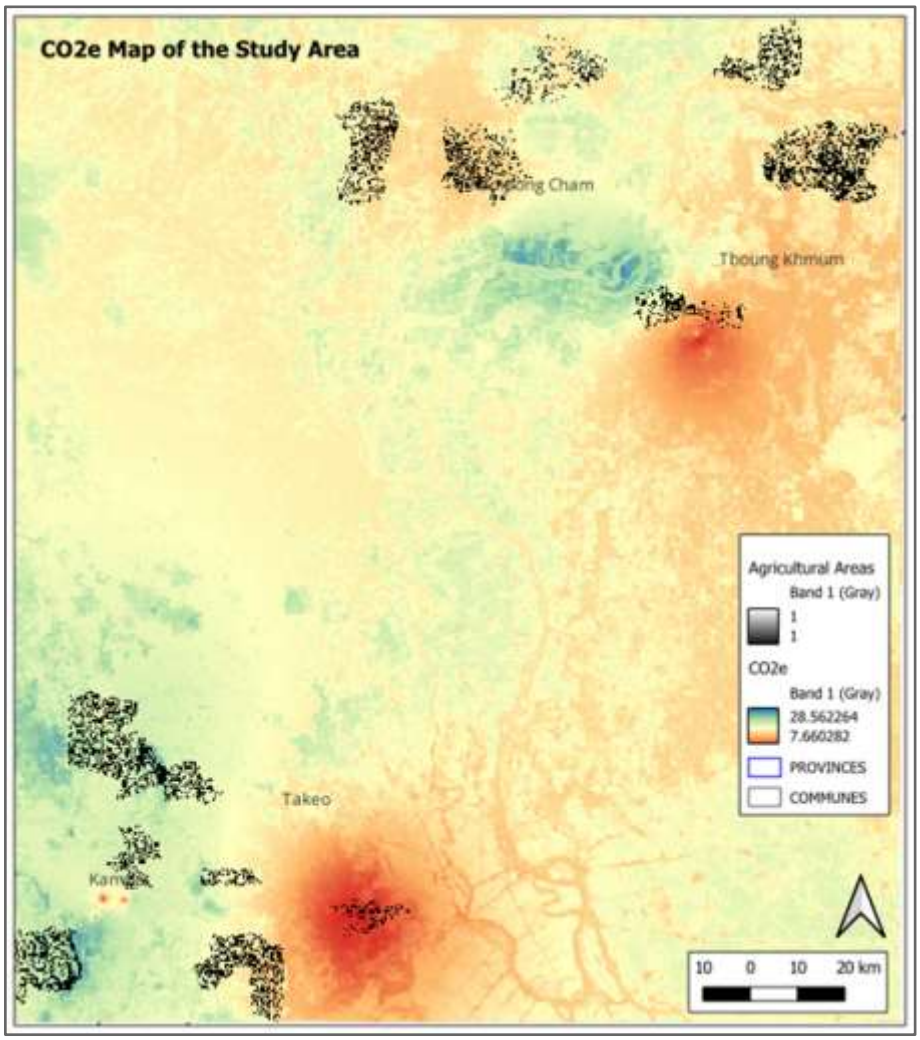


Figure 10. Map of the total CO2e of the study area.

Water condition. The assessment of water conditions across CFAVC rice fields showed significant shifts in field wetness between 2017 and 2025, directly influencing methane and nitrous oxide dynamics, as illustrated in **Figure 11**. NDVI and NDWI analyses revealed that

while rice production expanded, improved irrigation and the adoption of AWD created more regulated hydrological conditions, replacing the extensive flooding seen in 2017 with balanced moisture levels in 2025 that suppressed methane formation without triggering nitrous oxide increases. NDVI values near 1.0 in 2025 confirmed vigorous crop growth and efficient water use, while NDWI provided detailed gradients of surface moisture essential for spatial GHG modeling. Comparison of NDWI maps showed wetter conditions in northern Tboung Khmum, western Kampong Cham, and southeastern Takeo in 2017, with 2025 patterns reflecting localized wetness gains in newly irrigated plots and drying in areas converted to settlements; these spatial shifts are detailed in **Figure 12**. NDWI-driven reductions in prolonged anaerobic conditions explain the drop in emission intensity from 2.67 tCO_2e/ha under BAU to 0.18 tCO_2e/ha under CSA. Raster-based analysis integrating GEE and SAGA GIS confirmed that irrigation investments generated more optimal moisture regulation across rice areas, demonstrating CFAVC's contribution to improved water management, methane reduction, and low-emission rice cultivation.

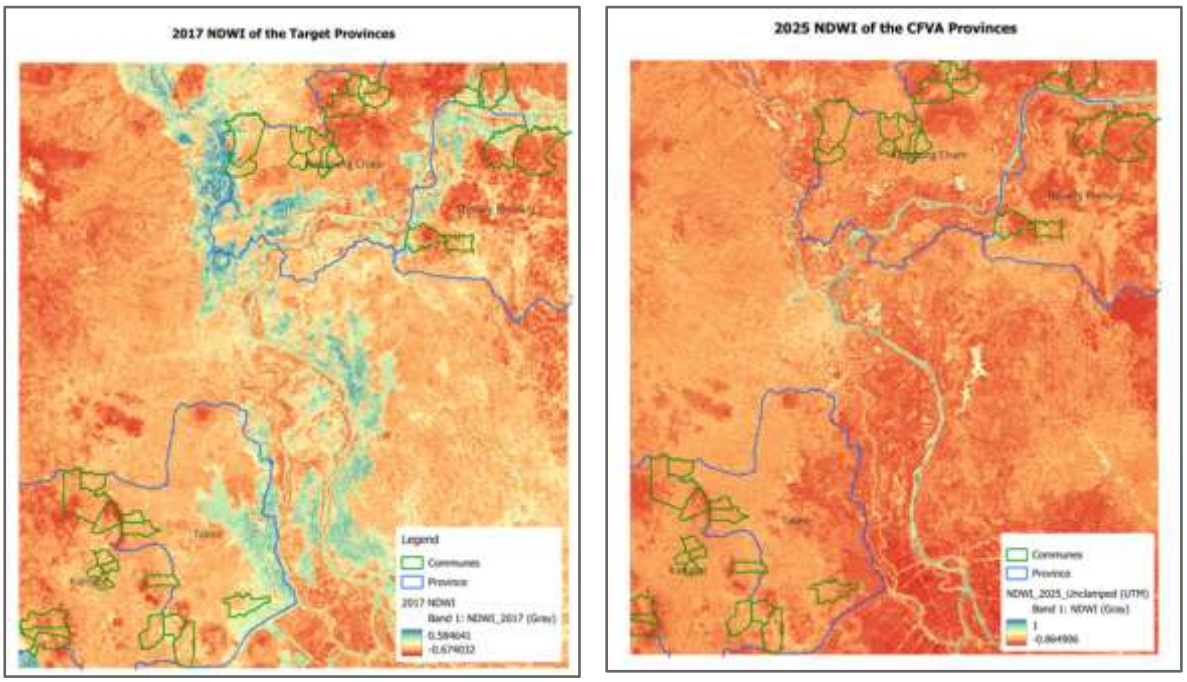


Figure 11. NDWI map of the CFAVC provinces in 2017 and in 2025.

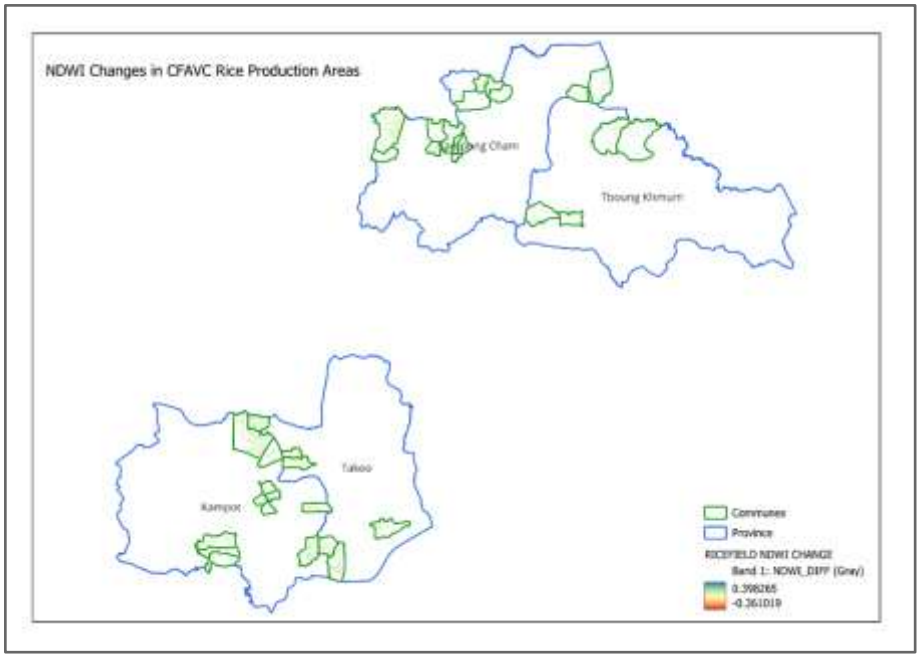


Figure 12. NDWI change in the rice production areas.

Adoption of the Alternate Wetting and Drying Method. Adoption of Alternate Wetting and Drying (AWD) was central to CFAVC's strategy for reducing methane emissions from rice cultivation. GHG mitigation from rice systems was modeled using IPCC Tier 1 emission factors, comparing continuous flooding with partial AWD adoption, which indicated substantial potential methane reductions. However, household survey results showed that formal AWD adoption—based on farmers' self-identification with the AWD terminology—remained limited, with only 11.8 percent of respondents reporting that they practiced AWD. Adoption varied across provinces, with the highest uptake observed in Takeo (32.6 percent), moderate adoption in Kampot (14.6 percent), and very low uptake in Kampong Cham (6.0 percent) and Tboung Khmum (6.4 percent), as summarized in **Table 30**.

Despite low formal recognition of AWD, practice-based survey responses revealed widespread alignment with core AWD principles. A large majority of farmers (79.4 percent) reported allowing rice fields to dry before re-flooding, and 70.6 percent maintained recommended shallow water depths of 5–10 cm. Only 20.6 percent of respondents indicated reliance on continuous flooding. This divergence between terminology-based reporting and observed water management practices suggests limited familiarity with the AWD label rather than absence of AWD-consistent behavior, a finding further corroborated through focus group discussions (FGDs). FGDs indicated that many farmers are increasingly adjusting irrigation schedules and reducing standing water, though full institutionalization of AWD remains constrained by rainfall variability, canal water availability, and collective water management challenges.

Remote sensing analysis further supports evidence of partial AWD uptake. Normalized Difference Water Index (NDWI) and surface wetness assessments showed that 2017 exhibited persistently high flood conditions, creating strong anaerobic environments conducive to methane generation, whereas 2025 displayed more regulated moisture patterns, consistent with improved irrigation control and partial AWD implementation (**Figure 13**). These spatial trends align with self-reported reductions in water use and observed shifts toward intermittent flooding.

Given this context, methane mitigation estimates were based on observed water management practices rather than stated familiarity with AWD terminology, consistent with

IPCC guidance to prioritize activity-based indicators over self-reported labels. Formal AWD adoption (11.8 percent) therefore represents a conservative lower bound, while practice-based partial AWD adoption reflects a higher but plausible scenario within which the reported estimates fall. Under these assumptions, AWD-related interventions contributed an estimated 357,713 tCO_2e in mitigation from rice systems. Sustaining and scaling these gains will require expanded farmer training, strengthened coordination among water user groups, and the introduction of practical AWD tools such as field water tubes and digital advisory applications to support consistent low-emission rice cultivation.

Table 30. Adoption of Alternate Wetting and Drying (AWD) and Water Level Management in Rice Fields

	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
PRACTICE AWD					
• Do not know / Not familiar with AWD	0.0%	4.2%	0.0%	0.0%	0.7%
• No	94.0%	81.3%	67.4%	93.6%	87.5%
• Yes	6.0%	14.6%	32.6%	6.4%	11.8%
Respondents	84	48	46	110	288
HOW WATER LEVEL IS NANAGED					
• I keep the field flooded most of the time	20.0%	42.9%	6.7%	28.6%	20.6%
• I let the field dry before re-flooding (AWD)	80.0%	57.1%	93.3%	71.4%	79.4%
WATER LEVEL					
• Do not know	0.0%	14.3%	0.0%	0.0%	2.9%
• Less than 5 cm	20.0%	14.3%	20.0%	0.0%	14.7%
• 5 to 10 cm	60.0%	57.1%	66.7%	100.0%	70.6%
• More than 10 cm	20.0%	14.3%	13.3%	0.0%	11.8%
WATER LEVEL MANAGEMENT TREND					
• I use less water than before	40.0%	42.9%	40.0%	28.6%	38.2%
• I use more water than before	40.0%	28.6%	26.7%	42.9%	32.4%
• No change in water level	20.0%	28.6%	33.3%	28.6%	29.4%

Source: HH survey



Figure 13. Farmers transplanting rice in their rice paddies.

3.3.1.2.1.2 Biodigesters

The biodigester intervention generated substantial climate, livelihood, and gender co-benefits, reducing an estimated 1,111 tCO_2e per year through methane capture from livestock manure (≈959.9 tCO_2e) and biogas substitution for firewood and LPG (≈910.9 tCO_2e), as shown in **Table 29**. Using IPCC 2006 Tier 1 emission factors and AR6 GWPs, avoided emissions were calculated from cattle and pig populations and spatially aggregated using georeferenced livestock data. Biodigesters displaced about 752,000 kg of firewood or 245,000 kg of LPG annually, reducing deforestation pressure and household energy costs while improving indoor air quality and nutrient recycling. KIIs confirmed additional benefits, including 30–40% crop-yield increases from slurry use, reduced fertilizer dependence, and new income from surplus produce, with women gaining most from reduced fuel collection and smoke exposure—aligning with SDGs 5, 7, and 13. Capacity building through cooperatives strengthened installation, maintenance, and compost use, while integration with road and irrigation improvements enhanced market access and cropping intensity. Provincial variations reflected livestock density and biodigester distribution, demonstrating biodigesters' scalability as a low-cost climate solution supporting Cambodia's transition to resilient, low-emission agricultural systems.

3.3.1.2.1.2.1 Manure GHG Emissions

Manure-based methane emissions represent a major mitigation opportunity in smallholder systems, and the CFAVC Project's household biodigesters substantially reduced these emissions by fully utilizing livestock manure for biogas production. Using IPCC 2006 Tier 1 emission factors—3.0 kg CH_4/head/year for cattle and 7.5 kg CH_4/head/year for pigs, converted with AR6 GWP_{100} = 27.2—the project achieved an estimated 35.3 tons of CH_4 avoided annually, equivalent to 959.9 tCO_2e, averaging 243 kg CO_2e per household, with pig manure contributing over 75% of total reductions. Provincial estimates showed the highest avoided emissions in Tboung Khmum due to large pig herds, followed by Kampot, which had the most biodigester installations; baseline CH_4 emissions ranged from 7.92–10.50 tons across provinces, translating to 215–285 tCO_2e per year, as detailed in **Table 31** (emission factors referenced in **Table 28**). These reductions not only mitigate GHGs but also provide clean cooking energy, reduce firewood dependence, and generate nutrient-rich slurry that improves soil fertility, highlighting biodigesters as a scalable, low-cost solution that simultaneously advances climate mitigation, energy security, and sustainable livestock management for smallholder farmers.

Table 31. *Estimated GHG emission mitigated by biodigester by animal.*

Information	Kampong Cham	Kampot	Tboung Khmum	Takeo	Total
No. of sites	88	120	68	136	412
Ave. cows per household	5.6	5.7	6.7	5.9	5.975
Ave. pigs per household	10	7.5	17.9	5.4	10.2
EF cow CH4 kg per head	3.00	3.00	3.00	3.00	3.00
EF pig CH4 kg per head	7.50	7.50	7.50	7.50	7.50
Total cow CH4 ton	1.478	2.052	1.367	2.407	7.3044
Total pig CH4 ton	6.60	6.75	9.13	5.51	27.99
Total CH4 ton	8.078	8.802	10.496	7.915	35.2914
Total CO2e ton	219.733	239.414	285.486	215.293	959.9261

*References for emission factors are based on Table 27

3.3.1.2.1.2.2 Fuel Substitution

Fuel substitution from household biodigesters generated substantial GHG reductions under the CFAVC Project, with each unit replacing about 1.8 tons of firewood per year (≈594 kg LPG) (**Table 32**) and avoiding roughly 2.2 tCO_2e annually, which, when combined with manure-related reductions (~0.5 tCO_2e), totaled about 2.7 tCO_2e per household per year. Using IPCC 2006 Tier 1 combustion factors and AR6 GWPs—based on assumptions outlined in Table 27—project-wide fuel substitution avoided 910.9 tCO_2e/year, contributing nearly 80% of all biodigester-related emission savings. Provincial reductions ranged from 194.6–300.7 tCO_2e/year, with Kampot and Takeo leading due to higher installation numbers; collectively, biodigesters displaced about 751.9 tons of firewood and 244.7 tons of LPG annually across 412 sites, as detailed in Table 32. These shifts reduced forest pressure, enhanced household energy security, and lowered indoor air pollution while reducing women's and children's time spent collecting biomass. By replacing non-renewable fuels with biogas, biodigesters strengthened resilience to fuel price volatility and advanced Cambodia's NDC mitigation commitments, demonstrating their viability as a scalable, low-emission solution delivering strong climate, health, and gender co-benefits.

Table 32. *Province-level GHG and fuel substitution statistics from biodigesters.*

No. of biodigester sites	**Kampong Cham**	**Kampot**	**Tboung Khmum**	**Takeo**	**Total**
Biodigester sites	88	120	68	136	412
Average avoided GHGs/site					
Ave. avoided CO2e – Livestock (kg)/site	485.52	485.52	485.52	485.52	485.52
Ave. fuel CO2e avoided (kg)/site	2,210.99	2,210.99	2,210.99	2,210.99	2,210.99
Total CO2e avoided (kg)/site	2,696.51	2,696.51	2,696.51	2,696.51	2,696.51
Average fuelwood saved/site					
Ave. Fuelwood saved (kg)/site	1,825.00	1,825.00	1,825.00	1,825.00	1,825.00
Ave. LPG equivalent (kg)/site	593.82	593.82	593.82	593.82	593.82
Total avoided GHG					
Total Avoided CO2e – from Livestock (t)	219.73	239.41	285.49	215.29	959.93
Avoided CO2e from Fuel (t)	194.57	265.32	150.35	300.69	910.93
Total CO2e avoided (kg)	414.3	504.73	435.83	515.99	1,870.85
Total fuelwood saved					
Total fuelwood saved (t)	160.6	219	124.1	248.2	751.9
LPG equivalent (t)	52.26	71.26	40.38	80.76	244.65

*The assumptions of the emission is based in Table 29

3.3.1.2.1.3 Road Improvements

The rehabilitation of rural roads under the CFAVC Project generated measurable climate, health, and social benefits by improving transport efficiency, reducing vehicle emissions, and minimizing dust exposure for nearby communities. Across 250 km of rehabilitated roads, total annual GHG savings were estimated at approximately 386 tCO_2e, based on the reduced emission factor of 0.19 kg CO_2e/km compared to the 0.27 kg CO_2e/km baseline. These recurring reductions, though smaller than those achieved through agricultural or energy components, contribute consistently to low-carbon rural development. Using a geospatial workflow in GEE, road improvement shapefiles were intersected with provincial boundaries to compute total road length, while GHG emissions were estimated under the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (Volume 2: Energy Sector, Tier 1 approach) with emission factors from ADB regional transport studies. For light diesel trucks, baseline emissions on poor-quality roads were assumed at 0.27 kg CO_2e/km, while improved roads emitted 0.19 kg CO_2e/km, with traffic modeled at 10 trips per day over 365 days per year, applying the formula:

Emissions (kg CO_2e) = Road length (km) × EF (kg CO_2e/km) × Trips/day × 365

Applying these parameters yielded an estimated reduction of ~386 tCO_2e/year, confirming that smoother surfaces improve vehicle performance and fuel economy. Beyond carbon savings, the smoother road conditions reduced idling and mechanical wear, enhanced logistics efficiency, and lowered vehicle maintenance costs, extending asset lifespans and improving economic connectivity. The WorldPop 2020 population raster analysis revealed that communities within 100–500 m of upgraded roads experienced reduced dust exposure, leading to lower risks of respiratory and eye health problems, particularly among children, women, and the elderly. These co-benefits demonstrate that road upgrades not only reduce GHG emissions but also improve air quality and access to markets, schools, and health facilities, thereby advancing social inclusion and rural well-being. While annual GHG reductions of 386 tCO_2e may appear modest, their cumulative impact over a 10–15-year road lifespan is significant, aligning with Cambodia's NDC targets for transport-sector mitigation. Overall, the integration of geospatial monitoring, emission modeling, and population exposure mapping provides a replicable, evidence-based framework for evaluating both climate and health co-benefits of rural infrastructure. The road improvement component thus exemplifies how sustainable transport investments can jointly advance emission reduction, resilience, and inclusive development goals.

3.3.1.2.1.4 Integrated GHG Mitigation

The integrated analysis confirms that the project effectively reduced GHG emissions across agriculture, transport, and household energy sectors, demonstrating the strength of a cross-cutting mitigation approach. Cumulative annual reductions reached approximately 1,111 tCO_2e from biodigester adoption, complemented by additional savings from road improvements (about 386 tCO_2e) and AWD irrigation in rice fields. Together, these results indicate a consistent and measurable decline in total project emissions between 2017 and 2025. The combined impacts of cleaner transport, renewable household energy, and climate-smart irrigation practices highlight how integrated interventions can jointly deliver environmental, livelihood, and public health benefits while supporting Cambodia's NDC targets.

Analytical framework and methodological consistency. The project adopted a multi-sectoral GHG accounting framework based on IPCC Tier 1 methods, ensuring methodological consistency across interventions. The total GHG reduction was calculated using the equation:

Total GHG Savings (tCO_2e) =
Road Improvement Savings
+ Biodigester Savings
+ Rice Field AWD Savings

Each component used activity data (road length, livestock herd size, and rice field extent) matched with corresponding emission factors. Biodigester-related reductions were calculated from livestock methane capture (approximately 200 tCO_2e) and fuelwood substitution (approximately 911 tCO_2e), totaling approximately 1,111 tCO_2e per year. The integrated accounting approach ensured consistency across components, avoided double counting, and maintained transparency through documented assumptions and geospatial datasets.

Sectoral contributions to GHG reduction. The project's overall GHG mitigation performance was driven by 3 core intervention streams: (1) renewable household energy; (2) sustainable transport infrastructure, and (3) climate-smart agriculture. Each contributed

distinct but complementary reductions that together formed the foundation of an integrated low-emission development model addressing both direct and indirect emission sources. The following analysis presents their respective contributions and illustrates how biodigesters, road rehabilitation, and AWD irrigation practices collectively produced measurable and verifiable emission reductions across Cambodia's rural landscape.

Box 5. *Core intervention streams for GHG mitigation.*

Energy and livestock management
Biodigesters were the largest single contributor to total GHG mitigation, avoiding ~1,111 tCO_2e/year through two channels: methane capture from livestock manure (~200 tCO_2e) and replacement of non-renewable fuelwood with biogas (~911 tCO_2e). This also translated to 751.9 t of fuelwood saved annually, equivalent to 244.7 t of LPG, reducing both deforestation pressure and household energy costs.

Transport efficiency
Improved road quality lowered vehicle emission factors from 0.27 to 0.19 kg CO_2e/km, yielding ~386 tCO_2e/year in avoided emissions. Though smaller than energy-related impacts, this component reinforced the project's low-carbon logistics model by enhancing transport efficiency and reducing particulate emissions that degrade air quality and health.

Sustainable rice cultivation
The transition from continuous flooding to AWD in rice fields led to a measurable reduction in methane generation. The 2025 NDWI analysis showed drier soil conditions than in the 2017 baseline, confirming the success of AWD practices in reducing anaerobic decomposition. This component further amplified the project's mitigation potential within the agricultural sector, Cambodia's largest source of methane emissions.

Observed and projected reductions. Temporal analysis showed a net reduction in total GHG emissions between 2017 and 2025, driven mainly by AWD irrigation and renewable household energy adoption. Lower field wetness reduced methane emissions, while biodigester use decreased emissions from both manure and fuel combustion. Road upgrades reinforced these outcomes by cutting per-trip transport emissions along rural supply chains. The spatial concentration of these interventions within shared agricultural areas enhanced their combined effectiveness, demonstrating the efficiency of geographically focused, multi-benefit climate actions.

Integrated climate and social benefits. The project's integrated GHG mitigation model produced complementary climate, resource, and social dividends.

Box 6. *Benefits produced by the integrated GHG mitigation model.*

Climate benefits
Measurable reductions in methane and CO_2e emissions across multiple sectors, totaling well above 1,500 tCO_2e/year when combined.

Resource benefits
Significant decreases in non-renewable biomass use and associated deforestation risk due to widespread fuelwood substitution.

Social benefits
Enhanced household energy access through biogas, improved air quality from cleaner transport and reduced smoke exposure, and improved health outcomes from lower dust emissions and indoor air pollution.

The project linked infrastructure upgrades, renewable energy, and climate-smart agriculture to demonstrate a practical model for low-emission rural development. Together, these interventions strengthened community resilience, supported climate goals, and advanced Cambodia's transition toward a sustainable, low-carbon economy.

3.3.1.3 Resource efficient agribusiness

Progress in developing resource-efficient agribusinesses under the CFAVC Project was mixed. The project has achieved notable gains in post-harvest loss reduction and emerging improvements in energy efficiency, while water-saving targets were largely inapplicable. Compared with the 2026 target of 50 agribusinesses achieving measurable efficiency improvements (5–10% water savings, 20% energy savings, and 10% post-harvest loss reduction; 2017 baseline: 0), progress varied across indicators (**Table 33**).

Table 33. *Progress on outcome indicator: By 2026, At least 50 agribusinesses become more resource efficient in terms of water savings (5-10% efficiencies); energy savings (20%); and reduction in post-harvest losses (10%) (2017 baseline: 0).*

Component	Unit	Baseline	Target	Accomplished	% Accomplished
Agribusinesses water savings (5-10% efficiencies)	Agribusinesses	0	50	0	0.00%
Agribusinesses energy savings (20%)	Agribusinesses	0	50	12	24.00%
Agribusinesses reduction in post-harvest losses (10%)	Agribusinesses	0	50	40	80%

No measurable improvement was observed in water-use efficiency, as most participating enterprises, including rice millers and agricultural cooperatives, did not rely on water as an operational input, making the indicator non-applicable. In contrast, moderate progress has been achieved in energy efficiency, with 25 agribusinesses (30.8%) reporting ~20% reductions in energy use, equivalent to 50% of the target and rated as “Low Achievement” (**Table 34**). These gains were driven by the use of solar-powered systems, improved logistics from better road connectivity, and modernized processing equipment, which together reduced fuel consumption and electricity costs. The strongest results were seen in reducing post-harvest losses, where 40 agribusinesses (50%) have achieved at least a 10% reduction, averaging 21.1% and representing 80% target achievement, rated “Satisfactory”. Upgraded drying and storage facilities, warehouse construction, and improved road infrastructure collectively reduced grain spoilage and moisture-related losses from 10–30% before the project to only 1–10% after implementation, while cooperative-led management further strengthened efficiency and product quality.

Table 34. *Resource efficiency and loss reduction among CFAVC processors and traders.*

I. Water	
No change / No reduction	100.00%
Saved water by 5-10% - Not applicable / Not using water as input	-
Total no. of agribusinesses (50 agricultural cooperatives + 30 agribusinesses)	-
Average Reduction	-
II. Electricity	
Experienced no changes (from survey)	69.20%
Agribusiness saved energy/power by 20%	30.80%
Average reduction	15.50%
Total no. of agribusiness (50 agricultural cooperatives + 30 agribusinesses = 80) x 30.8%	25
III. Post-Harvest Losses	
No reduction	50.00%
Reduced losses by 10%	50.00%
Average losses	21.10%
Total no. of agribusiness (50 agricultural cooperatives + 30 agribusinesses = 80) x 50%	40

Source: KII with traders and processors

Field verification identified several innovative and resource-efficient practices among agribusinesses. An agricultural cooperative operating a corn-drying facility used fuelwood to generate heat for flatbed dryers, offering a locally sourced and carbon-neutral alternative to fossil fuels. This approach reduced operational costs and GHG emissions from fuel

substitution. A cassava flour mill supported by the project demonstrated integrated wastewater management and energy recovery, where wastewater was treated through a biodigester system and recycled for reuse. The biodigester also produced biogas used for cassava drying, showcasing circular resource use that reduced both water waste and fossil-fuel dependence.



Figure 14. Use of renewable resources (Fuelwood) and waste recovery by agriprocessors

Overall, the project's results highlight strong progress in improving post-harvest management, energy efficiency, and circular production systems, even as water efficiency remains less relevant to most value-chain operations. In order to build on these achievements, future initiatives should focus on:

- Scaling solar and bioenergy applications across agribusiness facilities
- Establishing differentiated efficiency benchmarks by enterprise size and commodity
- Providing sustained technical assistance to strengthen low-emission and resource-efficient agribusiness practices nationwide

3.3.2 GCF Outcome

The CFAVC Project demonstrates strong overall progress across key GCF outcome indicators, with notable gains in institutional strengthening and household-level adaptive capacity—many of which align closely with, and are also reflected in, the project's DMF outcome indicators on productivity, climate-smart adoption, and GHG mitigation. The project fully achieved its target for strengthening climate-responsive institutional and regulatory systems (A5.1: 100%), evidenced by the development of gender-responsive policies, improved coordination mechanisms, and enhanced climate-planning instruments. Under Outcome A7.0, which measures adaptive capacity and reduced exposure to climate risks, progress is mixed but generally positive: 68.8% of vulnerable households adopted Fund-supported climate tools and strategies, while early warning systems and risk reduction measures reached 91.5%, reflecting strong dissemination and preparedness. In contrast, Outcome A8.0, on climate-threat awareness, remains at 0%, indicating insufficient implementation or documentation of awareness-raising activities. Similarly, Outcome M9.0 on sustainable land and forest management shows 0% progress, signaling delays in land-based mitigation efforts. The cross-cutting outcome—capturing biodigester and compost hut adoption—achieved 75%, demonstrating integrated mitigation–adaptation benefits at the farm level and aligning with parallel DMF indicators on emissions reduction and climate-smart technology uptake. Overall, the GCF outcomes show substantial progress in institutional capacity and community resilience, while highlighting the need to accelerate

awareness-building and land management components to achieve the full transformational ambition of the project.

3.3.2.1 Strengthened institutional and regulatory systems for climate responsive Planning and development (A5.0)

The CFAVC Project fully achieved all targets under Outcome **A5.0**, demonstrating strong performance in strengthening Cambodia's institutional and regulatory framework for climate-responsive agribusiness development. Three key national-level instruments were successfully delivered: (i) the approval of a climate-smart and gender-responsive agribusiness policy; (ii) the formulation of a public–private partnership (PPP) framework focusing on agribusiness; and (iii) the enforcement of two CAMGAP standards for tropical fruit and organic fertilizers. Each of these outputs reached **100% accomplishment**, indicating that the project effectively enhanced policy incentives, coordination mechanisms, and regulatory standards supportive of climate resilience and gender inclusion in the agrifood sector. These achievements directly contribute to the project's objective of mainstreaming climate adaptation and mitigation within Cambodia's agricultural planning and development systems.

3.3.2.2 Strengthened adaptive capacity and reduced exposure to climate risks (A7.0)

Under Outcome A7.0, the CFAVC Project made strong progress in strengthening household adaptive capacity through climate-smart agriculture (CSA) training, climate-risk information, and risk-sharing instruments, reaching **29,709 farmers** (74.3%) and **19,368 households** (96.8%), including substantial numbers of women. However, despite these achievements, the national target of reducing the number of climate-affected households by 50% was not met, as climate hazards intensified beyond the project's control. Survey findings in **Table 35** show that households affected by major climatic events rose dramatically from **0.3% in 2020** to **20.1% in 2024**, moderating to **10.8% in 2025**, with increases across drought (up to 9.0%), floods (up to 9.7%), typhoon winds (1.0%), and emerging compound events. These trends mirror national patterns reported by NCSD and ODC, which indicate rising climate variability and more frequent extremes, although updated national data beyond 2019 remain unavailable. Given the severity and acceleration of climate shocks, the rising number of affected households reflects broader climatic conditions rather than shortcomings in project performance. While CFAVC investments in irrigation, CSA, and value-chain resilience contributed meaningfully to long-term adaptive capacity, achieving measurable reductions in climate-affected households will require larger-scale national infrastructure, systemic climate-risk management, and longer implementation horizons beyond the scope of a single value-chain project.

Table 35. Result of the response of the Timeline Analysis

MAJOR CLIMATE EVENTS	IMPACTS	HHs Affected by Climatic Disturbance Episodes					
		2020	2021	2022	2023	2024	2025
Drought	Damage home	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%
	Damage of agriculture crops	0.0%	0.3%	2.1%	4.5%	5.9%	0.7%

MAJOR CLIMATE EVENTS	IMPACTS	HHs Affected by Climatic Disturbance Episodes					
		2020	2021	2022	2023	2024	2025
	Have enough water for irrigation for farming	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%
	Lacking the water irrigation for farming	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%
	Less the agriculture crops	0.0%	0.0%	0.0%	0.3%	0.3%	0.0%
	Lost the agriculture crops yeild	0.0%	0.3%	1.7%	0.7%	1.7%	0.3%
	Total	**0.0%**	**0.7%**	**3.8%**	**5.6%**	**9.0%**	**1.0%**
Drought and floods	Damage of agriculture crops	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%
Floods	Damage home	0.0%	0.0%	0.3%	0.0%	0.7%	0.0%
	Damage of agriculture crops	0.0%	1.7%	1.4%	3.8%	8.7%	8.7%
	Lost the agriculture crops yeild	0.3%	0.0%	0.0%	0.0%	0.3%	0.0%
	Total	**0.3%**	**1.7%**	**1.7%**	**3.8%**	**9.7%**	**8.7%**
Typhoon winds	Damage home	0.0%	0.3%	0.3%	0.7%	1.0%	0.7%
Total HHs Affected by Climatic Events (Respondents - = 288)		0.3%	2.8%	5.9%	10.1%	20.1%	10.8%

3.3.2.3 Strengthened awareness of climate threat and risk reduction processes (A8.0)

Under Outcome A8.0, the project has made moderate progress in strengthening awareness of climate threats and risk reduction processes, reaching 165,399 people, or 42.4% of the overall target of 390,000 individuals. While the total awareness outcome remains below the expected level at mid-stage, performance on women's awareness shows relatively stronger progress, achieving 81,941 women, equivalent to 52.5% of the gender-specific target of 156,000. These results indicate that although the project is successfully reaching a significant number of beneficiaries—particularly women—further efforts are needed to

expand climate awareness activities, deepen community engagement, and accelerate outreach to ensure broader coverage and alignment with the project's ambition to build climate-informed, resilient agrifood communities.

3.3.2.4 Improved management of land or forest areas contributing to emissions reductions (M9.0)

Under Outcome M9.0, the CFAVC Project made partial progress in expanding climate-friendly land management practices but remained significantly below its area-based targets. Only 3,250 ha of land were placed under climate-friendly agriculture practices, achieving 8.1% of the planned 40,000 ha. Similarly, land improvement through laser leveling covered 949 ha, corresponding to 31.6% of the 3,000 ha target. These results indicate that while technical interventions were implemented and demonstrated at field level, scaling them to the intended landscape coverage proved challenging. Limited adoption, resource constraints, and the need for more intensive extension support likely constrained progress. Overall, the modest achievement under M9.0 suggests that substantial additional effort and investment are required to expand sustainable land management practices at scale and fully realize the expected GHG mitigation benefits.

3.3.2.5 Cross Cutting (biodigesters and compost huts introduced)

The CFAVC Project made limited progress in the deployment of cross-cutting climate-smart technologies, specifically biodigesters and compost huts. Against a target of 6,000 units each, the project successfully introduced only 459 biodigesters and 459 compost huts, achieving 7.7% of the expected outputs for both interventions. While these technologies have demonstrated strong potential to reduce emissions, improve soil fertility, and enhance farm-level sustainability, the low accomplishment rate indicates significant challenges in large-scale adoption—likely linked to high upfront investment costs, maintenance requirements, and varying levels of household readiness. Overall, the cross-cutting outcome shows that although the project piloted important low-emission technologies, substantial gaps remain in scaling them to reach the intended number of beneficiaries.

3.3.3 Outputs and Activities

3.3.3.1 DMF Outputs and Activities

A. Achievement of DMF OUTPUTS

The consolidated performance of the CFAVC Project's DMF outputs shows substantial progress across most areas, demonstrating strong institutional, policy, and technical achievements while also highlighting several implementation gaps, as outlined in Box 7. Output 1 recorded mixed but meaningful gains in climate-resilient infrastructure, with irrigation and water management systems achieving 61.7%, farm road upgrading reaching a strong 74.0%, and National Agricultural Laboratory enhancements at 88.1%, while agricultural cooperatives fully integrated adaptation measures (100%). However, slow progress was seen in rainwater harvesting ponds (27.8%) and in the adoption of biodigesters and compost huts (47.0%). Output 2 performed well in advancing climate-smart agriculture, fully releasing climate-resilient crop varieties (100%) and making steady progress in strengthening FWUCs/FWUGs (69.8%) and establishing agricultural development centers (75.0%), although farmer training and SRP compliance (67.9%) indicate a need for continued extension and capacity building. Output 3—focused on the

enabling environment—achieved near-complete success, with climate-smart agribusiness policy formulation, CAMGAP endorsement, green finance training for banks and agribusinesses, and household outreach on climate-risk instruments all reaching 70–100%, aside from the ICT platform for climate-friendly agribusiness, which remained 0%. Overall, the DMF outputs show that the project has established strong physical and institutional foundations for climate-resilient agribusiness development, delivering high achievements in infrastructure, crop innovation, and policy frameworks, while the next phase will require strengthening ICT systems, scaling farmer inclusion, and expanding institutional coordination to translate these gains into sustainable, community-centered value chain improvements.

Box 7. *CFAVC outputs and activities.*

Output 1: Critical agribusiness value chain infrastructure improved and made climate-resilient

- By 2024, 27 irrigation and water management systems targeting 15,000 ha and 25,000 households (with at least 50,000 women) rehabilitated and made climate resilient (2017 baseline: 0)
- By 2024, 500 on-farm rainwater harvesting ponds commissioned (2017)
- By 2024, At least 250 km of farm road networks upgraded to climate standards to improve connectivity of farms to cooperatives and markets (2017 baseline: 0).
- By 2024, 80 agricultural cooperatives* integrated adaptation measures in post-harvest infrastructure investments (2017 baseline: 5).
- By 2024, Crop product quality and safety testing infrastructure in National Agricultural Laboratory upgraded to test 1500 samples (2017 baseline: 700) and generate service income more than $75,000 (2017 baseline: $0).
- By 2024, 6,000 additional biodigesters and 6,000 compost huts made operational, benefiting at least 80,000 persons, including at least 50% women, due to better household air quality (2017 baseline beneficiaries: 11,468 persons, including 5,721 women).

Output 2: Climate smart agriculture and agribusiness promoted

- 3 additional climate resilient varieties of rice and maize released (2017 baseline: 0).
- 40,000 farmers (of whom 16,000 are women) trained in CSA and agribusiness development skills, of which 50% are SRP compliant with direct links to millers and exporters (2017 baseline for SRP compliance: 0).
- 27 FWUCs/FWUGs made operational and 500 FWUC/FWUG members (of which 30% women) developed capacity to operate and maintain their irrigation schemes (2017 baseline: 0).
- 4 provincial agricultural development centers and 4 engineering workshops made fully operational to provide agribusiness services and strengthen farmer value chain linkages (2017 baseline: 0).

Output 3: Enabling environment for climate friendly agribusiness enhanced

- Climate-smart and gender-responsive agribusiness policy for target commodities, including a PPP framework focusing on agribusinesses formulated (2017 baseline: 0)
- CAMGAP for tropical fruit and organic fertilizers endorsed as national standard for tropical fruit and organic fertilizers (2017 baseline: 0).
- 50 staff, including 30% women, from financial institutions trained in CSA and green finance (2017 baseline: 0).
- 30 agribusinesses, including 30% women-led and/or owned, trained on green finance and CSA (2017 baseline: 0)
- 20,000 households, including 20,000 women, provided with information on climate risk sharing instruments (2017 baseline: 0)
- ICT platform for climate friendly agribusiness established in Kampong Cham province

B. Achievement of DMF activities

The CFAVC Project demonstrated strong overall performance across most DMF activities, with substantial progress in infrastructure, capacity building, and policy implementation, although key gaps persist in ICT systems and renewable energy adoption. Activity Group 1 (Infrastructure) showed mixed but meaningful progress, with water management rehabilitation reaching 50.4%, farm road upgrading achieving 74.0%, and National Agricultural Laboratory strengthening reaching 88.1%, while cooperative value chain infrastructure was fully completed (100%). However, renewable energy promotion remained low at 47.0%, consistent

with broader delays reflected in only 275 biodigesters and compost huts installed (4.6% of target), despite benefiting over 73,000 people. Broader infrastructure accomplishments included 19 of 27 irrigation schemes rehabilitated (70.4%) covering 9,815 hectares and 278 rainwater harvesting ponds completed (55.6%). Under Activity Group 2 (Climate-Smart Agriculture), deployment of climate-resilient varieties achieved 100%, farmer training reached 68.9–74.3%, FWUC strengthening reached 63%, and mechanization and extension support achieved 75%, reflecting steady but incomplete capacity-building progress. Activity Group 3 (Enabling Environment) performed strongly, with climate-friendly agribusiness policies, CAMGAP standards, PPP frameworks, and green finance capacity building all nearing or achieving 92–100%, alongside 19,400 households receiving climate risk-sharing information (96.8%); however, the ICT platform for climate-risk management remained unimplemented (0%). Activity Group 4 (Project Management) was fully accomplished (100%), with timely consultant mobilization, PPMS establishment, and staff training. Overall, DMF activity achievements indicate robust advancements in policy, standards, institutional capacity, and physical infrastructure, while highlighting persistent challenges in irrigation completion, renewable energy adoption, and ICT-enabled climate services that must be accelerated to meet the remaining project targets.

3.3.3.1.1 Output 1: Critical agribusiness value chain infrastructure improved

Output 1 showed strong progress in physical infrastructure development, particularly in farm road rehabilitation and irrigation improvement, which enhanced market connectivity and agricultural productivity in project areas. Farm road rehabilitation was the most notable achievement, reflecting significant gains in facilitating the movement of goods, reducing post-harvest losses, and improving access to markets and services. Irrigation rehabilitation also advanced steadily, reaching 70.4% of the target with 9,815 hectares (65.4%) of irrigated area completed. However, household and women beneficiaries, 1,690 (6.8%) and 4,970 (9.9%) respectively, remained relatively low, indicating a need to strengthen utilization and social outreach as system commissioning progresses. Progress in on-farm water management was moderate, with rainwater harvesting ponds completed at 55.6%, while biodigester and compost hut construction remained limited at 2.3% and 3.1%, mainly due to cost-sharing and implementation delays. The Q2 2025 Progress Report noted that eight irrigation schemes have been awarded, with full completion expected within 2025. NAL also performed well, achieving 53.8% of its testing target and generating USD 43,350 in income (86.4%, rated Good), indicating progress toward financial sustainability. Following the 2023 Midterm Review, the biodigester target was revised from 12,000 to 6,000 units, maintaining 6,000 compost huts, with MAFF contracting 1,398 units and planning to complete about 3,500 by the end of 2025, subject to project extension. Overall, Output 1 demonstrated strong performance in infrastructure delivery and emerging gains in technical facilities, with remaining opportunities to expand household adoption, strengthen gender inclusion, and ensure sustained benefits through continued capacity building and support.

3.3.3.1.1 Activity 1.1: Rehabilitating water management infrastructures

Improvements in irrigation access under Activity 1.1 show clear progress in enhancing agricultural resilience and productivity, though water availability remains uneven across provinces. Respondents in Kampong Cham, Takeo, and Kampot reported that rainwater and pond water can now be used more effectively for irrigation, with improvements of up to 50% in some sites, resulting in better crop yields and higher market prices (FGDs with agricultural cooperatives from Kampong Cham, Takeo, and Kampot). These gains demonstrate the

project's contribution to the GCF criterion of Effectiveness, particularly through infrastructure that supports climate adaptation. However, water shortages during the dry season, especially in Takeo and Tboung Khmum, continue to limit consistent irrigation, highlighting the need for additional measures such as water storage expansion and integrated management. Irrigation source diversity also reflects these differences: ponds and reservoirs dominate in Kampot (27.1%), rivers and streams in Kampong Cham (28.6%), and irrigation canals in Takeo (23.9%), while reliance on seasonal rainwater harvesting remains significant (**Table 36**). This diversity increases flexibility but also indicates varying levels of vulnerability to climate variability, particularly in rain-fed areas.

Table 36. *Main sources of irrigation water by province.*

Irrigation source	Kampong Cham	Kampot	Takeo	Tboung Khum	Average
Pond or reservoir	23.80%	27.10%	15.20%	14.50%	19.40%
Groundwater (well, tube well)	22.60%	8.30%	2.20%	18.20%	15.30%
River or stream	28.60%	6.30%	6.50%	9.10%	13.90%
Rainwater harvesting pond	15.50%	20.80%	8.70%	9.10%	12.80%
Irrigation canal	10.70%	8.30%	23.90%	8.20%	11.50%
Canal or irrigation scheme	1.20%	6.30%	17.40%	8.20%	7.30%
River/Stream	6.00%	2.10%	6.50%	1.80%	3.80%
Groundwater/Well	4.80%	0.00%	4.30%	3.60%	3.50%
Rainwater collection	1.20%	0.00%	0.00%	0.00%	0.30%

Source: Household survey



Figure 15. Irrigation canals rehabilitated by the project.

Regarding reliability, 23.6% of respondents reported irrigation water as always available during the cropping season, with the highest rate in Kampong Cham (34.5%) and the lowest in Takeo (13.0%) (**Table 37**). Another 28.1% indicated that water was available most of the time but occasionally limited, while only 4.5% reported frequent shortages (**Table 38**). These results suggest moderate but uneven water reliability across provinces, with Kampong Cham performing better due to diversified water sources, and Takeo and Tboung Khmum remaining more vulnerable to dry-season constraints. Overall, irrigation rehabilitation under CFAVC has improved access and water source diversity, enhancing climate resilience in

several communities. Continued investment in water management, pond expansion, and capacity building will be necessary to achieve equitable, year-round reliability and sustain long-term adaptation benefits.

Table 37. *Reliability of irrigation water supply by province.*

Irrigation water reliability	Kampong Cham	Kampot	Takeo	Tboung Khum	Average
Always available during cropping season	34.50%	22.90%	13.00%	20.00%	23.60%
Available most of the time, but sometimes limited	35.70%	22.90%	23.90%	26.40%	28.10%
Often insufficient or unreliable	7.10%	2.10%	4.30%	3.60%	4.50%

Source: Household survey

Table 38. *Year-round availability of irrigation water by province.*

Irrigation water reliability	Kampong Cham	Kampot	Takeo	Tboung Khum	Average
Always available during cropping season	34.50%	22.90%	13.00%	20.00%	23.60%
Available most of the time, but sometimes limited	35.70%	22.90%	23.90%	26.40%	28.10%
Often insufficient or unreliable	7.10%	2.10%	4.30%	3.60%	4.50%

Source: Household survey

3.3.3.1.1.1 Irrigation schemes

The rehabilitation of irrigation and water management systems under Sub-activity 1.1.1 has improved water availability, cropping intensity, and diversification, though progress varies across provinces. Farmers reported being able to cultivate rice two to three times a year instead of once and diversify into vegetables and livestock due to upgraded canals. Insights from KIIs with agricultural cooperatives indicated that approximately 70% of farmers near main canal systems now have extended irrigation access from the rainy season through May. As of the latest reporting period, 19 of 27 targeted irrigation schemes have been rehabilitated (70.4%), covering 9,815 ha (65.4%) and benefiting 11,998 households (48%) and 31,460 women (62.9%), rated Satisfactory. Detailed engineering designs (DED) for all 27 schemes have been completed, with nine fully completed (3,250 ha), ten 83% complete (7,329 ha), and eight 99% complete (5,180 ha), reflecting efficient sequencing and coordination. In total, 29 subprojects now cover 15,759 ha (105% of target), benefiting 20,500 households (82%) and 49,898 women (99.8%), demonstrating strong coordination between MAFF, MOWRAM, and local stakeholders. Field consultations showed that most farmers depend on rainwater and ponds feeding main and tertiary canals, with 76.4% using water pumps, 68.1% of which are diesel or gasoline-powered, 6.6% electric, and 1.7% solar, indicating limited renewable energy use. Drip irrigation adoption remains low at 20.5%, marking early progress toward climate-smart irrigation (**Table 39**). Post-rehabilitation, farmers apply more systematic irrigation schedules and use AWD methods, reducing water consumption and costs while maintaining yields (FGD with Prey Kduoch Agricultural Cooperative in Takeo). However, dry-season shortages persist in areas with shallow reservoirs or incomplete canals, requiring secondary canal expansion and improved water gates. Gender inclusion remains strong, with 99.8% of targeted women beneficiaries reached (CFAVC 2025 Q1 Report). Women are active in irrigation management and production, indicating potential for inclusive governance as systems become fully operational. Continued focus on women's leadership, infrastructure expansion, and renewable energy adoption will be essential for achieving climate-resilient and gender-responsive irrigation systems.

Table 39. Use of Water Pumps and Drip Irrigation in Surveyed Provinces

	Kampong Cham	Kampot	Takeo	Tboung Khum	TOTAL
USE WATER PUMP					
No	3.1%	3.8%	4.2%	12.5%	23.6%
Yes	26.0%	12.8%	11.8%	25.7%	76.4%
Respondents	29.2%	16.7%	16.0%	38.2%	N=288
WATER PUMP TYPE					
Diesel or gasoline-powered water pump	25.0%	11.1%	10.4%	21.5%	68.1%
Electric-powered water pump	1.0%	1.7%	1.4%	2.4%	6.6%
Solar-powered water pump	0.0%	0.0%	0.0%	1.7%	N=288
USE DRIP IRRIGATION					
No	18.1%	12.2%	11.5%	14.2%	55.9%
Yes	8.0%	0.7%	0.3%	11.5%	20.5%

Source: HH survey

3.3.3.1.1.2 Rainwater harvesting ponds

The commissioning of rainwater harvesting ponds under Sub-activity 1.1.2 has made steady progress in improving local water security and supporting climate-resilient agribusiness infrastructure. Of the 500 on-farm ponds targeted for construction by 2024, building on a 2017 baseline of 500, a total of 278 ponds have been completed, representing 55.6% achievement (**Figure 16**). As of the 2025 Q1 Progress Report, all DEDs were finalized, and Due Diligence Reports (DDRs) approved for 275 sites, with 215 ponds already constructed across Kampot, Tboung Khmum, Kampong Cham, and Takeo. This phased approach reflects efficient resource management and effective coordination, though variations in contractor performance and site conditions have influenced implementation pace. The ponds have already improved on-farm water retention and supported year-round cultivation, addressing dry-season shortages reported by agricultural cooperatives and contributing to national climate resilience goals. Their low-cost, community-based design strengthens local adaptive capacity and provides social benefits for women by reducing time and labor demands for water collection. As a cost-effective and replicable adaptation measure, rainwater harvesting ponds offer strong potential for scaling up, provided coordination among contractors, local authorities, and farmer groups is further improved to ensure timely completion, maintenance, and equitable access.



Figure 16**.** Rainwater harvesting pond installed by the project.

3.3.3.1.1.3 Drip irrigation demonstration

The drip irrigation demonstration initiative for mango farmers aims to promote climate-smart and water-efficient agricultural practices. The project targeted 15 demonstration units for installation by 2024, but none have been completed to date, reflecting 0% achievement (Table 65). Preparatory work has been completed, including beneficiary reconfirmation, site selection, and finalization of technical specifications and Bills of Quantity (BoQs), aligning with national climate priorities and GCF criteria of relevance, efficiency, and innovation (2025 Q1 Progress Report). The initiative, implemented jointly by GDA, PMU, CS2, DoEA, and DTLs, is ready for rollout once procurement and installation begin. The solar-powered drip systems are expected to reduce water use by 30–40%, improve yields, lower fuel costs, and enhance farmers' adaptive capacity. The demonstration model will also involve women farmers and cooperative members in training and maintenance to ensure equitable access and participation. Although progress remains at the preparatory stage, the activity is well-positioned for rapid implementation and offers strong potential for replication and capacity building toward climate-resilient agribusiness development.

3.3.3.1.2 Activity 1.2: Upgrading agricultural cooperative value chain infrastructure

The upgrading of agricultural cooperative infrastructure under Activity 1.2 represents a significant step in strengthening post-harvest systems, market access, and climate-resilient value chains. Of the 25,000 cooperatives targeted for upgrading and equipment support, 11,998 have been completed, representing 47.99% achievement (2025 Q1 Progress Report). This indicates steady progress in improving drying, processing, and storage facilities, although faster implementation is needed to reach full completion. Most respondents are members of producer organizations such as agricultural cooperatives, farmer groups, and savings or credit groups that facilitate collective production, input management, and marketing. These cooperatives serve as central hubs for aggregation,

input distribution, and training, with several members holding leadership positions that reflect stronger local governance capacity. Through these structures, farmers gain access to certified seeds, organic inputs, and technical training, while warehouses and collection points improve post-harvest handling and market efficiency. Governance processes within cooperatives are participatory and transparent, with committees meeting regularly to coordinate activities, resolve issues, and mobilize resources through member contributions or local fundraising. Commune authorities often mediate conflicts, reinforcing accountability and trust. Although less than half the target has been achieved, progress so far has strengthened value chain performance, enhanced management capacity, and improved market readiness. Continued coordination, technical support, and inclusive participation, particularly by women and small producers, will be critical to complete remaining targets and sustain long-term benefits for climate-resilient agribusiness development.

3.3.3.1.2.1 Integrating adaptation measures in post-harvest infrastructure investments

The integration of adaptation measures into post-harvest infrastructure investments has been central to strengthening the climate resilience and competitiveness of agricultural cooperatives. A total of 80 agricultural cooperatives constructed climate-resilient warehouses and related facilities, achieving 100% of the target and earning an Excellent performance rating (2025 Q1 Progress Report). This outcome aligns with the project's Theory of Change, national adaptation priorities, and GCF criteria for relevance and ownership. The completed facilities enhance cooperative capacity by reducing post-harvest losses, improving grain quality, and providing stable storage that protects produce from climate variability. Insights from KIIs with agricultural cooperatives indicated that complementary infrastructure (rehabilitated canals, reservoirs, and on-farm ponds) has supported multiple cropping cycles, while improved roads have reduced travel time and transport costs. Together, these investments strengthen low-emission, climate-resilient value chains by improving logistics efficiency and enabling broader market participation. Ongoing follow-up by CS1-MAFF and PPIUs ensures continued functionality, and the results across provinces offer a solid foundation for replication, scale-up, and long-term integration of climate adaptation in Cambodia's agribusiness sector.

3.3.3.1.2.2 Photovoltaic study and installation

The photovoltaic study and installation initiative has made strong progress in integrating renewable energy technologies into Cambodia's agricultural value chains, contributing directly to GCF objectives on climate mitigation, innovation, and sustainability. A total of 80 agricultural cooperative warehouses were constructed with rooftop solar PV systems, achieving full energy cost savings in daily operations, while additional installations in 3 Provincial Agriculture Development Centers (PADCs) and 3 Mechanization Engineering Workshops have reached 75% completion (2025 Q1 Progress Report). These results demonstrate measurable improvements in efficiency and cost reduction and establish a foundation for low-emission agricultural production. The project also prepared technical specifications, procurement documents, and bankable business plans to support future expansion and private-sector participation, reflecting strong governance and financial preparedness. More than 200 participants, including women and youth, received hands-on training in solar technology operation and maintenance, promoting inclusive participation and local ownership. The integration of training, technology deployment, and market facilitation provides a practical model for scaling clean energy use across the agribusiness sector and supports the long-term goal of a climate-resilient agricultural economy.

3.3.3.1.2.3 Equipment and materials for drip irrigation systems

The preparation and design of 15 drip irrigation systems, including tube wells, solar-powered pumps, and related agricultural inputs, demonstrate significant progress toward promoting climate-smart and resource-efficient farming practices. The activity aligns closely with GCF evaluation criteria on relevance, efficiency, and innovation, reflecting a strong technical and institutional foundation for implementation (2025 Q1 Progress Report). Detailed technical specifications and Bills of Quantity were developed collaboratively by MAFF-PMU, IA-GDA, DTL, and consulting experts, ensuring that system designs are both context-specific and operationally feasible. The inclusion of solar-powered pumping components exemplifies a low-emission innovation that integrates renewable energy with efficient water management. This preparatory phase showcases effective inter-agency coordination and readiness for procurement and installation, setting the stage for tangible improvements in water-use efficiency, reduced production costs, and enhanced resilience of smallholder farmers to drought and climate variability. Once completed, these drip irrigation systems are expected to serve as demonstration models for scaling sustainable water management solutions across other climate-vulnerable agricultural zones in Cambodia.

3.3.3.1.2.4 Supply circulated cylindrical dryers

The supply and installation of two circulated cylindrical dryers with electrical voltage transformer sets for 100-ton warehouses represent a strategic investment in postharvest modernization and climate-resilient agribusiness infrastructure. Although implementation is ongoing, the initiative demonstrates strong alignment with GCF evaluation criteria on relevance, efficiency, and effectiveness, directly addressing postharvest losses and product quality constraints identified within agricultural value chains (2025 Q1 Progress Report). The integration of energy-efficient drying technology underscores the project's innovative shift toward low-emission, climate-smart practices, offering both environmental and financial benefits to farming cooperatives. Once operational, the dryers are expected to reduce spoilage during high-moisture periods, stabilize farm incomes through improved grain quality, and enhance competitiveness in regional markets. The inclusion of full installation services ensures operational readiness, while the design's scalability provides a viable model for replication across other climate-vulnerable production zones, reinforcing long-term adaptation and sustainable agricultural transformation.

3.3.3.1.3 Activity 1.3: Climate-resilient farm road network: Upgrading farm roads

Enhanced rural connectivity under CFAVC has emerged as a major driver of agricultural competitiveness and community resilience. Upgraded road networks have reduced transport time and costs, strengthened market linkages, and improved farmers' access to buyers and services across key production areas.

3.3.3.1.3.1 Upgrading farm roads

The upgrading of farm-to-market roads under Sub-activity 1.3.1 stands as one of the most tangible and transformative outcomes of the CFAVC Project, improving rural connectivity, agricultural competitiveness, and community resilience. From a baseline of zero, 185

kilometers of farm roads were upgraded, fully meeting the target and demonstrating strong performance in relevance, efficiency, and effectiveness (2025 Q1 Progress Report). Implementation progressed in three phases: Batch I (71 km) completed, Batch II (100.12 km) nearing completion, and Batch III (100.72 km) under construction, reflecting sound planning, procurement, and supervision. The upgraded roads have led to significant reductions in travel time and transport costs; all surveyed households reported faster travel, and 96.9% noted lower costs. Most households (59.7%) can now reach local markets within 7–20 minutes, and traders can collect produce directly from farms, reducing post-harvest losses, expanding market access, and strengthening farmers' bargaining position (**Table 40**). These improvements have enhanced logistical efficiency across interprovincial value chains connecting production areas in Kampot, Tboung Khmum, and Takeo with trade centers in Sihanoukville and Phnom Penh.

Table 40. Reported Changes in Travel Time and Transportation Costs for Agricultural Goods

	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
TRAVEL TIME TREND AFTER ROAD IMPROVEMENT					
• Travel time decreased	29.2%	16.7%	16.0%	38.2%	100.0%
TRANSPORT COST TREND AFTER ROAD IMPROVEMENT					
• No change in transportation cost	0.0%	1.4%	0.3%	0.0%	1.7%
• Not applicable (I do not sell products at the market)	0.0%	1.0%	0.0%	0.3%	1.4%
• Transportation cost decreased	29.2%	14.2%	15.6%	37.8%	96.9%
TRANSPO TIME RANGE					
• <2 minutes	0.3%	0.0%	0.3%	0.7%	1.4%
• 2-6 minutes	5.6%	3.5%	1.0%	1.7%	11.8%
• 7-20 minutes	14.2%	8.7%	9.7%	27.1%	59.7%
• >20 minutes	9.0%	4.5%	4.9%	8.7%	27.1%

Source: HH survey

Beyond economic impacts, the initiative also brought important social benefits. Nearly all respondents reported easier transport of farm goods (97.6%), faster access to health services (94.8%), and improved school connectivity (83.7%) (**Table 41**). These outcomes show the project's contribution to inclusive development, particularly for rural households and women traders. Variations in dust reduction were noted, with lower results in Kampot (41.7%) compared to other provinces (65–79%), indicating a need for consistent surfacing quality and localized dust-control measures. Health outcomes also improved, as 44.1% of households within 80 meters of upgraded roads reported fewer health issues, although 54.9% observed no change (**Table 41**). This suggests that additional environmental safeguards, such as roadside vegetation or buffer planting, could further improve air quality and community well-being.

Table 41. Reported Household Benefits from Improved Roads

IMPROVE ROAD BENEFITS	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
Better access to schools	81.0%	81.3%	87.0%	85.5%	83.7%
Easier transportation of farm products	100.0%	93.8%	91.3%	100.0%	97.6%
Faster access to health services (clinics, hospitals)	92.9%	97.9%	97.8%	93.6%	94.8%
Less dust entering the house	77.4%	41.7%	65.2%	79.1%	70.1%
Respondents	84	48	46	110	288

Source: HH survey

Table 42. *Reported change in health problems by distance from improved roads.*

Distance	No change in health problems	Not sure	Yes, fewer health problems	Total
0 (abutting the road)	34.70%	0.00%	33.30%	68.10%
>0—0.08 km (≈ 0—80 m)	2.10%	0.00%	1.70%	3.80%
>0.08—0.63 km (≈ 80—630 m)	10.40%	0.00%	6.90%	17.40%
>0.63 km (≈ >630 m)	7.60%	1.00%	2.10%	10.80%
Total	54.90%	1.00%	44.10%	288

Source: Household survey

The engineering design incorporated climate-resilient features to ensure durability under extreme weather conditions. Roads were constructed using high-quality aggregate surfacing materials, with adequate thickness and compaction to withstand heavy truck traffic carrying agricultural produce (**Figure 17**). Concrete culverts and proper drainage systems were installed to prevent washouts and flooding during heavy rains, ensuring year-round access. These design standards not only protect the infrastructure from climate-related damage but also secure long-term maintenance efficiency.



Figure 17. Farm to market roads constructed by the project: Extent of the road (upper-left); the culverts installed (upper-right); Relative thickness of the surface materials (lower-left); and quality aggregate materials used for surfacing (lower right).

Each road segment was strategically aligned to connect agricultural cooperatives, which serve as product aggregation and storage centers, to the main highway network and key market hubs. This integration has strengthened physical and economic linkages between production zones and markets, directly supporting CFAVC's goal of building climate-resilient and inclusive agribusiness value chains. Overall, the farm-to-market road program exceeded output expectations, delivering measurable economic, health, and social benefits while reinforcing community resilience through reliable, year-round mobility. To sustain these outcomes, future priorities should include systematic maintenance, periodic rehabilitation of secondary roads, and cost-sharing mechanisms with local authorities to preserve infrastructure quality and ensure equitable access for all beneficiaries.

3.3.3.1.4 Activity 1.4: Strengthening the National Agricultural Laboratory

The strengthening of the National Agricultural Laboratory (NAL) (**Figure 18**) under Activity 1.4 showed balanced progress across infrastructure improvement, technical capacity development, and institutional sustainability, reflecting strong alignment with GCF evaluation criteria for relevance, effectiveness, efficiency, and country ownership. The NAL achieved 84.1% of its testing target (1,261 samples analyzed against the target of of 1,500) and generated USD 69.0334,832.50 in service income, reaching 9286.4% of its USD 75,000 annual revenue goal, indicating operational efficiency and growing financial self-reliance. Under Sub-activity 1.4.1 (Upgrading Crop Quality and Safety Testing Infrastructure), the laboratory was fully renovated, and a net house was constructed, improving its physical facilities. Procurement of modern testing equipment and laboratory consumables is ongoing to strengthen testing capability and service delivery. Although sample throughput remains moderate, NAL's cost-recovery performance and increased client engagement indicate sound institutional management (2025 Q1 Progress Report). The public services of quality testing for organic fertilizer and biofertilizer is also revised and updated for the new services of NAL in term of the pathogen testing and other parameters (particle size, pH, contamination levels).



Figure 18. NAL equipment.

Sub-activity 1.4.2 (Development of GMO and Phytotoxin Testing Capacity) made important technical advances through the establishment of standard operating procedures (SOPs), procurement planning for strip test kits, and delivery of inclusive technical training involving 81 participants (32 women) and 13 specialized trainees (9 women). These efforts strengthened Cambodia's biosafety foundation and supported the gradual establishment of GMO detection and food safety monitoring systems. Under Sub-activity 1.4.3 (ISO/IEC 17025 Accreditation), the NAL progressed toward international accreditation through the endorsement and dissemination of national testing guidelines to over 230 stakeholders, preparation of a Laboratory Management System Manual, and close collaboration with the Department of Accreditation and academic partners (**Figure 19**). These efforts enhance the NAL's readiness for accreditation, ensuring compliance with international standards and increasing its credibility as a national reference laboratory.



Figure 19. Manuals and guide produced by the project.

In Sub-activity 1.4.4 (Plant Tissue Culture Development), the laboratory has achieved major milestones with the publication and dissemination of the Cassava Plant Tissue Culture Manual. Over 40 training sessions and consultative meetings were conducted, reaching hundreds of participants with significant female participation. International technical exchanges further strengthened NAL's expertise in plant propagation, genetic purity, and quality assurance, supporting improved seed systems for climate-resilient crops. Sub-activity 1.4.5 (Commercialization and Institutional Sustainability) positioned NAL as a market-responsive and service-oriented institution. Through business forums on cassava plantlet production, commercialization training, a national laboratory capacity assessment, and legal reviews on seed policy, biosafety, and intellectual property, the project laid the foundation for sustainable service delivery and public–private partnerships in agricultural innovation. Progress under Sub-activity 1.4.6 (Installation of Analytical Testing Equipment) continued through transparent bid evaluation and procurement, which will soon expand analytical precision and broaden NAL's national testing capacity in soil, biofertilizer, and pesticide residue analysis. Finally, Sub-activity 1.4.7 (Biofertilizer and Organic Fertilizer Quality Assurance) has achieved strong performance and wide stakeholder participation. A total of 187 participants (98 women, 52.4%) received technical training, while the manuals on organic and biofertilizer quality testing were officially endorsed by IA-GDA following extensive consultations with 488 stakeholders (178 women, 36.5%). These standards are particularly crucial for supporting agricultural cooperatives that are producing and

commercializing compost and organic fertilizers derived from biodigesters and compost huts. By ensuring that locally produced compost meets recognized quality benchmarks, these guidelines enhance both market confidence and environmental integrity in Cambodia's emerging bio-circular agribusiness sector.

Collectively, these achievements illustrate NAL's transformation into a technically advanced, financially viable, and gender-responsive institution at the forefront of Cambodia's agricultural innovation and biosafety agenda. The upgraded laboratory facilities, certified testing systems, and quality standards for organic inputs will play a pivotal role in supporting sustainable agribusiness, farmer cooperatives (**Figure 20**), and climate-resilient agricultural production nationwide.



Figure 20. Organic fertilizers produced by an Agricultural Cooperative from the dried sludge produced from the compost huts.

3.3.3.1.5 Activity 1.5: Promoting renewable energy and use of solar energy

Activity 1.5 has effectively advanced renewable energy adoption in Cambodia's agricultural sector, aligning with Green Climate Fund criteria for relevance, effectiveness, efficiency, and gender equity by promoting climate-resilient agribusiness practices and low-emission infrastructure. The activity engaged 306 participants (58 women, 19.0%) across workshops, training sessions, and exchange visits, with women's participation varying by province, peaking at 24.3% in KPT, though overall gender disparities highlight the need for more inclusive strategies (2025 Q1 Progress Report). Equipping 80 agricultural cooperative warehouses with solar PV systems have achieved 100% energy cost savings, while three Provincial Agriculture Development Centers and three Mechanization Engineering Workshops reached 75% completion with solar installations, bolstering institutional capacity and market linkages (2025 Q1 Progress Report). Technical support for 59 AC board members and training for 134 participants (22 women, 16.4%) further strengthened local expertise, particularly in solar technology maintenance (2025 Q1 Progress Report). These outcomes demonstrate significant progress in scaling renewable energy and fostering financial sustainability, though targeted efforts are needed to enhance women's access to training and market opportunities for equitable impact.

3.3.3.1.5.1 Biodigester made operational

Sub-Activity 1.5.1 has achieved significant outreach but faces critical challenges in operationalizing biodigesters and compost huts (**Figure 21**), with only 275 of 6,000 targeted units each (4.6%) completed, far below expectations, though procurement for 180 additional units in Takeo shows progress (Table 69). Training reached 73,972 farmers (47.0% women, 29,000), surpassing the DMF target by 159.9%, and identified 9,866 potential adopters (4,847 women, 49.1%), with 48.0% intending to purchase, while 165 demonstrations engaged 544 participants (60.7% women) (2025 Q1 Progress Report). Beneficiary impact is contested, with Table 69 for value chain improvement. reporting zero beneficiaries against an 80,000-person target, while the 2025 Q1 Progress Report claims 73,679 beneficiaries (47.1% women, 34,712), achieving 92.1%; the higher value is adopted per the conflict-resolution rule (2025 Q1 Progress Report). High female participation (47.0% in training, 49.1% among adopters) supports gender equity, but limited infrastructure progress and data discrepancies highlight logistical and monitoring gaps, risking the activity's goals of climate-resilient livelihoods and equitable benefits for women.



Figure 21. Compost huts of the farmers supported by the project.

3.3.3.1.5.2 Compost hut made operational

The establishment of a National Framework on Biodigester Quality marked a pivotal step in institutionalizing Cambodia's renewable energy transition by integrating policy direction, technical standards, and market facilitation under a unified national system. Anchored in the Policy on Biodigester Development in Cambodia 2021–2030 and supported by the drafting of the Cambodian Domestic Biodigester Standard for Farmer's Friend Units, the initiative advanced the GCF criteria on relevance, effectiveness, and country ownership by creating an enabling policy and regulatory environment that promotes quality assurance, safety, and private sector participation (2025 Q1 Progress Report). The policy aligns with the Long-Term Strategy for Carbon Neutrality and the Agricultural Development Policy 2019–2030, positioning biodigesters as a sustainable solution for rural energy and climate resilience while reducing reliance on firewood and chemical fertilizers. The standardization process further ensures consistency and user confidence by defining benchmarks for design, materials, and operation, thereby enabling certification and accredited local production. Together, these outputs catalyze private sector engagement by lowering investment risks, expanding manufacturing and maintenance services, and establishing predictable market conditions that support scaling and replication. Embedded within MAFF's institutional framework, the policy and standards not only reinforce coherence with national strategies on renewable energy and sustainable agriculture but also ensure long-term sustainability and

ownership of biodigester initiatives, transforming them from donor-driven pilots into self-sustaining, market-based low-emission solutions nationwide.

3.3.3.1.2 Output 2: Climate-smart agriculture and agribusiness promoted

Output 2 showed substantial progress in advancing climate-smart agriculture through technological innovation, participatory engagement, and gender-inclusive capacity development. The project has achieved 100% of its targets in developing climate-resilient crop varieties for rice, maize, and cassava, marking a major step forward in improving productivity and adaptive capacity under changing climatic conditions. Institutional strengthening also advanced steadily, with 17 FWUCs established, representing 62.9% of the target, and 372 members (74.4%), including 108 women (72%), trained in irrigation management, reflecting strong gender inclusion and local ownership. Farmer behavioral change further reinforced the project's success, as adoption of climate-resilient practices increased across all indicators: proper fertilizer dosage rose from 10% to 63%, organic fertilizer and compost use from 28% to 48%, integrated pest management from 9% to 38%, and intercropping from 11% to 33% (**Figure 22**). The use of improved crop varieties expanded from 2% to 24%, while weather-based planting schedules increased from 10% to 26%, showing growing responsiveness to climate information and adaptive learning. As shown in Figure 6, these collective improvements reflect a consistent upward trend across all categories, confirming that the project's participatory and adaptive training approach fostered sustainable climate-smart farming practices and strengthened the institutional foundations for long-term resilience.

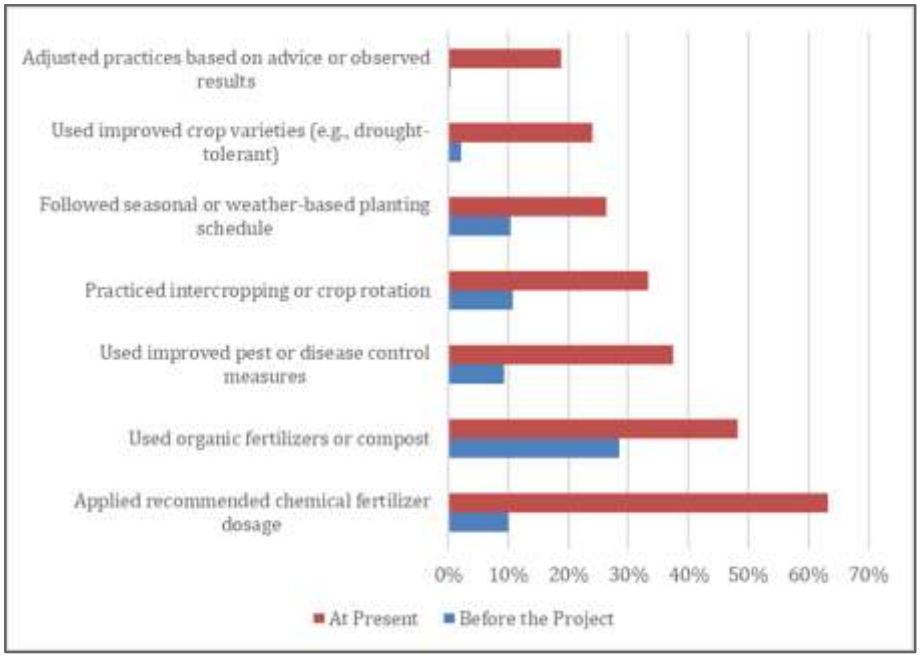


Figure 22. Adoption of climate-resilient practices before and during the project.

3.3.3.1.2.1 Activity 2.1: Deploying climate-resilient varieties

The deployment of climate-resilient crop varieties under Activity 2.1 has achieved exceptional success, fully meeting and far exceeding its targets across rice, maize, and cassava, marking one of the project's strongest technical accomplishments. A total of 80 rice

varieties were deployed against a target of 2, 820 maize varieties against 1, and 43,350 cassava varieties against 1, reflecting unprecedented overachievement and strong coordination between research and extension systems (2025 Q1 Progress Report). These results show Cambodia's growing capacity to strengthen agricultural resilience through improved seed systems that address climate-induced stressors such as drought, submergence, heat, and pest outbreaks. Building on earlier releases such as Phka Rumduol, CAR-16, Phka Mealdey, CM1, and CHM01, the project introduced Champeisar 70, a high-value aromatic rice resistant to brown planthopper and blast disease, further enhancing adaptation and market potential. CARDI has achieved 100% completion in varietal advancement, multi-location and adaptive trials, disease-free cassava propagation, and breeder and foundation seed production, reinforcing a strong research-to-field delivery pipeline. Capacity building complemented these technical gains, with 44 training courses on rice seed production and best management practices for rice, cassava, and maize, reaching thousands of farmers and PDAFF staff, nearly half of them women, showing strong gender inclusivity in knowledge transfer. Demonstrations, seed increases, and farmer field days supported wide adoption potential, while ongoing varietal trials continue to identify promising lines for future release. Overall, the activity aligns with GCF criteria on relevance, effectiveness, and innovation, contributing significantly to climate-resilient agriculture, improved market opportunities, and the sustainable scaling of Cambodia's seed systems.

3.3.3.1.2.2 Activity 2.2: Strengthening the capacity in climate-friendly production practices and technologies

CFAVC interventions under Activity 2.2 have strengthened farmer capacity, improved water-use efficiency, and deepened community-based irrigation governance to advance climate-smart and inclusive agribusiness development. Training initiatives reached nearly 30,000 farmers, including strong participation by women, and promoted the adoption of sustainable rice practices and agribusiness skills. Complementary investments in laser land leveling enhanced irrigation precision, boosted rice yields by up to 30%, and reduced pumping costs across more than 3,000 hectares. Farmer field demonstrations further accelerated the uptake of high-yield, climate-resilient crop varieties and strengthened local seed systems through hands-on learning. At the institutional level, 17 Farmer Water User Committees and Groups were established and capacitated to manage irrigation schemes more effectively, reinforcing decentralized water governance and climate resilience in farming communities.

3.3.3.1.2.2.1 Training of farmers on climate-smart agriculture and agribusiness development

Training under Sub-Activity 2.2.1 substantially expanded farmer capacity in climate-smart agriculture (CSA) and agribusiness, reaching 29,709 farmers (74.3% of target), including 13,854 women (86.6%), with strong female participation across SRP (58%), BMP (52%), and seed production (59%) modules. While adoption remains uneven, early behavioral shifts are evident: 75.7% of farmers continue to use chemical fertilizers, but 16.5% have reduced chemical use and 23.4% have increased organic inputs, as shown in **Table 43**, while changes in fertilizer quantities across crops confirm rising use of compost and organic materials (**Table 44**). Organic input use is increasingly diversified, with cow dung (35.8%), compost huts (9.0%), and biodigester slurry (4.2%) emerging as key contributors to nutrient management (**Table 45**). Burning of agricultural residues has also declined, particularly in rice where non-burning practices improved from 43.8% to 51.4%, and burning dropped from 39.2% to 30.2% (**Table 46**). FGDs with cooperatives in Tboung Khmum confirmed that farmers are integrating composting, biogas slurry, and livestock feed reuse to reduce

emissions and improve soil health, supported by FWUC-led water management meetings that enabled more efficient irrigation and two to three cropping cycles per year. Women constituted 46% of all trainees (12,642 of 27,227), holding leadership positions in several technical areas, illustrating strong gender inclusion and uptake. Overall, the training program delivered wide knowledge gains, measurable improvements in nutrient and residue management, and enhanced women's participation, positioning farmers to advance low-emission, climate-resilient, and market-ready agrifood systems in Cambodia.

Table 43. Chemical and Organic Fertilizer Use and Changes in Application Practices

	Kampong Cham	Kampot	Takeo	Tboung Khum	TOTAL
Use Chemical Fertilizers					
No	8.0%	3.5%	2.1%	10.8%	24.3%
Yes	21.2%	13.2%	13.9%	27.4%	75.7%
Respondents	84	48	46	110	288
FERTILIZER USED RANGE					
<4 kg/Ha. (Very low)	1.8%	0.0%	0.0%	0.0%	1.8%
> 150 kg/Ha. (Moderate)	15.1%	0.9%	6.9%	17.4%	40.4%
22 – 150 kg/Ha. (Moderate)	10.1%	15.1%	11.5%	17.4%	54.1%
4 - 22 kg/Ha. (Low)	0.9%	1.4%	0.0%	1.4%	3.7%
FERTILIZER USE TREND					
I use less chemical fertilizer now	3.2%	4.1%	4.6%	4.6%	16.5%
I use more organic fertilizer now	2.8%	8.7%	5.5%	6.4%	23.4%
No change in fertilizer usage	18.3%	3.7%	8.3%	22.0%	52.3%
Not applicable (New farmer or first-time fertilizer user)	3.7%	0.9%	0.0%	3.2%	7.8%

Source: HH survey

Table 44. Fertilizer Use Before and After Project Implementation

FERTILIZER	BEFORE THE PROJECT		AT PRESENT	
	Farmers	kg per Ha	Farmers	kg per Ha
Cassava				
Compost	0.0%		0.7%	275.00
Organic	3.1%	420.00	2.1%	367.50
With Nitrogen	14.9%	114.38	17.7%	127.91
Maize				
Compost	0.0%		0.7%	300.00
With Nitrogen	15.6%	194.51	17.0%	318.16
Organic	0.7%	101.00	0.0%	
Mango				
Compost	0.0%		1.0%	5.67
Organic	1.7%	2.50	3.5%	2.05
With Nitrogen	11.8%	0.84	12.2%	1.06
Rice dry season				
Compost	0.3%	500.00	1.4%	512.50
Organic	1.7%	1890.00	3.8%	913.64
With Nitrogen	16.7%	215.00	19.4%	211.34
Rice rainy season				
Compost	1.4%	725.00	4.2%	825.00
Organic	17.0%	1056.09	21.2%	880.36
With Nitrogen	58.7%	170.51	51.4%	174.96

Source: HH survey

Table 45. *Types and extent of organic materials used in rice cultivation.*

Organic materials	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
Cow dung	7.60%	10.10%	9.00%	9.00%	35.80%
Compost from compost huts	0.70%	4.20%	1.70%	2.40%	9.00%
Chicken manure	1.40%	0.30%	1.70%	3.10%	6.60%
Biodigester slurry	0.30%	0.30%	1.00%	2.40%	4.20%
Organic fertilizer	0.30%	1.70%	0.70%	0.00%	2.80%
Pig and duck manure	0.30%	0.30%	0.70%	0.70%	2.10%
Tree leaf	0.30%	0.70%	0.00%	0.00%	1.00%
Rice husk mixed with manure	0.00%	0.30%	0.30%	0.00%	0.70%
Ash	0.00%	0.00%	0.00%	0.30%	0.30%
Other organic materials	0.00%	0.00%	0.30%	0.00%	0.30%

Source: Household survey

Table 46. *Changes in agricultural waste burning practices.*

Cassava				
Method	**Before the Project**	**At Present**	**Before the project**	**At Present**
Do not burn agriwastes	13.90%	18.10%	40	52
Burn Agriwastes	5.20%	3.10%	15	9
Maize				
Method	**Before the Project**	**At Present**	**Before the project**	**At Present**
Do not burn agriwastes	11.80%	12.50%	34	36
Burn Agriwastes	5.60%	6.30%	16	18
Mango				
Method	**Before the Project**	**At Present**	**Before the project**	**At Present**
Do not burn agriwastes	14.60%	17.70%	42	51
Rice				
Method	**Before the Project**	**At Present**	**Before the project**	**At Present**
Do not burn agriwastes	43.80%	51.40%	126	148
Burn Agriwastes	39.20%	30.20%	113	87

Source: Household survey

3.3.3.1.2.2.2 Support of land leveling technology

Support for laser land leveling (LLL) under Sub-Activity 2.2.2 delivered measurable gains in water-use efficiency, productivity, and gender inclusion, with demonstrations showing yield increases of up to 30%, more uniform irrigation, and the potential for two to three rice crops annually when paired with improved canals. The initiative mapped 3,000 ha across 14 FWUCs and 19 ACs, benefiting 5,727 households, including 1,733 female-headed households (30.3%), and the first 48.6 ha in Takeo's Kraing Ampil scheme supported 90 farmers, 44% of whom were women. Despite these benefits, awareness remains limited: only 32.3% of farmers had heard of LLL, with the highest awareness in Kampong Cham and the lowest in Tboung Khmum, although 96.8% of those aware expressed strong interest in adoption (**Table 47**). Key barriers include lack of access to service providers (22.9%), high cost (10.1%), and limited technical skills (6.6%), as shown in **Table 48**, with FGDs confirming that smallholders—particularly in Kampot—face financial and operational constraints requiring rental schemes, subsidies, and cooperative-led service delivery. Women benefitted significantly through FWUC and AC participation—comprising 44% of the Kraing Ampil tranche—taking active roles in water allocation and efficient irrigation practices. Improved connectivity from upgraded roads further strengthened LLL outcomes by

enhancing market access and reducing transport costs. Institutional integration through FWUCs and ACs strengthened ownership and capacity for long-term operation, while procurement efficiencies enabled timely scaling. Overall, LLL demonstrates high potential as a precision agriculture intervention that strengthens climate-smart rice systems, resource efficiency, and gender equity, provided that awareness gaps, financing barriers, and service bottlenecks are systematically addressed.

Table 47. Awareness and Interest in Laser Land Leveling Technology

	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
HEARD LASER LAND LEVELING					
No	18.8%	9.7%	6.3%	33.0%	67.7%
Yes	10.4%	6.9%	9.7%	5.2%	32.3%
Respondents	29.2%	16.7%	16.0%	38.2%	N=288
INTERESTED TO ADOPT LASER LAND LEVELING					
No, not interested	1.1%	1.1%	0.0%	0.0%	2.2%
Not sure	0.0%	1.1%	0.0%	0.0%	1.1%
Yes, interested	31.2%	18.3%	30.1%	16.1%	N=93

Source: HH survey

Table 48. Reported Barriers to Adopting Laser Land Leveling Technology

LASER LAND LEVELING NON-ADOPTION REASONS	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
High cost of equipment or service	3.5%	2.1%	2.8%	1.7%	10.1%
Lack of knowledge or skills	0.3%	3.8%	1.7%	0.7%	6.6%
No access to service providers	7.3%	4.2%	8.0%	3.5%	22.9%
Respondents	29.2%	16.7%	16.0%	38.2%	N=288

Source: HH survey

3.3.3.1.2.2.3 Demonstrating and training in farmer fields

The farmer field demonstrations under Sub-Activity 2.2.3 effectively translated research innovations into field-level application, achieving strong progress toward the GCF criteria on relevance, effectiveness, and innovation. Demonstrations for rice, cassava, and maize engaged 401, 82, and 110 key farmers respectively, with 45% women in each group, indicating substantial gender inclusion and equitable access to technology (2025 Q1 Progress Report). Covering 95.54 ha for rice, 82 ha for cassava, and 55 ha for maize, the activities introduced high-yield, disease-resistant varieties such as cassava 81, Rayong-9, and maize CHM01, resulting in impressive yields—3.64 t/ha for rice, 28.65–31.5 t/ha for cassava, and 5.12–6.92 t/ha for maize. The “learning by doing” training approach enhanced technical skills in varietal selection, seed care, and crop management, while community-level seed multiplication improved local seed security and adaptive capacity. Farmers also provided practical feedback on varietal performance across seasons, generating insights on herbicide tolerance, soil response, and drought resilience that strengthened adaptive management. The active involvement of women in demonstration plots and seed multiplication not only advanced equity but also enhanced their leadership in technology adoption and household decision-making. Overall, the demonstrations have proven to be an effective and scalable model for climate-resilient agriculture, reinforcing food security, local seed systems, and inclusive agribusiness development in Cambodia.

3.3.3.1.2.2.4 Strengthening Farmer Water User Committees of Farmer Water User Groups

Strengthening Farmer Water User Committees and Groups (FWUCs/FWUGs) under Sub-Activity 2.2.4 made substantial progress in establishing inclusive, community-driven irrigation governance systems, with 17 of 27 groups (63%) fully operational and the remaining 10 advancing toward completion. A total of 6,299 representatives and authorities, including 1,737 women (27.6%), received training through 162 courses on irrigation operation, maintenance, bookkeeping, and gate management, resulting in 372 participants (74.4%)—including 108 women (72%)—now capable of managing systems independently. FWUCs developed structured governance arrangements with main and subcommittees overseeing water allocation, fee collection, and dispute resolution alongside commune councils, supported by transparent maintenance protocols that strengthened trust and ownership. Women's participation increased to 29.3%, with growing leadership roles in administration, financial management, and recordkeeping. FWUCs also served as platforms for disseminating climate-smart technologies such as laser land leveling, biodigesters, and composting, enhancing irrigation efficiency, enabling two rice crops per year, and reducing emissions through improved soil and residue management. Complementary investments in roads and reservoirs further boosted production and market connectivity, while integration with commune-level governance and farmer contributions reinforced long-term sustainability. Overall, FWUCs have become key anchors of climate-resilient, inclusive irrigation management with strong potential for replication across Cambodia's agricultural water systems.

3.3.3.1.2.2.5 Developing the capacity of FWUCs and FWUGs to operate and maintain their irrigation schemes

The project made strong progress in developing the institutional and technical capacity of FWUCs and FWUGs to sustainably operate and maintain irrigation schemes, with 17 of 27 FWUCs (62.9%) fully established, forming a solid foundation for decentralized, participatory water governance aligned with national policy frameworks (2025 Q1 Progress Report). Capacity-building achievements were substantial: 372 FWUG representatives (74.4%), including 108 women (72%), were trained through 162 sessions that reached 6,299 participants, of whom 1,737 were women, strengthening competencies in system maintenance, gate operation, fee collection, recordkeeping, and seasonal inspection, while fostering equitable water allocation and reducing conflicts. Women's engagement increased significantly as they assumed more active roles in planning, bookkeeping, and coordination, reflecting enhanced confidence and leadership in traditionally male-dominated irrigation management. Training platforms also supported the diffusion of climate-smart practices—such as composting, biodigester use, and laser land leveling—improving water-use efficiency, soil health, and input cost savings, thereby strengthening resilience and contributing to low-emission agricultural systems. Overall, FWUCs have evolved into increasingly competent, inclusive, and self-sustaining community-based institutions capable of managing irrigation schemes effectively beyond the project's direct support.

3.3.3.1.2.3 Activity 2.3: Promoting farm mechanization and extension

Under Activity 2.3, the promotion of farm mechanization and extension services progressed substantially, with 3 of 4 Agricultural Development Centers (ADCs) and 3 of 4 Engineering Workshops (EWs) becoming fully operational—equivalent to 75% completion across both components (2025 Q1 Progress Report). This reflects significant advances in establishing decentralized hubs that support agribusiness services, mechanization training, extension demonstrations, and machinery maintenance, all of which contribute to Cambodia's transition toward climate-smart and modernized agriculture. The remaining 25% is attributed to facilities still undergoing procurement and scheduled for completion in 2025, indicating procedural rather than structural delays; both sub-activities received "Satisfactory" implementation ratings. Once fully operational, the combined ADC–EW network will expand farmers' access to post-harvest handling, repair services, and climate-resilient technologies, enhancing institutional capacity and enabling wider adoption of labor-saving, productivity-boosting, and low-emission mechanization in alignment with the project's Theory of Change and national agricultural development strategies.

3.3.3.1.2.3.1 Improvement of Provincial Agricultural Development Centers

The improvement of Provincial Agricultural Development Centers (PADCs) represents a major institutional milestone in advancing agribusiness service delivery and climate-resilient farming systems, with three of the four targeted centers now fully operational, achieving 75% completion and earning a "Satisfactory" rating (2025 Q1 Progress Report). These centers serve as decentralized hubs for training, technology demonstration, and agribusiness support, directly strengthening local institutional capacity and enhancing the enabling environment for low-emission, market-oriented agriculture. Their operationalization aligns with national agricultural modernization priorities and the project's Theory of Change by improving farmer access to technical services, mechanization, and value chain linkages. The remaining 25% gap corresponds to the completion of the fourth PADC, which has finalized its design and bill of quantities and is currently under procurement review, reflecting readiness for timely implementation rather than structural delay. Once completed, the full network of PADCs will provide equitable and scalable service delivery across provinces, consolidating the project's contribution to sustainability, effectiveness, and long-term climate-resilient agricultural growth.

3.3.3.1.2.3.2 Improvement of engineering workshops

The improvement of engineering workshops (EWs) has advanced significantly, with three of four facilities fully constructed and operational—representing 75% completion and earning a "Satisfactory" rating (2025 Q1 Progress Report). These workshops now serve as key hubs for mechanization support, offering repair, fabrication, and equipment servicing that enhance the reliability of irrigation systems and farm machinery, thereby strengthening climate-resilient and market-oriented agriculture. Ongoing reviews of equipment specifications and bills of quantities ensure technical quality and cost-efficient procurement, while the remaining 25%—focused on equipping the final workshop—is scheduled for completion in 2025, indicating procedural rather than structural delays. Once completed, the full workshop network will provide complete geographic coverage, reduce machinery downtime, and bolster the sustainability of mechanization services, advancing the project's Theory of

Change and supporting Cambodia's transition toward efficient, low-emission agricultural systems.

3.3.3.1.3 Output 3: Enabling environment for climate-friendly agribusiness enhanced

Output 3 achieved major progress in strengthening the enabling environment for climate-friendly and gender-responsive agribusiness, with the project completing a national climate-smart agribusiness policy, a PPP framework, and the endorsement of CAMGAP standards for tropical fruits and organic fertilizers—each reaching 100% of targets (2025 Q1 Progress Report). Institutional capacity building exceeded goals, training 64 financial institution staff (128%) and engaging 41 agribusinesses (137%), including several women-led enterprises, demonstrating strong institutional readiness and commitment to gender inclusion. However, downstream implementation of risk-sharing and digital systems is lagging: while 19,368 households (96.8%) have received climate risk-sharing information, only 43.1% of the targeted women have been reached, and the ICT platform for climate-friendly agribusiness remains under procurement, with completion expected in 2026. Overall, Output 3 establishes a strong policy and institutional foundation for green agribusiness, but accelerated progress in digital integration, financial inclusion, and gender-responsive risk management is needed to ensure these upstream achievements translate into scalable, farm-level benefits.

3.3.3.1.3.1 Activity 3.1: Formulating climate-friendly agribusiness policies and standards

Activity 3.1 is nearly fully achieved at 95.5% completion, establishing a comprehensive policy and standards framework for climate-friendly and gender-responsive agribusiness. Key deliverables—including the national climate-smart agribusiness policy, climate neutrality and adaptation Prakas, the IDP strategy, a PPP framework, CAMGAP standards for tropical fruit, organic fertilizer and biodigester standards, and nationwide dissemination—collectively provide a coherent regulatory foundation that reduces institutional bottlenecks, clarifies compliance requirements, and lowers risks for producers, buyers, and financial institutions. With the policy and standards package now essentially complete, the next critical phase is to shift from formulation to active adoption and enforcement to ensure these upstream achievements translate into measurable gains in productivity, resilience, inclusion, and agribusiness market confidence.

3.3.3.1.3.1.1 Formulating policy on climate-smart and gender-responsive agribusiness and PPP framework

The project completed a comprehensive policy package for climate-smart, gender-responsive agribusiness and PPPs, with all policy outputs have been achieved in full: the climate-smart and gender-responsive agribusiness policy, the CSA policy, the climate neutrality and adaptation guidance manual (Prakas), the IDP strategy for climate-friendly agribusiness, and the PPP framework. Together, these instruments form a solid legal and procedural foundation to integrate climate and gender considerations, reduce investment risks, and ensure consistent implementation across ministries, financial institutions, and private firms. System readiness is reinforced by near-final CSA manuals (98%) for rice, cassava, and maize, and the fourth draft of the Producer Group Establishment Guideline linking smallholders to markets. The Tropical Fruit CAMGAP Standard on mango is fully

endorsed, providing a concrete pathway for quality assurance, export competitiveness, and low-emission production. Because the policies and PPP framework explicitly embed gender responsiveness, their adoption can translate into enforceable provisions that expand women's access to inputs, services, and contracts, shifting participation from nominal inclusion toward genuine equity in lending, procurement, and producer–buyer arrangements (CFAVC 2025 Q1 Report).

3.3.3.1.3.1.2 Good agriculture practice of tropical fruits endorsed

The project established the core standards and policy framework for climate-resilient, market-compliant agribusiness, finalizing CamGAP for tropical fruit, organic-fertilizer and biodigester standards, an IDP strategy for climate-friendly agribusiness, a climate-neutrality and adaptation guidance manual, and nationwide GAP socialization. These measures remove key regulatory bottlenecks to quality assurance and export readiness. Endorsement and publication of the CamGAP tropical fruit standard and the climate-neutrality guidance provide clear practices for climate-smart production and facility management. The SOP for Organic Fertilizer Quality Testing Manual was endorsed by IA-GDA, technical specifications were finalized, and the guideline distributed, strengthening input quality control and supporting low-emission agronomy alongside national standards for biodigester development and organic fertilizer, which provide traceability and safety baselines (2025 Q1 Progress Report). Ongoing work on the biofertilizer standard manual demonstrates adaptive standard development. Standard-setting and roll-out included broad, gender-responsive engagement: TWGs and consultations involved 29 women of 100 participants and 20 of 74 in public consultation, orientation and awareness reached 390 women of 764 participants, and field monitoring and coaching covered 356 farmers, including 173 women, with follow-up to 85 farmers, 44 of whom were women, indicating that women producers are being prepared to comply with CamGAP and capture market benefits. Private-sector uptake remains a key gap, with only 4 of 8 large rice millers and exporters in the climate-friendly alliance (50%), limiting rapid aggregation of climate-aligned volumes and highlighting the need for targeted onboarding of remaining firms, buyer-driven procurement requirements, and phased compliance checklists to accelerate adoption (2025 Q1 Progress Report).

3.3.3.1.3.2 Activity 3.2: Promoting green finance and risk-sharing mechanisms

3.3.3.1.3.2.1 Staff from financial institutions trained in CSA and green finance

Activity 3.3.2.1 achieved strong progress in building green-finance and CSA capacity within the financial sector, surpassing training targets with 64 staff trained (vs. 50 target) including 26 women (vs. 15 target), demonstrating enhanced institutional readiness to appraise CSA investments and integrate climate-risk assessment, green-lending products, and ESG principles into routine operations (2025 Q1 Progress Report). Women comprised 40.6% of trainees—well above the 30% target—positioning them to influence gender-responsive credit innovations such as flexible repayment schedules and bundled advisory services. Broader participation reached 253 cross-stakeholder representatives from PDAFF, banks, MFIs, and agricultural cooperatives, strengthening alignment between financial products and producer needs. Foundational systems, including a completed Training Needs Assessment, a near-final training development plan, and finalized training materials, supported delivery of five standardized courses coordinated with the Association of Banks in Cambodia. Parallel policy

and ecosystem engagement advanced with 50 banks and MFIs identified for collaboration and ongoing dialogue with ARDB, the National Bank of Cambodia, and the Ministry of Environment on establishing a national green financing facility, reinforcing the long-term sustainability and scalability of green-finance capacity building.

3.3.3.1.3.2.2 Agribusiness trained in green finance and CSA

The project fully completed Sub-activity 3.2.2, exceeding the training target for agribusiness staff with 41 trained against a target of 30 and meeting the female staff target of nine, earning an “Excellent” rating for overall and gender-specific performance (2025 Q1 Progress Report). Although 2 near-duplicate indicators in the table appear, “green finance in CSA” and “in green finance,” both reflect the same underlying achievement, and the reported 100% accomplishment likely caps the actual 137% performance. This result demonstrates strong progress in building the technical and financial literacy of agribusiness actors, particularly in linking climate-smart agricultural practices with sustainable financing mechanisms. The training enhanced participants’ understanding of green investment principles, risk management, and CSA adoption, reinforcing the enabling environment for private sector engagement in low-emission agribusiness. Overall, the outcome reflects both quantitative overachievement and qualitative gains in institutional readiness, capacity development, and gender equity, highlighting scalability and alignment with the GCF climate-resilient development framework.

3.3.3.1.3.2.3 Households provided with information on climate-sharing instruments

Sub-activity 3.2.3 has achieved strong performance in household-level outreach on climate risk-sharing literacy but revealed persistent gender disparities that limit equitable impact (2025 Q1 Progress Report). A total of 19,368 households, or 96.8% of the 20,000 target, received training and materials on green finance in climate-smart agriculture, earning an “Excellent” rating, while only 8,613 women, or 43.1% of the same target, were reached, corresponding to a “Low” rating for gender equity. The delivery systems supporting this outcome are robust. A total of 18,852 participants, including 8,459 women, joined trainings and meetings. The project produced 25,000 leaflets and 46 flipchart sets, distributing 22,000 leaflets and 44 sets. Partnerships with service providers such as Forte for crop insurance and ACLEDA/ARDB for green loans were formalized through a data-sharing agreement with Forte, reflecting strong progress in institutional coordination and ownership. These results demonstrate high performance in establishing functional systems for climate-finance literacy and risk-sharing information delivery. However, gender inclusion remains a critical gap. Addressing this requires targeted measures such as scheduling adjustments, women-led facilitation through agricultural cooperatives and FWUCs, and localized quotas to ensure women farmers benefit equally from climate finance opportunities.

3.3.3.1.3.2.4 Creating an enabling environment for PPPs in agribusiness in the four value chains

Sub-activity 3.2.4 made substantial progress in creating an enabling environment for PPPs across the rice, cassava, maize, and mango value chains, strengthening cooperative–buyer linkages and advancing GCF criteria on relevance, effectiveness, equity, and country ownership (2025 Q1 Progress Report). A combined package of interventions—including

eight crop-focused forums engaging 360 participants (20% women), five ToT courses for 131 cooperative committee members (31% women), and 17 awareness meetings reaching 768 farmers (48% women)—culminated in legally binding contract-farming agreements between agricultural cooperatives and major buyers such as Amru Rice, THAN CHEA Rice Miller, Heng Leap Company, and Vietnamese importers, as illustrated in **Figure 23**, covering up to 20,000 tons annually and securing predictable markets for smallholders. Complementary investments in warehouses, dryers, and cooperative strengthening enhanced aggregation, reduced post-harvest losses, and increased price negotiation power, while capacity building improved governance, compliance, and production scheduling. Although women's participation in high-level negotiation remains below parity, their strong involvement in awareness events signals potential for greater leadership with targeted mentoring. Climate-smart clauses integrated into contract terms incentivized composting, efficient irrigation, and other low-emission practices, and government facilitation of legal processes underscored strong national ownership. Overall, these achievements provide a scalable foundation for climate-resilient, market-integrated PPPs in Cambodia's agrifood sector.



Figure 23. Commercial processors buying commodities from the farmers: Corn processors (top) and cassava (bottom).

3.3.3.1.3.3 Activity 3.3: Supporting ICT-based climate risk management

Activity 3.3 made strong institutional progress toward establishing Cambodia's ICT-based climate risk management system but remained delayed in field-level implementation despite completion of system architecture design, ministerial approval, and integrator contracting (2025 Q1 Progress Report). Although the platform—intended to deliver climate-risk

advisories, market information, early warnings, and integrated Climate-Smart Agriculture (CSA) applications—has a fully approved technical design, its three core deliverables (system development, equipment procurement, and call center installation) remained at 0% completion, limiting delivery of climate services to farmers, particularly women, land-poor households, and remote communities. Despite strong country ownership, demonstrated by the onboarding of the system integrator in March 2025 and MAFF's approval of the final ICT architecture in June 2024, the absence of an operational platform restricts access to timely planting, irrigation, marketing, and precision-farming guidance. To recover momentum, the project should fast-track procurement, deploy a minimum viable service (e.g., SMS or IVR advisories), advance parallel CSA application rollouts, and establish clear O&M protocols tied to disbursement milestones, while providing targeted capacity building for extension officers, FWUC focal points, and cooperatives with emphasis on women's participation. A deployment dashboard tracking system uptime, equipment delivery, and sex-disaggregated user engagement—supported by interim advisory channels through MAFF and PDAFF—would help maintain adaptive management until the full platform is operational.

3.3.2.2 GCF Outputs

Across the three GCF outputs, the project demonstrated strong overall progress, particularly in policy development, institutional strengthening, and key climate-resilient infrastructure, though several transformative and market-driven outputs—such as PPP establishment, climate-information uptake, and land leveling—showed limited or no progress. Under Output 1, climate-resilient agribusiness infrastructure advanced well, with 61.7% completion of water-management systems, 81.5% of rainwater harvesting ponds, 74.0% of climate-resilient farm roads, and 92.0% utilization of upgraded laboratory facilities, while agricultural cooperatives fully integrated climate actions (100%). However, land laser leveling recorded no progress (0%) and biodigester-related household energy access achieved only 55.5%. Output 2 showed mixed results: release of climate-resilient crop varieties achieved 100% and agricultural development centers reached 75%, but CSA farmer training reached only 53.6%, underscoring the need for expanded extension support. Output 3 performed exceptionally well in policy and institutional domains, achieving 100% in climate-friendly agribusiness policy formulation, CAMGAP enforcement, and training of banks and MFIs in green finance, while enterprises and households reached with risk-sharing instruments achieved 85%. Nonetheless, critical gaps remain in establishing PPPs (0%) and improving the generation and use of climate information (0%), both requiring deeper coordination and sustained investment in the remaining implementation period.

3.3.2.3 GCF Activities

All GCF activity indicators directly correspond to the DMF activity indicators and share the same levels of progress and accomplishments. Therefore, the assessment of GCF activities is fully reflected in the analysis presented under the DMF Achievement of Activity Indicators, which should be referenced for detailed performance results and implementation progress.

3.4 Coherence

The project demonstrated strong institutional and policy coherence by aligning multi-sectoral interventions with Cambodia's national climate and agricultural development frameworks, with coordination among MAFF, MOWRAM, MRD, MEF, ADB, and GCF ensuring that irrigation rehabilitation, road improvements, and farmer capacity-building were implemented

as complementary, mutually reinforcing components (2025 Q1 Progress Report). Provincial departments, agricultural cooperatives, and NGO partners further strengthened coherence at the local level by integrating infrastructure rollouts with training, market engagement, and community mobilization. Policy alignment with the Agricultural Strategic Development Plan and national climate strategies reinforced the project's emphasis on low-emission, climate-resilient farming systems. While some gaps were noted—such as uneven private-sector participation and delays in completing certain facilities—the overall approach fostered strong institutional synergy, donor alignment, and gender-responsive implementation, creating a coherent enabling environment for sustainable agribusiness development and adaptive climate governance.

3.4.1 Coherence with other national and donor interventions

The project exhibited strong coherence with national and donor interventions by integrating agricultural extension, irrigation, rural roads, and climate-resilient livelihood support within Cambodia's broader agricultural and climate policy frameworks (2025 Q1 Progress Report). Coordination among MAFF, MOWRAM, MRD, and MEF—supported by ADB and GCF financing—ensured vertical alignment from policy to implementation and horizontal coherence across sectors, while PPIUs, commune authorities, and village chiefs facilitated community mobilization and strengthened local ownership. Collaboration with development partners such as CEDAC, AVSF, ASPIRE, HKI, AIMS, FNN, and the Cambodian Farmers' Cooperative, along with CARDI's agronomic research, created a unified service platform delivering climate-smart technologies and market access, with particularly strong synergies in Kampong Cham and Tboung Khmum. Transport and infrastructure investments further improved logistics and reduced post-harvest losses, reinforcing low-emission agrifood systems. Overall, the project remained well aligned with Cambodia's Agricultural Strategic Development Plan, Climate Change Action Plan, and the GCF paradigm-shift pathways, with future gains dependent on expanding private-sector engagement and institutionalizing inter-agency coordination for sustained long-term impact.

3.4.2 Policy and regulatory coherence

The project demonstrated strong policy and regulatory coherence by closely aligning with Cambodia's National Climate Change Strategic Plan, Agricultural Strategic Development Plan 2019–2023, and NDC implementation framework, effectively advancing Output 3 indicators on climate-resilient agriculture (2025 Q1 Progress Report). Household survey data confirmed substantial behavioral change, with 52.4% of farmers reducing chemical-input use and 45.8% adopting organic fertilizers or compost. Additionally, 34.4% utilized drought- or flood-tolerant varieties, 33.7% practiced intercropping, and 33.0% improved irrigation efficiency, all contributing to low-emission agricultural pathways. Sustainability outcomes were particularly strong, as 91.7% of respondents continued using introduced technologies, while only 8.3% discontinued (**Figure 24**) due to operational difficulties, indicating effective alignment between national policies, farmer training, and local support systems. Farmers who did not adopt climate-smart practices cited lack of perceived advantage, difficulty of application, or cost constraints, highlighting the need for adaptive policies such as demonstration plots and cost-sharing to maintain coherence between policy design and field realities (**Figure 25**).

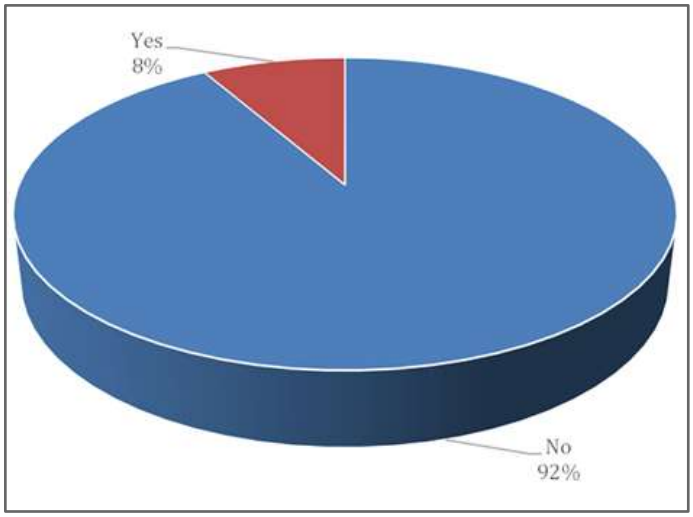


Figure 24. Discontinuation of technology use due to problems. Source: Household survey.

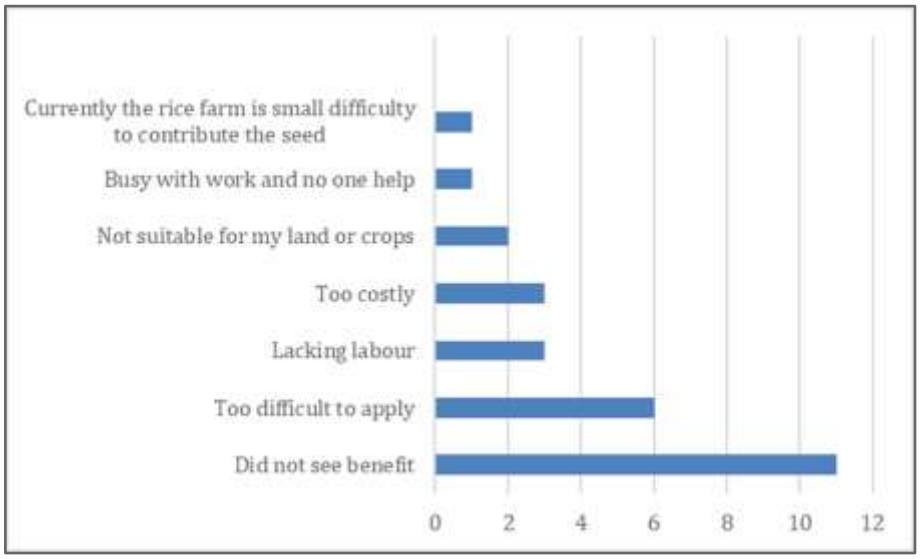


Figure 25. Reasons for not benefiting from CSA practices. Source: Household survey.

Field-level complementarity was evident through targeted partnerships. In Kampong Cham, coordination with AIMS, FNN, and the Cambodian Farmers' Cooperative enhanced training and market access, while in Tboung Khmum, collaboration with Asrise, ANN, and Cambotra integrated seed provision, livestock support, and cassava marketing (FGDs with agricultural cooperatives). Survey results further validated institutional synergy, with provincial agricultural departments and NGOs or development partners rated as the most helpful support providers, followed by agricultural extension officers and input suppliers (**Table 49**). External support was mostly delivered through technical training and seed or input provision, while market or price information and marketing assistance were less common, revealing partial alignment with market-development frameworks (**Table 50**). Adaptive implementation strengthened coherence by addressing infrastructure delays through additional training and inputs, while beneficiaries in Kampot and Tboung Khmum reported improved yields, reduced migration, and better soil management.

Table 49. *Perceived helpfulness of project support partners.*

Support providers	Not helpful	Somewhat helpful	Very helpful	Total
PDAFF	0.00%	22.90%	37.50%	60.40%
NGO/Development partner	0.00%	23.30%	29.50%	52.80%
Agriculture extension officers	0.00%	15.60%	21.50%	37.20%

Table 49. *Perceived helpfulness of project support partners.*

Support providers	Not helpful	Somewhat helpful	Very helpful	Total
Input supplier (e.g., fertilizer, seeds)	0.00%	24.70%	11.50%	36.10%
Agricultural cooperative	0.00%	10.40%	13.90%	24.30%
Agribusiness company/buyer	0.30%	11.80%	2.40%	14.60%
FAO	0.00%	4.20%	2.80%	6.90%
UNDP	0.00%	2.40%	0.30%	2.80%
Do not remember	0.00%	0.70%	0.70%	1.40%

Source: Household survey

Table 50. *Support provided by other organizations.*

Support	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
Technical training	21.90%	13.20%	13.20%	27.40%	75.70%
Seeds or farm inputs	19.40%	10.40%	12.50%	22.20%	64.60%
Market or price information	12.50%	5.20%	4.90%	11.50%	34.00%
Support to sell products	2.80%	3.80%	3.10%	3.80%	13.50%
Help during disasters or emergencies	1.40%	1.40%	2.40%	1.70%	6.90%
Offering bicycle to the poor family	0.00%	0.00%	0.30%	0.00%	0.30%
Offering loan	0.00%	0.00%	0.00%	0.30%	0.30%
Offering material and money to community	0.00%	0.30%	0.00%	0.00%	0.30%
Saving group support	0.00%	0.30%	0.00%	0.00%	0.30%

Gender coherence was strong, as collaboration with women-led cooperatives ensured inclusive access to climate-smart agriculture training and inputs, consistent with MAFF's Gender Mainstreaming Policy and GCF gender-equity principles. Data on CSA benefits show the greatest gains from reduced chemical use and organic fertilization, followed by drought- or flood-tolerant crops and improved irrigation, while only 9.7% of respondents reported improved market access (please see **Table 12**), highlighting a policy gap in translating production gains into value-chain inclusion. Collectively, the findings confirm that the project maintained strong policy and regulatory coherence by embedding national climate priorities into practical, inclusive, and adaptive implementation mechanisms that bridged institutional frameworks with farmer-level adoption and sustained technology use.

3.5 Efficiency

The project demonstrated strong operational and adaptive efficiency through integrated field interventions, participatory management, and structured monitoring systems that collectively enhanced productivity, improved water use, and promoted long-term adoption of climate-smart practices. Land leveling emerged as a major driver of on-farm efficiency, creating uniform fields that improved irrigation performance, reduced water wastage, and increased yields, while boosting farmers' confidence to reinvest in land preparation and inputs. Adaptive management strengthened delivery by incorporating real-time feedback from farmers and local authorities into scheduling, logistics, and training, ensuring interventions remained responsive to climatic and operational conditions. Monitoring and evaluation mechanisms, particularly in Kampong Cham, translated data into actionable improvements that refined training calendars, demonstration planning, and resource allocation. Regular follow-ups across provinces reinforced accountability and accelerated learning, with Kampong Cham maintaining twice-monthly visits, Takeo quarterly, and Tboung Khmum and Kampot through coordinated monitoring with local authorities.

The project demonstrated strong cost effectiveness and economic viability, generating substantial benefits relative to the resources deployed. Adjusted to 2025 prices, total economic, environmental, and ancillary benefits reached approximately $76.2 million (**Table**

51)[4], driven primarily by productivity gains in rice, maize, and cassava, as well as complementary savings in transport, fertilizer, and fuel. Climate co-benefits through greenhouse-gas (GHG) mitigation added another $4.36 million, reinforcing the project's contribution to sustainable and climate-smart development. Against total expenditures of $54.5 million, the resulting Benefit–Cost Ratios (BCRs) of 1.29–1.36 and positive Net Present Values (NPVs) under all discount-rate scenarios confirm high economic returns. However, the project's disbursement utilization rate stood at only 51.8 percent, with $114.6 million spent from the $221.4 million budget, indicating persistent implementation delays and capacity constraints. Overall, the interventions that were completed proved highly cost-effective, achieving strong returns with limited outlay—underscoring the project's efficiency but also revealing opportunities to improve budget execution and timeliness in future cycles.

Economic, environmental, and ancillary benefits. Between 2021 and 2025, project interventions delivered a diversified portfolio of economic, environmental, and ancillary benefits, combining productivity gains, cost savings, and climate co-benefits. The most substantial outcomes were in agricultural productivity, with cumulative yield improvements estimated at $33.2 million for rice, $25.4 million for maize, and $11.3 million for cassava (**Table 51**), reflecting the effectiveness of improved seed quality, enhanced agronomic practices, and upgraded water management systems that strengthened food security and rural incomes. Ancillary benefits further enhanced economic and environmental value. Road rehabilitation reduced transport costs by $62,688 through faster travel and lower fuel consumption, household biodigesters substituted biogas for traditional fuels, saving $235,027 while reducing indoor air pollution and fuelwood dependence, and compost huts generated $1.61 million in fertilizer savings through organic production that also improved soil fertility. NAL contributed $37,017 in quality-assurance and market-value services. Climate-related benefits were equally significant. With a valuation of $25 per ton of CO_2 equivalent, total greenhouse gas mitigation amounted to $4.36 million by 2025, driven primarily by methane reduction from Alternate Wetting and Drying in rice fields ($3.9 million), followed by avoided emissions from biodigesters and compost huts ($460,643). Collectively, these results demonstrate that project investments delivered strong economic returns while advancing environmental sustainability and climate mitigation, directly contributing to Cambodia's NDC.

Table 51. *Valued benefits of project interventions (converted to 2025 real values using CPI in thousand USD).*

	2021	2022	2023	2024	2025	Total
A. Value of yield improvement						
Cassava	0	1,680.80	2,468.70	3,220.70	3,939.20	11,309.40
Maize	0	2,069.40	4,052.70	7,930.70	11,329.60	25,382.40
Rice	0	2,747.60	6,121.50	9,983.90	14,332.70	33,185.70
B. Transport cost saving due to improved road	4.6	8.60	12.70	16.60	20.20	62.70
C. Fuel substitution from biogas	16.9	32.2	47.2	61.6	77	235
D. Fertilizer saving in using compost	302.3	307.4	320.9	333.5	345.5	1,609.60
E. NAL services	3.8	3.6	4.4	22.5	2.7	37
F. Value of GHG mitigated						
Road improvement	0.04	0.07	0.099	0.13	0.158	0.49
Biodigester and compost huts	33.4	63.5	93.2	121.7	148.8	460.60
CH_4 reduction by AWD practices in rice	707.4	732.7	777.3	819.2	858.9	3,895.50
Total	1,068.50	7,645.80	13,898.80	22,510.50	31,054.80	76,178.60

Investment structure and resource allocation. Cumulative project investment from 2021 to 2025 reached $54.5 million in 2025 constant prices, with the majority, approximately 80 percent or $43.7 million, allocated to civil works such as irrigation systems, farm roads, and

[4] The detailed cost benefit analysis can be seen in Appendix 13.

water facilities, reflecting the project's infrastructure-intensive design (**Table 52**). Equipment, materials, and implementation services accounted for $1.9 million, while operating costs totaled $4.8 million to support ongoing field operations. Incremental project management expenses ($356,841) and interest charges ($3.7 million) comprised relatively small shares, demonstrating sound financial control and adherence to efficiency standards. The predominance of civil works investment underscores a deliberate strategy to achieve long-term, tangible impacts on agricultural productivity and resilience, with strong evidence of high marginal returns on infrastructure spending. The low share of administrative and operational expenditures, together under 10 percent of total project costs, aligns with best-practice benchmarks for large-scale, infrastructure-based rural development programs, indicating prudent fiscal management and effective resource utilization throughout the project period.

Table 52. *Project investments by category and year (converted to 2025 real values using CPI).*

	2021	2022	2023	2024	2025	Total
A. Civil works	454	6,126.70	20,714.50	8,939.20	7,507.10	43,741.70
B. Equipment, material, goods, and project implementation services	458.9	854.00	608.80	0.00	0.00	1,921.70
C. Operating costs	709.6	1,886.40	1,868.50	321.00	0.00	4,785.50
D. Incremental operating costs (project management)	0	0.00	0.00	0.00	356.80	356.80
E. Interest charges	2,109.60	815.50	784.40	0.00	0.00	3,709.40
Total	3,732.10	9,682.60	23,976.20	9,260.20	7,864.00	54,515.10

Economic performance and viability. Economic-analysis results demonstrate that the project remained viable across all discount-rate scenarios in Cambodia's 2017 Cost–Benefit Analysis Guide. At a three percent discount rate, the NPV was $18.6 million and declined only modestly to $13.0 million at ten percent, remaining positive in every case (**Table 53**). The Modified Internal Rate of Return (MIRR) ranged from 8.9 to 13.6 percent, consistently exceeding the cost of capital, while the BCR stood between 1.29 and 1.36. These indicators confirm that each dollar invested generated more than one dollar in benefits, verifying robust economic efficiency. The application of MIRR provided a realistic reinvestment assumption, avoiding the distortions common in conventional IRR analyses. The consistent pattern of strong NPV and BCR values demonstrates that the project's economic success was resilient to changes in discount rates and financing costs, providing credible evidence of long-term sustainability and fiscal soundness.

Table 53. Economic Analysis Results under Alternative Discount Rate Scenarios (NPV, MIRR, and BCR at 2025 Prices)

NPV (USD)	
Interest Rate = 3%	18,590,761
Interest Rate = 7%	15,139,318
Interest Rate = 10%	12,951,224
MIRR (%)	
Interest Rate = 3%	8.9%
Interest Rate = 7%	11.6%
Interest Rate = 10%	13.6%
BCR	
Interest Rate = 3%	1.36
Interest Rate = 7%	1.32
Interest Rate = 10%	1.29

Disbursement utilization and timeliness. Financial-management data reveal that only $ 114.6 million of the total $ 221.4 million budget was disbursed, yielding a burning rate of 51.8 percent (**Table 54**). This partial utilization reflects implementation delays, administrative bottlenecks, or overestimated cost projections. However, despite the low disbursement ratio, the project's economic benefits remained robust, illustrating that the resources actually spent were concentrated on high-impact, cost-effective activities. From a performance perspective, the project has achieved strong outcomes with limited financial absorption—effectively "doing more with less." Agricultural productivity improvements, GHG reductions, and ancillary savings collectively produced $ 76.2 million in benefits against $54.5 million in expenditures. This suggests that underutilization of funds did not compromise overall efficiency; rather, it highlights the high return on investment of the implemented interventions. Nonetheless, accelerating procurement, strengthening implementation capacity, and improving coordination among executing agencies would enhance timeliness and ensure full capitalization of available financing in future programs.

Table 54*. Disbursement utilization (burning rate) of the project.*

Total budget (USD)	221,389,669.70
Total expenditure (USD)	114,626,829
Unspent budget (USD)	106,762,841
Burning rate	51.80%

3.6 Gender equity

Gender equity was consistently advanced throughout project implementation, with women participating not only as beneficiaries but as decision-makers and leaders across FWUCs, cooperatives, and project committees, where six women and twelve men served in governance roles. Qualitative evidence from KIIs, FGDs, and household surveys shows women accessed the same technologies, training, and resources as men, taking on crucial roles in water allocation, recordkeeping, biofertilizer preparation, and cooperative management. Inclusive provisions—such as allowing widows, female-headed households, and persons with disabilities to contribute only 30% of biodigester and compost hut installation costs—further strengthened participation and targeted support, including complementary livelihood activities (e.g., sewing, barbering). Quantitative data affirm strong gender outcomes: 72.9% of respondents agreed the project provided gender-equal opportunities, 65.6% participated directly in decision-making, and 52.1% were fully informed of their rights and benefits (**Table 55**). However, gaps remained for poor households, landless farmers, persons with disabilities, and ethnic minorities, whose inclusion in planning ranged only from 13.9% to 19.8% (**Table 56**), while youth and ethnic minorities were least likely to perceive direct benefits (**Table 57**). The Gender Action Plan (GAP) operationalized gender mainstreaming through targeted employment, leadership development, and safeguards integrated across MAFF, MOWRAM, and MRD, resulting in 57,495 consultation and training participants—43.81% of whom were women—and women contributing 144,926 workdays (28.61%) across 556,980 construction workdays. Women's participation in agribusiness capacity building reached 40–45%, supported by functional Gender and Children Working Groups, 123 gender focal points (nearly 80% women), and gender-sensitive compliance by all contractors. Women played an increasingly influential role in CamGAP tropical fruit standard development and cooperative strengthening. While high satisfaction levels (70–80%) and equitable benefits were noted across provinces, constraints such as childcare duties and time burdens persisted, underscoring the need for flexible scheduling and localized training. Overall, the project achieved substantive gender

mainstreaming by embedding women's leadership, institutional participation, and equitable benefit-sharing, while highlighting where future climate-smart agribusiness programs should strengthen targeted outreach to ensure full inclusion of marginalized groups.

Table 55. Perceptions of Gender Equity in Project Implementation

	Female	Male	Total
PROJECT PROVIDE GENDER EQUAL OPPORTUNITIES			
Agree	36.8%	36.1%	72.9%
Neutral / Not sure	2.4%	2.4%	4.9%
Strongly agree	13.2%	9.0%	22.2%
HH MEMBER INVITED TO PROJECT CONSULTATIONS			
No	17.0%	19.4%	36.5%
Not sure	0.7%	0.7%	1.4%
Yes	34.7%	27.4%	62.2%
INFORMED OF RIGHTS AND BENEFITS			
I am not sure / Cannot remember	1.7%	2.1%	3.8%
No, I was not informed	5.9%	5.2%	11.1%
Yes, but only partially informed	18.1%	14.9%	33.0%
Yes, I was fully informed	26.7%	25.3%	52.1%
INVITED IN PROJECT DECISION MAKING			
Don't know / Not applicable	2.4%	1.7%	4.2%
No, and I was not informed	5.9%	6.3%	12.2%
No, but I was informed about the decisions	6.3%	5.9%	12.2%
Yes, I was personally involved	34.7%	30.9%	65.6%
Yes, my group was involved but I did not attend	3.1%	2.8%	5.9%
CONSULTATION PROCESS IS FAIR			
Agree	38.5%	37.5%	76.0%
Don't know	3.8%	3.1%	6.9%
Strongly agree	10.1%	6.9%	17.0%
SATISFACTION TO PROJECT SUPPORT			
Neutral	2.4%	3.8%	6.3%
Not applicable / Didn't receive any support	0.3%	0.0%	0.3%
Satisfied	34.0%	31.9%	66.0%
Very satisfied	15.6%	11.8%	27.4%
PROJECT PROVIDE EQUAL OPPORTUNITY			
Agree	38.9%	38.2%	77.1%
Disagree	0.0%	0.3%	0.3%
Neutral	3.5%	1.7%	5.2%
Strongly agree	10.1%	7.3%	17.4%

Source: HH survey

Table 56. Inclusion of Marginalized Groups in Project Planning

INVOLVED IN PLANNING	Fair	N/A	Not Sure	Very Fair	Total
Female-headed households	41.3%	0.0%	0.3%	5.2%	46.9%
Poor households	15.6%	0.0%	0.0%	4.2%	19.8%
Landless or land-poor farmers	14.9%	0.0%	0.3%	2.8%	18.1%
People with disabilities	16.0%	0.0%	0.0%	1.0%	17.0%
Ethnic minority grou	11.8%	0.0%	0.3%	1.7%	13.9%
None	0.0%	2.4%	0.0%	0.0%	2.4%

Source: HH survey

Table 57. Perceptions of Beneficiary Groups Reached by the Project

GROUPS BENEFITED BY PROJECT	Kampong Cham	Kampot	Takeo	Tboung Khum	Total
Poor households	22.2%	12.8%	13.5%	27.1%	75.7%
Female-headed households	22.2%	10.8%	12.5%	26.4%	71.9%
Well-connected or influential households	10.8%	4.9%	6.9%	16.7%	39.2%
Youth or young farmers	8.3%	4.5%	3.8%	12.2%	28.8%
Landless farmers	7.6%	4.9%	4.2%	10.1%	26.7%
I don't know	4.9%	3.1%	1.7%	8.0%	17.7%
Ethnic minority groups	0.0%	0.7%	0.0%	1.4%	2.1%

Source: HH survey

3.7 Country ownership

The results demonstrate that Cambodia's government and rural communities have both the motivation and growing capacity to sustain and scale climate-friendly agribusiness practices introduced by the project. The strong involvement of MAFF, MOWRAM, MRD, and MEF reflect the political commitment and effective cross-sector coordination. Communities, through cooperatives, FWUCs, and producer organizations, actively contributed labor, cost-sharing, and governance support, confirming local ownership. Continued technical backstopping, institutional coordination, and market integration will be essential to consolidate this ownership and fully embed the project's climate-adaptation model into Cambodia's national systems.

3.7.1 Alignment with national policies and climate strategies

The CFAVC Project is strongly aligned with Cambodia's national policies and climate strategies, directly supporting the Rectangular Strategy IV (2018–2023), NSDP (2019–2023), and ASDP (2019–2023), all of which emphasize climate-smart, market-driven agricultural transformation (no associated figure/table for this subsection). Its interventions—ranging from irrigation rehabilitation, canal development, and land leveling to agribusiness service centers, contract farming, and value-chain integration—are coherent with MOWRAM's Water Resources Policy (2018), MAFF's Climate Change Strategic Plan (2014–2023), and the National Agricultural Investment Plan (2019–2023). The project also advances Cambodia's NDC (2020) commitments on sustainable land and water management, agricultural emissions reduction, and climate-resilient farming systems, while its strong community engagement and gender-responsive design align with the Gender and Climate Change Strategic Plan (2022–2026). By operationalizing low-emission, climate-resilient agriculture consistent with the GCF paradigm-shift framework, the project enhances Cambodia's institutional readiness and credibility for future climate-finance mobilization.

3.7.2 Use of government systems

CFAVC was implemented through existing government structures, reinforcing institutional accountability and financial sustainability. The PMU operated within MAFF, while PPIUs linked national ministries with commune and village authorities. This structure ensured policy coherence and embedded project management into regular public-sector operations. Procurement, financial management, and environmental-social safeguards followed national systems adapted to ADB–GCF fiduciary standards, enhancing government ownership of procedures. Local ownership was equally evident at community level: FWUCs and agricultural cooperatives were established and trained under MAFF and MOWRAM guidance to manage irrigation assets, oversee maintenance, and facilitate equitable water

distribution. Commune councils supported beneficiary selection, grievance handling, and monitoring, integrating CFAVC activities into sub-national planning cycles. This reliance on domestic systems strengthens long-term sustainability by ensuring that infrastructure, capacity building, and climate-smart extension services remain under national stewardship after project closure.

3.7.3 National policy contributions

The project made tangible contributions to Cambodia's policy and regulatory landscape for climate-resilient agribusiness. It supported the formulation of a Climate-Smart and Gender-Responsive Agribusiness Policy and PPP Framework (2024), establishing national guidance for green investment and private-sector engagement in climate-smart agriculture. Additionally, the CamGAP standards for tropical fruits and organic fertilizers were endorsed as national benchmarks, promoting environmentally responsible production and market competitiveness. CFAVC also developed training modules on green finance and climate-smart agriculture for 64 financial-institution staff and 41 agribusiness enterprises, embedding climate-risk management principles in Cambodia's banking and business sectors. These policy-level achievements strengthen the enabling environment for future investments and demonstrate the government's commitment to mainstreaming climate considerations into agrifood systems. Moreover, the integration of climate-finance concepts, biogas and compost utilization, and inclusive governance within cooperatives reinforces the paradigm shift toward sustainable, low-emission rural economies.

3.8 Innovation

The project demonstrated strong innovation through the introduction of climate-smart technologies, modern farming practices, and circular resource systems that enhanced productivity, reduced costs, and strengthened the resilience of smallholder farmers. These innovations combined technological advancement with farmer training, institutional coordination, and adaptive learning. Field evidence from FGDs and KIIs highlights four major clusters of innovation and one emerging gap:

3.8.1 Precision and water-smart farming

Laser land leveling and improved irrigation systems were among the most transformative interventions. Uniform field leveling optimized water and fertilizer distribution, reduced fuel use, and increased yields (KII – Trapaing Kragnogn AC, Takeo). Complementary investments in ponds, canals, and irrigation scheduling allowed farmers to plan watering by crop stage, lowering pumping costs and sustaining dry-season production (KII – Sin Chong, Takeo). Together, these technologies improved resource efficiency, profitability, and drought resilience.

3.8.2 Climate-smart agronomy and circular resource use

Farmers shifted from heavy chemical fertilizer use toward compost, manure, and bio-slurry, guided by training on seed selection, planting techniques, and soil health management (KII – Akphivath Kaksikor AC, Kampong Cham). Biodigesters transformed organic waste into biogas and fertilizer, cutting household energy costs and indoor smoke exposure.

Enterprises such as Two Swans Cassava Starch Manufacturing (Tboung Khmum) demonstrated circular use of residues as livestock feed or soil amendments. In several provinces, farmers produced 10–20 kg of compost weekly, partially substituting chemical inputs and improving yields. Compost was valued as “safe and beneficial for long-term fertility” (FGD – Tboung Khmum). These practices collectively advanced soil health, reduced emissions, and fostered behavioral change toward low-carbon farming.

3.8.3 Post-harvest and market innovations

Post-harvest improvements strengthened value chains and market linkages. Drying and residue-management systems improved product quality and enabled cooperatives to sell 20–50 tons of corn per season to feed companies at stable prices (KII – Ly Sok, Chiro Rung Roeung AC, Tboung Khmum). Farmers across Kampong Cham, Takeo, and Kampot acknowledged that new techniques and equipment made farming easier, increased productivity, and improved living standards (FGDs – Akphivath Kaksikor, Akphivat Samaky Phum 3, Poloeu Kaksekor Srok Chhouk Cooperatives). These outcomes demonstrate how technology transfer translated into tangible livelihood gains and greater market confidence.

3.8.4 Knowledge-sharing and institutional synergies

Innovation diffusion was reinforced through technical guidance and peer-to-peer learning. Provincial Departments of Agriculture provided coaching on cassava management, composting, and biodigesters, enabling replication across communities (FGD – Tboung Khmum). Participants also noted complementarity with national initiatives such as ASPIRE, Cambodra, and KNN, emphasizing strong institutional coherence and alignment with Cambodia’s climate-resilient agriculture strategies (KII – Agricultural Cooperatives).

3.8.5 Emerging gap: Access to green and climate finance

Despite technological progress, no new mechanisms were established to mobilize climate or green finance for cooperatives and SMEs. Respondents confirmed the absence of concessional credit lines, carbon-finance schemes, or blended-finance models supporting climate investments (KIIs – Keo Sao, Kampot; Lorn Sophal, Kampong Cham). While the project delivered tangible production and infrastructure benefits, financial innovation remains a key area for future scaling and sustainability.

3.9 Sustainability, replication and scalability

Project sustainability, replication, and scalability were strongly supported by farmers’ confidence that improvements in water management, modern farming techniques, and productivity would continue beyond project closure, with FGDs highlighting the need for periodic refresher trainings, structured water gate management, and continued institutional support from ministries and local authorities. Communities demonstrated ownership through labor, in-kind contributions, and water fees, while local governments and cooperatives reinforced interventions through irrigation operations, seed distribution, and market support. Sustainability was most robust in areas where ministries, NGOs, and local leaders remained active, providing seeds, wells, training, and marketing linkages, although constraints persisted in sites facing delayed inputs, undersized ponds, or climate shocks. Replication potential was widely acknowledged by FGD participants, who emphasized expanding

reservoirs, deepening ponds, lining canals, improving water gates, and extending tertiary and secondary canals to enable double-cropping and reach remote plots. Survey results confirmed that institutional and social support—particularly from NGOs (71.2%), local authorities (59.4%), and community trust (55.6%)—were the strongest enablers of sustainability (**Table 58**), and 75% of households indicated they would continue using project technologies without support, with an additional 17% requiring only occasional assistance (**Table 59**). For scaling, key enablers included training (59.0%), market access (49.7%), and cooperative support (44.1%), while the main barriers were lack of capital (66.3%), limited technical knowledge (54.9%), and poor market access (51.4%) (**Table 60**). Knowledge retention was high across all sites, with farmers confident in applying improved irrigation, composting, and farming skills, though continued technical guidance was viewed as essential to prevent regression. Overall, strong local participation, active leadership, and coordination with agricultural departments supported sustained outcomes, while areas with limited resources, weaker participation, or environmental constraints underscored the importance of ongoing capacity building, institutionalization of roles, and integration into commune and provincial development plans to ensure long-term sustainability and scalable impact.

Table 58. *Local enabling factors influencing project success.*

Enabling factors	Female	Male	Total
Support from NGOs or development partners (institutional/social)	36.50%	34.70%	71.20%
Support from local authorities or commune officials (political/institutional)	26.70%	32.60%	59.40%
Community trust and collaboration (social)	29.50%	26.00%	55.60%
Active participation of local farmer groups or cooperatives (social)	27.80%	25.70%	53.50%
Availability of extension services or trainings (institutional)	26.70%	25.70%	52.40%
Access to water, soil quality, or favorable weather (environmental)	17.70%	15.30%	33.00%

Source: Household survey

Table 59. *Intended continuation of project technologies and practices by households.*

Intention	Female	Male	Total
Yes, I will continue using it without support	39.90%	35.10%	75.00%
Yes, but I will need occasional support (e.g., advice, repairs, inputs)	8.00%	9.00%	17.00%
No, I am unlikely to continue without project support	0.00%	0.70%	0.70%
Not applicable / I did not use the technology or practice	4.50%	2.80%	7.30%

Source: Household survey

Table 60. *Enabling factors and barriers to technology adoption for replication and scaling.*

Enabling factors of technology adoption			
Enabling factors	**Female**	**Male**	**Total**
Training or capacity building	29.20%	29.90%	59.00%
Access to markets	22.60%	27.10%	49.70%
Support from farmers' cooperatives or groups	22.90%	21.20%	44.10%
Support from agricultural extension workers	14.60%	11.80%	26.40%
Access to financial support (e.g., loans, grants)	13.50%	10.40%	24.00%
Government policy support	7.30%	6.90%	14.20%
Don't know	1.00%	0.00%	1.00%
Barriers to technology adoption			
Barriers	**Female**	**Male**	**Total**
Lack of funding or capital	35.10%	31.30%	66.30%
Lack of technical knowledge	27.80%	27.10%	54.90%
Poor market access	25.30%	26.00%	51.40%
Risk of crop loss or failure	19.10%	14.90%	34.00%

Table 60. *Enabling factors and barriers to technology adoption for replication and scaling.*

Resistance to change among farmers	12.50%	11.50%	24.00%
No support from local authorities	3.80%	3.10%	6.90%
Lacking the irrigation	1.00%	0.70%	1.70%
Lacking the labour	0.70%	0.00%	0.70%
Don't know	0.70%	0.70%	1.40%

Source: Household survey

3.9.1 Likelihood of sustained infrastructure use

Based on KIIs, community and household contributions to biodigester and compost-hut projects varied widely, with co-financing inconsistently tracked. Contributions included cash, approximately 400,000 riels ($100) for biodigesters and 200,000 riels ($50) for compost huts, as well as labor and voluntary in-kind support such as providing meals or signboards. Where households participated through cost-sharing or labor, local ownership and sustainability prospects were stronger. In cases where contributions were absent or poorly documented, long-term maintenance is likely to rely on external support. Standardizing cost-sharing mechanisms and improving documentation would enhance both accountability and the sustainability of these interventions.

3.9.2 Enabling environment for scaling csa and green finance

Sustainability correlates strongly with institutional and social support—NGOs and development partners (71.2 %), local authorities (59.4 %), and active cooperatives (53.5 %) were identified as top enablers (**Table 61**). Yet, barriers remain significant: lack of capital (66.3 %), limited technical knowledge (54.9 %), and poor market access (51.4 %) (**Table 62**). To scale CSA and circular innovations, the project's next phase should mobilize concessional finance and risk-sharing facilities for land-leveling, solar/drip systems, and post-harvest equipment. Integrating green-finance windows, buyer contracts, and blended credit mechanisms would address these systemic constraints and strengthen the enabling environment for replication.

Table 61. *Local enabling factors influencing project success.*

Enabling factors	**Female**	**Male**	**Total**
Support from NGOs or development partners (institutional/social)	36.50%	34.70%	71.20%
Support from local authorities or commune officials (political/institutional)	26.70%	32.60%	59.40%
Community trust and collaboration (social)	29.50%	26.00%	55.60%
Active participation of local farmer groups or cooperatives (social)	27.80%	25.70%	53.50%
Availability of extension services or trainings (institutional)	26.70%	25.70%	52.40%
Access to water, soil quality, or favorable weather (environmental)	17.70%	15.30%	33.00%

Source: Household survey

Table 62. *Enabling factors and barriers to technology adoption for replication and scaling.*

Enabling factors of technology adoption			
Factors	**Female**	**Male**	**Total**
Training or capacity building	29.20%	29.90%	59.00%
Access to markets	22.60%	27.10%	49.70%
Support from farmers' cooperatives or groups	22.90%	21.20%	44.10%
Support from agricultural extension workers	14.60%	11.80%	26.40%
Access to financial support (e.g., loans, grants)	13.50%	10.40%	24.00%
Government policy support	7%	6.90%	14.20%
Don't know	1%	0.00%	1.00%
Barriers to technology adoption			

Barriers	Female	Male	Total
Lack of funding or capital	35.10%	31.30%	66.30%
Lack of technical knowledge	27.80%	27.10%	54.90%
Poor market access	25.30%	26.00%	51.40%
Risk of crop loss or failure	19.10%	14.90%	34.00%
Resistance to change among farmers	12.50%	11.50%	24.00%
No support from local authorities	3.80%	3.10%	6.90%
Lacking the irrigation	1.00%	0.70%	1.70%
Lacking the labour	0.70%	0.00%	0.70%
Don't know	0.70%	0.70%	1.40%

3.9.3 Supportive policies and institutional mechanisms

Project implementation was strongly reinforced by supportive policies, institutional mechanisms, and community-based facilitation structures that anchored biodigester and compost-hut installations within local governance systems. Commune and village authorities played critical roles in mobilizing households, coordinating implementing partners, facilitating land access and construction permissions, resolving bottlenecks, and even contributing materials, labor coordination, and small cash inputs, thereby ensuring smooth implementation and local ownership. Community participation and shared-cost models further strengthened sustainability, with households providing labor, in-kind support, and meals for work crews, while donors and government agencies co-financed construction materials and contractor services, reducing financial burdens and deepening beneficiary commitment. Agricultural cooperatives complemented these efforts by organizing bulk procurement, reducing transport costs, and maintaining household demand by compiling waiting lists and communicating cost-sharing requirements, thereby creating enabling conditions for future installations. Although commune-level contributions were often modest in monetary value, KIIs confirm that their in-kind support—land access, labor, and local materials—substantially lowered installation costs and accelerated implementation. Collectively, the integration of commune leadership, community labor, donor co-financing, and cooperative facilitation established a multi-layered institutional support system that strengthened long-term sustainability, enhanced user ownership, and created favorable conditions for replication and scaling, with further gains expected from institutionalizing cost-sharing frameworks and formally documenting local contributions.

3.10 Unexpected results

The evaluation identified several unintended results arising from project interventions across institutional, community, and household levels. These outcomes reveal the project's broader influence on local governance, adaptive behavior, and market resilience beyond its original scope.

3.10.1 Institutional functioning and local water governance

Project interventions significantly strengthened Farmer Water User Communities (FWUCs), improving collective water management and community coordination. In Trapeang Beung, Kampot, structured FWUC leadership introduced monthly meetings and fines for non-compliance, ensuring transparent fund use for canal maintenance (FGD, Trapeang Beung Cooperative). Similarly, Prey Kduoch, Takeo maintained regular meetings and reported no irrigation disputes, showing high compliance with allocation schedules (FGD, Prey Kduoch Cooperative). In Poutatres, Kampong Cham, regular consultations prevented conflicts but occasional unauthorized water use persisted (FGD, Poutatres Cooperative). Trapeang Tros, Tboung Khmum faced challenges in enforcing gate schedules and water fee transparency,

underscoring the need for stronger accountability mechanisms (FGD, Trapeang Tros Cooperative). These governance experiences highlight both institutional progress and the continuing need for community sensitization and transparent financial management.

3.10.2 Project implementation and uptake dynamics

Overall uptake of innovations was high, but uneven delivery affected perceptions. Farmers quickly adopted biodigesters, composting, and CSA practices, though delays in procurement—particularly for biodigesters, compost huts, and chicken coops—created uncertainty (KII, 2025). Digital engagement emerged as an unplanned innovation: farmers began using Facebook, Telegram, and TikTok to market produce and coordinate logistics, demonstrating rapid digital adaptation (KII, 2025). Infrastructure upgrades—roads, reservoirs, and warehouses—reduced post-harvest losses and transport costs, while biodigesters lowered fuelwood dependency and improved household health (KII, 2025). However, weak buyer networks, especially in mango-producing areas, limited price stability and profitability, revealing the need for continued market facilitation (FGDs, 2025).

3.10.3 Positive results and areas for improvement

Farmers across provinces reported several positive and unexpected benefits from the project, including higher yields, improved technical knowledge, and expanded market access, with cooperative members in Takeo noting that interventions “created clear market access and improved understanding of agricultural techniques,” and participants in Kampot highlighting that improved water availability “allowed farmers to increase yields, improve livelihoods, have sufficient food, and sell to markets” (no associated table/figure for this subsection). At the same time, respondents identified areas for improvement, particularly related to delays and unmet commitments; in Kampong Cham, cooperative members acknowledged that they “did not expect that the project would help this much” but cited unfulfilled provisions such as biofertilizer, composting facilities, net houses, and chicken cages, while participants in Tboung Khmum emphasized that learning gains were constrained by limited resources, personal obligations, and environmental conditions.

3.10.4 Quantified unintended results from household survey

The household survey identified both positive spillovers and emerging risks, offering key insights for assessing Impact, Effectiveness, and Adaptive Management (**Table 63**).

Positive spillovers. One-third of respondents (33.3%) gained access to new buyers or markets, suggesting improved market connectivity beyond the project’s immediate scope.

Trade-offs. Approximately 26.7% reported reducing traditional crop areas, indicating a shift toward project-promoted crops, possibly at the expense of diversification.

Enhanced support. A portion of respondents, 20.8%, reported receiving additional assistance from other organizations, reflecting improved visibility and networking benefits.

Risks and costs. A small share experienced higher input costs (8.3%) or community-level conflict related to project support (4.2%), indicating potential equity or targeting issues. Only 0.3% of respondents reported income increases as “unexpected,” suggesting that income gains were generally anticipated rather than unforeseen.

Table 63. *Unintended results from project interventions.*

Results	Female	Male	Total
I gained access to new buyers or markets	17.40%	16.00%	33.30%
I had to reduce the area of traditional crops	14.60%	12.20%	26.70%
I received more support from other organizations after joining	9.70%	11.10%	20.80%
My costs increased unexpectedly (e.g., more expensive inputs)	5.90%	2.40%	8.30%
There was conflict in the community related to project support	3.10%	1.00%	4.20%
Income has increased	0.00%	0.30%	0.30%

Source: Household survey

3.10.5 Drivers behind the unintended results

Analysis of contributing factors indicates that unintended outcomes were shaped by a combination of external and internal dynamics (**Table 64**). These findings highlight the importance of stronger market integration, enhanced climate risk management, and ongoing technical support to sustain project results and strengthen adaptive capacity in future programming.

Market drivers. Market volatility, especially price drops and lack of buyers, was the most common driver, reported by 34.7% of respondents.

Climate and environmental stressors. Weather events such as floods and droughts were cited by 21.5% of respondents, underscoring vulnerability to climate variability.

Knowledge and implementation gaps. Approximately 8% reported difficulty applying new techniques, and 4.2% mentioned insufficient follow-up support.

Operational constraints. Delays in project implementation (3.5%) and misalignment with local needs (2.8%) also contributed to mixed outcomes. A small proportion (0.7%) noted land use conflicts.

Table 64. *Factors contributing to unintended project results.*

Factors	Female	Male	Total
Market-related issues (e.g., price drop, lack of buyers)	16.00%	18.80%	34.70%
Weather or climate events (e.g., floods, drought)	8.70%	12.80%	21.50%
Difficulty understanding new farming techniques	4.50%	3.50%	8.00%
Lack of follow-up support after training or input distribution	1.00%	3.10%	4.20%
Delays in project implementation	2.10%	1.40%	3.50%
Project activities not matching local needs	1.00%	1.70%	2.80%
Community disagreement or land use conflict	0.30%	0.30%	0.70%
Don't Know	2.40%	1.00%	3.50%

Source: Household survey

3.11 Scorecard-based assessment of paradigm shift contribution

The scorecard-based assessment applies the GCF Integrated Results Management Framework (IRMF) and Evaluation Guidelines (GCF, 2023) to assess the CFAVC's interim contribution to the fund's paradigm shift objective. The assessment covers five key dimensions of transformational change: (1) Emission reduction; (2) Resilience; (3) Gender and SDG co-benefits; (4) Institutional change; and (5) Systemic/Transformational change. These are based on verified results and institutional progress as of 2025. Each dimension is rated on a five-point GCF scale, where:

1 = Low (minimal or no contribution)

2 = Moderate (early signs of progress)
3 = Substantial (replicable but not yet systemic)
4 = Significant (widespread influence and institutional uptake)
5 = Transformational (systemic, sustained, large-scale change)

Scores are evidence-based, reflecting measurable performance indicators under the project's monitoring framework, household survey findings, and key informant interviews. The resulting narrative and scorecard provide a structured appraisal of how CFAVC interventions contribute to low-emission, climate-resilient agrifood systems in alignment with GCF's results-management and paradigm-shift criteria (GCF, 2023: Integrated Results Management Framework; Evaluation Standards and Guidance).

The CFAVC Project demonstrated moderate-to-strong progress toward catalyzing systemic change in climate-resilient agribusiness. Interim achievements highlight substantial advances in emission reduction and climate adaptation through land leveling, improved irrigation efficiency, and farmer adoption of climate-smart practices. Gender participation and cooperative engagement indicate growing social inclusiveness, while institutional coherence among MAFF, MOWRAM, MRD, and MEF has reinforced the enabling environment for sustained resilience and low-emission value chains. However, delays in ICT rollout and partial progress in operationalizing institutional service centers have constrained the depth of systemic transformation. The following scorecard summarizes the project's interim standing across these five GCF dimensions of paradigm shift.

3.11.1 Emission reduction

The project's emission reduction contribution stems from sustainable fertilizer management, biogas and compost use, and efficient water control practices that collectively lower greenhouse gas emissions from rice and livestock systems (**Table 65**). Adoption of organic fertilizers reached 48% of farmers, while 63% adopted recommended chemical fertilizer dosages, reflecting reduced N_2O emissions and nutrient loss. Training on biodigester slurry application, composting, and manure management further strengthened mitigation practices. Field-level adoption of precise irrigation and mechanized land leveling improved drainage uniformity, reducing methane (CH_4) emissions by minimizing flooded durations in rice paddies. Although quantitative GHG measurement is ongoing, behavioral and agronomic shifts indicate clear progress toward lower-emission production systems and a replicable mitigation baseline for future scaling.

Table 65. *Emission reduction assessment under the GCF paradigm shift framework.*

Indicator	Rating	Justification
Reduction of GHG emissions intensity through CSA practices and efficient irrigation	3 - Substantial	Farmers adopted fertilizer dosing, composting, and irrigation control that reduced emission intensity per hectare; field evidence of water-use efficiency, but CH_4 quantification still pending.
Adoption of low-emission production systems	3 - Substantial	Organic fertilizer and biodigester uptake, combined with mechanized land leveling, indicate reduced emission pathways; further replication needed for large-scale mitigation.

3.11.2 Resilience

Resilience outcomes are among the project's strongest achievements. Land leveling and canal rehabilitation improved water distribution and reduced climate exposure, while uniform fields enabled efficient irrigation and stable yields even during erratic rainfall (**Table 66**).

Farmers reported higher incomes, reliable harvests, and lower labor demands, allowing reinvestment in production and household needs. Improved drainage and timely access to irrigation strengthened adaptive capacity and reduced crop loss risks. Complementary training on compost use, resilient seed varieties, and fertilizer management reinforced climate readiness. However, the delayed operationalization of the ICT platform limited dissemination of climate advisories and early-warning information, leaving a minor gap in climate-risk communication.

Table 66. *Resilience assessment under the GCF paradigm shift framework.*

Indicator	Rating	Justification
Increased adaptive capacity and reduced vulnerability of target farmers	4 - Significant	Land leveling, irrigation efficiency, and adaptive training improved productivity and resilience, reducing vulnerability to rainfall variability and drought.
Establishment of mechanisms for climate information and risk management	2 - Moderate	ICT architecture completed and vendor contracted, but system deployment still pending; limited access to climate advisories at field level.

3.11.3 Gender and SDG co-benefits

The project made meaningful progress toward gender equity and SDG-aligned outcomes. Smoother fields and predictable watering schedules reduced heavy field labor traditionally borne by women, freeing time for childcare, health, and entrepreneurial activities. Women gained greater decision-making power in production and marketing, participated in cooperative leadership, and managed household finances more independently. Participation rates reached 43-48% of household members in risk-sharing literacy and 31% of trainees in agribusiness ToTs (**Table 67**), reflecting strong inclusion relative to regional benchmarks. These outcomes correspond to tangible improvements in food security, nutrition, and health, as reported by cooperative members across all provinces. Increases in crop yields and income stability enabled households to access nutritious foods and healthcare, advancing SDGs 2 (Zero Hunger), 5 (Gender Equality), and 13 (Climate Action).

Table 67. *Gender and SDG co-benefits assessment under the GCF paradigm shift framework.*

Indicator	Rating	Justification
Gender equality and women's empowerment outcomes	4 - Significant	Women's participation reached 40–50% in several sub-activities; expanded roles in decision-making, finance, and market engagement reflect improved agency.
Contribution to SDG co-benefits (climate, food security, livelihoods)	4 - Significant	Enhanced productivity, diversified livelihoods, and better nutrition outcomes contribute directly to SDGs 2, 5, and 13.

3.11.4 Institutional change

CFAVC strengthened institutional coordination and policy coherence across MAFF, MOWRAM, MRD, and MEF, embedding climate-smart agriculture (CSA) principles within national and subnational systems. Seventeen Farmer Water User Communities (62.9% of target) were formalized and 372 members trained (29% women), enhancing irrigation governance and equitable water distribution. Provincial Project Implementation Units (PPIUs) functioned as coordination hubs linking national policy with local implementation, while the Climate-Smart Agribusiness Policy and PPP Framework anchored CSA practices within MAFF's strategic planning. Institutional capacity was further reinforced through gender focal points and inter-ministerial technical working groups (**Table 68**). However, the incomplete rollout of Provincial Agricultural Development Centers (PADCs) and engineering

workshops constrained the full institutionalization of service delivery and mechanization support.

Table 68. *Institutional change assessment under the GCF paradigm shift framework.*

Indicator	Rating	Justification
Institutional coordination and capacity for climate-smart agriculture	4 - Significant	Effective inter-ministerial collaboration and well-functioning PPIUs improved policy coherence and local water governance.
Integration of project outcomes into government programs and policies	3 - Substantial	CSA frameworks embedded within MAFF and MOWRAM strategies; full mainstreaming into budgets and PADCs still pending.

3.11.5 Systemic or transformational change

CFAVC initiated broader systemic shifts toward a low-carbon, climate-resilient agrifood economy. Climate-smart models (laser land leveling, biodigesters, compost huts, and organic fertilizer use) are now being replicated by neighboring cooperatives and non-project farmers, signaling diffusion of innovation beyond the project's direct beneficiaries. Public–private partnerships established under the PPP Framework catalyzed new market linkages and green-finance mechanisms through ARDB and commercial banks, while integration of CSA principles into provincial planning and women's leadership in FWUCs illustrate emerging behavioral and governance changes (**Table 69**). The forthcoming ICT-based Climate Risk Management System further positions the project for structural transformation and data-driven agricultural decision-making. However, transformational depth remains contingent on the full national rollout of ICT services, sustained financing, and expanded private-sector participation to maintain momentum beyond the project's timeframe.

Table 69. *Assessment of systemic and transformational change in climate-smart agriculture initiatives.*

Indicator	Rating	Justification
Evidence of replication, scaling, and sustainability of climate-smart models	3 - Substantial	Replication observed among neighboring cooperatives; strong PPP models established, though replication beyond pilot areas is still limited.
Degree of systemic integration and long-term transformation	3 - Substantial	Foundational systems and institutional linkages established; broader transformational impacts contingent on ICT rollout and continued private-sector engagement.

4.0 Lessons learned

The implementation of the CFAVC Project generated important lessons across technical, institutional, and operational dimensions. These findings, which are derived from KIIs, FGDs, and the household survey, illustrate what worked well, where implementation challenges emerged, and what actions can sustain and scale the project's impacts.

4.1 Agricultural technologies and on-Farm interventions

Land leveling proved highly effective in boosting yields and household incomes. Land leveling consistently improved crop yields, reduced water use, and simplified cultivation.

Farmers from KIIs regarded it as a high-return intervention that enhanced income stability and labor efficiency. The activity was implemented smoothly and enjoyed strong community ownership, with no significant operational issues reported. Its success demonstrates the scalability and cost-effectiveness of land leveling as a climate-resilient agricultural technology.

Biodigesters and compost huts enhanced farmers' skills but required continued technical support. Insights from KIIs indicated that farmers gained hands-on experience operating biodigesters, producing compost, and applying organic fertilizer to improve soil fertility. Training on stove safety, slurry management, and equipment maintenance proved essential for ensuring consistent gas output and compost quality. Benefits included reduced fuel costs, better waste use, and improved cooking convenience. However, delayed construction and limited follow-up reduced adoption momentum. Continued mentoring, simplified manuals, and peer demonstrations are recommended to institutionalize use and ensure sustainability.

Improved water management increased productivity but seasonal constraints persisted. Insights from KIIs indicated that training on irrigation practices and investments in ponds, canals, and reservoirs enhanced productivity and income, while solar-powered pumps improved reliability in selected sites. Nonetheless, dry-season water shortages remained a major constraint, particularly in areas dependent on rainfall or incomplete conveyance systems. Future programs should deepen reservoirs, expand canals, and align construction schedules with cropping cycles to maximize performance and efficiency.

4.2 Delivery, Execution, and Infrastructure Management

Weather-related delays and logistical constraints reduced implementation efficiency. Project activities (pond construction, reservoir rehabilitation, biodigester installation, access road repair, and drying yard development) faced delays due to weather and logistical challenges. As highlighted in the KIIs, some communities self-financed interim solutions or mobilized labor to sustain progress. These experiences highlight the need for stronger contingency planning, maintenance budgeting, and adherence to implementation schedules to ensure infrastructure quality and operational continuity.

Timely delivery and maintenance planning are essential for sustaining performance. Delays in the construction and handover of assets (e.g. greenhouses, digesters, and compost huts) affected trust and reduced local confidence in project delivery. Maintenance provisions were often minimal or ad hoc. Embedding clear maintenance responsibilities, budget lines, and seasonal scheduling would enhance long-term asset functionality and community satisfaction (KII).

4.3 Capacity Building, Market Linkages, and Innovation

Training and capacity-building activities were the most valued project interventions. Across provinces, farmers repeatedly identified training and capacity-building as the project's most significant contribution. Members of the Akphivath Kaksikor Cooperative (Kampong Cham) and Akphivat Samaky Phum 3 Cooperative (Takeo) shared that "all the lessons provided by the project are important, and my group always participates without fail." Training on agricultural machinery, safe fertilizer use, and CSA improved productivity, strengthened adaptive capacity, and built community trust in project processes.

Strong market linkages are essential to sustaining productivity gains. Beneficiaries expressed the need for deeper and more sustained support in developing market linkages. Farmers from Akphivath Kaksikor Cooperative requested "assistance in finding larger markets for the community," while participants in Tboung Khmum cited missed opportunities in "training, knowledge sharing, and addressing environmental challenges." These views reinforced that technical interventions alone cannot ensure long-term benefits without structured market facilitation and value-chain integration.

Business and climate-smart agriculture training built entrepreneurial and adaptive capacity. In Kampot's Poloeu Kaksekor Srok Chhouk Cooperative, participants emphasized the importance of combining technical instruction with management and business planning. Training covered CSA practices, sustainable rice production, and post-harvest management, improving entrepreneurship and negotiation skills. These transferable competencies can be replicated by other cooperatives to scale resilience and productivity across provinces.

4.4 Institutional strengthening and governance

FWUCs improved irrigation management and equity. Based on the KIIs, FWUC members developed stronger technical and managerial skills in canal maintenance, gate operation, and equitable water distribution. Improved fee collection and coordination contributed to more reliable irrigation service delivery. However, sustainability will depend on continuous coaching, youth engagement, and leadership renewal to institutionalize effective water governance.

Agricultural cooperatives proved crucial for sustaining collective action and market access. Insights from KIIs indicated that cooperatives effectively functioned as platforms for disseminating technologies, coordinating training, and linking farmers with buyers. Strengthening cooperative management systems, through transparent recordkeeping, leadership training, and gender-responsive governance, will be vital for ensuring long-term institutional resilience and ownership.

Timely and inclusive communication is critical to maintaining trust. Insights from KIIs indicated that in some sites, delays in the delivery of materials and uneven access to training created frustration among beneficiaries. Some private operators also reported limited engagement or guidance. Strengthening feedback mechanisms, improving communication channels, and involving private-sector partners more systematically in project activities would foster greater inclusion and accountability.

4.5 Challenges and missed opportunities

Household survey data showed that the most frequent challenge was insufficient post-intervention support or follow-up (5.9%), followed by difficulties in using technologies such as biodigesters and compost huts (4.2%) (**Table 70**). Other reported issues included unclear training (2.1%), delayed materials (1.7%), and unexpectedly high costs (1.0%). These findings highlight the need for continuous mentoring, simplified technology design, and clearer training content to strengthen adoption and long-term outcomes.

Table 70. Reported Challenges and Lessons Learned from Project Implementation

Things that Did Not Go Well	Female	Male	Total
Not enough support or follow-up from the project	3.5%	2.4%	5.9%
Difficult to use the technology (e.g., biodigester, compost hut)	2.8%	1.4%	4.2%
Training was not clear or not useful	1.0%	1.0%	2.1%

Things that Did Not Go Well	Female	Male	Total
Materials or equipment were delayed or missing	0.7%	1.0%	1.7%
Costs were higher than expected	1.0%	0.0%	1.0%
Don't Know	0.7%	0.3%	1.0%

Source: HH survey

4.6 Integrating technical, market, and institutional support for long-term impact

The CFAVC experience highlights that productivity gains alone are insufficient for lasting transformation. Sustainable impact requires strong market systems, reliable infrastructure, and capable local institutions. It is therefore recommended that future interventions integrate the following to establish the foundation for climate-resilient, market-oriented, and community-driven agrifood systems in Cambodia:

- Integrate technical innovations with market development to sustain income and investment incentives.
- Ensure timely delivery and maintenance planning through pre-defined schedules and local accountability.
- Provide continuous capacity building and peer-to-peer exchanges to reinforce learning and local problem-solving.
- Strengthen cooperative and FWUC governance through mentoring, youth engagement, and inclusive leadership.
- Institutionalize feedback and monitoring systems to capture emerging issues and sustain trust among stakeholders.

5.0 Conclusion

The interim evaluation finds that overall project performance has been strong at the outcome level but uneven across outputs and activities, reflecting both early achievements and the ongoing implementation of several key components that remain incomplete as of 2025. Because activities such as biodigester installations, the establishment of engineering workshops, PADCs, and ICT platforms are still underway or awaiting contractual approval (**Table 71**), their contributions are not yet fully reflected in current accomplishment ratings but are expected to significantly influence final performance outcomes once completed. Despite these structural delays, the project has made substantial progress toward its climate-smart agribusiness objectives and is on a clear trajectory toward delivering transformational impacts in climate-resilient agriculture and low-emission rural development. Continued coordination, adaptive management, and government and private-sector ownership will be essential to finalize these remaining components and consolidate CFAVC's long-term sustainability and paradigm-shift potential.

Table 71. *Performance assessment of project outcomes, outputs, and activities (as of 2025)*

	% Accomplished	Rating	Adjectival rating
I. Outcome			
A. By 2026, At least 15% increase in yields (2017 baseline: rice 2.7 tons, maize 4 tons, cassava 20 tons and mango 15 tons/ha	97%	4	Excellent
B. By 2026, GHG emissions reduced by 240,000 tons of CO2 (2017 baseline: 0 tons reduced due to the project).	100%	4	Excellent
C. By 2026, At least 50 agribusinesses become more resource efficient in terms of water savings (5-10% efficiencies); energy	43%	1	Low

	% Accomplished	Rating	Adjectival rating
savings (20%); and reduction in post-harvest losses (10%) (2017 baseline: 0).			
Average	**80%**	**3**	**Satisfactory**
II. Outputs			
1. Critical agribusiness value chain infrastructure improved and made climate-resilient	66%	1	Low
2. Climate smart agriculture and agribusiness promoted	78%	2	Satisfactory
3. Enabling environment for climate friendly agribusiness enhanced	78%	2	Satisfactory
Average	74%	2	Satisfactory
III. Activities			
1.1. Activity 1.1 Rehabilitating water management infrastructures	50%	1	Low
1.2. Activity 1.2: Upgrading agricultural cooperative value chain infrastructure	100%	4	Excellent
1.3. Activity 1.3: Climate-resilient farm road network (achievement of output indicators and activities)	74%	2	Satisfactory
1.4. Activity 1.4: Strengthening the National Agricultural Laboratory (achievement of output indicators and activities)	88%	2	Good
1.5. Activity 1.5: Promoting renewable energy and use of solar energy	47%	1	Low
2.1. Activity 2.1: Deploying climate-resilient varieties: release of climate-resilient varieties	100%	4	Excellent
2.2. Activity 2.2: Strengthening the capacity in climate-friendly production practices and technologies	69%	1	Low
2.3. Activity 2.3: Promoting farm mechanization and extension	75%	**2**	**Satisfactory**
3.1. Activity 3.1: Formulating climate-friendly agribusiness policies and standards	95%	4	Excellent
3.2. Activity 3.2: Promoting green finance and risk sharing mechanisms	92%	4	Excellent
3.3. Activity 3.3: Supporting ICT-based climate risk management	0%	1	Low
4.1. Mobilize project implementation consultants (Q4, 2018).	100%	4	Excellent
4.2. Establish PPMS, and conduct needs assessment for specific project management skills (Q2,2019).	100%	4	Excellent
4.3. Provide training courses to project staff in project management, procurement, financial management, gender, social and environment safeguard (Q4 2018–Q3 2024).	100%	4	Excellent
Average	78%	**2**	**Satisfactory**
Average	77%	2	**Satisfactory**

Outcome-level performance. The project demonstrated excellent performance in enhancing agricultural productivity and delivering measurable climate co-benefits. By 2025, crop yield improvements and GHG reductions both reached near or full completion (97–100%), earning “Excellent” ratings. These results confirm that CFAVC interventions, particularly land leveling, improved irrigation efficiency, and the promotion of climate-smart production practices, have been effective in driving productivity gains and climate benefits. However, only 65% of targeted agribusinesses adopted resource-efficiency measures such as water and energy savings and post-harvest loss reduction, resulting in a “Low Achievement” rating. The average outcome performance reached 87% (“Satisfactory”), reflecting strong progress in core adaptation and mitigation goals while underscoring the need for greater private-sector engagement in efficiency-oriented agribusiness operations.

Output-level performance. Output performance was more modest, with an average accomplishment rate of 74% (Satisfactory Achievement). Critical agribusiness infrastructure improvement reached 64%, climate-smart agriculture promotion has achieved 78%, and enabling environment development attained 78%. These results indicate partial delivery of planned interventions, constrained by implementation delays in renewable energy systems,

laboratory strengthening, and policy mainstreaming. Institutional coordination among MAFF, MOWRAM, MRD, and MEF has improved, but gaps remain in operationalizing service centers, scaling renewable energy adoption, and accelerating policy uptake. The findings emphasize the need for accelerated implementation and resource alignment to translate outcome-level gains into sustainable system-wide results.

Activity-level performance. Performance was mixed, with several areas of excellence counterbalanced by lagging components. High-performing activities included the rehabilitation of farm roads, promotion of green finance and risk-sharing mechanisms, and deployment of ICT-based risk management systems, all rated "Excellent." Capacity building, project management, and extension activities also has achieved 100% completion. Conversely, activities involving renewable energy promotion (47%), laboratory enhancement (88%), and climate-friendly policy support (63%) lagged behind targets. The overall activity-level accomplishment rate of 77–79% (Satisfactory) suggests that while operational foundations are strong, timing and sequencing challenges have affected delivery of some specialized or cross-sectoral components.

Overall project performance. When aggregated, the project's overall accomplishment rate stood at 79% ("Satisfactory"), largely due to underperformance in intermediate outputs and the pending completion of critical infrastructure and institutional activities. Despite this, CFAVC has already demonstrated clear impacts in improving productivity, building climate resilience, and reducing emissions, consistent with its overarching objectives. The disconnect between strong outcomes and weaker output conversion highlights implementation bottlenecks, particularly in infrastructure readiness, private-sector efficiency adoption, and institutional service delivery. These areas should be prioritized during the remaining implementation period. As several key interventions are still in progress, final achievements are expected to exceed current interim ratings once all components are completed.

Paradigm shift and GCF scorecard assessment. Complementing the quantitative performance ratings, the project's progress was assessed through the GCF Integrated Results Management Framework (IRMF) using a five-point Scorecard-Based Paradigm Shift Assessment. The CFAVC Project has achieved a weighted mean score of 3.4, indicating Substantial Progress Toward Transformational Change. This reflects significant achievements in emission reduction and resilience (rated 3–4), strong gender and SDG co-benefits (rated 4), and effective institutional coordination (rated 4), though systemic transformation (rated 3) remains emergent. The scorecard corroborates that the project is on a clear upward trajectory, with strong adaptive and institutional foundations already in place. In order to reach Level 5 (Transformational) status by project completion, the remaining period must focus on completing ongoing investments, scaling up successful climate-smart models, and strengthening private-sector participation.

- Emission reduction (3 – Substantial). Widespread adoption of low-emission farming and composting practices, with measurable reduction in fertilizer intensity and improved irrigation efficiency.
- Resilience (4 – Significant). Enhanced water management and adaptive capacity, reflected in higher yields, income stability, and livelihood diversification.
- Gender and SDG co-benefits (4 – Significant). Women's participation and leadership strengthened, with broader contributions to SDGs 2, 5, and 13.
- Institutional change (4 – Significant). Effective cross-ministry collaboration and local water governance, though PADCs remain pending.
- Systemic or transformational change (3 – Substantial). Foundational systems and partnerships established; full transformation contingent on completion of ICT and infrastructure rollouts.

6.0 Recommendations

Strong progress has been achieved in yield improvement and GHG reduction, though implementation delays and limited private-sector engagement continue to constrain output-level performance. Sustained investment in infrastructure and institutional delivery will be key to maintaining momentum. Survey findings highlight that technical training, market access, and quality inputs are the most influential factors for long-term impact. Consolidating and integrating best practices in climate-smart agriculture and cooperative agribusiness into national programs will be essential to drive a low-emission, climate-resilient transformation.

The recommendations are intended to inform management decision-making and can be operationalized through a Management Response and Action Plan in line with GCF Evaluation Guidelines.

6.1 Effectiveness: Addressing constraints to achieving DMF targets

The interim evaluation confirms that CFAVC is performing strongly at the outcome level, particularly in crop yield improvement and GHG emission reduction. However, gaps remain at the output and activity levels due to implementation delays, institutional bottlenecks, and uneven private-sector participation. As several activities, including biodigester deployment, engineering workshop construction, PADC establishment, and ICT platform rollout, are still underway, the following recommendations aim to accelerate implementation and enhance transformational impact during the remaining project period. These recommendations are organized around seven thematic areas aligned with the GCF Results Management Framework and the project's logical results hierarchy.

Accelerate completion of pending infrastructure and institutional activities

- Fast-track ongoing contracts and construction. Expedite the approval and completion of biodigester systems, engineering workshops, and PADCs, all of which are critical to achieving emission-reduction, innovation, and institutional service delivery targets. Assign clear milestones and contractor accountability to avoid further delays.
- Operationalize rehabilitated infrastructure. Define maintenance protocols for canals, reservoirs, and roads through FWUC and commune council agreements, ensuring cost-sharing and continued functionality after handover.
- Deploy the ICT-based Climate Risk Management System. Finalize vendor installation, pilot test functionality, and link the platform to provincial agriculture offices and farmer cooperatives to enhance early-warning dissemination and data-driven planning.

Strengthen private-sector participation and agribusiness engagement

- Close the agribusiness efficiency gap. Provide targeted incentives (e.g., partial grant-matching, performance-based rebates) for agribusinesses adopting resource-efficient irrigation, solar dryers, and cold storage to reach the 50-agribusiness target.
- Leverage blended finance mechanisms. Expand partnerships with financial institutions trained under the green finance program, coupling credit guarantees with technical assistance to help SMEs access climate-aligned capital.
- Scale up PPP and contract farming models. Extend proven partnerships with Amru Rice, THAN CHEA, and Heng Leap Company to new provinces, prioritizing cooperatives with women's leadership or organic certification potential.

Enhance policy implementation and institutional mainstreaming

- Embed climate-smart agribusiness policy into national planning. Accelerate integration of the 2024 Climate-Smart Agribusiness and PPP Framework into MAFF's and

MOWRAM's budget cycles and annual work plans, ensuring sustained government ownership.
- Strengthen CamGAP certification and compliance. Build cooperative and SME capacity to obtain CamGAP and organic certifications, linking certification achievement to market incentives and buyer contracts.
- Institutionalize data integration. Incorporate CFAVC's monitoring indicators and GHG tracking outputs into MAFF's Agricultural Management Information System (AMIS) to institutionalize lessons and enable national replication.

Scale up gender-responsive and climate-smart practices
- Institutionalize women's participation in governance. Formalize gender parity targets (≥40%) in FWUC and AC committees, ensuring women's representation in leadership and technical decision-making.
- Ensure equitable access to ICT and training. Tailor digital advisory services and training schedules for women farmers with limited mobility or literacy, leveraging existing women-led cooperatives as training hubs.
- Support women's climate enterprises. Promote women-managed ventures in composting, biodigester operation, and input supply, linked with MSME programs and green value-chain financing at the provincial level.

Reinforce monitoring, learning, and adaptive management
- Standardize and digitalize M&E. Introduce a harmonized monitoring schedule and digital data entry tools across PPIUs to improve timeliness and comparability of reporting.
- Expand participatory feedback systems. Scale the use of scorecards and farmer feedback loops to adapt interventions dynamically and document lessons on climate-smart practice adoption.
- Conduct a mid-to-endline validation study. Use consistent indicators (e.g., yields, water efficiency, CH_4 reduction, agribusiness adoption rates) to quantify progress toward the GCF paradigm-shift criteria and update final performance baselines.

Sustain country ownership and post-project continuity
- Formalize institutional mandates. Integrate FWUCs and PPIUs into MAFF and MOWRAM's regular structures, assigning operational budgets and technical backstopping responsibilities post-project.
- Promote co-financing and program convergence. Align CFAVC results with national programs such as ASDP, NAIP, and Cambodia's NDC Implementation Framework to ensure continuity beyond GCF-ADB financing.
- Localize sustainability through subnational systems. Encourage provincial councils to adopt maintenance cost-sharing models and embed adaptation financing within commune investment plans.

Expected strategic gains if recommendations are implemented
If the above recommendations are executed within the remaining period (2025–2026), the CFAVC Project is expected to achieve:
- ≥90% overall accomplishment rate and an "Excellent" completion rating.
- Full realization of emission reduction potential, following biodigester and compost technology deployment.
- Operational PADCs and ICT platforms, ensuring durable institutional benefits and knowledge sharing.
- GCF Scorecard improvement from 3.4 ("Substantial") to 4.0+ ("Significant"), reflecting widespread institutional uptake and near-transformational change in Cambodia's climate-smart agribusiness landscape.

6.2 Replication and scalability: Leveraging results for expansion

Continued technical training, market access, and quality inputs are the most critical factors for sustaining and replicating outcomes, while access to credit, farmer cooperation, and institutional support also play important roles. These findings highlight the need to strengthen capacity building, market facilitation, and financial access, supported by coordinated institutional mechanisms and knowledge-sharing platforms. Consolidating proven practices in climate-smart agriculture and cooperative-based agribusiness into scalable models under national programs will be essential to achieving lasting, low-emission, and climate-resilient transformation.

6.2.1 Priority needs for long-term impact

The household survey asked respondents to assess how helpful various factors were in sustaining and replicating project outcomes. Participants rated each factor using a four-point scale: Very Helpful, Moderately Helpful, Slightly Helpful, or Not Helpful (**Table 72**). The percentages shown in the table below represent the proportion of respondents selecting each level of helpfulness, with a combined column ("Moderately–Very Helpful") summarizing the overall share of participants who viewed each factor as significantly supportive of long-term sustainability. As shown, continued technical training and support (86%) emerged as the most influential factor, underscoring the importance of maintaining post-project extension services and refresher training. Market access (67%) and availability of quality inputs (56%) followed as major enablers, reflecting that livelihood sustainability depends on reliable buyer linkages and affordable input supply. Farmer cooperation (48%) and access to credit (41%) remain critical for scaling production and investing in improved equipment and inputs. Meanwhile, government and NGO extension support (31%), though secondary, still contributes meaningfully to sustaining gains beyond the project's duration. These findings emphasize that future replication and scaling strategies should prioritize capacity building, market facilitation, and access to finance, complemented by continued institutional coordination and the creation of knowledge-sharing platforms for cross-provincial learning.

Table 72. *Priority factors influencing replication and long-term sustainability.*

Rank	Sustainability factor	Very helpful (%)	Moderately helpful (%)	Combined (Moderately - Very Helpful %)	Key implication for scaling
1	Continued technical training/support	45.2	40.9	86.1	Maintain post-project extension and capacity-building programs.
2	Better access to markets	33.1	34.3	67.4	Link cooperatives with reliable off-takers and contract buyers.
3	Access to quality inputs	28.4	27.5	55.9	Strengthen input supply chains and certification systems.
4	Farmer cooperation/group work	24.5	23.4	47.9	Support collective marketing and cooperative management.
5	Access to credit/loans	19.8	21.5	41.3	Expand green finance and microcredit facilities.
6	Extension / government / NGO	15.7	14.9	30.6	Maintain institutional

Table 72. *Priority factors influencing replication and long-term sustainability.*

Rank	Sustainability factor	Very helpful (%)	Moderately helpful (%)	Combined (Moderately - Very Helpful %)	Key implication for scaling
	support				linkages beyond project closure.
7	Clear land rights	6.2	6.6	12.8	Encourage tenure documentation to support investment.

6.2.2 Strategic implications for replication

Building on these findings, CFAVC's best practices in land leveling, climate-smart irrigation, composting, and cooperative-based contract farming should be consolidated into replicable packages that can be scaled under MAFF's national programs or future GCF pipelines. This will ensure that the project's paradigm-shift contribution, currently rated 3.4 (Substantial), translates into a sustained national model for low-emission, climate-resilient agribusiness transformation.

APPENDICES

Appendix 1: Case studies

Case study 1 *"From fields to futures: Paths to climate-smart rice"*

1.0 Introduction

Rice farming remains central to rural livelihoods in Cambodia, yet climate variability, declining soil fertility, and reliance on chemical inputs continue to challenge smallholder productivity; this case study documents how two women farmers—61-year-old Chab Sreymom from Damnak Sokrom Commune in Kampot and 71-year-old Long Sok from Trapeang Kronhoung Commune in Takeo—successfully adopted climate-smart practices through project-supported training, improved infrastructure, and farmer group engagement (no associated figure/table for this section). As active members of farmer groups, and in Long Sok's case an agricultural cooperative, both women illustrate how capacity building, water-management improvements, and farmer-to-farmer learning have strengthened production, marketing, and environmental sustainability. By comparing their experiences across two provinces, the case study highlights what has worked well, the challenges that persist, and key lessons to inform future scaling of climate-smart rice production in Cambodia.

2.0 Technology Used and Cultural Practices

Following project training, both farmers adopted climate-smart technologies and cultural practices that significantly reduced labor and input costs while improving soil health and productivity, with Sreymom shifting from chemical fertilizers to Kbal Krabei compost, manure, and leaf residues, practicing direct seeding, residue retention, and phased composting, and Long Sok integrating high-quality seed, a balanced fertilizer mix (50% manure, 40% compost, 10% chemical), bio-slurry use, mulching, and an AWD-style irrigation method to enhance crop vigor (no associated figure/table for this section). These practices contrasted sharply with pre-project conditions in both provinces, where farmers relied heavily on chemical fertilizers, labor-intensive transplanting, residue burning, and rainfed systems that limited cropping to one season in Takeo. Water access remained uneven—Kampot farmers depended mainly on rainfall and a small project pond, while Takeo's expanded irrigation supported two crops in better-served areas but remained constrained by shallow reservoirs and canal distance. Production and marketing also improved: Sreymom reported greater efficiency through direct seeding and reduced transport costs via hired electric cattle and traders' trucks, while in Takeo transport shifted from ox-carts to tractors and power tillers, enabling faster movement of harvests to middlemen and cooperatives.

3.0 Impacts

In Kampot, Sreymom observed that "the soil is darker, softer, and more fertile than before," a change she attributed to the combined use of compost, residue retention, and reduced dependence on chemical fertilizers. While yields remain similar, direct seeding has lowered labor needs and input costs by blending natural fertilizers with only small doses of chemicals. In Takeo, Long Sok reported that "crop yields have increased with better seed and fertilizer management," noting that training on efficient fertilizer use, the shift to compost and bio-slurry, and reduced chemical reliance have not only improved soil fertility and cut fertilizer costs but also contributed to a cleaner environment with less pollution.

4.0 Challenges in Technology Adoption and Production

In Kampot, limited irrigation restricts the timing of second compost applications and prevents farmers from practicing multi-cycle cropping, leading to calls for additional ponds to improve water availability. In Takeo, the adoption of AWD-style water management and composting

is challenged by uneven access to irrigation and shortages of organic inputs, as some farmers live far from canals and struggle to secure enough manure or compost feedstock to sustain the practice.

5.0 Role of the Project

In Kampot, the project played a vital role by providing training, constructing a rainwater pond, and establishing a community warehouse for crop collection, fertilizer storage, and training sessions, while also delivering an unexpected benefit through the construction of a paved road that, as one farmer expressed, “we never imagined to have paved road like this.” In Takeo, the project introduced new agronomic techniques, improved irrigation access that made two cropping cycles possible in some areas, promoted the use of compost and bio-slurry, and contributed to the shift from traditional methods to mechanized transport, further enhancing efficiency and productivity.

6.0 Lessons learned

In Kampot, farmers emphasized that training helped them “properly select varieties and use fertilizers correctly according to technical standards,” but highlighted the need to expand training opportunities to reach more farmers and to build additional ponds that would support multiple crop cycles. In Takeo, lessons focused on strengthening farmer capacity through further training on organic vegetable production, water-saving practices, post-harvest handling, and market skills, alongside calls for improved infrastructure such as a concreted community rice-drying yard to reduce losses and enhance grain quality.

Case study 2: *"From waste to worth: How compost huts and biodigesters are shaping climate-smart rice farming in Kampot and Takeo"*

1.0 Introduction

This case study highlights the experiences of two senior women rice farmers—61-year-old Chab Sreymom from Dangtung District, Damnak Sokrom Commune in Kampot and 71-year-old Long Sok from Tram Kok District, Trapeang Kronhoung Commune in Takeo—who demonstrate the practical realities and opportunities of climate-smart agriculture in Cambodia, drawing on their active participation in farmer groups and, in Long Sok's case, an agricultural cooperative as key platforms for accessing training, inputs, compost huts, biodigesters, and improved water-management practices (no associated figure/table for this section). By documenting their perspectives, the case study shows how project-supported technologies have enabled a transition from traditional, chemical-intensive methods toward more sustainable and climate-resilient farming systems, while illustrating how farmer groups and cooperatives function as essential mechanisms for sharing innovations, strengthening livelihoods, and scaling climate-smart rice production at community and policy levels.

2.0 From Chemical Dependence to Organic Innovation

Before project support, the Kampot farmer relied entirely on chemical fertilizers and had no exposure to organic inputs, while in Takeo farmers used animal manure but lacked organized composting systems and still depended on chemical fertilizers for about 20% of their nutrient mix—baseline conditions that highlighted both the potential and the difficulty of transitioning to organic practices (no associated figure/table for this section). With the introduction of project-supported compost huts, farmers began converting crop residues and animal waste into high-quality compost that improved soil structure, moisture retention, and nutrient cycling, leading the Kampot farmer to observe that "the soil is darker, softer, and more fertile than before." In Takeo, training and inputs enabled a more optimized fertilizer mix—50% manure, 40% compost, and 10% chemical—while improved seed and bio-slurry integration increased yields, lowered input costs, and strengthened long-term soil health.

3.0 Climate-Smart Gains Farmers Can See

Compost huts and biodigesters have generated visible climate-smart gains for farmers by reducing residue burning, lowering methane emissions, and replacing costly chemical fertilizers with stabilized compost and bio-slurry, which improve soil structure, water retention, and overall field productivity (no associated figure/table for this section). In Kampot, farmers now layer manure and leaf litter before plowing and top-dress with branded compost one to two months later, reporting lower input costs, healthier soils, and steadier yields, while in Takeo fertilizer practices have shifted from an 80% manure–20% chemical mix to a balanced 50% manure–40% compost–10% chemical system that reflects stronger confidence in organic inputs and better nutrient timing. Farmers consistently describe these technologies as cost-saving, environmentally friendly, and supportive of long-term soil fertility, with one Kampot farmer noting that residues and compost "make the soil darker, softer, and more fertile," and a Takeo farmer affirming that "crop yields have increased with better seed and fertilizer management," demonstrating how the combined use of compost, improved seed, and bio-slurry strengthens both sustainability and productivity.

4.0 The Project's Role

The project acted as the catalyst for change by combining practical training, on-farm demonstrations, and key infrastructure investments. Compost huts gave farmers a way to systematically turn residues and manure into usable fertilizer, while rainwater harvesting ponds supported both compost preparation and bio-slurry application. Cooperative facilities provided spaces that served as both training venues and input depots, strengthening the community's capacity to manage and share resources. In Kampot, the farmer linked her practice change directly to these interventions, explaining that the training taught her how to

choose varieties and “use fertilizers correctly according to technical standards,” alongside learning the benefits of organic fertilizers. In Takeo, the farmer emphasized that her new organic mix and resulting yield improvements stemmed from project coaching and the support of community organization, which together gave her the confidence to adopt and sustain the practices.

5.0 Challenges

Not every household can run a biodigester or maintain a compost site. In Takeo, some families lacked space for a digester and did not keep enough cattle or pigs to supply feedstock; as one farmer explained, this limited the use of the “biogas system and composting facility” even though the training and hardware were available (Source: Interview with Long Sok). In Kampot, water scarcity remains a constraint, and without sufficient moisture it can be hard to compost quickly or apply bio-slurry at optimal times in the season; nonetheless, farmers are adapting with batch composting and staged applications timed to rainfall and pond availability (Source: Interview with Chab Sreymom).

6.0 Lessons learned

Lessons from Kampot and Takeo show that infrastructure such as compost huts and biodigesters is effective only when supported by hands-on coaching, clear schedules, adequate feedstock, and reliable water access, while cooperative organization further strengthens results by enabling shared facilities, input pooling, and peer learning that help sustain compost and bio-slurry use despite labor or weather constraints. These insights are illustrated by two long-time women rice farmers: a 61-year-old in Kampot who shifted from chemical-only inputs to manure, leaf litter, and compost, reporting darker, softer, more fertile soil and reduced costs; and a 71-year-old in Takeo who adopted a mix of 50% manure, 40% compost, and 10% chemical fertilizer, achieving higher yields but noting limitations in biodigester use due to space and manure availability.

Case study 3: *"Linking fields to markets: How cooperative action and better roads strengthened the rice value chain in Kampot and Takeo"*

1.0 Introduction

Two elderly women farmers—one in Damnak Sokrom, Kampot, and another in Trapeang Kronhoung, Takeo—both reliant on rice cultivation and active in farmer groups and cooperatives, illustrate the baseline conditions in which rice production was labor-intensive, costly, and constrained by weak infrastructure and limited market access. In Kampot, farmers transported small rice lots by motorbike or paid haulage and depended on labor- and cash-intensive transplanting with chemical fertilizers, while in Takeo, restricted irrigation permitted only one annual crop and ox-cart transport reduced bargaining power. As one Kampot farmer noted, "before, farmers spent a lot of time for transplant rice… now [we] sow seeds, which saves time and money," reflecting early shifts away from high-cost practices and underscoring the need for targeted interventions to reduce production risks and strengthen value-chain participation.

2.0 Impacts of Value Chain Improvements

In both Kampot and Takeo, the project's combination of paved roads, community warehouses and cooperative facilities, targeted agronomic training, and selective irrigation access reshaped how rice moves through the value chain. What was once fragmented and costly—small, scattered loads moved with high effort and low bargaining power—has become more coordinated, efficient, and market-responsive. Deliveries are now larger, timelier, and of higher quality, reducing costs for farmers while strengthening their position in negotiations and making the value chain work for them rather than against them.

3.0 The Project's Role in Strengthening the Rice Value Chain

The project strengthened the rice value chain in Kampot and Takeo by improving logistics, market access, and production practices. In Kampot, a paved road and community warehouse reduced transport costs, streamlined harvest management, and created a central space for storage and training, with farmers noting that the new road "reduces expenses significantly." In Takeo, expanded irrigation, cooperative engagement, and targeted training enabled farmers to sell through agricultural cooperatives rather than solely to middlemen, increasing bargaining power and market reliability. Production improvements further reinforced these gains: Kampot farmers adopted compost, manure, and leaf residues, stopped burning straw, and reported "darker, softer, and more fertile" soil that improved grain quality and reduced costs, while Takeo farmers implemented balanced nutrient inputs and alternate wetting and drying, enhancing grain uniformity and making post-harvest handling more efficient for cooperative buyers.

4.0 Transport and Market Access

Transport and market access improved considerably in both provinces, though through different pathways: in Kampot, farmers continued using flexible transport options—motorbikes for small loads, hired "electric cattle" for larger volumes at 2,500 riels per sack, and trader trucks for direct household purchases—highlighting how scale reduces per-unit transport costs, while the community warehouse and training enabled predictable bulking and local buyer engagement that lowered search costs and stabilized margins. In Takeo, modernization from ox-carts to tractors and power tillers, combined with cooperative-led aggregation, accelerated movement from fields to collection points, reduced labor, and improved farmers' ability to meet buyer schedules. These logistical gains, paired with stronger cooperative participation and better seed and fertilizer management that increased yields, enabled farmers to deliver larger, more consistent lots to both cooperatives and traders, reducing post-harvest losses and strengthening market reliability.

5.0 Impact of Improved Roads on Market Performance

Improved roads significantly enhanced market performance in both provinces: in Kampot, the new paved road lowered per-trip transport costs, reduced spillage, enabled traders' trucks to reach households directly, and, as farmers noted, "made it easier… saving time and money," allowing quicker delivery and better price capture during high-demand periods; in Takeo, upgraded road access and faster on-farm evacuation using tractors allowed farmers to assemble larger, fresher, and more consistent lots for cooperative sales, strengthening their bargaining power and improving negotiation outcomes during peak procurement seasons, thereby reinforcing overall market efficiency and farmer leverage.

6.0 Challenges

Despite significant gains, farmers in both provinces continue to face important challenges: in Kampot, seasonal water scarcity and limited working capital delay second compost applications and force early sales to traders, prompting farmers to emphasize the need for additional ponds to stabilize water supply and improve price timing; in Takeo, uneven access to project benefits persists as shallow reservoirs, distant fields, and shortages of manure and compost constrain sustained organic practices, while cash-flow pressures and coordination demands lead many households to continue selling to middlemen despite cooperative support.

7.0 Lessons learned

Farmers in both provinces emphasized that sustained progress requires stronger technical and market-oriented support: in Kampot, they called for expanded practical training on proper variety selection and fertilizer use, paired with additional water infrastructure to enable multi-cycle production, larger harvest volumes, and timely delivery that meets buyer demands; in Takeo, they stressed the need for improved capacity in market engagement, post-harvest handling, and water-saving techniques, noting that establishing a concrete community rice-drying yard would reduce losses, enhance grain quality, and help secure more consistent cooperative contracts and long-term market participation.

Case study 4: *"From rain-dependent ricefield to smarter flows: Community irrigation management in Kampot and Takeo"*

1.0 Introduction

In Kampot's Dangtung District (Damnak Sokrom Commune), a 61-year-old woman farmer who depends on rice cultivation actively participates in farmer group activities, trainings, and community meetings despite unspecified formal education, demonstrating strong engagement in local water and farming initiatives; similarly, in Takeo's Tram Kok District (Trapeang Kronhoung Commune), a 71-year-old woman farmer who earns her livelihood from rice is active in both a farmer group and an agricultural cooperative, strengthening her links to collective resource management and market channels while contributing to group learning and practice change (Sources: Interviews with Chab Sreymom and Long Sok).

2.0 Water Management for Climate-Smart Rice

Before the project, farmers in Kampot and Takeo faced fragmented and unreliable water access—Kampot relying almost entirely on rainfall with only a small canal and a project pond providing seasonal support, and Takeo depending on rain and ponds that typically allowed just one annual crop, making synchronized planting and moisture management difficult. Water use is now more deliberate and coordinated: Kampot farmers ration limited pond and canal water for early establishment and top-dressing, reducing disputes and avoiding over-irrigation, while Takeo farmers manage water levels strategically across the season, draining excess during heavy rains and pumping during dry spells, applying an alternate wetting and drying approach that conserves water and maintains crop vigor. Despite progress, gaps remain—Kampot still depends on a narrow water portfolio that cannot ensure a reliable second season, whereas Takeo's expanded mix of rainfall, ponds, canals, and on-farm pumping has enabled more farmers to cultivate a second crop and coordinate group schedules for improved production and market consistency.

3.0 Strengthening Irrigation Management Through Training and Shared Infrastructure

Project support strengthened irrigation management in both provinces by combining shared infrastructure with practical training: in Kampot, the rainwater harvesting pond constructed under the project provided farmers— including respondent Chab Sreymom—with a crucial buffer during delayed rains and, through hands-on training, introduced them to basic scheduling practices that improved coordination across plots and reduced neighbor disputes despite tight water availability; in Takeo, expanded access to canals and pumping points enabled farmers such as Long Sok to move from one to two annual rice crops, with training and farmer-to-farmer exchanges promoting staged watering and timed drainage that reinforced cooperative discipline, reduced waste, and aligned irrigation more closely with crop needs to stabilize yields and optimize scarce water resources.

4.0 Challenges

In Kampot, the key water challenge highlighted by respondent **Chab Sreymom** is insufficient storage, as reliance on a single pond and shallow canal means farmers "have water only during the rainy season," limiting late-season irrigation and preventing dry-season cropping, prompting calls for additional ponds to stabilize supply and reduce production risks; in Takeo, respondent **Long Sok** emphasized that the issue is uneven water distribution—"some reservoirs are shallow and cannot store large amounts of water," and households farther from canals face difficulty accessing flows when needed, resulting in patchy adoption of improved scheduling practices and unequal benefits from opportunities for double-cropping.

5.0 Impacts

In Kampot, respondent Chab Sreymom reported that water-management training also transformed soil practices, with farmers abandoning residue burning in favor of retaining straw and leaves, resulting in “darker, softer, and more fertile” soil that improved infiltration and made limited irrigation water more effective; in Takeo, respondent Long Sok noted that clearer rules for inflows and drainage, paired with improved seed and nutrient management, led to higher yields, as “crop yields have increased with better seed and fertilizer management,” demonstrating how disciplined water control and consistent community-wide application practices strengthened overall field performance.

6.0 Lessons Learned

In Kampot, respondent Chab Sreymom highlighted that even modest infrastructure—such as a small shared pond—can meaningfully reduce production risks when paired with practical training and simple, community-agreed irrigation rules, though sustaining and scaling these gains will require additional ponds and continued coaching on scheduling and soil moisture conservation; in Takeo, respondent Long Sok emphasized that infrastructure must be supported by strong operation and maintenance systems, including deepening reservoirs, extending access to distant plots, and reinforcing alternate wetting and drying (AWD) practices through farmer groups and cooperatives to ensure more equitable water access, sustain double-cropping gains, and maximize the value of irrigation investments.

Case study 5: *"From chemicals to compost: Cassava farmers building fertile soil and reliable markets"*

1.0 Introduction

This case study highlights the experiences of four cassava farmers—Koeun Rum (45, Kok Srok, Dambae District, Tboung Khmum; primary education; ~$500/month), Lorn Sieng Hai (38, Koh Baen, Kampong Siem, Kampong Cham; secondary education; ~$355/month), Sararn Sidarth (50, Sopheas, Stung Trang, Kampong Cham; lower secondary; ~$833/month), and Fork Matt (41, Masinsrov, Beung Pruol, Tboung Khmum; primary education; ~$1,050/month)—all active in cooperatives or farmer groups and relying on cassava alongside other crops and livelihood activities. Before project support, these farmers depended heavily on chemical fertilizers, often overapplying them despite minimal yield gains and declining soil quality; as Rum recalled, "I used only chemicals before… but yields did not really improve," while Sidarth noted that poor guidance led to higher risks and unstable incomes. Without a storage warehouse, they were also forced to sell immediately after harvest at low prices when supply was high. The case study therefore examines how project interventions in training, infrastructure, and cooperative strengthening helped reduce chemical dependency, promote more sustainable practices, stabilize incomes, and improve farmers' bargaining power within the cassava value chain.

2.0 Technologies and Cultural Practices

Cassava farmers adopted a mix of organic and chemical fertilizers and improved residue management, with Koeun Rum noting her shift from "100% chemical fertilizers" to mixing animal manure with rice husks to avoid soil degradation and disease, and Sararn Sidarth replacing about half of his chemical inputs with cow dung, resulting in "better crops, higher yields, and health benefits." Fork Matt continues using roughly 90% chemical and 10% manure but credits training on proper rates and timing for improved yields and healthier soils, while Lorn Sieng Hai reverted to full chemical use after mixed results with organic blends. The project also discouraged residue burning, promoting recycling of organic matter—Rum emphasized that "cassava residues are plowed into the soil," and Fork added that manure use continues despite declining livestock numbers. Water access remains a key constraint: Rum relies on rainfall and drilled wells, Sidarth noted ponds often dry before rains, and Fork benefits from community ponds that nevertheless "dry up late in the dry season," underscoring that sustained cassava productivity depends on improved water availability and management alongside soil-focused practices.

3.0 Impacts on Cassava Yields and Costs

The impacts of project interventions on yields and production costs varied across sites. Rum explained that her yields remained steady at about 50 tons per hectare, noting that the new cassava variety had not yet reached harvest and its performance was still to be assessed. In contrast, both Sidarth and Fork observed yield increases alongside noticeable improvements in soil structure after reducing chemical use and incorporating more organic inputs. For Sidarth, the shift brought financial as well as environmental benefits: he highlighted that lower spending on chemical fertilizers, combined with healthier soils, translated into stronger margins and safer produce, emphasizing that "profits are better, and the crops are healthier."

4.0 Role of the Project

The project strengthened cassava production and marketing by providing improved planting material (variety 81), technical training, and a community warehouse that enhanced storage and reduced transaction losses—benefits emphasized by Koeun Rum, who noted that "traders can now purchase directly from the warehouse, making it easier for us." Training promoted balanced chemical–organic fertilizer use and sustainable practices, with Sararn Sidarth highlighting how guidance on compost and organic fertilizers "helped reduce chemical use and improved awareness of protecting the environment." Water-related interventions were also valued: Fork Matt stressed the importance of ponds and seed

support while recommending “deeper ponds and solar pumps” to make irrigation more reliable and extend water use later into the dry season, underscoring the project’s role in addressing both agronomic and resource constraints.

5.0 Challenges in Adoption

Despite important gains, farmers continue to face challenges in adopting sustainable practices: Fork Matt noted that declining livestock numbers mean “not enough manure for everyone,” limiting organic fertilizer availability; Sararn Sidarth highlighted market risks from price drops during peak harvests; and Lorn Sieng Hai explained that inconsistent results from organic fertilizers discouraged her from continued use. The project also produced mixed outcomes—Fork expressed disappointment that “we expected a canal system but only received ponds,” which restricted water distribution, while Koeun Rum observed that many households still lacked compost huts or biodigesters and thus remained dependent on chemical fertilizers. Nonetheless, farmers acknowledged positive impacts, particularly the community warehouse and improved roads, which brought traders directly to villages, reduced transport costs, raised farm-gate prices, and strengthened overall market access.

6.0 Lessons Learned

Farmers agreed that blending chemical and organic fertilizers offers a more sustainable path, though full replacement remains unrealistic without a larger supply of manure and compost. As Sidarth reflected, “burning is easy but like burning down a house… composting gives higher yields and protects the soil.” The experience underscored that while training and storage facilities are valuable, long-term resilience in cassava farming also depends on reliable irrigation and stable markets that can safeguard both productivity and incomes.

Case study 6: **"Roads, warehouses, and better soil: How cassava farmers are upgrading their market pathways"**

1.0 Introduction

This case study draws on the experiences of four cassava farmers—Koeun Rum (45, Kok Srok, Dambae District, Tboung Khmum; primary education; ~$500/month), Lorn Sieng Hai (38, Koh Baen, Kampong Siem, Kampong Cham; secondary education; ~$355/month), Sararn Sidarth (50, Sopheas, Stung Trang, Kampong Cham; lower secondary; ~$833/month), and Fork Matt (41, Masinsrov, Beung Pruol, Tboung Khmum; primary education; ~$1,050/month)—all active in cooperatives or farmer groups and supporting their livelihoods through cassava and additional crops or labor. Across sites, farmers emphasized that project support has improved both knowledge and market access, with one noting, "since the project started, we understand inputs and markets better," and another explaining that cooperative membership "makes it easier for traders to find us and offer fairer prices." The case study documents how training, infrastructure, and cooperative linkages have shaped changes in production practices, soil and water management, and marketing strategies, offering insights into how cassava farming can become more sustainable, resilient, and profitable for smallholders in Cambodia.

2.0 Technologies, Transport and Storage

Cassava farmers have refined fertilizer use, soil management, transport, and storage with project support, as illustrated by respondents Koeun Rum, Sararn Sidarth, and Fork Matt: Rum reported shifting from "100% chemical fertilizer" to mixing animal manure and rice husks to prevent soil damage, Sidarth now replaces half his chemical use with cow dung, noting healthier crops and better profits, and Fork observed that reduced chemical application has left her soil "less compacted," with plants growing well; residues are no longer burned but plowed back into the soil, with Rum stressing that "cassava residues go into the soil—nutrients return," and Sidarth warning that burning is "like burning down a house." Transport has improved from ox-carts to motorized vehicles and "electric cattle," enabling easier movement of tubers and better village access for middlemen due to upgraded roads, which one cooperative member summarized as: "The smoother the road, the better the price." Storage and bulking have also strengthened through the community warehouse, which Rum described as allowing farmers to "wait for a better offer instead of rushing at a low price." Water availability remains a constraint—Rum relies on rainfall and drilled wells, while Fork noted ponds "dry late in the dry season" and need to be deeper or connected to canals. Overall, training on fertilizer management, residue recycling, improved seed (cassava variety 81), and investments in roads and the warehouse enabled farmers to stabilize yields, reduce losses, and improve marketing outcomes, with Rum affirming that "traders can buy at the warehouse now," and Sidarth noting that training "opened our eyes to organic fertilizer… and we still meet buyer demand."

3.0 Cassava Value Chain

Before the project, cassava marketing was costly and fragmented due to damaged dirt roads, limited home-based storage, and weak bargaining power, with farmers recalling that "the road was rough and slow; by the time we reached buyers, costs were higher and the price went down." With project support, however, upgraded road access and the establishment of a community warehouse created major efficiencies—**Koeun Rum** noted that "traders now come directly to the village and to the warehouse," while **Sararn Sidarth** emphasized that improved concrete and rubber roads allow "larger vehicles right to the farms," reducing transport time and costs. Agricultural cooperatives became central actors in the value chain, coordinating harvest schedules, signaling expected volumes, and sharing technical guidance, with one member explaining that "with the cooperative, we sell together—buyers respect volume, and we get clearer market information." These changes strengthened bargaining positions through bulking, lowered transport and production costs—

especially for farmers like Fork and Sidarth who reduced chemical fertilizer use—and improved crop health and soil conditions, though Rum's yields remained steady at about 50 tons per hectare pending results from new variety trials. Overall, enhanced roads, warehousing, cooperative coordination, and farm-gate purchasing reduced delays, minimized spoilage risks, and increased predictability and confidence in cassava marketing.

4.0 Challenges

Despite significant improvements, challenges persist across the cassava value chain, including recurring price volatility during peak harvests and limited access to organic matter as livestock numbers decline and many households lack biodigesters or compost huts—constraints underscored by Koeun Rum, who noted that "natural fertilizer can't replace chemicals completely—we just don't have enough." Water distribution remains uneven, with ponds drying before rains and lacking canals to extend their reach, while adoption of organic practices is inconsistent, as some farmers reverted to full chemical programs when short-term results from organics appeared uncertain. Fork Matt expressed disappointment that "we expected canals but received ponds only," limiting irrigation reliability and the ability to time harvests for better prices. Nonetheless, unexpected positive outcomes emerged: road upgrades rapidly increased buyer visits, reduced transport costs, and raised farm-gate prices, strengthening farmer confidence in market access despite ongoing constraints.

5.0 Lessons Learned

Farmers identified several key lessons: aggregation through cooperatives strengthens bargaining power—one member noted that "selling together through the cooperative gets better offers" by attracting buyers and improving price negotiations; improved soil management through residue incorporation and partial substitution of chemical fertilizers with organics delivers long-term benefits by enhancing soil tilth and reducing input costs, a point emphasized by respondents such as Koeun Rum and Sararn Sidarth; and infrastructure such as warehouses and upgraded roads multiplies the value of training, with farmers observing that "the warehouse and better roads cut our costs and save time—without them, training would help less." Looking ahead, respondents including Fork Matt stressed the need for deeper ponds and canal connections to stabilize water supply, expanded access to compost or biodigester slurry, and better cooperative-based price and quality information systems to guide production and marketing decisions.

Case study 7: *"Improvement of maize farming"*

1.0 Introduction

This case highlights the experience of Lorn Sieng Hai, a 38-year-old farmer from Koh Baen, Kampong Siem District, Kampong Cham, who earns about $355 per month from maize ($125), vegetables ($250), water hyacinth collection ($150), and casual labor ($30), and is an active member of her agricultural cooperative, where she gains access to shared learning and improved techniques. Before the project, Lorn faced unstable markets, limited irrigation, and heavy dependence on chemical fertilizers; she cultivated maize twice yearly with yields of 7–8 tons per hectare but experienced sharp price drops—sometimes down to 500 riels ($0.12) per kilo—explaining that "market prices are not stable because during the harvesting season, some corn is not yet fully mature, which causes traders to drop down the price." Transport and storage constraints further weakened her position: in the rainy season maize had to be moved by boat and then by electric cattle to her home, while in the dry season traders bought at the field, but without proper storage she was pressured to sell quickly at low prices, leaving her vulnerable to market fluctuations and limiting profitability.

2.0 Technologies and Farming Practices

The project introduced improved maize seeds and training on combining organic and chemical fertilizers, but Lorn Sieng Hai reported that the recommended mix did not improve yields, explaining, "I only use chemical fertilizers—7-color fertilizer, urea, and NPK… the combination with organic fertilizer did not give much yield, so I returned to chemicals." Nonetheless, she adopted improved residue management, now plowing leaves and cobs into the soil to enrich nutrients and enhance uniform growth, noting that "corn residues… enrich the soil without degrading its quality, and the crops grow evenly and achieve higher yields." Water access remains a major constraint, as maize relies on rivers and streams that are dependable only during the rainy season, leading to lower yields in the dry months—"water is sufficient only during the rainy season… in the dry season there is shortage," she said. Unlike rice farmers, maize growers in her area cannot implement AWD due to the absence of canals to deliver water from rivers or ponds, leaving irrigation fragmented and limiting the benefits of improved seeds and cultivation training.

3.0 Role of the Project

The project expanded farmers' technical knowledge and provided improved maize seeds, with Lorn Sieng Hai noting that "since the project has been implemented, I have observed that farmers have gained much knowledge about crop cultivation techniques," which strengthened her confidence and improved her crop management practices; however, she emphasized that these gains are constrained by inadequate irrigation, stressing that "the project should provide irrigation canals to supply water for the community's crops," a reminder that training and improved varieties must be paired with reliable water infrastructure to achieve sustained productivity improvements.

4.0 Impacts of Technology and Interventions

The impacts of the project on maize production have been mixed: yields for Lorn Sieng Hai remain steady at 7–8 tons per hectare, but she and other farmers gained improved technical knowledge, better seed access, and stronger awareness of soil management, particularly through adopting residue retention that enhances soil health and reduces reliance on purchased inputs, even though production still depends heavily on chemical fertilizers. Lorn emphasized that "farmers have learned techniques for growing corn," but persistent water shortages continue to limit the full benefits of these interventions and expose farmers to ongoing risk. While no major unintended effects were observed, an important positive side effect has been strengthened cooperative learning, as farmers increasingly share techniques and reinforce each other's adoption of improved practices, even where yield gains have yet to materialize.

5.0 Lessons Learned

Several important lessons emerged from Lorn's experience. Cooperative aggregation has proven vital, giving farmers stronger bargaining power and attracting buyers directly to the village. Improved cultural practices, especially composting crop residues, have enhanced soil quality and supported more stable yields, showing that small changes in field management can generate lasting benefits. Infrastructure also plays a decisive role: road upgrades and storage facilities have multiplied the value of training and knowledge sharing, but irrigation canals remain a crucial missing link for resilience. As Lorn reflected, "I would like to propose that the project provide irrigation canals to supply water to the community's crops," while also calling for more training courses on cultivation techniques to ensure that skills continue to expand alongside infrastructure improvements.

Case study 8: **"Strengthening market access and value chains of maize through cooperatives"**

1.0 Introduction

This case highlights the experience of Lorn Sieng Hai, a 38-year-old farmer from Koh Baen, Kampong Siem District, Kampong Cham Province, who earns about $355 per month from maize, vegetables, water hyacinth collection, and casual labor, and actively participates in an agricultural cooperative that strengthens her access to shared marketing and technical training. Before project support, she and other farmers faced fragmented markets, high transaction costs, and volatile maize prices—often between 500 riels ($0.12) and 800 riels ($0.20) per kilo—with traders discounting heavily when crops were not fully mature; as she explained, "market prices are not stable because during the harvesting season, some corn is not yet fully mature, which causes traders to drop down the price." Poor rural roads further weakened their position by limiting trader access and forcing farmers to sell at lower village-level prices, leaving them with little bargaining power or storage capacity to withstand unfavorable market conditions.

2.0 Marketing and Cooperative Role

The agricultural cooperative now plays a central role in the maize value chain by coordinating seed distribution, crop scheduling, and collective marketing, enabling farmers to deliver larger and more consistent volumes to buyers and strengthen their bargaining position—reflected in the shared view that "selling together through the cooperative gets better offers." It also serves as a platform for exchanging production techniques and managing basic post-harvest storage, reducing losses and improving product quality. Transport remains a blend of traditional and modern methods: during the dry season, traders purchase maize directly from fields, while in the rainy season farmers still rely on boats and electric cattle to move harvests. However, improved roads have made trader access easier and reduced transport costs, a change highlighted by Lorn Sieng Hai, who noted that "the smoother the road, the better the price—we don't pay extra for multiple trips."

3.0 Project Interventions

The project introduced improved maize seed, provided hands-on training in modern cultivation practices, and strengthened linkages with agricultural cooperatives, giving farmers— including Lorn Sieng Hai—practical knowledge on crop management, fertilizer use, blending organic and chemical inputs, and recycling residues to protect long-term soil fertility, even though many still rely primarily on chemical fertilizers. In addition to capacity building, the project supported road upgrades that eased transport bottlenecks and enabled traders and cooperative buyers to access farms more easily, while discussions about future irrigation investments raised expectations for more reliable water supply—an essential missing component for fully realizing the benefits of improved seeds and training. Collectively, these interventions have begun laying the groundwork for more resilient, efficient, and market-oriented maize production.

4.0 Impacts

The project's impacts were most visible in improved farmer knowledge, stronger cooperative marketing, and gradual enhancements in soil health, with Lorn Sieng Hai and others maintaining steady yields of 7–8 tons per hectare while adopting residue management practices that enrich rather than degrade the soil; as Lorn explained, "after harvesting, corn residues such as leaves or cobs are returned to make compost… crops grow evenly and achieve higher yields." Market access also became more reliable as cooperative engagement and improved roads attracted traders directly to villages, increasing farm-gate purchasing, strengthening bargaining power, and reducing the repeated trips and losses that previously eroded profits. Together, these changes demonstrate how training, cooperative

organization, and infrastructure investments can improve production practices and marketing outcomes even when yield levels remain stable.

5.0 Challenges in the Value Chain

Despite progress, maize farmers continue to face key constraints, including heavy reliance on chemical fertilizers—since trials with organic mixes did not yield the expected improvements—and chronic irrigation shortages, as maize depends mainly on rivers and streams that provide adequate water only during the rainy season; as Lorn Sieng Hai explained, “water is sufficient only during the rainy season, while in the dry season there is shortage, resulting in lower crop yields.” Market volatility also persists, with prices dropping sharply when large volumes arrive simultaneously, leaving farmers vulnerable even with cooperative marketing. Although no major unintended effects were reported, stronger peer learning within the cooperative emerged as an indirect benefit, while delays in expected infrastructure, particularly irrigation canals, limited the full realization of project gains and left water access as a critical ongoing challenge.

6.0 Lessons Learned

Several lessons emerged from Lorn’s experience. First, aggregation through cooperatives strengthens farmers’ bargaining power and helps attract buyers to the village. Second, improved cultural practices, such as composting residues, enhance soil quality and support stable yields. Third, infrastructure is critical: better roads and storage facilities multiply the value of training, while irrigation canals remain a key missing link for resilience. As Lorn concluded, “I would like to propose that the project provide irrigation canals to supply water to the community’s crops,” along with more training courses on cultivation techniques.

Case study 9: *"Sowing change: how technology transformed mango farming practices in Kampong Cham"*

1.0 Introduction

The case of Thai Samol, a 56-year-old farmer from Dombak L'it village in Rokakoy commune, Kampong Cham Province, illustrates how project interventions improved smallholder resilience and productivity. Earning about $600 per month from mango farming and an additional $60 from vegetable production, Samol supplements her livelihood through active participation in an agricultural cooperative, farmer group, and savings and credit group, which enhance her access to markets and financial services. Before the project, farming in her community was labor-intensive, water access was limited, and yields were modest; farmers relied heavily on animal manure (80%), used minimal chemical fertilizer (20%), and typically burned crop residues—practices that, as Samol recalled, meant "waste was simply burned," contributing to soil degradation and air pollution. Water sources were restricted to rainfall and small ponds, permitting only two vegetable cycles per year and leading to inconsistent mango yields due to unreliable irrigation. This case study documents how project support—through improved farming practices, enhanced water management, and stronger cooperative linkages—has helped farmers like Samol increase productivity, reduce environmental impacts, and build greater resilience in mango and vegetable production systems in Cambodia.

2.0 Technologies, Cultural Practices and Marketing

Water access for farmers like Thai Samol has transformed from scarcity to reliability, shifting from dependence on rainfall and small ponds to year-round supply through reservoirs, ponds, and solar pumps, with drip irrigation—introduced through support from a fertilizer company—reducing fuel and labor needs while improving yields and crop marketability. Marketing has also strengthened: formerly, poor road conditions prevented trucks from reaching farms and forced farmers to accept low village-level prices, but improved access now allows central traders and cooperatives to purchase directly from farms, leading to better returns; as Samol noted, "central traders now come directly to the farms and the cooperative to purchase produce, resulting in higher prices than before." The cooperative facilitates collective marketing, price negotiation, and basic storage, while farmers increasingly use online platforms such as Facebook and Telegram to promote and sell their produce, expanding their market reach.

3.0 Project Interventions

Through project interventions, Thai Samol adopted a more balanced fertilizer regime—50% manure, 40% compost, and 10% chemical inputs—producing about 8.4 tons of compost annually and noting that "the soil now has higher fertility, crop yields have increased, spending on chemical fertilizers has decreased, and the soil retains its nutrients," reflecting both cost savings and improved soil health. Water management innovations further enhanced her farming system, with solar-powered pumps installed for her mango orchard and drip irrigation applied to her vegetable fields two to three times daily, a technology she praised for reducing fuel costs, saving time, improving crop growth, increasing yields, and enabling higher selling prices. These improvements were supported by complementary project inputs such as ponds, reservoirs, road upgrades, compost huts, and training on sustainable practices, while strengthened cooperative and online market linkages ensured that increased production translated into better sales. Collectively, these integrated interventions made Samol's farming system more efficient, profitable, and climate-resilient.

4.0 Impacts

The project generated notable impacts for farmers like Thai Samol, who adopted new cultural practices such as composting crop residues instead of burning them, using corn bedding to control livestock odor, and grading produce into types 1, 2, and 3 to secure fairer pricing; composting, in particular, delivered multiple benefits, as Samol noted: “it increased productivity, allowed sales at higher prices, reduced spending on chemical fertilizers, avoided environmental pollution, and preserved soil fertility,” prompting neighboring farmers to replicate these practices. Productivity further increased through the combined use of organic fertilizers, compost, and solar-powered irrigation, with Samol reporting higher yields of both mangoes and vegetables due to improved seeds, composting facilities, and training in modern techniques, emphasizing that proper fertilizer management—“Farmers have learned proper fertilizer usage, reduced chemical fertilizer application, and applied compost produced from animal manure and biogas byproducts”—was essential for soil health, cost reduction, and minimizing environmental impacts. Overall, the project contributed to higher yields, reduced input costs, improved soil fertility, and stronger market prices, while the unanticipated uptake of online marketing via Facebook and Telegram expanded sales opportunities; however, delays in delivering some promised infrastructure slowed the full realization of certain benefits, underscoring the importance of timely support alongside technical innovations.

5.0 Challenges

Despite notable improvements, several challenges continue to affect technology adoption. Natural fertilizers alone cannot fully replace chemical inputs, making a balanced mix necessary to sustain yields. Farmers also faced delays in receiving key project-supported technologies such as mesh houses, chicken coops, and drip irrigation systems. These delays slowed the timely adoption of practices that could have further improved productivity and resilience. As Samol explained, “promised items have not yet been delivered due to ongoing price negotiations and bidding discrepancies,” underscoring the need for more efficient and reliable project implementation.

6.0 Lessons Learned

Samol’s experience underscores the value of integrated farming practices that blend modern technologies with traditional knowledge. Farmers came to recognize that balanced fertilizer use improves soil fertility and reduces costs, while solar and drip irrigation systems make water use more efficient and reliable. Equally important, participation in cooperatives strengthened their collective capacity to market produce, negotiate prices, and access resources. The central lesson is that sustainable farming depends not only on adopting appropriate technologies but also on building strong collective action to ensure resilience, profitability, and long-term impact.

Appendix 2. ADB design and monitoring framework

Impact the Project is Aligned with Agricultural competitiveness improved (Agriculture Sector Strategic Development Plan, 2014–2018)[a]			
Results Chain	**Performance Indicators with Targets and Baselines**	**Data Sources and Reporting Mechanisms**	**Risks**
Outcome Productive and resource-efficient agribusiness value chains developed in project areas.	By 2026 a. At least 15% increase in yields (2017 baseline: rice 2.7 tons/ha, maize 4 tons/ha, cassava 20 tons/ha and mango 15 tons/ha). b. GHG emissions reduced by 240,000 tons of CO_2 (2017 baseline: 0 tons reduced as a result of the project). c. At least 50 agribusinesses become more resource-efficient in terms of water savings (5%–10% efficiencies); energy savings (20%); and reduction in postharvest losses (10%) (2017 baseline: 0).	a. MAFF agricultural census b. UNFCCC reports c. PPMS reports	Declining demand for Cambodian agricultural products because of competition from external markets and stringent requirements for quality and safety from importing countries
Outputs 1.Critical agribusiness value chain infrastructure improved and made climate-resilient.	By 2024 1a. 27 irrigation and water management systems targeting 15,000 ha and 25,000 households (with at least 50,000 women) rehabilitated and made climate-resilient (2017 baseline: 0). 1b. 800 on-farm rainwater harvesting ponds commissioned (2017 baseline: 0). 1c. At least 250 km of farm roads upgraded to climate resilient standards to improve connectivity of farms to cooperatives and markets (2017 baseline: 0). 1d. 80 agricultural cooperatives[b] have integrated adaptation measures in post-harvest infrastructure investments (2017 baseline: 5). 1e. Crop product quality and safety testing infrastructure in National Agricultural Laboratory upgraded to test 1,500 samples (2017 baseline: 700) and generate service income of more than $75,000 (2017 baseline: $0). 1f. 12,000 additional biodigesters and 6,000 compost huts made operational, benefiting at least 80,000 persons, including at least 50% women, due to better household air quality (2017 baseline beneficiaries: 11,468 persons, including 5,721 women).	1a–1f. PPMS annual progress reports 1a-1b. MOWRAM annual report 1c. MRD annual report 1d–1f. MAFF annual progress reports	Capacity constraints to infrastructure design and procurement Climate change impacts may adversely impact project investments. Limited attention to O&M of agribusiness infrastructure

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks
2.Climate-smart agriculture and agribusiness promoted. 3. Enabling environment for climate-friendly agribusiness enhanced.	2a. Three additional climate-resilient varieties of rice and maize released (2017 baseline: 0). 2b. 40,000 farmers (of whom 16,000 are women) trained in CSA and agribusiness development skills, of which 50% are SRP- compliant with direct links to millers and exporters (2017 baseline for SRP compliance: 0). 2c. 27 FWUCs or FWUGs made operational and 500 FWUC/FWUG members (of which 30% women) developed capacity to operate and maintain their irrigation schemes (2017 baseline: 0). 2d. Four provincial agricultural development centers and four engineering workshops made fully operational to provide agribusiness services and strengthen farmer value chain links (2017 baseline: 0). 3a. Climate-smart and gender-responsive agribusiness policy for target commodities, including a PPP framework focusing on agribusinesses, formulated (2017 baseline: 0).[c] 3b. Cambodia good agricultural practice for tropical fruit and organic fertilizers endorsed as national standard for tropical fruit and organic fertilizers (2017 baseline: 0). 3c. 50 staff, including 30% women, from financial institutions trained in CSA and green finance (2017 baseline: 0). 3d. 30 agribusinesses, including 30% led or owned by women,[d] trained on green finance and CSA (2017 baseline: 0). 3e. 20,000 households, including 20,000 women, provided with information on climate risk-sharing instruments (2017 baseline: 0). 3f. ICT platform for climate-friendly agribusiness established in Kampong Cham Province (2017 baseline: 0).	2a–2d. PPMS annual progress reports 3a–3f. PPMS annual progress reports	
Key Activities with Milestones			
1. **Critical agribusiness value chain infrastructure improved and made climate-resilient** 1.1 Construct representative subproject for irrigation and confirm implementation plans for rehabilitating or developing critical infrastructure for priority value chains (Q1–Q4 2019). 1.2 Confirm land availability, locations, suitability, and connectivity for siting processing, storage, marketing, and logistics infrastructure (Q1 2019–Q1 2020).			

Key Activities with Milestones
1.3 Undertake detailed design, tender, and construct critical production and post-harvest infrastructure to climate-resilient condition (Q2 2019–Q3 2024). 1.4 Establish management systems for O&M of infrastructure (Q1 2022–Q3 2023). **Output 2: Climate-smart agriculture and agribusiness promoted** 2.1 Deploy climate-resilient varieties of rice and maize (Q2 2019–Q2 2024) [G/CD]. 2.2 Conduct training for farmers, SMEs, and private sector on CSA (Q2 2019–Q2 2024) [G/CD]. 2.3 Establish or upgrade mechanical workshops and training facilities (Q3 2019–Q2 2020). **Output 3: Enabling environment for climate-friendly agribusiness enhanced** 3.1 Assist in formulating climate-smart agribusiness support including policy and regulations, and advice on agronomy, markets, and links between farmers and the private sector (Q2 2019–Q4 2022) [G/CD, GE]. 3.2 Conduct training on climate risk management and green finance, including structuring of public–private partnerships in agribusiness (Q2 2019–Q1 2024) [G/CD, PSD]. 3.3 Establish ICT platform for climate risk management (Q3 2020–Q2 2024) [G/CD, PSD]. **Project Management Activities** Mobilize project implementation consultants (Q4 2018). Establish PPMS, and conduct needs assessment for specific project management skills (Q2 2019). Provide training courses to project staff on project management, procurement, financial management, gender, and social and environment safeguards (Q4 2018–Q3 2024).
Inputs ADB: $90,000,000 (loan) Green Climate Fund: $40,000,000 ($10,000,000 loan and $30,000,000 grant) Government: $7,376,000 Beneficiaries: $3,664,000
Assumptions for Partner Financing Not applicable.

Appendix 3. Achievement of DMF Indicators

A. DMF Outcome Indicators and Accomplishments

Outcome	Outcome Indicators	Outcome component	Unit	Baseline	Target	Accomplished	% Accomplished
Productive and resource efficient agribusiness value chains developed in project areas.	1.1 At least 15% increase in yields (2017 baseline: rice 2.7 tons, maize 4 tons, cassava 20 tons and mango 15 tons/ha).	Increase in rice yield	Tons/Ha.	2.70	3.11	3.64	100%
		Increase in maize yield	Tons/Ha.	4.00	4.60	6.23	100%
		Increase in cassava yield	Tons/Ha.	20.00	23.00	20.13	88%
		Increase in mango yield	Tons/Ha.	15.00	17.25	17.51	100%
	1.2 GHG emissions reduced (CO2)	Reduced CO2	Tons	0.00	240,000	359,209	100%
	1.3 At least 50 agribusinesses become more resource efficient in terms of water savings (5-10% efficiencies); energy savings (20%); and reduction in post-harvest losses (10%) (2017 baseline: 0).	Water savings (5-10% efficiencies)		0	50	0	0%
		Energy savings (20%)		0	50	25	50%
		Reduction in post-harvest losses (10%)		0	50	40	80%

B. DMF Output Indicators and Accomplishments

Output	Output Indicators	Indicator Component	Unit	Baseline	Target	Accomp.	% Accomplished
Output 1: Critical agribusiness value chain infrastructure improved and made climate-resilient	1a. By 2024 27, irrigation and water management systems targeting 15,000 ha and 25,000 households (with at least 50,000 women) rehabilitated and made climate resilient (2017 baseline: 0).	Irrigation Systems	Units	0	27	19	70.4%
		Area Covered by Rehabilitated Irrigation Schemes	Ha.	0	15,000	9,815	65.4%
		HHs Benefited	HHs	0	25,000	11,998	48.0%
		Women Benefited	Persons	0	50,000	31,460	62.9%
	1b. By 2024, 500 on-farm rainwater harvesting ponds commissioned (2017)	Rainwater Harvesting Ponds Commissioned	Ponds	500	500	278	55.6%
		Drip Irrigation Demonstration Units Installed	Units	0	15	0	0.0%
	1c. By 2024, At least 250 km of farm road networks upgraded to climate	Farm Road Network Improved	km	0	250	185	74.0%

Output	Output Indicators	Indicator Component	Unit	Baseline	Target	Accomp.	% Accomplished
	standards to improve connectivity of farms to cooperatives and markets (2017 baseline: 0).						
	1d. By 2024, 80 agricultural cooperatives* integrated adaptation measures in post-harvest infrastructure investments (2017 baseline: 5).	Agricultural Cooperatives Upgraded and Installed with Drying, Processing and Storage Facilities	ACs	5	80	80	100.0%
	1e. By 2024, Crop product quality and safety testing infrastructure in National Agricultural Laboratory upgraded to test 1500 samples (2017 baseline: 700) and generate service income more than $75,000 (2017 baseline: $0).	Samples Tested	Samples	700	1,500	1,261	84.1%
		Service Income Generated	$	0	75,000	69,033	92.0%
	1f. By 2024, 6,000 additional biodigesters and 6,000 compost huts made operational, benefiting at least 80,000 persons, including at least 50% women, due to better household air quality (2017 baseline beneficiaries: 11,468 persons, including 5,721 women).	Biodigesters Operational	Units	0	6,000	275	4.6%
		Compost Huts Operational	Units	0	6,000	275	4.6%
		Persons Benefited	Persons	11,468	80,000	73,679	92.1%
		Women Benefited	Persons	5,721	40,000	34,712	86.8%
Output 2: Climate smart agriculture and agribusiness promoted	2a. By 2024, 3 additional climate resilient varieties of rice and maize released (2017 baseline: 0).	Climate-Resilient Rice Varieties Deployed	No.	5	2	2	100.0%
		Climate-Resilient Maize Varieties Deployed	No.	0	1	1	100.0%

Output	Output Indicators	Indicator Component	Unit	Baseline	Target	Accomp.	% Accomplished
		Climate-Resilient Cassava Varieties Deployed (Tissue Culture)	No.	0	1	1	100.0%
	2b. By 2024, 40,000 farmers (of whom 16,000 are women) trained in CSA and agribusiness development skills, of which 50% are SRP compliant with direct links to millers and exporters (2017 baseline for SRP compliance: 0).	Farmers trained on CSA and Agribusiness	Farmers	0	40,000	29,709	74.3%
		Women Farmers Trained on CSA and Agribusiness	Farmers	0	16,000	13,854	86.6%
		Farmers Are SRP Compliant and Linked to Millers and Exporters	Farmers	0	20,000	8,581	42.9%
	2c. By 2024, 27 FWUCs/FWUGs made operational and 500 FWUC/FWUG members (of which 30% women) developed capacity to operate and maintain their irrigation schemes (2017 baseline: 0).	FUWCs Formed	No.	0	27	17	63.0%
		FWUG members developed capacity to operate and maintain their irrigation schemes	Persons	0	500	372	74.4%
		Women FWUG members developed capacity to operate and maintain their irrigation schemes	Persons	0	150	108	72.0%
	2d. By 2024, 4 provincial agricultural development centers and 4 engineering workshops made fully operational to provide agribusiness services and strengthen farmer value chain linkages (2017 baseline: 0).	Improvement of PADCs	No.	0	4	3	75.0%
		Improvement of Engineering Workshops	No.	0	4	3	75.0%
Output 3: Enabling environment for climate friendly	3a. By 2024, Climate-smart and gender-responsive agribusiness	Climate-Friendly Agribusiness Policies and	No.	0	1	1	100.0%

Output	Output Indicators	Indicator Component	Unit	Baseline	Target	Accomp.	% Accomplished
agribusiness enhanced	policy for target commodities, including a PPP framework focusing on agribusinesses formulated (2017 baseline: 0)	Standards Formulated					
	3b. By 2024, CAMGAP for tropical fruit and organic fertilizers endorsed as national standard for tropical fruit and organic fertilizers (2017 baseline: 0).	CamGAP for Tropical Fruits	No.	0	1	1	100.0%
		CamGAP for Organic Fertilizers	No.	0	1	1	100.0%
	3c. By 2024, 50 staff, including 30% women, from financial institutions trained in CSA and green finance (2017 baseline: 0).	Staff from Financial Institutions Trained on CSA and Green Finance	Persons	0	50	64	100.0%
		Female staff from Financial Institutions Trained on CSA and Green Finance	Persons	0	15	26	100.0%
	3d. By 2024, 30 agribusinesses, including 30% women-led and/or owned, trained on green finance and CSA (2017 baseline: 0)	Agribusinesses trained on green finance and CSA	Agribusinesses	0	30	41	100.0%
		Women-led agribusinesses trained on green finance and CSA	Agribusinesses	0	9	9	100.0%
	3e. By 2024, 20,000 households, including 20,000 women, provided with information on climate risk sharing instruments (2017 baseline: 0)	Households provided with information on climate risk sharing instruments	HHs	0	20,000	19,368	96.8%
		Women, provided with information on climate risk sharing instruments	Women	0	20,000	8,613	43.1%
	3f. By 2024, ICT platform for climate friendly agribusiness established in Kampong Cham province	ICT platform for climate friendly agribusiness established in Kampong Cham province	Platform	0	1	0	0.0%

C. DMF Activity Accomplishments

Activities	Sub-Activities	Sub-activity component	Unit	Baseline	Target	Accomplished	% Accomplished
Activity 1.1. Rehabilitating water management infrastructure	Sub-activity 1.1.1 27 Irrigation and water management systems rehabilitated and made climate-friendly	Irrigation and water management systems rehabilitated and made climate-friendly	Schemes	0	27	19	70.4%
		Command areas covered by rehabilitated irrigation schemes	Ha.	0	15,000	9,815	65.4%
		Households benefited from irrigation and water management systems rehabilitated and made climate-friendly	Households	0	25,000	11,998	48.0%
		Wome benefited from irrigation and water management systems rehabilitated and made climate-friendly	Women	0	50,000	31,460	62.9%
	Sub-activity 1.1.2 500 On-farm rainwater harvesting ponds commissioned	Rainwater harvesting ponds commisioned	Ponds	0	500	278	55.6%
	Sub-activity 1.1.3 15 Drip irrigation demonstration units on mango farmers' land	Drip irrigation demonstration units installed	Drip irrigation demonstration units	0	15	0	0.0%
Activity 1.2 Upgrading agricultural cooperative value chain infrastructure	Sub-activity 1.2.1 80 Agricultural cooperatives have integrated adaptation measures in postharvest infrastructural investments	Constructed AC warehouses	Agricultural cooperatives	5	80	80	100.0%
Activity 1.3 Improving connectivity to cooperatives and market	Sub-activity 1.3.1 At least 250 kms. of farm roads were upgraded to	Farm road networks upgraded to climate-resilient standards	Km.	0	250	185	74.0%

Activities	Sub-Activities	Sub-activity component	Unit	Baseline	Target	Accomplished	% Accomplished
through climate-resilient farm road networks	climate-resilient standards to improve connectivity to cooperatives and markets						
Activity 1.4 Strengthening infrastructure for agricultural quality and safety testing at the National Agricultural Laboratory (NAL)	Sub-activity 1.4.1 Crop product quality and safety testing infrastructure in the National Agriculture Laboratory upgraded	Testing of plant samples	Samples	700	1,500	1,261	84.1%
		Income genertated from testing of plant samples	USD	0	75,000	69,033	92.0%
Activity 1.5 Promoting renewable energy (biodigester and use of solar energy in target cooperative areas) for value chain improvement	Sub-activity 1.5.1 6,000 additional biodigesters and 6,000 compost huts made operational benefitting at least 80,000 persons, including at least 50% women beneficiaries, due to improved household air quality	Biodigesters made operational	Biodigesters	0	6,000	275	4.6%
		Compost huts made operational	Compost huts	0	6,000	275	4.6%
		Persons benefitted from biodigesters and compost-huts made operational	Persons	11,468	80,000	73,679	92.1%
		Women benefitted from biodigesters and compost-huts made operational	Women	5,721	40,000	34,712	86.8%
Activity 2.1 Deploying climate-resilient varieties	Sub-activity 2.1.1 3 additional climate-resilient varieties of rice and maize released	Additional climate-resilient varieties of rice released	Rice varities	0	2	2	100.0%
		Additional climate-resilient varieties of maize released	Maize varieties	0	1	1	100.0%
		Climate-Resilient Cassava Varieties Deployed (Tissue Culture)	Cassava varieties	0	1	1	100.0%
Activity 2.2 Strengthening capacity in climate-friendly production practices and technologies	Sub-activity 2.2.1 40,000 Farmers trained in Climate-smart Agriculture and agribusiness	Farmers trained on CSA	Farmers	0	40,000	29,709	74.3%
		Women farmers trained on CSA	Women	0	16,000	13,854	86.6%
		Farmers are SRP compliant	Farmers	0	20,000	8,581	42.9%

Activities	Sub-Activities	Sub-activity component	Unit	Baseline	Target	Accomplished	% Accomplished
	development skills	with direct links to millers and exporters					
	Sub-activity 2.2.2 27 FWUCS of FWUGS made full operational	FWUCs of FWUGs made operational	FWUCs	0	27	17	63.0%
		Representatives of FWUCs developed the capacity to operate and maintain irrigation schemes	Representatives	0	500	372	74.4%
		Women representatives of FWUCs developed the capacity to operate and maintain irrigation schemes	Women representatives	0	150	108	72.0%
Activity 2.3 Promoting farm mechanization and extension	Sub-activity 2.3.1 4 Agricultural development centers were made fully operational to provide agribusiness services	Agricultural development centers were made fully operational	Centers	0	4	3	75.0%
	Sub-activity 2.3.2 4 Engineering workshops were made fully operational to provide agribusiness services	Engineering workshops were made fully operational	Workshops	0	4	3	75.0%
Activity 3.1 Formulating climate-friendly agribusiness policies and standards	Sub-activity 3.1.1 Policy on Climate Smart and Gender Responsive Agribusiness and PPP Framework formulated	Drafted climate smart and gender responsive agri-policy	Policy	0	1	1	100.0%
		Drafted guidance manual for climate neutrality and adaption for agribusiness operation	Prakas	0	1	1	100.0%
		Drafted IDP strategy for climate friendly agribusiness	Strategy	0	1	1	100.0%

Activities	Sub-Activities	Sub-activity component	Unit	Baseline	Target	Accomplished	% Accomplished
		Draft PPP framework formulated	Framework	0	1	1	100.0%
	Sub-activity 3.1.2 Good Agriculture Practice for Tropical Fruit Endorsed (CamGAP)	Guidance manual for climate neutrality and adaptation standards for agribusiness operation	Strategy	0	1	1	100.0%
		Climate-friendly become more widely utilized with eight of largest Cambodia millers/exporters being part of alliance	Rice miller	0	8	4	50.0%
		Standards on CamGAP tropical fruit formation	Standard	0	1	1	100.0%
		Development of standards for organic fertilizer	Standard	0	1	1	100.0%
		Development of IDP strategies for climate friendly agribusiness	Strategy	0	1	1	100.0%
		National standards on biodigester development	Standard	0	1	1	100.0%
		Socialize GAP Standards for tropical fruit	Standard	0	1	1	100.0%
Activity 3.2 Promoting green finance and risk-sharing mechanisms	Sub-activity 3.2.1 50 Staff from financial institutions trained in CSA and green finance	Staff participated in implementation training on green finance in CSA	Staff	0	50	64	100.0%
		Female staff participated in implementation training on green finance in CSA	Female staff	0	15	26	100.0%
		Staff participated in implementation training in green finance	Staff	0	50	64	100.0%
		Female staff participated in implementation	Female staff	0	15	26	100.0%

Activities	Sub-Activities	Sub-activity component	Unit	Baseline	Target	Accomplished	% Accomplished
		training in green finance					
	Sub-activity 3.2.2 30 agribusinesses trained in green finance and CSA	Staff participated in implementation of training on green finance in CSA	Staff	0	30	41	100.0%
		Female staff participated in implementation of training on green finance in CSA	Female staff	0	9	9	100.0%
	Sub-activity 3.2.3 20,000 Households were provided with information on climate risk-sharing instruments	Households participated in implementation of training on green finance in CSA	Households	0	20,000	19,368	96.8%
		Women provided with information on climate-sharing instruments	Women	0	20,000	8,613	43.1%
Activity 3.3 Supporting climate risk management through information and communication technologies (ICT)	Sub-activity 3.3.1 Supporting Climate Risk Management through Information and Communication Technologies (ICT)	Development of ICT	System	0	1	0	0.0%
		Purchase of equipment		0	1	0	0.0%
		Installation of the center	Center	0	1	0	0.0%

Appendix 4: Achievement of the GCF Logframe Target Indicators

A. GCF Impact Indicators

RESULT ASPECT	Result	DESCRIPTION OF RESULT	TARGET INDICATOR	TARGET	UNIT	TARGET	ACCOMP	% ACCOMP
ADAPTATION	A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities, and regions	Total number of direct and indirect beneficiaries	Total number of direct and indirect beneficiaries	Direct Beneficiaries	Direct Beneficiaries	390,000	165,399	42.4%
				Women Direct Benefiaries (40%)	Women Direct Benefiaries (40%)	156,000	81,941	52.5%
				Indirect Benefiaries	Indirect Benefiaries	975,000	859,083	88.1%
	A1.2 Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options	40,000 farmers, of which at least 40% are women	40,000 farmers, of which at least 40% are women	Farmers	Farmers	40,000	29,709	74.3%
				Women	Women	16,000	16,000	100.0%
RESILIENCE	A2.0 Increased resilience of health and well-being, and food and water security (e.g. climate resilient crops, efficient irrigation systems, etc.)	A2.2 Number of food-secure households (in areas/periods at risk of climate change impacts)	390,000 direct beneficiaries, among which at least 40% are women, representing approximately 80,000 households. 975,000 indirect beneficiaries (approximately 190,000 households)	390,000 direct beneficiaries, among which at least 40% are women, representing approximately 80,000 households.	Direct Beneficaries	390,000	165,399	42.4%
					Women direct Beneficiaries	156,000	81,941	52.5%
					Households	80,000	73,679	92.1%
				975,000 indirect beneficiaries (approximately 190,000 households)	Indirect Benefiaries	975,000	859,083	88.1%
					Indirect HH Benefiaries	190,000	171,817	90.4%
	A3.0 Increased resilience of infrastructure and the built environment to climate change threats	A3.1 Number and value of physical assets made more resilient to climate variability and change, considering human benefits	27 water management systems constructed and upgraded to climate standards; 33 post-harvest storage facilities built or upgraded to climate standards; 250km of roads	27 water management systems constructed and upgraded to climate standards;	water management systems	27	19	70.4%
				33 post-harvest storage facilities built or upgraded to climate standards	post-harvest storage facilities	33	80	100.0%
				250 km of roads	km	250	185	74.0%

RESULT ASPECT	Result	DESCRIPTION OF RESULT	TARGET INDICATOR	TARGET	UNIT	TARGET	ACCOMP	% ACCOMP
			upgraded to climate standards; 4 provincial agricultural development centers and 1 national Agriculture Testing ab (NAL) rehabilitated; Total value of assets: USD 111 million	upgraded to climate standards				
				4 provincial agricultural development centers established	PADC	4	3	75.0%
				1 national Agriculture Testing ab (NAL) rehabilitated	NAL	1	1	100.0%
MITIGATION	M1.0 Reduced emissions through waste management and increased low emission energy access and power generation	Tons of carbon dioxide equivalent (t CO2eq) reduced or ided	A reduction of 240,000 tons of CO2-eq by 2024	A reduction of 240,000 tons of CO2-eq by 2024	tons of CO2-eq	240,000	359,209	100.0%
		Volume of Finance leveraged by und funding	13.6 million in direct co-financing leveraged	13.6 million in direct co-financing leveraged	Million USD	13.60	0	0.0%

B. **GCF Outcome Indicators**

Result	DESCRIPTION	TARGET INDICATOR	UNIT	TARGET	ACCOMP	% ACCOMP
A5.0 Strengthened institutional and regulatory systems for climate responsive Planning and development	A5.1 Number of gender – friendly policies, institutions, coordination mechanisms and regulatory frameworks that improve incentives for climate resilience and their effective implementation.	One climate smart and gender responsive agribusiness policy is approved at the national level	Policy	1	1	100.0%
		One PPP framework focusing on agribusinesses is formulated	Framework	1	1	100.0%
		Two CAMGAP are enforced as national standards for tropical fruit and organic fertilizers	CAMGAP	2	2	100.0%
A7.0 Strengthened adaptive capacity and reduced exposure to climate risks	A7.1 Use by vulnerable households (including number of female beneficiaries), communities, businesses and Public- sector services of Fund-supported/developed	40,000 farmers, including at least 16,000 women trained in CSA and agribusiness development skills;	Farmers	40,000	29,709	74.3%
			Women Farmers	16,000	13,854	86.6%

Result	DESCRIPTION	TARGET INDICATOR	UNIT	TARGET	ACCOMP	% ACCOMP
	tools, instruments, strategies, and activities to respond to limate change and variability National Climate M&E Indicator: Number of households affected by floods, storms and droughts (National M&E Framework for Climate Change)	20,000 households, including 10,000 women, use information on climate risk sharing instruments such as crop insurance	HHs	20,000	19,368	96.8%
			Women	10,000	8,613	86.1%
		National Climate M&E Target: A reduction of 50% in number of families affected by floods, storms and droughts in project areas by end of project	%	50%	0%	0.0%[5]
	A7.2 Number of males and females reached by climate related early warning systems and other risk reduction measures established/strengthened	Households Using CC Information and Insurance	HHs	20,000	19,368	96.8%
		Women Using CC Information and INsurance	Women	10,000	8,613	86.1%
A8.0 Strengthened awareness of climate threat and risk reduction processes	A8.1 Number of males and females made aware of climate threats and related appropriate responses	390,000 people are made aware of climate threats and risk reduction processes	People	390,000	165,399	42.4%
		Women (40%) are made aware of climate threats and risk reduction processes	Women	156,000	81,941	52.5%
M9.0 Improved management of land or forest areas contributing to emissions reductions	M9.1 Hectares of land or forests areas under sustainable management of improved protection and management leading to reduced GHG emissions and/or enhancement of carbon stocks	40,000 ha under climate friendly agriculture practices	Ha.	40,000	3,250	8.1%
		4,000 ha of land laser levelled	Ha.	3,000	949	31.6%
Cross Cutting	Cross Cutting	6,000 biodigesters introduced	biodigesters	6,000	459	7.7%
		6000 compost huts introduced	Compost Huts	6,000	459	7.7%

C. GCF OUTPUT INDICATORS

[5] The total HHs affected by climate disturbances have increased from 0.3% in 2020 to 10.8% in 2025. This indicates a worsening climae risk exposure and teh government's mitigating measures has not sufficiently mitigated the impacts of cc.

OUTPUT	OUTPUT INDICATORS	TARGET INDICATOR	TARGET INDICATOR	UNIT	TARGET	ACCOMP	% ACCOMP
Output 1: Critical agribusiness value chain infrastructure improved and made climate resilient	1a. Number of climate resilient water management systems rehabilitated and/or built	1a. 27 climate resilient water management systems targeting at least 15,000 ha and 25,000 households (with 50,000 women) rehabilitated	climate resilient water management systems targeting	Systems	27	19	70.4%
			Area covered by climate resilient water management systems	Ha	15,000	9,815	65.4%
			HH benefited by climate resilient water management systems	HH	25,000	11,998	48.0%
			Women benefited by climate resilient water management systems	Women	50,000	31,460	62.9%
	1b. Number of on-farm rainwater harvesting ponds commissioned	1b. 800 on-farm rainwater harvesting ponds commissioned and 27 FWUCs developed capacity to operate and maintain heir irrigation schemes	on-farm rainwater harvesting ponds commissioned	Ponds	500	500	100.0%
			FWUCs developed capacity to operate and maintain heir irrigation schemes	FWUCs	27	17	63.0%
	1c. Number of hectares of land laser leveled	1c. 4,000 ha of land laser levelled	Area of land laser levelled	Ha	3,000	949	31.6%
	1d. Expected increase in the number of agricultural cooperatives integrating climate change actions	1d. 50 agricultural cooperatives integrate adaptation measures in post harvest infrastructure investments	agricultural cooperatives integrate adaptation measures in post harvest infrastructure investments	ACs	50	80	100.0%
	1e. Length of farm road networks upgraded to climate resilient condition	1e. At least 250 km of farm road networks improved to climate resilient condition	km of farm road networks improved to climate resilient condition	km	250	185	74.0%
	1f. Number of samples tested in upgraded laboratory facilities	1f. Quality and safety testing infrastructure in National Agricultural Laboratory upgraded to test 1,500 samples and	Quality and safety testing infrastructure in National Agricultural Laboratory upgraded	NAL	1	1	100.0%
			Samples Tested	samples	1,500	1,261	84.1%

OUTPUT	OUTPUT INDICATORS	TARGET INDICATOR	TARGET INDICATOR	UNIT	TARGET	ACCOMP	% ACCOMP
		generate service income in excess of $75,000	Income generated	$	75,000	69,033	92.0%
	1g. Number of people with access to energy from biodigesters	1g. 12,000 additional biodigesters made operational benefitting health and productivity of 90,000 persons, including 43,353 women, due to improved household air quality	additional biodigesters made operational	biodigesters	6,000	459	7.7%
			persons benefitting health due to improved household air quality	persons	80,000	73,679	92.1%
			Women benefitting health due to improved household air quality	Women	40,000	34,712	86.8%
Output 2: Climate Smart Agriculture and Agribusiness promoted	2a. Number of climate resilient varieties released	2a. Three additional climate resilient varieties of rice and maize released	climate resilient varieties of rice and maize released	Varieties	3	3	100.0%
	2b. Number of farmers trained in CSA practices; on standard compliance.	2b. 40,000 farmers, including at least 16,000 women trained in CSA practices, of which 50% are SRP compliant, with direct links to millers and exporters	farmers trained in CSA practices with direct links to millers and exporters	Farmers	40,000	29,709	74.3%
			Women trained in CSA practices with direct links to millers and exporters	Women	16,000	13,854	86.6%
			50% of 40,000 farmers are SRP compliant, with direct links to millers and exporters	%	20,000	32,350	100.0%
	2c. Number of agricultural development centers established	2c. 4 provincial agricultural development centers and engineering workshops made fully operational to provide agribusiness services and strengthen farmer value chain linkages	provincial agricultural development centers made fully operational to provide agribusiness services and strengthen farmer value chain linkages	PADC	4	3	75.0%
			provincial engineering workshops made fully operational to	Workshops	4	3	75.0%

OUTPUT	OUTPUT INDICATORS	TARGET INDICATOR	TARGET INDICATOR	UNIT	TARGET	ACCOMP	% ACCOMP
			provide agribusiness services and strengthen farmer value chain linkages				
Output 3: Enabling environment for climate friendly agribusiness enhanced	3a. Number of climate friendly and gender responsive agribusiness policy formulated	3a. One Climate friendly and gender responsive agribusiness policy, including a PPP framework focusing on agribusinesses formulated	Climate friendly and gender responsive agribusiness policy focusing on agribusinesses formulated	Policy	1	1	100.0%
			PPP framework focusing on agribusinesses formulated	Framework	1	1	100.0%
	3b. Number of standards enforced as national standard	3b. CAMGAP enforced as national standard for tropical fruit and organic fertilizers	CAMGAP enforced as national standard for tropical fruit and organic fertilizers	CAMGAP	1	1	100.0%
	3c. Number of staff from banks and MFI trained on green financing	3c. 50 staff, including 30% women, from financial institutions trained in CSA lending and green finance	staff from financial institutions trained in CSA lending and green finance	staff	50	64	100.0%
			women (30%), from financial institutions trained in CSA lending and green finance	women	15	26	100.0%
	3d. Number of enterprises trained on green finance and number of households benefitting from information on risk sharing instruments	3d. 30 privately owned enterprises, at least 30% women-led and/or owned**, are trained on green finance and 20,000 households, including 20,000 women, provided with information on climate risk sharing instruments such as crop insurance	privately owned enterprises are trained on green finance provided with information on climate risk sharing instruments such as crop insurance	enterprises	30	41	100.0%
			30% women-led and/or owned enterprises are trained on green finance provided with information on climate risk sharing instruments	enterprises	9	9	100.0%

OUTPUT	OUTPUT INDICATORS	TARGET INDICATOR	TARGET INDICATOR	UNIT	TARGET	ACCOMP	% ACCOMP
			such as crop insurance				
			households provided with information on climate risk sharing instruments such as crop insurance	HHs	20,000	19,368	96.8%
			women provided with information on climate risk sharing instruments such as crop insurance	Women	20,000	8,613	43.1%
	3e. Number of public private partnerships and agribusinesses established	3e. 40 agricultural cooperatives* entered into a profitable agribusiness or trading venture	agricultural cooperatives* entered into a profitable agribusiness or trading venture	ACs	40	30	75.0%
	3f. Expected increase in generation and use of climate information in decision-making	3f. ICT platform for climate smart agribusiness established in Kampong Cham province	ICT platform for climate smart agribusiness established in Kampong Cham province	ICT	1	0	0.0%

Appendix 5**. Cost Benefit Analysis of CFAVC**

	2021	2022	2023	2024	2025	Total
I. ESTIMATED BENEFITS	950,902	7,167,732	13,306,719	22,025,956	31,054,815	74,506,123
A. Yield Improvement						
1.0 Agricultural Land (Ha.)						
Identified Area						
Cassava (news report published in August 2023 by Cambodianess.)	5,060	5,060	5,060	5,060	5,060	
Corn Production Area	19,596	19,596	19,596	19,596	19,596	
Rice	87,438	95,401	103,364	111,327	119,290	
Total Agriculture Production Area	**112,094**	**120,057**	**128,020**	**135,983**	**143,946**	
Attribution Factor (Area Adopting the CFAVC Technology = 75%)						
Cassava	4,554	4,554	4,554	4,554	4,554	
Corn	17,636	17,636	17,636	17,636	17,636	
Rice	78,694	85,861	93,028	100,194	107,361	
2.0 Cassava yield gain (Tboung Khmum)						
Baseline yield **t/ha**	20	20	20	20	20	
Annual yield **t/ha**	20	23.46	25.19	26.92	28.65	
Improvement(t/Ha)	0	3.46	5.19	6.92	8.65	
Total Imrovement (t)	0	15,757	23,635	31,514	39,392	
price **USD/t** (https://dir.tridge.com/prices/fresh-cassava/KH)	100	100	100	100	100	
USD/year	0	1,575,684	2,363,526	3,151,368	3,939,210	
3.0 Corn (HYVs)						
Baseline yield (t/ha)	4	4	4	4	4	
Annual Yield (t/ha)	4	4.5	5	6	6.92	
Yield gain, t/Ha.	0	0.5	1	2	2.92	
Total Yield Gain, t	0	8,818	17,636	35,273	51,498	

	2021	2022	2023	2024	2025	Total
Farmgate price: 220 USD/t (180–260)	220	220	220	220	220	
Total Value of Yield Gain, $	0	1,940,004	3,880,008	7,760,016	11,329,623	
4.0 Rice yield gain						
Rice Production Area	112,094	120,057	128,020	135,983	143,946	
Baseline yield **t/ha**	2.70	2.70	2.70	2.70	2.70	
Reference yield **t/ha**	3.41	3.41	3.41	3.41	3.41	
Annual yield, t/Ha.	3.41	3.61	3.83	4.06	4.30	
Improvement(t/Ha)	0.00	0.20	0.42	0.65	0.89	
Total Imrovement (t)	0	17,172	39,072	65,126	95,551	
USD/t	150	150	150	150	150	
USD/year	0	2,575,827	5,860,739	9,768,944	14,332,694	
B. Transport cost saving						
0.10 = baseline transport cost **USD/ton-km**	0.1	0.1	0.1	0.1	0.1	
0.15 = cost reduction **fraction** (15%)	0.15	0.15	0.15	0.15	0.15	
30 = average **km** per trip	30	30	30	30	30	
Total Agricultural Cooepratives Operational	9	18	27	36	45	
Total Products Handled per AC	1,000	1,000	1,000	1,000	1,000	
Products transported per year	9,000	18,000	27,000	36,000	45,000	
Benefit = 0.10 * 0.15 * 30 * Tons_affected_year	4,050	8,100	12,150	16,200	20,250	
C. Road Avoided GHG emission						
Ave. Daily TrafficT (**vehicles/day)**	5	5	5	5	5	
Road length (**km)**	162	162	162	162	162	
Days/yr.	365	365	365	365	365	
veh_km_year = vehicle-km affected per year	295,650	295,650	295,650	295,650	295,650	
diesel saved, **L/km**	0.02	0.02	0.02	0.02	0.02	
EF, **kg CO_2/L**	2.68	2.68	2.68	2.68	2.68	

	2021	2022	2023	2024	2025	Total
tCO_2e = (veh_km_year * diesel saved * EF) / 1000 (using 20% rollout ramp)	3.169	6.339	9.508	12.677	15.847	
carbon value, **USD/tCO_2e**	10	10	10	10	10	
Total value of beenfits, $ (tCO_2e * carbon value)	32	63	95	127	158	
D. Biodigester: Value of Avoided GHG Emission (tCO_2e)						
HH_total_OWM = households adopting organic-waste management (any modality)(with rollout ramp)	27	55	82	109	139	
share_biodigester	0.6	0.6	0.6	0.6	0.6	
share_compost hut	0.4	0.4	0.4	0.4	0.4	
Animal Holdings						
No. of Cows (Heads)	6	6	6	6	6	
No. of Pigs (Heads)	12	12	12	12	12	
Avoided manure CH_4 per head (tCO_2e/head/yr):						
EF The EF values are calibrated so a typical biodigester HH (≈2 cattle + 3 pigs) ≈ 1.48 tCO_2e/HH/yr, close to your 1.5 mid-estimate; a compost-only HH ≈ 0.26 tCO_2e/HH/yr.						
Biodigester						
EF_cattle_bio	0.35	0.35	0.35	0.35	0.35	
EF_pig_bio	0.26	0.26	0.26	0.26	0.26	
Compost hut						
EF_cattle_comp	0.07	0.07	0.07	0.07	0.07	
EF_pig_comp	0.04	0.04	0.04	0.04	0.04	
HH_bio = HH_total_OWM * share_bio	16	33	49	65	84	
HH_comp = HH_total_OWM * share_comp	11	22	33	44	56	
tCO2e_per_HH_bio = cattle_per_HH*EF_cattle_bio + pigs_per_HH*EF_pig_bio	5.22	5.22	5.22	5.22	5.22	
tCO2e_per_HH_comp = cattle_per_HH*EF_cattle_comp + pigs_per_HH*EF_pig_comp	0.9	0.9	0.9	0.9	0.9	
tCO2e_bio = HH_bio * tCO2e_per_HH_bio	85	171	256	342	436	
tCO2e_comp = HH_comp * tCO2e_per_HH_comp	10	20	29	39	50	
tCO2e_total = tCO2e_bio + tCO2e_comp	95	190	286	381	487	

	2021	2022	2023	2024	2025	Total
Carbon_Price, USD/tCO_2e	10	10	10	10	10	
$GHG = tCO2e_total * Carbon_Price	29,760	59,520	89,280	119,040	148,800	
E. Biodigester fuel substitution (USD)						
Households adopting biodigesters	27	55	82	109	139	
kg wood/HH/year displaced	6	6	6	6	6	
FW Saved (t/yr)	151	302	452	603	771	
USD/kg wood	0.1	0.1	0.1	0.1	0.1	
Benefit, USD/Yr. = FW Displaced* 0.10 * 1000	15,076	30,152	45,227	60,303	77,054	
F. Fertilizer saving from compost						
Agriculture Production Area	112,094	120,057	128,020	135,983	143,946	
Area Applied with Composts, %	20%	20%	20%	20%	20%	
Area Applied with Composts, Ha.	22,419	24,011	25,604	27,197	28,789	
kg N/ha substituted	10	10	10	10	10	
USD/kg N	1.2	1.2	1.2	1.2	1.2	
Benefit, USD/year	269,026	288,137	307,248	326,359	345,470	
G. NAL service revenue (USD)						
Tests Conducted	79	98	141	416	375	
Income	3,405	3,358	4,225	22,044	2,667	
H. AWD in rice (CH_4 reduction)						
Area under AWD (full 2025): 30,000 ha (15,000–50,000)	78,694	85,861	93,028	100,194	107,361	
EF reduction vs. continuous flooding: 0.8 tCO_2e/ha/yr	0.80	0.80	0.80	0.80	0.80	
Total tCO_2e/yr	62,955	68,689	74,422	80,155	85,889	
Carbon_Price, USD/tCO_2e	10	10	10	10	10	
Total Value of Mitigated GHG	629,554	686,887	744,221	801,554	858,888	
Less:						

	2021	2022	2023	2024	2025	Total
II. INVESTMENTS	**3,321,241**	**9,077,155**	**22,954,735**	**9,060,898**	**7,863,989**	**52,278,018**
A. Civil Works	404,043	5,743,613	19,832,015	8,746,814	7,507,147	**42,233,631**
Grant 0579-CAM				0	788,250	**788,250**
Loan 3661-CAM				8,746,814	5,765,489	**14,512,303**
Loan 8346-CAM				0	953,408	**953,408**
RGC				0		**0**
RGC (Royal Government of Cambodia)					0	**0**
B. Equipment, Material, Goods, and Project Implementation Services	**408,344**	**800,619**	**582,867**	**0**		**1,791,831**
C. Operating Costs	**631,476**	**1,768,451**	**1,788,893**	**314,084**		**4,502,904**
Grant 0579-CAM				0		**0**
Loan 3661-CAM				314,084		**314,084**
Loan 8346-CAM				0		**0**
RGC				0		**0**
D. Incremental Operating Costs (Project Management)					**356,841**	**356,841**
Grant 0579-CAM					0	**0**
Loan 3661-CAM					293,721	**293,721**
Loan 8346-CAM						**0**
RGC (Royal Government of Cambodia)					63,120	**63,120**
E. Interest Charges	**1,877,377**	**764,472**	**750,961**	**0**	**0**	**3,392,810**
III. CPI Adjustment Factor	**1.1237**	**1.0667**	**1.0445**	**1.0220**	**1.0000**	
IV. CASH FLOW ANALYSIS						
Benefits Adjusted to 2025 Real Values	1,068,528	7,645,820	13,898,868	22,510,527	31,054,815	76,178,557
Less: Investment Adjusted to 2025 Real Values	3,732,078	9,682,601	23,976,221	9,260,238	7,863,989	54,515,127

	2021	2022	2023	2024	2025	Total
Net Cash Flow	(2,663,550)	(2,036,782)	(10,077,353)	13,250,289	23,190,826	21,663,430
Discounted Cash Flow Analysis						
Interest Rate = 3%						
DF @ 3%	1.000	0.971	0.943	0.915	0.888	
Discounted Benefits	1,068,528	7,423,126	13,101,016	20,600,321	27,591,801	69,784,792
Less: Discounted Investment	3,732,078	9,400,584	22,599,888	8,474,429	6,987,052	51,194,031
Discounted Net Cash Flow	(2,663,550)	(1,977,458)	(9,498,872)	12,125,891	20,604,749	18,590,761
Compound Factor	1.126	1.093	1.061	1.030	1.000	
Compounded Benefits	1,202,638	8,354,794	14,745,309	23,185,843	31,054,815	78,543,398
Interest Rate = 7%						
DF @ 7%	1.000	0.935	0.873	0.816	0.763	
Discounted Benefits	1,068,528	7,145,626	12,139,810	18,375,295	23,691,569	62,420,828
Less: Discounted Investment	3,732,078	9,049,160	20,941,760	7,559,112	5,999,399	47,281,510
Discounted Net Cash Flow	(2,663,550)	(1,903,534)	(8,801,950)	10,816,183	17,692,170	15,139,318
Compound Factor	1.311	1.225	1.145	1.070	1.000	
Compounded Benefits	1,400,623	9,366,458	15,912,814	24,086,264	31,054,815	81,820,973
Interest Rate = 10%						
DF @ 10%	1.000	0.909	0.826	0.751	0.683	
Discounted Benefits	1,068,528	6,950,745	11,486,668	16,912,492	21,210,856	57,629,289
Less: Discounted Investment	3,732,078	8,802,365	19,815,059	6,957,354	5,371,210	44,678,065
Discounted Net Cash Flow	(2,663,550)	(1,851,620)	(8,328,391)	9,955,138	15,839,646	12,951,224
Compound Factor	1.464	1.331	1.210	1.100	1.000	
Compounded Benefits	1,564,432	10,176,586	16,817,630	24,761,579	31,054,815	84,375,043
Economic Analysis						
NPV						
Interest Rate = 3%	18,590,761					

	2021	2022	2023	2024	2025	Total
Interest Rate = 7%	15,139,318					
Interest Rate = 10%	12,951,224					
MIRR						
Interest Rate = 3%	8.9%					
Interest Rate = 7%	11.6%					
Interest Rate = 10%	13.6%					
BCR						
Interest Rate = 3%	1.36					
Interest Rate = 7%	1.32					
Interest Rate = 10%	1.29					

Appendix 6. Core Data Collection Instruments (Structured Outlines)

1. **Structured Outline – Individual Farmer Interview Tool**

A. Interview Introduction and Ethics

- Enumerator introduction and purpose of the evaluation
- Explanation of voluntary participation
- Informed consent and right to withdraw
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Socio-Demographic Characteristics

- Age, sex, household headship
- Education level
- Household size
- Primary and secondary livelihood sources
- Monthly household income by source (farming, livestock, labor, business, remittances, others)
- Membership in farmer groups, cooperatives, water user groups, savings/credit groups, women/youth groups

C. Project Awareness and Participation

- Awareness of the CFAVC project
- Information channels through which the project was known
- Household participation in project activities
- Types of support received:
    - Training and capacity building
    - Infrastructure and equipment (irrigation, compost huts, land leveling, water harvesting)
    - Demonstration farms or model farmer activities
    - Membership in project-supported groups or cooperatives

D. Relevance of Project Interventions

- Perceived relevance of project activities to household and community needs
- Perceived impacts on income, productivity, water access, skills, and community cooperation
- Suitability of project activities to address key farming challenges
- Most useful project-supported activities
- Changes or adoption of climate-resilient and climate-smart practices
- Perceived contribution of different project supports to observed changes
- Recall of major external events in the past five years (e.g., disasters, government programs) and household impacts

E. Effectiveness and Outcome Changes

- Adoption of specific farming practices promoted by the project
- Changes in income, household expenses, market access, and quality of life
- Crop production and yield levels:
    - Current production by crop and season
    - Production before project support
- Fertilizer use:
    - Chemical and organic fertilizer usage before and after the project
- Cultural and soil management practices (burning, mulching, green manure)

F. Water Management and Irrigation

- Access to irrigation water and main water sources
- Reliability and seasonal availability of irrigation
- Use of irrigation systems and technologies
- Adoption of Alternate Wetting and Drying (AWD) practices

- Water pumps and irrigation equipment used (diesel, solar, electric, drip irrigation)

G. Infrastructure and Market Access

- Distance to nearest improved road
- Perceived benefits of road improvements (health, transport, services)
- Changes in travel time and transportation costs to markets
- Market access pathways and transportation methods before and after the project
- Post-harvest losses during transport

H. Institutional Linkages and Coherence

- Support received from other institutions (government, NGOs, private sector)
- Perceived complementarity of project support with other initiatives
- Helpfulness of different service providers and partners

I. Gender Equity and Social Inclusion

- Perceptions of fairness and inclusiveness in project participation
- Inclusion of women, poor households, ethnic minorities, landless farmers, and persons with disabilities
- Participation in project decision-making
- Satisfaction with project support
- Perceived beneficiaries of project interventions

J. Innovation and Systemic Change

- Perceived degree of change in farming practices and systems
- Evidence supporting sustainability and transformation
- Knowledge dissemination and peer influence

K. Sustainability, Replication, and Scalability

- Local factors contributing to project success
- Intentions to continue using promoted practices after project completion
- Enablers and barriers to replication and adoption by other farmers

L. Impacts

- Perceived contribution to:
    - Climate resilience
    - Productivity
    - Agribusiness participation
    - Value chain development
    - Marketing efficiency
    - Sustainability of farming practices
- Improvements in access to inputs, markets, services, and infrastructure

M. Unexpected Results

- Unintended positive or negative effects
- Factors contributing to unexpected outcomes

N. Lessons Learned and Recommendations

- Challenges encountered during project participation
- Constraints related to cost, complexity, delays, or follow-up support
- Factors enabling continuation, scaling, and replication of project results

2. **Structured Outline – Key Informant Interview (Project Staff: PMU, NIO, PIO)**

A. Interview Introduction and Ethics

- Introduction of interviewer and purpose of the evaluation

- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Role

- Institutional affiliation (PMU, NIO, PIO)
- Position and role in the CFAVC project
- Geographic scope of responsibilities
- Level of engagement in project planning, implementation, monitoring, and reporting

C. Beneficiary Participation and Engagement

- Assessment of beneficiary participation levels (farmers, cooperatives, local groups)
- Factors influencing high or low participation
- Barriers to engagement and inclusion
- Observations on participation quality and ownership

D. Relevance of Project Design and Interventions

- Stakeholder consultation during project design
- Alignment of project activities with local needs
- Gaps in addressing community or beneficiary needs
- Issues or delays in delivery of planned activities and mitigation measures

E. Effectiveness and Results Achievement

- Factors enabling achievement of outcomes (adaptation, productivity, fertilizer use, GHG-related outcomes)
- Constraints limiting achievement of results
- Use of internal monitoring systems to track outputs and outcomes
- Observations on changes in agribusiness conditions (markets, inputs, training, government support)
- Strategies or approaches that could have enhanced effectiveness

F. Climate-Specific Practices and Technologies

- Water management practices for rice cultivation, including AWD adoption
- Changes in irrigation methods compared to pre-project practices
- Uptake of irrigation technologies (water pumps, solar pumps, drip irrigation)
- Factors affecting adoption of climate-smart irrigation technologies
- Approaches to monitoring and measuring GHG emissions
- Observed trends in emissions reduction or mitigation-related indicators

G. Coherence and Partnerships

- Identification of key project partners and their roles
- Assessment of partner capacity, coordination, and commitment
- Alignment with other climate change projects or programs
- Complementarity with government, NGO, and private-sector initiatives
- Contributions to emissions reduction and climate resilience through partnerships

H. Efficiency and Project Management

- Adequacy of project funding and resource allocation
- Use of Theory of Change and logframe in performance management
- Functionality of internal M&E systems
- Use of monitoring data for adaptive management and decision-making

I. Gender Equity and Social Inclusion

- Measures taken to promote gender equity
- Allocation of resources or activities targeting women, youth, persons with disabilities, and vulnerable groups
- Consideration of differential access and participation among social groups

- Comparative benefits for women and men
- Examples of inclusive or exclusionary outcomes

J. Country Ownership and Institutional Alignment
- Alignment with national development, climate, and sectoral plans
- Role of national and sub-national government institutions
- Coordination mechanisms, meetings, and governance arrangements
- Contribution to national priorities and long-term ownership

K. Innovation and Paradigm Shift
- Innovative approaches introduced by the project
- Mobilization of additional support or financing for climate action
- Contribution to systemic or paradigm-level changes
- Alignment with GCF Integrated Results Management Framework (IRMF)
- Broader co-benefits (livelihoods, ecosystems, food security, gender equity)

L. Unexpected Results and Scaling
- Identification of unintended positive or negative outcomes
- Factors contributing to unexpected results
- Examples of replication, scaling, or adoption beyond project areas
- Institutional or policy changes influenced by the project
- Sustainability of observed changes

M. Lessons Learned
- Key lessons from implementation experience
- Missed opportunities or areas for improvement
- Insights relevant for future GCF-funded or similar projects
- Reflections on scorecard assessment findings

N. Recommendations
- Suggested strategies to improve effectiveness
- Priorities for sustainability, replication, and scalability
- Strategic directions for future programming and policy engagement

2b. **Structured Outline – Key Informant Interview: National Agricultural Laboratory (NAL)**

A. Interview Introduction and Ethics
- Introduction of interviewer and purpose of the interim evaluation
- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Institutional Role
- Position and role of respondent within the National Agricultural Laboratory
- Involvement in CFAVC-supported activities
- Geographic and functional scope of responsibilities
- Role in laboratory management, testing services, and commercialization

C. Relevance of Project Support to NAL
- Assessment of how CFAVC support addressed key institutional needs of NAL
- Relevance of laboratory upgrading to national agribusiness and food safety priorities
- Identification of remaining gaps or unmet needs
- Delays or challenges in delivering planned laboratory support and how these were addressed

D. Effectiveness: Outputs, Activities, and Results

- Progress toward output indicators related to NAL strengthening:
  - Upgrading of laboratory infrastructure
  - Increase in number of crop product quality and safety samples tested
  - Generation of service income through testing services
- Assessment of achievement against baselines and targets
- Key factors contributing to achievement of outputs
- Constraints affecting full achievement of targets

E. Monitoring, Reporting, and Performance Management

- Existence and functionality of internal monitoring systems
- Tracking of output indicators (samples tested, income generated)
- Use of monitoring data for management decisions and reporting
- Linkages between laboratory performance data and project M&E systems

F. Contribution to Agribusiness and Value Chains

- Role of strengthened NAL services in improving agribusiness conditions
- Contribution to:
  - Market access
  - Compliance with quality and safety standards
  - Support to farmers, agribusinesses, and exporters
- Observed changes in demand for laboratory services

G. Coherence and Institutional Linkages

- Coordination with other projects, programs, or institutions
- Complementarity of CFAVC support with other national or donor-funded initiatives
- Role of NAL in broader agricultural and climate-related programs
- Contribution to strengthening system-wide results

H. Efficiency and Resource Adequacy

- Adequacy of financial and human resources to operate upgraded laboratory facilities
- Assessment of funding sufficiency for infrastructure, equipment, and operations
- Efficiency of laboratory operations following upgrading
- Use of monitoring and financial data to improve efficiency

I. Gender Equity and Inclusion (Institutional Perspective)

- Actions taken to promote gender equity within NAL-supported activities
- Consideration of women and vulnerable groups in access to laboratory services or employment
- Examples of inclusive practices or remaining gaps

J. Commercialization and Sustainability

- Experience with commercialization of NAL testing services
- Revenue generation and financial sustainability
- Institutional and market factors affecting commercialization
- Risks and opportunities related to long-term sustainability of NAL services

K. Unexpected Results

- Identification of unintended positive or negative outcomes
- Effects of commercialization on access, equity, or service demand
- Institutional or market changes resulting from NAL strengthening
- Drivers of unexpected results

L. Lessons Learned

- Key lessons from upgrading and operating the laboratory
- Challenges encountered during implementation
- Insights for future laboratory strengthening or similar GCF-supported interventions

M. Recommendations

- Suggested strategies to improve effectiveness of NAL support
- Measures to strengthen sustainability and commercialization
- Recommendations for replication or scaling of laboratory upgrading models

3.0 **Structured Outline – Key Informant Interview: Local Authorities (Village and Commune Chiefs)**

A. Interview Introduction and Ethics

- Introduction of interviewer and purpose of the evaluation
- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Local Role

- Position and office (Village Chief, Commune Chief)
- Administrative jurisdiction (province, district, commune, village)
- Role of respondent and local office in community development
- Involvement in CFAVC-related activities

C. Project Awareness and Local Engagement

- Knowledge and understanding of the CFAVC project in the area
- Nature of local authority involvement (coordination, mobilization, facilitation)
- Types of support or contributions provided by local authorities
- Role of local leadership in implementation and oversight

D. Relevance: Local Context and Needs

- Overview of farming systems, livelihoods, and poverty conditions in the community
- Market access and common sales channels for agricultural products
- Perceived relevance of project interventions to local challenges
- Problems addressed by the project (farming, water, income, climate risks)
- Major external events or changes in recent years (e.g., disasters, infrastructure, programs)
- Timeline of key local events and their impacts on the community

E. Effectiveness: Changes Observed at Community Level

- Changes in crop production and yields (rice, maize, mango, cassava)
- Changes in fertilizer use and farming practices
- Factors enabling or constraining productivity improvements
- Water sources for irrigation and reliability of supply
- Adoption of new farming methods or tools promoted by the project
- Barriers and enablers to wider adoption among farmers
- Effects of road improvements on livelihoods, health, and market access

F. Coherence and Coordination

- Coordination with other development programs or projects in the village
- Complementarity with government, NGO, or donor-supported initiatives
- Alignment of CFAVC activities with other local or sectoral efforts
- Added value of coordination and collaboration

G. Gender Equity and Social Inclusion

- Project support targeting women, youth, persons with disabilities, and vulnerable groups
- Perceived differential impacts on poor households, women, and minority groups
- Comparison of benefits received by women and men

- Observations on inclusiveness and equity of project implementation

H. Country Ownership and Local Ownership
- Perceived changes in the village since project start
- Contribution of the project to local development priorities
- Role of commune and village authorities in sustaining results
- Ownership and commitment at local level

I. Innovation
- Introduction of new farming methods or climate-friendly practices
- Perceived effectiveness of innovative approaches
- Farmer response to new technologies or ideas
- Environmental and climate-related benefits observed

J. Replication and Scalability
- Local conditions influencing project performance
- Factors facilitating or constraining implementation
- Perceived potential for replication in other villages
- Conditions required for scaling up similar interventions

K. Impacts and Local Contributions
- Observed changes in farming systems, marketing, and incomes
- Most important benefits brought by the project to the community
- Contributions by commune or local authorities (cash, labor, materials, coordination)
- Contributions by beneficiaries (cash, labor, materials)
- Estimated value of local and beneficiary contributions

L. Unexpected Results
- Identification of unintended positive or negative outcomes
- Causes of unexpected results
- Community-level responses to unplanned changes

M. Paradigm Shift and Broader Change
- Changes in livelihoods, income, gender outcomes, and environment
- Contribution to climate resilience and climate-friendly practices
- Potential for systemic or longer-term transformation
- Factors enabling sustained change

N. Recommendations
- Suggestions to strengthen project effectiveness
- Measures to support continuation and replication
- Local-level conditions needed for sustainability and scaling

4.0 **Structured Outline – Key Informant Interview: Model Farmers**

A. Interview Introduction and Ethics
- Introduction of interviewer and purpose of the evaluation
- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Socio-Economic Characteristics
- Age and sex
- Education level

- Primary and secondary livelihood sources
- Monthly income by source (farming, livestock, labor, business, remittances, others)
- Membership in farmer groups, cooperatives, water user groups, savings/credit groups, women's or youth groups
- Role as a model farmer and involvement in project activities

C. Project Participation and Role as Model Farmer

- Nature and duration of involvement in the CFAVC project
- Activities and responsibilities undertaken as a model farmer
- Role in demonstration, peer learning, or dissemination of practices
- Interaction with other farmers and extension services

D. Relevance: Farm Context and Needs

- Current farm situation (production, income, marketing)
- Perceived alignment of project activities with farmer needs
- Usefulness of project-supported interventions
- Major external events in the past five years (programs, disasters, infrastructure)
- Impacts of these events on household and farming activities

E. Effectiveness: Agricultural Practices and Productivity

- Changes in crop yields and productivity since project start
- Changes in fertilizer use (chemical vs. organic inputs)
- Adoption of composting, manure use, biodigester slurry, or residue management
- Factors contributing to observed changes
- Constraints limiting adoption or performance

F. Post-Harvest Handling, Marketing, and Value Chains

- Changes in post-harvest practices
- Marketing channels used before and after the project
- Transportation methods, distances, costs, travel time, and losses
- Role of infrastructure improvements in market access
- Effects of cooperative membership on market access and prices

G. Water Management and Irrigation

- Sources of irrigation water and reliability
- Water access challenges across seasons
- Use of irrigation technologies (diesel, solar pumps, drip systems)
- Adoption of Alternate Wetting and Drying (AWD) practices
- Changes in water use efficiency compared to pre-project practices

H. Adoption, Diffusion, and Peer Influence

- Uptake of promoted practices by other farmers
- Factors enabling or constraining diffusion
- Role of model farmers in influencing adoption
- Community-level learning and behavior change

I. Coherence and Complementarity

- Support from other projects, government offices, NGOs, or private actors
- Complementarity of CFAVC support with other initiatives
- Examples of coordination or overlap

J. Climate Change Awareness and Mitigation

- Awareness of greenhouse gas (GHG) emissions in agriculture
- Farming practices contributing to reduced emissions
- Perceived climate resilience benefits
- Suggestions for further mitigation improvements

K. Innovation, Sustainability, and Systemic Change

- Innovative practices or tools introduced through the project
- Skill development and knowledge gains
- Likelihood of sustaining practices after project completion
- Factors supporting or threatening sustainability

L. Replication and Scalability
- Local conditions enabling project success
- Barriers to scaling or replication
- Capacity and support needed to expand practices to other areas

M. Impacts at Household and Community Level
- Changes in farming practices, income, and decision-making
- Most significant benefits experienced
- Adoption of new tools or practices with tangible results
- Support received and challenges encountered

N. Unexpected Results and Contributions
- Unintended positive or negative outcomes
- Causes and effects of unexpected results
- Contributions by farmers or communities (cash, labor, materials)
- Experience with biodigester or compost hut establishment

O. Paradigm Shift and Broader Change
- Contribution to climate-resilient, inclusive, and sustainable farming
- Effects on livelihoods, land quality, and empowerment
- Evidence of broader or systemic change
- Interest and uptake by other farmers

P. Lessons Learned
- Key lessons from participation as a model farmer
- Challenges and areas for improvement
- Reflections on project design and implementation

Q. Recommendations
- Suggested improvements to project effectiveness
- Support needed to sustain and expand practices
- Conditions required for replication and scaling

5.0 **Structured Outline – Key Informant Interview: Farmer Water User Committee (FWUC) Head**

A. Interview Introduction and Ethics
- Introduction of interviewer and purpose of the evaluation
- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Institutional Role
- Name of FWUC and geographic coverage (province, district, commune, village)
- Position and responsibilities of the FWUC Head
- Role of FWUC in irrigation management and farmer coordination
- Involvement of FWUC in CFAVC project activities

C. Project Engagement and FWUC Responsibilities

- Nature of FWUC involvement in the project
- Activities related to irrigation management and climate-friendly farming
- Coordination with farmers, local authorities, and project teams
- Role in mobilization, operation, and maintenance of irrigation systems

D. Relevance: Alignment with Local Needs and Conditions

- Assessment of how project objectives and activities matched farmers' needs
- Responsiveness of interventions to irrigation-related priorities
- Remaining gaps or unmet needs
- Major external events or changes affecting irrigation and farming
- Timeline of key local events and impacts on water use and agriculture

E. Effectiveness: Irrigation, Farming Practices, and Outcomes

- Changes in crop yields, particularly rice
- Observed changes in farming practices and productivity
- Factors enabling or constraining achievement of results
- Changes in irrigation access and reliability
- Water sources used by farmers and seasonal availability
- Adoption of AWD and other improved irrigation practices
- Changes in fertilizer practices (chemical vs. organic inputs)
- Use of irrigation technologies (diesel/solar pumps, drip systems)
- Awareness and adoption of laser land leveling technology

F. Coherence and Coordination

- Other groups, projects, or institutions supporting irrigation or farming
- Complementarity and coordination with CFAVC activities
- Added value of collaboration for irrigation and farmer support

G. Efficiency and Governance of FWUC

- Implementation challenges (delays, technical or coordination issues)
- How challenges were addressed
- FWUC meeting practices and decision-making processes
- Systems for problem-solving and collective management

H. Gender Equity and Social Inclusion

- Support for men and women in irrigation and farming activities
- Inclusion of women, youth, persons with disabilities, and vulnerable groups
- Gender differences in participation, decision-making, and access to benefits
- Communication of project entitlements and services to members
- FWUC decision-making processes and inclusiveness

I. Country and Local Ownership

- Capacity-building and skill development among farmers
- Lasting benefits of training and support for irrigation management
- Strengthening of local institutions and farmer leadership

J. Innovation

- New practices or technologies introduced through the project
- Adoption and effectiveness of innovations in water management
- Environmental and productivity benefits observed

K. Replication and Scalability

- Local conditions enabling project success
- Role of leadership, cooperation, and institutional support
- Factors affecting replication or expansion to other areas

L. Impacts

- Changes in farming practices, water use, and market access

- Impacts on livelihoods, food security, gender roles, and environment
- Most significant changes observed and reasons

M. Unexpected Results
- Unintended positive or negative outcomes
- Behavioral or institutional changes in water use or cooperation
- Possible causes of unexpected results

N. Lessons Learned
- Key lessons from irrigation management and farmer support
- Challenges, missed opportunities, and areas for improvement

O. Recommendations
- Measures to strengthen sustainability of irrigation systems
- Support needed to continue, scale, or replicate results
- Strategic suggestions based on FWUC experience

7.0 **Structured Outline – Key Informant Interview: Beneficiaries of Irrigation, Rainwater Harvesting, and Drip Irrigation**

A. Interview Introduction and Ethics
- Introduction of interviewer and purpose of the evaluation
- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Socio-Economic Characteristics
- Age and sex
- Education level
- Primary and secondary livelihood sources
- Monthly household income by source (farming, livestock, labor, business, remittances, others)
- Membership in farmer groups, cooperatives, FWUCs, savings/credit groups, women's or youth groups

C. Project Participation and Type of Support Received
- Nature of involvement in the CFAVC project
- Types of irrigation or water-related support received (rainwater pond, drip irrigation, canals, pumps)
- Participation in related farming or water-management activities
- Roles and responsibilities taken on by the respondent

D. Relevance: Fit of Irrigation and Water Systems to Needs
- Perceived relevance of irrigation and water systems to household and farm needs
- Extent to which rainwater harvesting or drip irrigation addressed key constraints
- Mismatch or limitations in design, location, or functionality
- Major external events affecting water access and farming (floods, droughts, new projects)
- Timeline of key events and their impacts on livelihoods

E. Effectiveness: Agricultural Practices and Productivity
- Changes in crop production and yields (rice, maize, vegetables, etc.)
- Changes in fertilizer use (chemical vs. organic inputs)

- Factors enabling or constraining productivity improvements
- Changes in farming practices linked to improved water access

F. Water Access, Management, and Irrigation Practices

- Main water sources for irrigation and reliability throughout the year
- Experience with accessing water before and after the project
- Management of irrigation water for crops, including rice
- Adoption and experience with Alternate Wetting and Drying (AWD)
- Changes in water-use efficiency

G. Irrigation Technologies and Climate-Smart Practices

- Types of irrigation technologies used (pumps, solar pumps, drip irrigation)
- Reasons influencing choice of irrigation systems
- Awareness and experience with laser land leveling
- Barriers and incentives to adoption of new technologies

H. Adoption, Diffusion, and Community Uptake

- Interest or adoption of irrigation and farming practices by other farmers
- Factors facilitating or hindering uptake by peers
- Demonstration or learning effects within the community

I. Coherence and Institutional Support

- Role of local authorities, NGOs, FWUCs, and other organizations
- Complementarity with other projects supporting farming or water access
- Added value of coordination and external support

J. Gender Equity and Social Inclusion

- Access of women, youth, persons with disabilities, and vulnerable groups to project benefits
- Perceived fairness and inclusiveness of irrigation and farming support
- Gender-differentiated impacts on farming, income, and water access
- Remaining inclusion gaps or challenges

K. Country and Local Ownership

- Knowledge and skills gained in irrigation and farm management
- Perceived sustainability of practices after project completion
- Local ownership of irrigation systems and farming improvements

L. Innovation

- New irrigation or farming practices introduced by the project
- Benefits for productivity, resilience, or climate risk management
- Perceived effectiveness of innovative approaches

M. Replication and Scalability

- Likelihood that irrigation and farming improvements will continue
- Conditions needed for sustainability after project end
- Factors affecting replication or expansion to other farmers or areas

N. Impacts

- Changes in farming practices, water access, income, and food security
- Contributions made by beneficiaries or communities (labor, cash, materials)
- Support from local government or other institutions
- Most significant impacts experienced

O. Paradigm Shift and Broader Change

- Contribution to improved livelihoods, land and water management
- Changes in gender roles, inclusion, or environmental outcomes
- Evidence of climate-resilient and sustainable farming transitions

- Uptake of practices by other farmers

P. Lessons Learned
- Most useful aspects of project support
- Challenges or gaps encountered
- Areas for improvement in irrigation or farming interventions

Q. Recommendations
- Suggestions to strengthen effectiveness of irrigation and water systems
- Measures to improve sustainability and reach more farmers
- Recommendations for future similar interventions

8.0 **Structured Outline – Key Informant Interview: Entrepreneurs, Agri-Processors, and Traders**

A. Interview Introduction and Ethics
- Introduction of interviewer and purpose of the evaluation
- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Business Characteristics
- Type of enterprise (entrepreneur, trader, processor)
- Main products handled or processed
- Business scale and years of operation
- Membership in cooperatives, associations, or business groups
- Changes in income sources or business activities over time

C. Project Awareness and Participation
- How respondent became aware of the CFAVC project
- Nature of engagement with the project (training, services, partnerships, inputs)
- Interaction with farmer groups or cooperatives
- Perceived influence of project participation on business operations

D. Relevance: Agribusiness Context and Market Conditions
- Current situation of agribusiness and value chains in the area
- Main market channels for agricultural products
- Key challenges affecting trading, processing, and market access
- Major external events or changes (infrastructure, disasters, programs)
- Timeline of significant events and their impacts on business activities

E. Effectiveness: Value Chain Performance and Business Outcomes
- Changes in supply-chain efficiency (input access, transport, storage, logistics)
- Changes in marketing channels and product movement
- Effects of project support on business performance and farmer linkages
- Factors enabling or constraining improvements

F. Resource Use, Efficiency, and Climate-Related Practices
- Changes in water use during processing operations
- Changes in fuel (diesel/gasoline) consumption for processing and transport
- Changes in electricity use (machinery, cold storage, lighting)
- Adoption of energy- or water-efficient technologies
- Reduction in processing, post-harvest, or storage losses and contributing factors

G. Infrastructure and Transport

- Effects of road or transport infrastructure improvements
- Changes in delivery time, transport costs, and market reach
- Implications for business competitiveness and reliability

H. Coherence and Partnerships

- Key partners and organizations involved in supporting agribusiness activities
- Coordination with NGOs, government programs, or private-sector initiatives
- Complementarity of CFAVC support with other value-chain efforts
- Added value of partnerships for the respondent's business

I. Country Ownership and Sustainability

- Effectiveness of training, equipment, and technical assistance provided
- Strengthening of business capacity and operations
- Aspects of support likely to provide long-term benefits
- Alignment with national or local agribusiness priorities

J. Innovation

- Adoption of new business practices, technologies, or models
- Innovations contributing to improved product quality, reduced waste, or climate friendliness
- Perceived benefits and challenges of innovative approaches

K. Replication and Scalability

- Local conditions enabling project success for businesses
- Policy, institutional, or market factors supporting scale-up
- Constraints affecting replication in other areas or markets
- Types of support needed to expand similar business models

L. Impacts

- Changes in marketing strategies, product volumes, or business diversification
- Use of digital tools or improved trading practices
- Most significant impacts on business performance and livelihoods
- Challenges associated with observed changes

M. Unexpected Results

- Unintended positive or negative outcomes from project participation
- Causes and effects of unexpected changes on business operations

N. Paradigm Shift and Broader Change

- Contribution to job creation, gender equity, environmental protection, and food systems
- Evidence of more climate-friendly and sustainable agribusiness models
- Potential for broader systemic or market-level transformation

O. Lessons Learned

- Key lessons from engagement with the project
- Missed opportunities or implementation challenges
- Insights for improving support to entrepreneurs, traders, and processors

P. Recommendations

- Measures to strengthen sustainability of project benefits
- Support needed for expansion or replication to other businesses or regions
- Strategic recommendations for future agribusiness interventions

9.0 **Structured Outline – Key Informant Interview: Land Leveling Technology Adopters**

A. Interview Introduction and Ethics

- Introduction of interviewer and purpose of the evaluation
- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Socio-Economic Characteristics

- Age and sex
- Education level
- Primary and secondary livelihood sources
- Monthly household income by source (farming, livestock, labor, business, remittances, others)
- Membership in agricultural cooperatives, FWUCs, farmer groups, savings/credit groups, women's or youth groups

C. Project Participation and Role in Land Leveling

- Nature of involvement in land leveling activities supported by the project
- Roles and responsibilities undertaken during land leveling implementation
- Contribution of land leveling to individual farming practices or community outcomes

D. Relevance: Fit of Land Leveling to Local Needs

- Perceived relevance of land leveling technology to local farming conditions
- Alignment with farmers' needs and constraints
- Local challenges or conditions affecting suitability
- Major external events or changes influencing land leveling activities
- Timeline of key events and impacts on farming and community

E. Effectiveness: Farming Practices and Productivity

- Changes in crop yields following land leveling
- Changes in fertilizer use (types and application practices)
- Factors contributing to improved outcomes
- Remaining challenges or constraints after land leveling

F. Enabling Environment and Adoption

- Conditions created by the project to support adoption of land leveling
- Institutional, technical, or social factors influencing uptake
- Adjustments or improvements made during implementation
- Farmer perceptions of effectiveness and usability

G. Water Management and Irrigation

- Main sources of irrigation water in leveled fields
- Reliability and seasonal availability of water
- Changes in irrigation access after land leveling
- Water management practices in rice fields
- Adoption and experience with Alternate Wetting and Drying (AWD)
- Changes in water-use efficiency compared to pre-project practices

H. Technology Adoption and Diffusion

- Experience with laser land leveling technology
- Motivations for adoption
- Benefits and challenges encountered
- Interest or uptake among other farmers
- Barriers and incentives affecting wider adoption

I. Coherence with Other Programs

- Alignment of land leveling activities with other farming or climate initiatives
- Complementarity with government, NGO, or donor-supported programs

- Added value of coordination

J. Efficiency and Adaptive Management
- Adjustments made during implementation based on feedback or challenges
- Decision-making processes for improving land leveling activities
- Perceived efficiency of delivery and support mechanisms

K. Gender Equity and Satisfaction with Results
- Perceived impacts of land leveling on women and men
- Changes in access to water, income, or farming conditions
- Satisfaction with results and remaining gaps

L. Country and Local Ownership
- Farmer capacity to maintain and continue land leveling practices
- Local ownership and responsibility for sustainability
- Institutional or community support mechanisms

M. Innovation
- New land leveling-related practices introduced by the project
- Effectiveness of innovative approaches
- Observed productivity, resilience, or environmental benefits

N. Sustainability, Replication, and Scalability
- Likelihood that benefits of land leveling will continue after project end
- Local conditions required for sustainability
- Potential for replication or scale-up in other areas

O. Impacts and Contributions
- Impacts on yields, food security, livelihoods, and resilience
- Contributions made by farmers or households (labor, cash, materials)
- Support from cooperatives, local authorities, or other groups

P. Paradigm Shift and Co-Benefits
- Contribution to sustainable development co-benefits
- Effects on climate resilience, productivity, and inclusion
- Catalytic effects and potential for systemic change

Q. Lessons Learned
- Key lessons from adopting land leveling technology
- What worked well and what could have been improved
- Reflections on implementation challenges and opportunities

R. Recommendations
- Improvements needed to strengthen land leveling interventions
- Measures to enhance sustainability and wider adoption
- Recommendations for scaling to additional farmers or regions

10.0 **Structured Outline – Key Informant Interview: Beneficiaries of Biodigester and Compost Hut**

A. Interview Introduction and Ethics
- Introduction of interviewer and purpose of the evaluation
- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance

- Estimated interview duration

B. Respondent Profile and Household Background
- Household composition and main livelihood activities
- Membership in farmer groups, cooperatives, or organizations
- Role of respondent within the household or farming activities

C. Project Participation and Role
- Nature of involvement in biodigester or compost hut activities
- Responsibilities in construction, operation, or maintenance
- Interaction with project teams or supporting organizations

D. Relevance: Fit of Biodigester and Compost Hut to Local Needs
- Perceived relevance of the technology to local farming challenges
- Extent to which the project addressed key needs and constraints
- Perceived effectiveness in solving local problems
- Major external events (disasters, programs, policies) affecting activities
- Timeline of key events and impacts on biodigester/compost use

E. Effectiveness: Agricultural Practices and Productivity
- Current fertilizer practices (compost, bio-slurry, chemical fertilizers)
- Changes in crop yields since adopting biodigester or compost hut
- Evidence of benefits from using compost or bio-slurry
- Factors enabling or constraining achievement of results
- Suggestions for improving effectiveness of the technology

F. Compost and Bio-Slurry Production and Use
- Experience in producing compost or bio-slurry
- Quantity of compost produced and frequency
- Application methods and crops or land area covered
- Changes in chemical fertilizer use (reduction or substitution)
- Perceptions of quality, usability, and satisfaction with compost

G. Adoption, Diffusion, and Peer Interest
- Interest shown by other farmers in biodigesters or compost huts
- Factors facilitating or hindering adoption by others
- Role of demonstration or peer learning

H. Coherence and Partnerships
- Other organizations or stakeholders involved (government, NGOs, groups)
- Nature of partnerships and complementary support
- Added value of coordination for biodigester/compost activities

I. Sustainability, Replication, and Scalability
- Likelihood that biodigester or compost hut use will continue
- Conditions needed for long-term sustainability
- Potential for replication in other areas
- Barriers and enablers for wider adoption

J. Impacts and Contributions
- Contributions by households or groups (labor, cash, materials)
- Support received from the project or partners
- Impacts on livelihoods, input costs, soil health, or environment

K. Unexpected Results
- Unintended positive or negative outcomes
- Causes and effects of unexpected results on households or communities

L. Lessons Learned

- Key lessons from biodigester and compost hut implementation
- What worked well and what could have been improved
- Reflections on design, support, and follow-up

M. Recommendations

- Suggestions to improve effectiveness of biodigester and compost hut interventions
- Measures to strengthen sustainability and replication
- Recommendations for scaling up to other farmers or locations

11. **Structured Outline – Key Informant Interview: Transport Operators of Farm Products**

A. Interview Introduction and Ethics

- Introduction of interviewer and purpose of the evaluation
- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Transport Characteristics

- Type of transport operator and years of experience
- Type of vehicle(s) used for transporting farm products
- Main clients (farmers, cooperatives, traders, processors)
- Geographic coverage of transport services

C. Project Participation and Role

- Nature of involvement in CFAVC project activities
- Transport services provided to farmers, cooperatives, or groups
- Interaction with project-supported value chain actors
- Perceived role of transport operators within the project context

D. Relevance: Transport Context and Local Conditions

- Current situation of farm-product transport in the area
- Road conditions, demand for transport, and market destinations
- Relevance of project-related changes or support to transport needs
- Major external events (disasters, road construction, programs) affecting transport
- Timeline of key events and their impacts on transport activities

E. Effectiveness: Transport Practices and Changes Over Time

- Main destinations for transporting farm products (rice, mango, cassava, etc.)
- Distances, frequency, and modes of transport
- Changes in transport practices since project start
- Changes in delivery times, coordination, and demand
- Factors enabling or constraining improvements

F. Infrastructure and Cost Implications

- Effects of road or infrastructure improvements on transport services
- Changes in travel time and transportation costs
- Implications for reliability, efficiency, and service quality

G. Coherence and Complementarity

- Coordination with other local initiatives (road projects, farming programs)
- Complementarity between CFAVC activities and transport-related efforts
- Contribution of transport improvements to climate-resilient value chains

H. Efficiency and Adaptive Management

- Observed changes or adjustments in transport or logistics arrangements during implementation
- Responsiveness of project management to transport-related challenges
- Examples of adaptive management affecting transport services

I. Innovation

- New or improved transport practices introduced through the project
- Innovations in scheduling, coordination, or logistics
- Perceived effectiveness of innovative approaches

J. Paradigm Shift and Systemic Contribution

- Factors enabling improved transport services under the project
- Barriers such as poor roads, fuel costs, or coordination issues
- Contribution of improved transport to more efficient, resilient, and inclusive value chains

K. Lessons Learned

- Key lessons from participation as a transport operator
- What worked well and what could have been improved
- Insights relevant for future value-chain or infrastructure-linked projects

L. Recommendations

- Suggestions to improve transport services supporting farmers and agribusiness
- Measures to enhance efficiency, sustainability, and climate resilience
- Recommendations for strengthening transport roles in future projects

12.0 **Structured Outline – Focus Group Discussion: Farmer Water User Committee (FWUC)**

A. FGD Introduction and Ethics

- Introduction of facilitator and purpose of the evaluation
- Explanation of voluntary participation
- Group consent to participate
- Confidentiality and anonymity assurance
- Estimated duration of the discussion

B. Participant Profile and FWUC Roles

- Introduction of participants and their roles in the FWUC
- Responsibilities related to irrigation management and water allocation
- Involvement of FWUC members in CFAVC project activities
- Scope of FWUC coverage (villages, schemes, farmer groups)

C. Relevance: Local Context and Needs

- Overview of farming systems and livelihoods in the community
- Current irrigation access and water-related challenges
- Perceived alignment of project goals and activities with community needs
- Appropriateness of project interventions to local conditions
- Major external events (floods, droughts, infrastructure, programs) affecting water use and farming
- Timeline of key events and impacts on irrigation and productivity

D. Effectiveness: Water Management and Agricultural Practices

- Main sources of irrigation water and seasonal reliability
- Changes in irrigation infrastructure or management since project start
- Observed improvements in water availability or distribution
- Changes in farm productivity linked to improved water management

- Enabling and constraining factors affecting results

E. Irrigation Practices and Climate-Smart Approaches
- Irrigation practices for rice farming
- Adoption and experience with Alternate Wetting and Drying (AWD)
- Decision-making processes for irrigation scheduling
- Changes in water-use efficiency compared to pre-project practices

F. Irrigation Technologies
- Types of irrigation systems currently in use
- Adoption of water pumps, solar pumps, or drip irrigation
- Factors influencing technology choice and adoption
- Barriers and incentives to expanding use of improved technologies

G. Coherence and Partnerships
- Coordination with other programs, NGOs, or government initiatives
- Complementarity between CFAVC activities and other local efforts
- Added value of partnerships for irrigation management and farming

H. Efficiency and FWUC Governance
- FWUC approaches to water allocation and scheduling
- Management of meetings, coordination, and conflict resolution
- Decision-making processes during project implementation
- What worked well and what could be improved

I. Sustainability
- Likelihood that improved water management practices will continue
- Capacity of FWUCs to sustain irrigation systems after project completion
- Support required for long-term sustainability (technical, financial, institutional)

J. Replication and Scalability
- Potential for replicating FWUC-supported approaches in other villages
- Conditions needed to expand to additional farmer groups or schemes
- Improvements required to support successful scaling

K. Lessons Learned
- Key lessons from FWUC experience with the project
- Challenges, successes, and missed opportunities
- Insights for future irrigation and climate-friendly agribusiness projects

L. Recommendations
- Suggestions to strengthen effectiveness of FWUC support
- Measures to improve sustainability and inclusiveness
- Recommendations for replication and scaling of FWUC-based approaches

13.0 **Structured Outline – Focus Group Discussion: Agricultural Cooperative Members**

A. FGD Introduction and Ethics
- Introduction of facilitator and purpose of the evaluation
- Explanation of voluntary participation
- Group consent to participate
- Confidentiality and anonymity assurance
- Estimated duration of the discussion

B. Participant Profile and Cooperative Context

- Typical household characteristics of cooperative members (family size, income sources)
- Membership characteristics and roles within the agricultural cooperative
- Types of group memberships and collective activities
- Participation of cooperative members in CFAVC project activities (training, pilots, events)

C. Relevance: Fit of Project Activities to Cooperative Needs

- Suitability and practicality of project activities for cooperative members
- Extent to which activities could be applied in members' farming practices
- Alignment of project support with cooperative priorities
- External events or changes (droughts, roads, development projects) affecting farming or cooperative activities
- Timeline of key events and their impacts on cooperative performance

D. Effectiveness: Changes in Farming Practices and Outcomes

- Changes in farming practices, crop yields, and input use since project start
- Adoption of climate-friendly practices and residue management
- Changes in access to farming information, coordination, and support
- Changes in marketing channels and transport of agricultural products
- Changes in irrigation access and water sources

E. Adoption of Climate-Smart Technologies

- Experience with and perceptions of laser land leveling technology
- Factors influencing interest or reluctance to adopt land leveling
- Group experience with biodigesters and compost huts
- Compost production, application practices, and crops covered
- Changes in chemical fertilizer use (partial or full substitution)

F. Coherence and Institutional Support

- Presence of other farming or climate-related projects
- Alignment and complementarity between CFAVC and other initiatives
- Introduction of new rules, services, or institutional arrangements
- Usefulness of these measures for cooperative functioning

G. Efficiency and Cooperative Functioning

- Challenges faced by cooperatives during implementation
- How challenges were addressed
- Functioning of cooperative leadership, committees, and coordination mechanisms
- Follow-up, monitoring, and feedback mechanisms used by the project
- Examples of adaptive management based on what worked or did not work

H. Gender Equity and Social Inclusion

- Support provided to women, youth, and marginalized members
- Awareness of rights, benefits, and entitlements under the project
- Gender-differentiated impacts of project activities
- Inclusiveness of decision-making within cooperatives
- Overall satisfaction with project results

I. Country Ownership and Capacity Development

- Skills and knowledge gained by cooperative members
- Capacity of cooperatives to sustain practices beyond the project
- Strengthening of collective action and institutional ownership

J. Sustainability, Replication, and Scalability

- Likelihood that cooperative activities will continue after project completion
- Local conditions enabling or limiting sustainability
- Potential for replication or expansion to other cooperatives or areas
- Support required to sustain and scale successful practices

K. Unexpected Results

- Identification of unintended positive or negative outcomes
- Factors contributing to unexpected results
- Effects on cooperative dynamics or member livelihoods

L. Paradigm Shift and Broader Change

- Improvements in income, food security, environmental outcomes, or group performance
- Influence on other groups or cooperatives
- Enablers and barriers to shifting toward climate-resilient farming practices

M. Lessons Learned

- Key lessons learned by cooperative members
- Missed opportunities or aspects that could have been improved
- Reflections on project design, delivery, and support

N. Recommendations

- Measures to strengthen effectiveness of cooperative support
- Improvements needed to enhance sustainability and inclusiveness
- Recommendations to support replication and scaling

14. **Structured Outline – Case Study Interviews: Selected Farmers**

A. Interview Introduction and Ethics

- Introduction of interviewer and purpose of the evaluation
- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Household Background

- Age and sex
- Education level
- Household composition
- Primary and secondary livelihood sources
- Monthly household income by source
- Membership in farmer groups, cooperatives, FWUCs, savings/credit groups, women's or youth groups

C. Local Context and Market Access

- Overview of local farming and livelihood context
- Main crops cultivated (rice, maize, cassava, mango)
- Main markets accessed for selling crops
- Transport methods used to reach markets
- Changes in market access or transport since project start

D. Farming Practices and Input Use

- Current fertilizer practices (chemical, compost, manure, bio-slurry)
- Changes in fertilizer use since project participation
- Changes in crop yields and productivity
- Perceived drivers of change in yields or costs
- Crop residue management practices (burning, composting, mulching) and changes over time

E. Water Management and Irrigation

- Access to water for crops and main irrigation sources

- Reliability of water supply across seasons
- Irrigation practices for rice and other crops
- Experience with Alternate Wetting and Drying (AWD)
- Changes in water management practices compared to pre-project conditions

F. Adoption of Climate-Friendly Practices and Technologies

- Experience with compost huts or biodigesters
- Compost or bio-slurry production levels
- Crops to which compost is applied
- Extent of substitution or reduction of chemical fertilizers
- Farmer perceptions of compost quality, usefulness, and labor requirements

G. Results and Satisfaction

- Perceived benefits from project participation (productivity, costs, income, resilience)
- Aspects of project support that worked well
- Remaining challenges or gaps
- Overall satisfaction with results to date

H. Unintended Effects

- Identification of unexpected positive or negative outcomes
- Perceived causes of unintended results
- Effects on household, farming system, or community

I. Lessons Learned

- Key lessons from farmer experience with the project
- Practices or approaches that were particularly effective
- Missed opportunities or areas that could have been improved

J. Recommendations and Forward-Looking Insights

- Suggestions for improving future project design or delivery
- Conditions needed to sustain benefits after project completion
- Advice for scaling or replicating similar interventions

15. **Structured Outline – Key Informant Interview: Research Institutions (CARDI, RUA)**

A. Interview Introduction and Ethics

- Introduction of interviewer and purpose of the evaluation
- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Institutional Role

- Institutional affiliation (CARDI, RUA)
- Position and area of expertise
- Geographic or thematic scope of work
- Nature of engagement with agricultural research, extension, or policy
- Level of awareness or involvement with the CFAVC project

C. Project Awareness and Engagement

- Understanding of CFAVC project objectives and components
- Aspects of the project most relevant from a research perspective
- Nature of collaboration or interaction with project actors (if any)
- Observed strengths or distinctive features of the project

D. Effectiveness: Changes in Productivity and Input Use

- Observed changes in crop productivity among participating farmers
- Changes in fertilizer use patterns (chemical vs. organic inputs)
- Factors contributing to observed productivity or input-use changes
- Comparison of current practices with pre-project conditions

E. Fertilizer Use and Nutrient Management Trends

- Trends in nitrogen-based and other fertilizer use among project farmers
- Implications of fertilizer practices for yields, soil health, and sustainability
- Drivers influencing fertilizer choices (training, access, cost, knowledge)
- Observed differences between project-supported and non-supported farmers

F. Crop Residue Management and Soil Practices

- Changes in crop residue management practices (burning, mulching, composting)
- Outcomes observed from shifts in residue management
- Environmental and productivity implications
- Factors influencing adoption of improved practices

G. Evidence and Knowledge Base

- Sources of evidence used by the institution (research studies, field trials, observations)
- Degree of confidence in observed trends
- Data gaps or limitations in assessing outcomes

H. Paradigm Shift and Systemic Change (Scorecard Perspective)

- Key factors supporting climate-resilient agribusiness in Cambodia
- Institutional, technical, or policy enablers
- Constraints limiting wider adoption of climate-friendly practices
- Examples from research or field collaboration illustrating systemic change

I. Contribution to Policy, Research, and Capacity Development

- Role of research institutions in supporting climate-friendly agribusiness
- Linkages between project experience and national research or policy agendas
- Opportunities for strengthening research–practice–policy integration

J. Lessons Learned

- Key lessons emerging from observed project-related changes
- Insights relevant for future research, extension, or project design
- Missed opportunities or areas needing further investigation

K. Recommendations

- Recommendations to strengthen effectiveness of climate-friendly agribusiness interventions
- Suggestions for improving integration of research evidence into implementation
- Areas where further research or piloting is needed
- Advice for scaling and sustaining climate-resilient practices

16. **Structured Outline – Key Informant Interview: Development Partners and NGOs**

A. Interview Introduction and Ethics

- Introduction of interviewer and purpose of the evaluation
- Explanation of voluntary participation
- Informed consent
- Confidentiality and anonymity assurance
- Estimated interview duration

B. Respondent Profile and Organizational Role

- Organizational affiliation (FAO, IFAD, GIZ, NGO, etc.)
- Position and role of respondent
- Geographic and thematic scope of work
- Level of engagement with agriculture, climate change, or value-chain development

C. Awareness of and Engagement with CFAVC

- Familiarity with the Climate-Friendly Agribusiness Value Chains (CFAVC) project
- Understanding of key project interventions
- Observed or perceived impacts of the project
- Nature of interaction or coordination with CFAVC actors (if any)

D. Related Programs and Complementary Activities

- Description of respondent organization's activities related to climate-resilient agriculture or agribusiness
- Areas of thematic overlap with CFAVC (productivity, adaptation, mitigation, value chains)
- Contribution of these activities to sustainable agriculture outcomes

E. Relevance: Local Context and Development Conditions

- Observations on local livelihoods, farm productivity, and market access in project areas
- Key challenges and opportunities affecting farmers and value chains
- Major external events or developments (infrastructure, programs, environmental shocks)
- Effects of these events on climate-friendly agribusiness conditions

F. Effectiveness: Changes in Practices and Outcomes

- Observed progress in farm productivity or climate-resilient practices
- Changes in fertilizer use (chemical vs. organic, nitrogen-based inputs)
- Effects of these changes on yields, soil health, or resilience
- Trends in crop residue management (burning, mulching, composting) and outcomes

G. Value Chain, Market Access, and Transport

- Typical marketing and transport practices for crops (rice, maize, mango, cassava)
- Observed changes in value-chain functioning or market access
- Role of infrastructure or institutional support in facilitating these changes

H. Adoption of Climate-Friendly Technologies

- Observations on uptake of climate-friendly technologies or practices
- Factors supporting adoption (policy, incentives, capacity, coordination)
- Constraints limiting wider uptake (costs, knowledge, infrastructure, risks)

I. Sustainability, Replication, and Scalability

- Factors enabling sustainability of climate-friendly agribusiness initiatives
- Policy, institutional, and financing conditions affecting scale-up
- Examples from respondent organization's experience
- Risks or barriers to replication across regions or value chains

J. Coherence and Alignment

- Degree of alignment between CFAVC and other donor- or NGO-supported initiatives
- Complementarity with national strategies or sectoral programs
- Opportunities to strengthen coordination and reduce duplication

K. Paradigm Shift and Systemic Change (Scorecard Perspective)

- Key enablers supporting a shift toward climate-resilient agribusiness
- Structural, institutional, or market barriers limiting transformation
- Examples illustrating systemic or catalytic change from partner perspectives

L. Lessons Learned

- Key lessons from partner or NGO engagement in climate-friendly agribusiness
- Insights relevant for future program design or coordination
- Gaps or missed opportunities observed

M. Recommendations

- Recommendations to strengthen effectiveness and coherence of CFAVC-type interventions
- Suggestions to enhance sustainability, scaling, and partnerships
- Advice for improving donor coordination and knowledge sharing

*Appendix 7. **Fieldwork Timetable and Coverage***

Activity	Location(s)	Stakeholder Group	Period	Sample size
Inception briefing and travel	Phnom Penh	Evaluation team	21 July	–
Household survey / individual farmer interviews	Kampot, Takeo, Tboung Khmum, Kampong Cham (2 districts, 2 communes, 4 villages per province)	Farmer beneficiaries (rice, maize, cassava, mango producers; women and men)	22 July – 3 August	288
Key Informant Interviews (KIIs)	Kampot, Takeo, Tboung Khmum, Kampong Cham, Phnom Penh	Project staff (PMU, PPIU, IA), MAFF, MRD, MOWRAM, GCF Focal Point, research institutions, development partners, NGOs, finance officers	22 July – 3 August	124
Local authority interviews	Kampot, Takeo, Tboung Khmum, Kampong Cham	Commune Chiefs, Village Chiefs	22 July – 1 August	16
Farmer beneficiary interviews (technology-specific)	Kampot, Takeo, Tboung Khmum, Kampong Cham	Beneficiaries of irrigation, rainwater harvesting ponds, drip irrigation demos, land leveling, biodigesters, compost huts	22 July – 3 August	24
Model farmer interviews (demo farms)	Kampot, Takeo, Tboung Khmum, Kampong Cham	Model farmers (rice, maize, cassava, mango)	22 July – 3 August	16
Agri-entrepreneur / trader interviews	Kampot, Takeo, Tboung Khmum, Kampong Cham, Phnom Penh	Individual traders, cooperatives/community traders, corporate agri-traders	24 July – 2 August	21
Agri-processor interviews	Kampot, Takeo, Tboung Khmum,	Individual processors, cooperatives, corporate agri-processors	24 July – 2 August	21

Activity	Location(s)	Stakeholder Group	Period	Sample size
	Kampong Cham, Phnom Penh			
Logistics and transport operator interviews	Kampot, Takeo, Tboung Khmum, Kampong Cham	Transport and logistics operators	24 July – 2 August	4
Focus Group Discussions (FGDs)	Kampot, Takeo, Tboung Khmum, Kampong Cham	Farmer Water User Communities (FWUCs); Agricultural Cooperatives	23 July – 1 August	8 FGDs
Case study interviews	Kampot, Takeo, Tboung Khmum, Kampong Cham	Selected farmer beneficiaries (rice, maize, cassava, mango)	22 July – 3 August	12
Field observations and site visits	All four provinces	Irrigation schemes, demo farms, compost huts, biodigesters, rainwater harvesting ponds	22 July – 3 August	–
Return travel and debriefing	Phnom Penh	Evaluation team	3 August	–

Fieldwork Coverage, Methods, and Gender Inclusion:

- Fieldwork covered 4 provinces, 8 districts, 8 communes, and 16 villages
- Activities combined quantitative surveys, qualitative interviews, FGDs, case studies, and direct observation, enabling triangulation
- Gender balance and inclusion were ensured through sampling quotas and FGD composition

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