Developing Land Management Options for Diverse Cacao-based system in Mindanao

MEL CHRISEL A. SALES
Project Team Leader

Funded by:

EXTERNAL (GGGI-BKCF FUND)

Terminal Report
NARRATIVE REPORT
JULY 2025

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Philippines

NARRATIVE REPORT

A. BASIC INFORMATION		
1. Title	**Developing Land Management Options for Diverse Cacao-based system in Mindanao**	
2. Project Leader Study Leader (Indicate College/Unit)	**MEL CHRISEL A. SALES** **CA, Soil Science Department**	
Email Address	mcasales@usm.edu.ph	
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3. Lead Unit/College		
Collaborating Unit/College	**USM, Central Laboratory**	
4. Category	☒ Program ☒ Project ☐ Study	
5. Classification	☒ Research	☐ Development
	☐ Basic ☒ Applied	☐ Pilot Testing ☐ Prototype Development ☐ Tech. Promotion/Commercialization
6. Thematic Area	☐ Quality Learning Skills Development and Literacy ☒ Food Security and Poverty Reduction ☐ Social Development, and Strong Institutions ☐ Good Health and Well-being ☐ Preservation of Culture ☐ Innovations in Science, Engineering, and Technology ☐ Environmental Protection, Conservation, and Risk Reduction ☐ Sustainable Entrepreneurship and Management	
7. Sector/Commodity/Discipline	Cacao	
8. Project Duration	**2 years (November 25,2022 - November 30, 2024) Extended to July 30, 2025**	
9. Project Location	USM, Kabacan & Brgy. Sirib, Calinan District, Davao City	
10. Total Approved Budget (Php)	$ 136, 310.24	

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B. TECHNICAL DESCRIPTION

1. Rationale / Significance

Rationale

The Philippines and other members of BIMP-EAGA are among the few countries in the world growing cocoa as they lies within the cacao belt (18°N and 15°S of the equator). In the Philippines, registered cacao farms reached around 31, 299 hectares in 2020 with an annual expansion of around 3.4% (PSA, 2021). The majority of the cacao farms are located in the southern part of the country (P-EAGA area), particularly in the upland areas surrounding the rich soil of Mt. Apo. Philippine Statistics Authority (2021) showed that the two major cacao-producing areas of Davao City and North Cotabato have registered an annual growth of around 10% and 5%, respectively in terms of its production area. Globally, cocoa has a market value of around 8.6 billion in 2017 and a compound growth rate of 7.3%. The global cocoa market value is estimated to reach 189.89 billion by 2026 (Voora et al., 2019).

As local production continues to rise over the years in order to satisfy the market and consumer, issues and concerns such quality and safety of cacao beans, as well as environmental issues emerged. After many decades of cacao cultivation, soil fertility, land productivity and available cultivation areas per family are shrinking. Evidences show how much the cacao plots are getting degraded and need fertilization to replenish the soil nutrients and recover their production levels and income (Snoeck et al., 2016). Therefore, fertilization is a major issue for the future of cacao cultivation and cacao farmers (Ruf, 2012). Furthermore, cacao being perennial in nature is faced with the impact of climate change even during a single generation or in a standing plantation (Balasimha, 2016). Climate factor such as rainfall and temperature have significant effect in the production of cacao, thus a slight deviation in the normal microclimate of cacao farms will post a challenge to the cacao farming communities.

In addition to production and supply gap issues, quality of cacao products are becoming significant trade criterion. Recently, sticker regulations for food safety was put forward through the Codex Alimentarius Commission of the Joint FAO/WHO Food Standards Programme, setting maximum levels for Cadmium (Cd) in chocolate and cocoa derived products. Similarly, the European Union have imposed a parallel measures starting January 01, 2019 through Regulation (EU) No 488/2014 implemented the regulations governing chocolate and cocoa products containing excessive levels of Cd and pesticide residues (Ecolex, 2021).

If not properly studied, land management options and fertilization programs may lead to the production of poor quality and unsafe cacao beans. The exposure of cacao production areas to natural sources of heavy metals especially Cd (contaminated soil and water), and excessive use of synthetic fertilizers may lead to accumulation of heavy metals in the cacao beans. Cacao, being a small evergreen tree, has high propensity of Cd uptake. According to Ramtahal et al. (2016), the primary source of cadmium in cocoa beans has been linked to the direct uptake by the cacao plant from cadmium contaminated soils. In addition to this, excessive and repeated application of P-fertilizer (Maddela et al., 2020) and long term use of phosphate fertilizer (Chengrahi et al., 2011) are the key contribution to increased levels of Cd in both soil and cacao crops.

Putting solution to the issues on the growing preferences of the market and consumers for the safe and healthy food products are among the key priorities of our present generation. In 2021, UN convened the Food Systems Summit and launched bold new actions to deliver progress on all 17 SDGs, each of which relies to some degree on healthier, more sustainable and equitable food systems (United Nations, 2021).

These recent regulations and environmental trends posed a challenge to the growing cacao industry in Mindanao. Staying afloat would simply mean improving productivity and complying with the prevailing quality and safety standards and regulations for cacao. The proposed project will produce the concrete results that will guide the small-holder cacao farmers in improving their production of cacao in terms of quality and quantity. In 2019, Sales et al., (2019) of UPLB and USM, had conducted a research funded by DOST-ASTHRDP and CHED-K12 schoolarship programs. The research evaluated the land use system of Davao City to determine its suitability for cacao production and identify soil related constraints to achieve

the potential yield of cacao in the area. The said research recommended the conduct of site-specific experiments to determine the appropriate soil management technologies that will address the soil-related limitations of the area. The identified limitations of the soil in Davao City for cacao production are: low soil fertility, shallow and drought-prone soil in some areas and sloping topography in midland areas. Improper use of fertilizer and inputs to production as well as the lack of water and soil conservation measures were also documented by the said study. The project will be engaging 30 direct cooperators (farmer, agriculture extentionist/ technologist, agriculture student) from the organizations of cacao-based farmer- members of UNORKA Mindanao, academe and LGUs in Davao City and North Cotabato. The cacao-cooperator will be mentored by the project team in the field. The project team will engage the cacao–cooperators in the establishment of the experimental sites, gathering of data and information and interpretation of the experiment results. This is to show to the farmers and other cacao players the scientific process of evaluating different technologies and gave them the actual experience of growing cacao under different management technologies/ practices.

In addition, the project will benefit at least around 6,000 cacao farmers/ players in Davao Region and Region 12 from the knowledge sharing sessions and information drive activities that will be conducted by the project team.

Objectives

The main goal of the project is to empower small-holder cacao farmers in addressing the impact of climate change and other market challenges by providing them with the appropriate technologies and capacity to harness local resources towards producing quality and safe cacao beans.

1: Determine effective, regenerative and climate resilient soil management options for safe and sustainable cacao-based cropping system in Davao City and North Cotabato.

2: Showcase the advantages of the different soil management technologies to cacao farmers and other players in the industry.

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2. ACCOMPLISHMENTS

COMPONENT 1. DETERMINE EFFECTIVE, REGENERATIVE AND CLIMATE RESILIENT SOIL MANAGEMENT OPTIONS FOR SAFE AND SUSTAINABLE CACAO-BASED CROPPING SYSTEM IN DAVAO CITY AND NORTH COTABATO.

Output 1.1 Site-specific performance of different soil management technologies/techniques on cacao production evaluated.

The project coordinated with groups and agencies and formed partnerships. Memorandum of understanding were forged between USM-GGGI-BKCF and the Mindanao ARB's Farmer's Federation, UNORKA Mindanao (Federation of Agrarian Reform Beneficiaries ARB's and Farmer Cooperatives in Mindanao), and BLGU Sirib (Barangay Local Government Unit Sirib, Calinan District, Davao City). The USM-GGGI-BKCF also partnered with Sta. Catalina Multipurpose Cooperative, President Roxas, North Cotabato (ANNEX 1).

The project team and partners organized cacao farmers (30 cacao-cooperators, 18 in Davao City and 13 in North Cotabato) involved and mentored on the capacity building program focusing on the identification of best soil management options on cacao-based cropping systems. Cacao-cooperators were trained with the cacao-cropping systems management with science-based approach. Topics for training were as follows: a) Importance of Research and Data Recording in Cacao Production Management; b) Climate Change Effects and Mitigation; c) Cacao Characteristics and Requirement; d) Composting and Sustainable Agriculture; and e) Soil Fertility Evaluation and Recommendations (Davao City and North Cotabato) (ANNEX 2).

Prior to the conduct of mentoring activities, the project team conducted field experiments based on established outline in Davao City and North Cotabato (ANNEX 3). The experiments were showcased to the farmers as well as monitored by the project team. Consistently, the field experiments were monitored (ANNEX 4) gathered and analyzed. Best soil management options to increase cacao productivity and storage of C in soil were evaluated.

The cacao-cooperators and mentoring activity was completed June 13, 2024 in Sirib, Calinan District Davao City and October 26, 2024 in North Cotabato (ANNEX 5).

Output 1.2 Publication of the result of the experiment

Results were showcased to the different cacao-stakeholders. Initially, the results were published in the Mindanao Development Authority indexed in the Socio-Economic Research Portal for the Philippines (SERP-P) of the Philippine Institute for Development Studies (PIDS) (ANNEX 6). Part of the results was also presented in the Agri-life and Bioresource Science Symposium and was

circulated through the book of abstracts (*page 8*) (ANNEX 7). Additionally, the research experiment results were presented as poster in the USM in-house review (ANNEX 8) last November 28-29, 2024.

Key findings on the research on the different soil management are as follows:

Site 1 Davao City (see link https://www.minda.gov.ph/policy-initiatives/policy-brief/adapting-cacao-farming-in-mindanao)

a) Appropriate nutrient management can increase the yield of cacao, and can attain the potential yield of 3 kg/tree dried cacao beans.
b) Organic fertilizer and mulching application increased the yield of cacao which is at par with the application of inorganic fertilizer.
c) Soil Organic C (SOC) in soil is increased with fertilization.
d) Application of coconut mulch and lime in combination with organic fertilizer and organic fertilizer alone resulted to an increase in soil OC content implying that soil health is improving.
e) Stored C in soil can be improved with liming

Cacao yield can be enhanced with appropriate nutrient management and soil health indicated by increase in soil C and its storage is improved. Thus, giving emphasis to improving soil health with proper soil nutrient management is the key to improve soil and sustainable cacao production. It is important to note that combinations of these soil amendments can have interactions that may enhance or slowdown the rate of nutrient release affecting cacao productivity. Further study is needed to validate the result of the study.

Site 2-North Cotabato

a) Cropping system with optimum shading and planting density (CS 2) significantly increased the yield of cacao by three-folds (763.82 g/tree dried beans) whilst application of lime and organic fertilizer further improved the yield by 60%.
b) Stored C in soil is accumulated through time and is more effective with optimum cropping system (CS 2-53.26 t/ha).
c) Liming and lime combined with organic fertilizer increased the SOC content of the cacao systems, stabilizing the C by increasing the CN ratio and stored significantly higher amount of C in soil (80.22 t/ha and 71.33 t/ha, respectively).

The appropriate light intensity provided by proper planting density in a cacao-cropping system effect The increase in litterfall production in high density cacao plants in CS 2 and the effective growth and sequestration of C applied with lime and in combination with organic fertilizer contributes to the higher cacao yield and greater amount of C stored in soil which effectively contribute to mitigate C emission and improved C storage.

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COMPONENT 2. SHOWCASE THE ADVANTAGES OF THE DIFFERENT SOIL MANAGEMENT TECHNOLOGIES TO CACAO FARMERS AND OTHER PLAYERS IN THE INDUSTRY.

Output 2 .1 Training and IEC materials on effective , regenerative and climate resilient soil management technologies for cacao production developed.

Training and IEC Materials Development

Compendium was developed from the benchmarking activity conducted in the different Regions of Mindanao entitled "Best Land Management for Cacao-based Systems in Mindanao: Compendium of Cacao Systems Evaluation." The compendium is composed of topics to include the background of cacao in Mindanao; biophysical characteristics of cacao-producing areas in Mindanao; cacao-based systems in Mindanao; cacao situation analysis; and the best land management practices (ANNEX 9). The compendium was developed into IEC material (ANNEX 10) and presented in the knowledge-sharing activities. The best soil management practice for cacao-based system was evaluated and included in the field experiments conducted. Key findings reflected in the compendium are shown in Table 1 and 2. Result of the field experiment and benchmark activity (content of compendium) was developed into training and IEC materials (ANNEX 11). The IEC's and training materials were utilized during the knowledge-sharing activities. Leaflets on soil sampling in cacao (6000 copies reproduced) (ANNEX 12) were distributed to the students, farmers, and other stakeholders, as results of soil sampling and analysis are crucial basis for soil management recommendations.

Output 2.2 Planning Workshop with Cooperatives on the Schedules and Program of Knowledge-Sharing Session

The team with its partners undergoes training and workshop for the development of effective training materials and IEC's (ANNEX 13). Eventually, to effectively disseminate the project, Mindanao Development Authority assisted the project team and developed an audio visual presentation (AVP) (ANNEX 14) which was presented in Mindanao Development events and was posted on the FB page of MinDA, shared by the project team.

Table 1. Soil constraints and best management options for cacao in Region XII, Mindanao, Philippines.

SOIL/LOCATION	SOIL PHYSICAL/TOPOGRAPHY CONSTRAINTS	FERTILITY CONSTRAINTS	CLIMATE CONSTRAINTS	MANAGEMENT

REGION XII				
La Castellana Series (President Roxas, Cotabato)	Rolling topography and shallow soil, prone to erosion and drought	Moderately Acidic, Low OC, N, low P, Low fertility, low Ca, very low Mg		Contour planting, appropriate fertilization, OM application, liming (dolomite), mulching
Kidapawan Series (Magpet, Cotabato)	Slight to moderate erosion	Strongly Acidic, very low OC, low N, very low P, very low Ca and Mg		Appropriate conservation measures, fertilization, OC and dolomite application, mulching
San Manuel Series (Tulunan, Mlang)	Low elevation, prone to internal flooding		High temperature and humidity (high disease occurrence)	Dikes and ditches, appropriate cropping system
Quilada Series (Matalam, New Cebu	Internal flooding, and root restrictions, and drought	Low nutrient holding capacity, strongly acidic, very low OM, N, and P, low Ca and Mg	High temperature and humidity (high disease occurrence)	Boring (breaking of hard pan), dikes and canals, fertilization, OM, dolomite
Kudarangan Series (Libungan, Pigkawayan)	Prone to drought, slight to moderate soil erosion	Low nutrient holding capacity, moderately acidic, very low OM, N, and low P, low Ca and Mg	High temperature and humidity (high disease occurrence)	Appropriate fertilization, OM, dolomite application, mulching

Table 2. Soil constraints and best management options for cacao in Region XI and XIII, Mindanao, Philippines.

SOIL/LOCATION	SOIL PHYSICAL/TOPOGRAPHY CONSTRAINTS	FERTILITY CONSTRAINTS	CLIMATE CONSTRAINTS	MANAGEMENT
REGION XIII				
-Bolinao Series (Bigaan, Hinatuan)	Rolling topography and shallow to moderately deep soil, prone to erosion and drought	Strongly to slightly acidic, Low P, very low K, some areas are low in Mg		OM application, appropriate fertilization, $MgCO_3$ application (source of Mg), mulching
-Faraon Series (Nagasaka, Hinatuan)	Rolling to steep topography, very shallow rooting depth for anchorage, prone to drought	Very low P, very low Mg		Microbial inoculant that solubilize P, $MgCO_3$ application, mulching
REGION XI				

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-Camansa series (San Isidro, Davao del Norte)	Internal flooding (16-60 cm), slight to moderate erosion	Moderately acidic, very low OC and N, low P, very low K, very low Mg	High humidity from microclimate, high disease occurrence	Deep dikes and canals, proper system, and cultural mgt (pruning), contouring, nutrient application, OM application mulching, dolomite
-Malalag Series (Tiblawan and Nangan Governor Generoso)	Steep slope, highly prone to erosion	Slightly acidic, low OC and N, low to moderate P, very low P, very low K and Mg	Low rainfall	Mulching, irrigation, OM application appropriate fertilization, dolomite application

Knowledge-sharing activities were conducted by the project team with cacao-stakeholders coming from the different Regions of Mindanao. Initially the team conducted orientation and knowledge-sharing activity of the project which was participated by the 55 participants (>50% women) from USM Research, Development, and Extension Team and the team of Hanyang and Hanshin University of South Korea. Then another session was also conducted in areas of Davao-Calinan, District (91 participants), Paquibato District (52 participants), Marilog District (48 participants), Tugbok District (72 participants), and BARMM Region-Maguindanao (participants). The project was also presented in the Mindanao Farmer's Forum 2024, which was attended by more than 850 participants (ANNEX 15). Additionally, the project was also presented in an International Symposium (IABSS) attended by the different State Universities and Colleges of the Philippines (ANNEX 8) organized by the Visayas State University, Philippines and Hiroshima University, Japan (please see link https://www.vsu.edu.ph/articles/news/2691-goingglobal-vsu-to-hold-int-l-symposium-on-agriculture-and-bioresource-with-hiroshima-university). Key highlights during the presentation is the determination of specific soil management, **liming**, on the stabilization of C in soil which increases the C storage in cacao-systems reducing C emissions. This findings are essential on the management of cacao-cropping system in acid soil, which provides a good productivity of cacao and increasing the C sequestration and storage (SDG 1, SDG 11, and SDG 13).

Additionally the experimental sites in Davao City and North Cotabato were visited with cacao industry players and stakeholders. Visitors include the cacao-cooperatives (MAODFA, LAECS), farmer's federations and farmers, cacao consolidators and traders (CBT cocoa), local government units (LGU), Non-government organizations (CAMP Asia, MEDA), Department of Agriculture (local and national) technicians and heads, teachers, students/trainees, State Colleges and Universities (SUC's), Hanyang and Hanshin University, Mindanao Development Authority (USec and staffs), Philippine Coconut Authority (PCA), and other collaborators. A total of 1,240 visitors were recorded by the team (ANNEX 16). Additionally, the project was also showcased through the AVP posted on the MinDA FB page which garnered 8,300 views (pls see link https://www.facebook.com/MinDAgovphOfficial/videos/949924546689902). The AVP widens the accessibility of the cacao-stakeholders to the project information suppressing the field tour limitations.

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Expected Outcome 1. Significant Increase in Yield of Cacao grown under different soil management technologies/ techniques

The project research study showed that the land management options recommendations to cacao-based cropping systems significantly increase the cacao dry-bean yield by eight-folds, from its prevailing yield of 228 to 1,908 kg/ha (ANNEX 6), where notable pod number increase was observed by the farmers (please see this link https://www.facebook.com/story.php?story_fbid=pfbid029QBG6fdE44sAQLD6iPpKNExbhfheGCRk1BSamVtyQZmy20kLVY8tHXWb6VGzGmN6l&id=100065881391182&mibextid=Nif5oz&__rdr). The increase in yield provided an increase in farmer's income with an estimated annual profit of PhP 232,752 to PhP 551,499.00 per hectare from cacao.

The soil management option developed as technology generated from the project can store C in soil by 61.53 ton/ha in Davao City (ANNEX 6) up to 80.22 tons/ha in North Cotabato (ANNEX 18). This C stored in soil mitigates CO_2 emission which contributes to the SDG 13, sequestering C in soil, lowering C footprint.

Figure 1. Cacao pod development with the recommended soil management technologies.

Expected Outcome 2. Knowledge and Skills gained and Practice by Farmers and other players

Farmer-cooperators adopted the technology through Bayanihan System where farmer participants formed groups and worked together on applying the technologies effective for the cacao

production. (please see link https://www.facebook.com/100009980707532/videos/pcb.2407922109550456/2023232521421721). Individually, farmers were able to prune their cacao trees apply mulch, organic, fertilizers and lime in their area (ANNEX 17). During the interview farmers reported higher yield with the application of technology as compared to the previous practice.

Knowledge-sharing activities also provided information to the stakeholders of Mindanao. In Region XII, a group meeting was conducted with an NGO (Don Bosco Foundation) supporting agriculture farmers in Region XII, provide emphasis to their plan of activities to include the determination of suitable area for cacao production and pursue the technology generated by the project not only in cacao, but also in other crops. The Farmer's federation group of Paquibato District (more than 1,000 members) are now organizing and tapping the project experts and staffs on their plan for expansion of cacao production. Organized by their Federation President Dennis Canaliso, assisted by the Chair on Committee on Agriculture of Davao City Council Marissa Abella, the federation farmer members will expand cacao plantations following the technologies established from the project. This was transpired after the knowledge-sharing activity conducted in Paquibato District. The information from the knowledge-sharing and awareness of the cacao potential also enticed the group from BARMM Region Maguindanao, as the Cooperative Leader is pursuing to expand to at least 1,500 hectares of cacao, following the technology generated. The team sets out, soil sampling activity in the area and determine the feasibility of cacao farming. Several groups in Mindanao, is coordinating the team for collaboration requesting for an additional information drive. Additionally, the Department of Agriculture-Bureau of Agricultural Research, committed to support the farmers and stakeholders of cacao aiming for the sustainable and organic production through the cooperatives and groups linked and supported by the project. This will be one of the provide the sustainability of the farmers and stakeholders of cacao in Mindanao (ANNEX 19).

OTHER OUTPUTS.

The team tapped the expertise of the University of Southern Mindanao, Dr. Harem R. Rocca to conduct chocolate and cocoa tablet as one of the processed product of cacao for sustainability. Farmers in Davao City, North Cotabato, and the team learned the techniques of making chocolate. This was applied by the farmers, and is now processing their cacao as cacao tablet and chocolate as value adding for additional income (ANNEX 20).

4.1.2. Challenges and Solutions

- If actual performance (of output or activity) was lower than planned, please explain the reasons and how it was managed within the project period

The output of the activity corroborated to the plan of the project however certain delays were experienced during the delivery of the activity. One of the major challenges experienced is the changes in the Project Staffs. Moreover, the Project Leader and the Implementing Agency, USM, under the Human Resource Management take an action to hire Project Staffs following the similar selection process and ensured the capability of staff that performed the job.

Additionally, the procurement process of the institution takes time due to the rigid inspection, and undergoes several units, committees, and procurement activities prior to the awarding of materials and equipment. The procurement process of the University is following the Philippine Procurement Law (https://legacy.senate.gov.ph/republic_acts/ra%2012009.pdf). Despite this, the Project Team managed this by continuous and persistent follow-up of the documents in the financial and administrative unit of the implementing agency.

3.1. Achievement(s) in Gender and Other Cross-Cutting Issues

- Based on the considerations in the BKCF Guideline and Proposal, please mention the achievement regarding the Cross-Cutting Issues including gender mainstreaming during the project

The role of women in the implementation of the project is one of the priority. Initially, the project was led by a woman, and the Project Team is composed of >50% women. The overall overseer of the Project, VPRDE of USM, Dr. Debbie Marie Verzosa is also a woman.

In the course of mentoring activity, the role of women in cacao production is significant as

(17) females and fifteen (15) males participated. It was noted also that during the knowledge-sharing activity, more than 50% of the participants were female.

It was also observed that activities in the cacao production such cacao tablet processing is done by women, wherein majority of the attendees during the training for cacao tablet and chocolate processing were women. Additionally, adoption of the technology is effectively performed by women cacao cooperators, indicating that women empowerment.

3.2. Covid-19 recovery approaches

- Based on the considerations in the BKCF Guideline and Proposal, please mention the achievement regarding the Covid-19 recovery approaches during the project

All of the project team undergoes vaccination ensuring safety from COVID19 pandemic and other types of pandemic. As part of the Implementing Agency's programs, all of the staffs, yearly underwent flu/pneumonia vaccination.

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3.3. Risk management

- Please elaborate on specific challenges and risks confronted throughout the project and explain how your organization managed and describe lessons learned

The team was challenged by the hefty cost in travelling to the experimental fields due to the increasing price of fuel. However, the Project Team was able to employs cost-cutting measures in order to deliver initial output based on the implementation work plan. Catch-up plans were also formulated to deliver the output on time.

The team was also challenged by the availability of the schedules of the target cooperative/farmer groups for the benchmarking activity. However, the Project Team was able to get the final schedule for the benchmarking through proper coordination with the facilitation of Mindanao Development Authority (MinDA) and UNORKA Mindanao. Catch-up plans were also formulated to deliver the output (benchmarking activity is currently on-going, until the end of April 2023).

In the course of mentoring activity, the team was challenged by the availability of the schedules of the farmer cooperators in attending the activity and the untoward weather conditions in the scheduled date of activity. However, the team manages to continue the mentoring activity and spark the farmer's interest to continue the capability building activities. Catch-up plans were also formulated to deliver the output.

In the laboratory analysis, the team was challenged by the delays in some analysis conducted due to malfunctioned equipment; UV Vis Spectrometer used for conducting analysis for Phosphorus (P) and the Atomic Absorption Spectrophotometer (AAS) used for conducting analysis for macro and micro elements. Since other analysis was not conducted due to these issues, the project leader found other ways to provide the expected output of the project. Catch up plans and other alternative solutions were formulated and discussed during the project monthly meetings to cope up with these unforeseen problems.

Another is the declaration of the dry season and El Nino. The institution of the project team declares and implements the adjusted time of work to minimize the effect of experiencing higher heat index in the area that will cause health risk to every USM personnel. This was quite challenging to the project team but still manages to provide the expected outputs in different ways and strategize the allotted work time schedule to do well even if experiencing this hot weather conditions. Additionally, the occurrence of El Nino is of advantage, as it tested the effectiveness of land management strategies employed on field and spark the adoption of the most effective technology by the farmers.

4. SUSTAINABILITY MEASURES

- Please briefly explain how beneficiaries were strengthened to ensure that there are lasting results from your project. Explain what you have done to prepare for your exit strategy and the transfer of the project outputs to BIMP-EAGA.

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One of the activities conducted by the team is the training on the cacao tablet and chocolate making to the cacao cooperators. This will be one of the value adding activity skills to their cacao production to continue the profit whenever price of cacao beans fluctuate. Furthermore, continuous monitoring is done through partner coordination, regarding the adoption of the technologies other than the trained farmer cooperators. Additionally, the project team leader, through its Agency's Extension Program, is continuously conducting knowledge-sharing activity for further expansion and adoption of the technology, consequently boosting the cacao industry in Mindanao. Reproduction of leaflets and IEC materials developed from the project is continuously done which is distributed during the different University activities and showcases.

Agencies from the government, like Mindanao Development Authority, conducted a 2024 Farmer's Forum, wherein government commitments to support the cacao and tropical fruit industry were reiterated. Government agencies such as Department of Agriculture, Department of Trade and Industry, Local Government Units in the Different Mindanao Regions pledge their support during the 2024 Mindanao Farmer's Forum.

Additionally, the team also assisted the GGGI Philippines in crafting the proposal entitled "Climate Proofing and Scaling Up of Cacao Enterprise for Small-holder Farmers in Mindanao through Climate Change Adaptation and Innovation in Cacao Value Chain."

1. **Percent Budget Utilized**

68%

Component	Allocation (whole duration)	Allocation (3rd-4th tranche)	Utilized (3rd-4th tranche released budget)	% Utilized (3rd-4th tranche released budget)	% Utilized (whole duration)
Personnel	2,100,664.19	1,949,335.24	1,754,199.85	89.99%	83. 51%
Travel Expenses	540,533.7	551,039.70	286,430.12	51.98%	52.99%
Other Supplies and Materials Expenses	4,519,179.01	2,511,889.00	286,430.12	79.01%	43.91%
Total	7,160,376.91	5,012,263..94	4,025,225.89	80.31%	56.22%

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2. **Attachments:**

ANNEXES

Annex 1. Monitoring and Evaluation Activities

Figure 8. Hybrid Project Monthly Meeting held at College of Agriculture- Annex Building, Soil Science Division Office on September 5, 2024

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Figure 9. Project Monthly Meeting held at College of Agriculture- Annex Building, Soil Science Division Office on November 15, 2024

Annex 2. Updates on Completion Mentoring Activity

The completion of the mentoring activity and the workshop on Information, Education, and Communication (IEC) Materials played a crucial role in the project 'Developing Land Management Options for Diverse Cacao-Based Systems in Mindanao.' These activities recognized the efforts of the cacao farmer-beneficiaries who actively participated in the project.

On October 26, 2024, the active participation of the cacao beneficiaries underscored their dedication. As a gesture of appreciation, they were provided with cooperators' kits and IEC materials to aid their cacao farming efforts and boost income through the adoption of advanced technologies. The stakeholders and proactive cacao beneficiaries were genuinely appreciated for their collective contributions, which played a crucial role in the success of the event.

Figure 10. The Marketing Manager of SCMC delivers a welcome speech to the participants.

Figure 11. The project leader presented the outcome of the experimental output of the project.

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