Coconut-based Systems in the Philippines: Intensification and Diversification with Climate-Smart Agriculture

Working Paper No. 367

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

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Photos: International Institute of Rural Reconstruction

Abstract

To generate evidence on increasing household resilience to climate change through increased farm income while also generating social benefits, a Cost-Benefit Analysis (CBA) study was undertaken in 2021 by the International Institute of Rural Reconstruction (IIRR) with support from the International Research and Development Center (IDRC).

For the Philippine component of the study, the study determined the financial and social benefits of raising native pigs and planting fruit trees and black pepper gained by the households from Guinayangan, Quezon and Ivisan, Capiz.

The combination of planting fruit trees and black pepper as well as native pig production are viable when they are integrated with the main sources of livelihood of the villages of Himbubulo Weste and Magsaysay (Guinayangan). The study showed that the said villages will continue to financially benefit from the CSA interventions despite facing possible threats in the market. The funds invested by the community members in implementing the CSA interventions are expected to be recovered within three years after 2020. Diversifying farm production should be encouraged and practiced by more households as it serves as a cushion to minimize loss of livelihood for the family, and could help households maintain a steady and reliable income even if one of the crops failed or incurred losses.

The Climate-Smart Village effort also generated social benefits such as economic empowerment, social inclusiveness and contributed to knowledge on better resource management. Social support mechanism was nurtured, and environmental benefits are accrued such as sequestration of CO2, minimizing run-offs and soil erosion, and increasing soil nutrient content as result of residue management associated with multi storied cropping.

Keywords

Climate-smart agriculture; climate-smart villages; coconut agroforestry; intercropping

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Acronyms

BCR	Benefit-Cost Ratio
CBA	Cost Benefit Analysis
CSA	Climate-smart agriculture
CSV	Climate-Smart Village
IDRC	International Development Research Center
IIRR	International Institute of Rural Reconstruction
LGU	Local government unit
NPV	Net Present Value

Introduction

As climate change has globally influenced weather patterns and conditions, Southeast Asia is experiencing increasing occurrences of rising ambient temperature, prolonged rainfall patterns, droughts, and extremely strong typhoons. To ease the impact of climate change on the livelihood of farming communities, development programs and projects which incorporate climate adaptation options are currently being implemented. These options focus on an integrated scheme that utilizes technological and institutional interventions to achieve resilient and environmentally sustainable food production systems.

The Climate-Smart Village (CSV) approach is one of the initiatives developed to address the impact of climate change on marginalized rural households. By transforming farming communities into climate resilient sites, the CSV approach helps identify and establish agricultural technologies and farming systems that can enhance productivity, increase farm income, and withstand the effects of climate change (Aggarwal, et al., 2018). Appropriate options "differ based on the CSV site, its agroecological characteristics, level of development, and capacity and interest of the farmers and of the local government" (Aggarwal, et al. 2018). The CSV approach is comprised of a series of steps: baseline assessment, CSV design, creating evidence, and scaling. Baseline assessment involves generating data such as agricultural vulnerabilities to climate change at the household/village level, climate data, existing agricultural practices, and natural and socio-economic resources. These information are used as inputs to the CSV design aimed to develop a package of practices and technologies that are acceptable to the stakeholders, and are suitable to the available resources and the general conditions of the village or households. Afterwards, the CSV design are promoted for adoption at the village level. Baseline assessment and CSV design employ a consultative approach wherein community stakeholders are involved in the identification, prioritization and development of the package of technologies to be promoted, and then scaled. The third step, Creating Evidence, is the evaluation of the identified agriculture options after their adoption. The financial and social benefits, costs, and trade-offs of the technologies are assessed in this step. Promising interventions are made available to government and nongovernment entities for scaling up

to locations with similar agro-ecological characteristics. The last step, Scaling, involves the promotion of agriculture options found successful on a wider scale.

The International Institute for Rural Reconstruction (IIRR), in collaboration with the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and the International Development Research Center of Canada (IDRC), as well as local government units in Cambodia, Myanmar and the Philippines, implemented the Climate-Smart Village (CSV) approach. A number of climate-smart agriculture (CSA) options were identified through consultative meetings with farmer representatives including field trials in villages prior to their actual implementation in 2018. Other households followed suit in adopting the interventions in 2019 and 2020. In the Philippines the focus was on small livestock i.e., native pigs and multi storied agroforestry (planting of intercrops, e.g. fruit trees, black pepper and root and tuber crops).

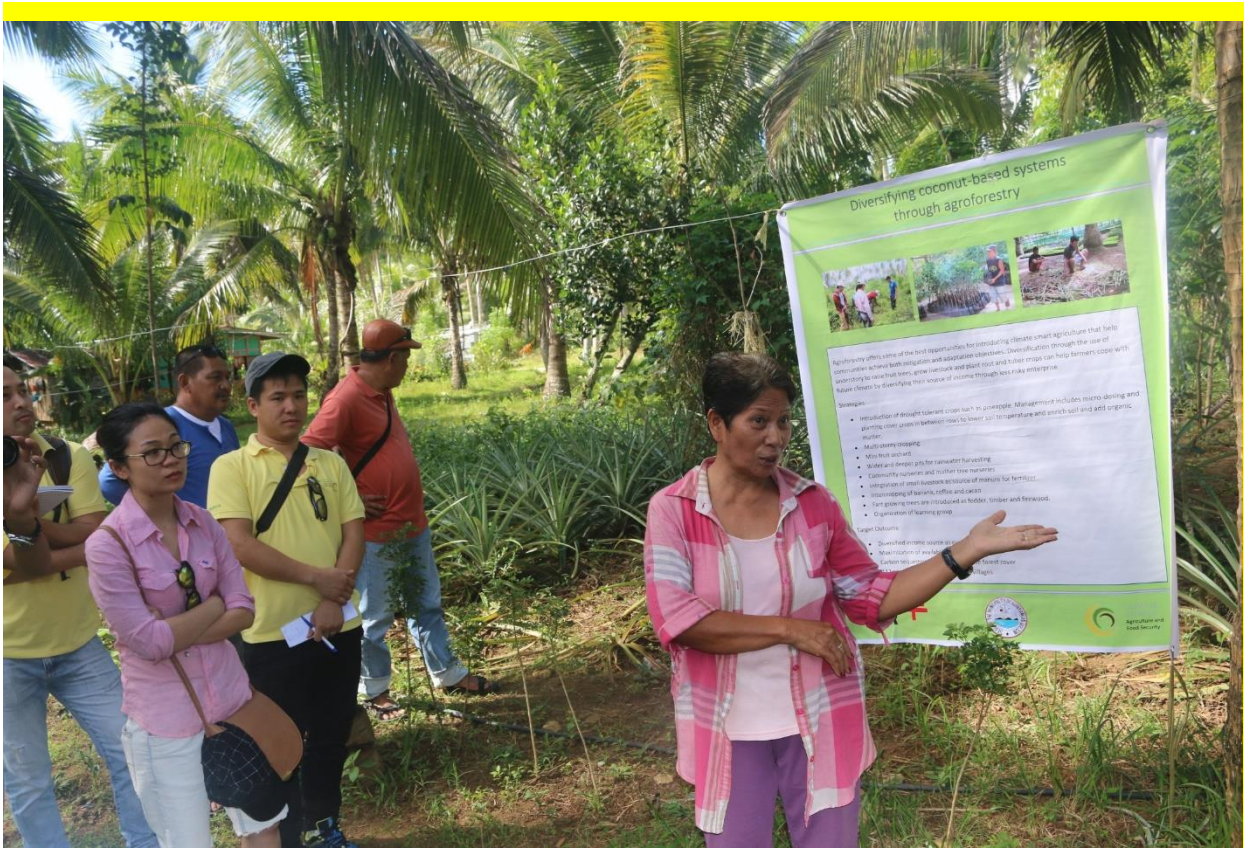

Image 1. Diversifying coconut-based systems through agroforestry. Source: IIRR

To support the objective for establishing evidence, a Cost-Benefit Analysis (CBA) study was conducted in 2021 to determine whether the agricultural interventions achieved the objective of increasing household resilience to climate change through increased farm income while generating social benefits. Short of an Impact Analysis where socio-economic data are compared with a counterfactual, the CBA limited its objective to the determination of the financial as well as the social benefits that the rural households and the villages as a whole have gained and will generate in the coming years from the climate-smart agriculture interventions.

The general objective of this study was to determine the socio-economic benefits of instituting the Climate-Smart Village (CSV) approach in Cambodia, Myanmar and the Philippines[1]

The specific objectives of the study were to:

1. Estimate the net income generated from a selected climate-smart agriculture (CSA) option that was adopted by the village households in the project sites;

2. Determine the combined net financial benefits from the package of CSA options that were implemented in the project sites;

3. Determine the social benefits that were gained by the village households where the project was implemented.

[1] This working paper will solely focus on the analysis of overall CSVs in the Philippines and of its social and environmental benefits.

Image 2. Multi storied cropping within coconut-based systems that can improve micro climate and other ecosystem services. Image source: IIRR

Analytical framework

The Cost-Benefit Analysis evaluated the overall Climate-Smart Village (CSV) approach that was applied by IIRR in increasing climate change resilience of the rural communities. Returns to investments (project and household funds, if any) that were and will be generated by combined climate-smart agriculture options were also determined.

In the Philippines, the study focused on determining the financial and social benefits of intercropping coconut with fruit trees and/or black pepper and raising native pigs.

Methodology

Analysis of the CSV approach

Cost benefit analysis of the CSV approach was conducted to determine whether the combined benefits generated by a portfolio of CSA options exceed the accompanying costs to implement these options. It also measured the returns on the farmers' capital in relation to the CSV project. The analysis focused on the aggregate households instead of the individual household. As such, the values used were totals instead of averages per household. The financial tools that were used for this type of analysis were the Net Present Value (NPV), and the Benefit-Cost Ratio (BCR). We can conclude that the returns (benefits) exceed the costs if the value of the NPV is positive and if BCR is greater than 1. In mathematical terms, a positive NPV and a BCR > 1 are obtained if the sum of the present values of the stream of discounted benefits is greater than the sum of the present values of the stream of discounted costs. The present values are generated by discounting the estimated benefits and costs using the opportunity cost of money as the discount rate. The discount rate that was used in this study was 9%. This was based on the Asian Development Bank's discount rate (ADB, 2017).

The analysis utilized an annual cashflow table incorporating generated revenues (benefits) and incurred costs from 2018 to 2020 from the portfolio of adopted CSA options. The cashflow table also included projections of the revenues and costs from the CSA options from 2021 to 2035.

Analysis of social benefits

Social benefits brought about by the agricultural interventions instituted by the CSV project were identified using both qualitative and quantitative data. These were social benefits related to:

1. Social learning
2. Economic empowerment
3. Inclusiveness and gender
4. Capacity to support other stakeholders
5. Contribution to knowledge sharing
6. Engagement of village/community/local leaders
7. Instituting support system mechanisms

Social learning

Social learning is simply understood as learning through observation of other people's behavior. In this study, the positive impacts of the CSV interventions, when witnessed by other residents of the village, could trigger an increase in the number of adopters of the technologies. People learn from each other in ways that benefit the wider community. The late adopters were convinced to test the interventions because they have witnessed the beneficial effects on the early adopters themselves.

Economic empowerment

Economic empowerment is defined as "enabling poor people to think beyond immediate daily survival and to exercise greater control over both their resources and life choices" (Combaz and McLoughlin, 2014). In the context of the CSV project, this social benefit may be represented by:

1. Improvement in household liquidity as a result of additional revenue generated from the CSV interventions

2. Improvement in household food security

3. Access to credit

Inclusiveness and women

Social inclusion refers to the "removal of institutional barriers and the enhancement of incentives to increase the access of diverse individuals and groups to development opportunities" (FAO, 2016). Other literature refers to it as women empowerment (Buvinic and Nichols, 2013; Cheston and Khun, 2002). For the purpose of this study, the indicators that were used to determine inclusiveness were:

1. Entrepreneurial opportunities for women (women running own income-generating activity)

2. Equal access to training courses and other media to increase technical knowledge in agriculture

3. Equal access to credit and other productive resources

4. Equal opportunity to join community organizations

Contribution to knowledge sharing

Knowledge sharing is one of the components of a broader discipline known as Knowledge Management which includes identifying, capturing, evaluating, as well as storage and retrieval of information (Koenig, 2018). To verify the presence of knowledge sharing by the CSV project, finding out the process by which information regarding agriculture interventions among rural village households were shared becomes an important task. Seminars and training courses conducted through the CSV project are indicators that the project was an instrument for sharing knowledge among the villagers. In addition, determining whether villagers share among each other their experiences and information obtained from sources of new knowledge such as CSV training courses and print media can also be used to determine the existence of this social benefit.

Capacity to support other stakeholders

The indicators to verify whether villagers possess the capacity to support other members of the community can be drawn from variables used as indicators of other social benefits. The indicators may vary from knowledge shared to another farmer that requires the information at one end to a household's capability to provide a loan to a neighbor as a result of an improved farm productivity.

Presence of support systems mechanisms

Social support systems provide a buffer against adverse life events. Thurston (1996) identified two sources of social support:

1. Formal (institutions, agencies, professionals)

2. Informal (extended family, friends, church, social clubs)

The success of the CSV project is dependent on support mechanisms, both formal and informal. The indicators to determine the presence of support system mechanisms are:

1. Formal –presence of institutions such as village savings and loan associations and establishment of formal ties with agricultural extension agencies

2. Informal - presence of farmer associations/groups and other social networks established by the project.

Engagement of village/community/local leaders

The participation of local leaders in the planning and implementation of the CSV project is a significant factor in ensuring its success. Their involvement is key in generating acceptance and support of the project among community members. The institutions represented by local officials can provide both technical and logistical support required by the project. This study examined the forms of support that were provided to the CSV project by the local government units (LGUs).

Image 3. Mungbean intercropped with coconut. Source: IIRR

Data collection

Survey method

Primary data was collected through personal interview of respondents using a set of questionnaires designed for this study. The number of households interviewed was determined using the Krejcie and Morgan equation for determining sample size.[2] All households were included in the survey (full enumeration) in cases where the total population of households participating in the CSV project were less than 20. The list of participating households was provided by the IIRR. The resulting number of households and their location in the Philippines are presented in Table 1.

[2] Krejcie and Morgan equation:

$n = [(Z\ score)^2 \times N \times SD \times (1-SD)]/[(Margin\ of\ error)^2 \times (N-1)+(Z\ score)^2 \times SD \times (1-SD)]$

n = sample size, Z score = 1.96 for 95% confidence level, SD = Standard Deviation = 0.5

N = population size, Margin of error = 0.1

Table 1. Number of households interviewed by location (Philippines)

Municipality	Barangay	No. of Households
Ivisan, Capiz	Balaring	6
	Malocloc Sur	11
Guinayangan, Quezon	Himbubulo Weste	29
	Magsaysay	26
	Capuluan Tulon[3]	35
Total		**107**

Key Informant Interviews (KII)

Village and municipal officials were interviewed as Key Informants. They were good sources of information regarding the support system in the implementation of the CSV project in their localities.

In the Philippines, a number of households that were surveyed were also selected as key informants to generate an in-depth analysis of the operation of their CSA enterprises. Variables such as time spent in raising native pigs, record keeping of income and expenses, and manner by which selling price of hogs is determined between buyer and the seller were details that were obtained through KIIs.

Secondary data

The secondary data that were collected were:

- IIRR project cost by country directly spent for the implementation of the CSA options
- Farm gate prices of fruits to be harvested
- Retail prices of fertilizer by type of fertilizer

[3] In Capuloan Tulon, the number of households that were included in the study was eventually reduced from 40 to 35 after five of the households that were surveyed were removed because these families were earning more than PhP 500,000.00 annually from coconut farming. Financial data coming from these households would be different from households with a much lower annual income and would, therefore, unnecessarily skew the data.

Objectives for the cost-benefit analysis of the Philippines-based CSV

The study (for the Philippine component) was undertaken with the following objectives:

1. To determine the combined net financial benefits gained from raising fruit trees, black pepper and native pigs; and

2. To identify the social benefits that were gained by the households from the CSV project.

Study sites

The Cost-Benefit Analysis of the CSV approach evaluated the combined effects of growing fruit trees, black pepper and native pigs in Barangay Himbubulo Weste and Magsaysay in the Municipality of Guinayangan, Province of Quezon. For the analysis of social benefits, Barangay Capuloan Tulon, located in the Municipality of Guinayangan, Province of Quezon and Barangays Malocloc Sur and Balaring, located in the Municipality of Ivisan, Province of Capiz are included aside from the mentioned villages[4]. The geographical locations of the project sites are shown in Figures 2, 3, and 4.

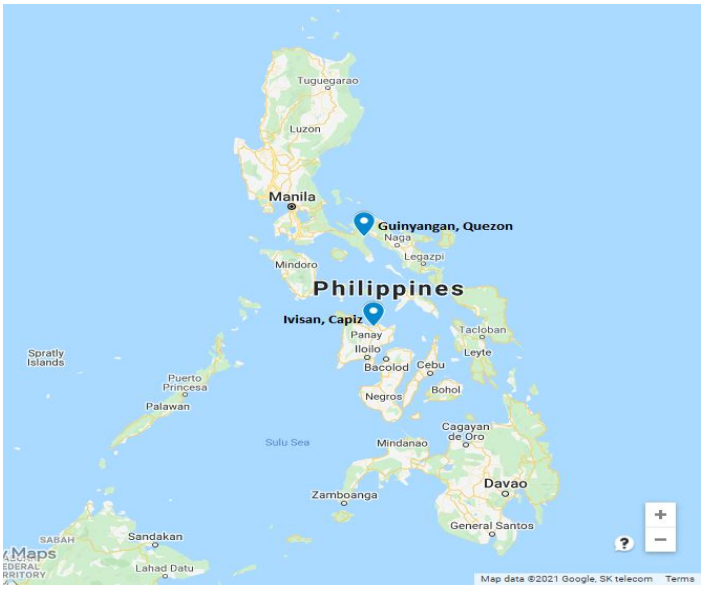

Figure 1. Geographical location of Guinayangan, Quezon

[4] Data collection in Capuloan Tulon, Guinyangan, Quezon and Malocloc Sur and Balaring, Ivisan, Capiz are done in conjunction with the survey for the cost benefit analysis of raising native pigs as part of the CSV project.

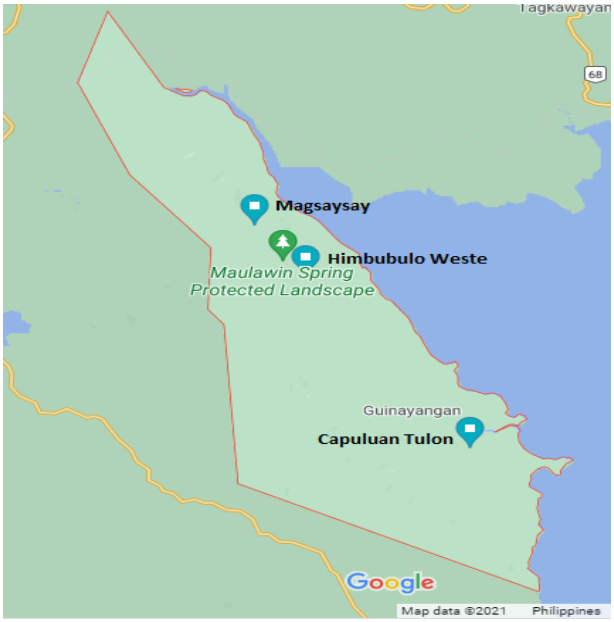

Figure 2. Geographical location of Capuloan Tulon, Himbubulo Weste and Magsaysay in Guinayangan, Quezon

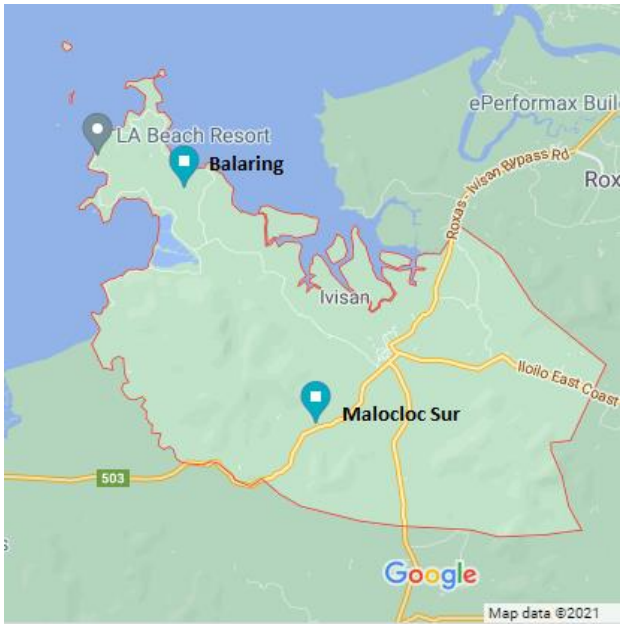

Figure 3. Geographical location of Malocloc Sur and Balaring, Ivisan, Capiz

Cost benefit analysis of the CSV approach to improve climate resilience of marginalized rural villages in Himbubulo Weste and Magsaysay, Guinayangan, Quezon

Demographic and economic profile of households

Number of persons per household

Of the 29 households that were interviewed in Himbubulo Weste, 55% had one to three household members in 2020. Thirty-four percent had four to six members while the remaining 10% had seven to nine persons living in the same household (Table 2). Altogether, there were a total of 110 persons residing in the 29 households in Himbubulo Weste.

In Magsaysay, majority (65%) of the 26 households that were interviewed had 4 to 6 household members. This was followed by households with only 1 to 3 members (27%). Two households had 7 to 9 members. A total of 97 persons were living in the households in Magsaysay.

Table 2. Number of persons in a household, Himbubulo Weste and Magsaysay, Quezon, 2020

Persons per household	Himbubulo Weste		Magsaysay		Total	
	Frequency	%	Frequency	%	Frequency	%
1 to 3	16	55%	7	27%	23	42%
4 to 6	10	35%	17	65%	27	49%
7 to 9	3	10%	2	8%	5	9%
Total	**29**	**100%**	**26**	**100%**	**55**	**100%**

Age distribution

The households in the two barangays shared a relatively equal distribution of members who are young adults and those who were in the middle age bracket (Table 3). Of the 110 household members, 35% were 19 years old or younger. Young adults (20 to 39 years old) represented 21% of the population while 38% belonged to the 40 to 59 year-old bracket. There were 8 senior citizens in Himbubulo Weste.

In Magsaysay, there was also a large number (40%) of members who were 19 years old or younger. Young adults (20 to 39 years old) made up 32% while 33% belonged to the middle age group (40 to 59 years old). The rest (5%) were senior citizens.

Table 3. Age distribution of household members, Himbubulo Weste and Magsaysay, Guinayangan, Quezon, 2020

Age	Himbubulo Weste		Magsaysay		Total	%
	Frequency	%	Frequency	%		
0 to 9	16	15%	16	16%	32	15%
10 to 19	22	20%	23	24%	45	22%
20 to 29	15	13%	15	16%	30	15%
30 to 39	8	7%	6	6%	14	6%
40 to 49	16	15%	14	14%	30	15%
50 to 59	25	23%	18	19%	43	21%
60 to 69	6	5%	5	5%	11	5%
70 and older	2	2%			2	1%
Total	**110**	**100%**	**97**	**100%**	**207**	**100%**

Educational attainment

Only one-third or 37 of the household members in Himbubulo Weste completed at least a high school education. The category is composed of eight (7%) husbands, 11 (10%) wives, and 17 (15%) sons/daughters. There were 20 (18%) husbands and 16 (14.5%) wives who had some primary and some high school education. One husband and one wife, on the other hand, earned a college degree (Table 4).

Table 4. Educational attainment by type of household member, Himbubulo Weste, Quezon, 2020

Educational attainment	Husband	Wife	Son/ daughter	Son-in-law	Grand child	Total	Percent
Below school age/ No education	1		5		2	8	7%
Nursery Or Kindergarten				1		1	1%
Some Elementary School	10	6	8		1	25	23%
Completed Elementary Sch.	5	7	1	1	1	15	14%
Vocational Trng. Certificate	1		2			3	3%
Some High School	4	3	10		4	21	19%
Completed High School	6	10	8			24	22%
Some College	1		9	1		11	10%
Completed college	1	1				2	2%
Total	**29**	**27**	**43**	**3**	**8**	**110**	**100%**

The level of educational attainment in Magsaysay was almost the same as that of Himbubulo Weste. Only 12% of the population graduated from high school and 9% reached college or earned a college degree. Majority (66%) of the households either had some high school or primary education or a vocational training certificate (Table 5).

Table 5. Educational attainment by type of household member, Magsaysay, Quezon, 2020

Educational Attainment	Husband	Wife	Son/ Daughter	Grand child	Total	Percent
Below school age			4	3	7	7%
Nursery Or Kindergarten			4	1	5	5%
Some Elementary School	12	6	7	1	26	27%
Completed Elementary Sch.	4	3	2		9	9%
Vocational Trng. Certificate			2		2	2%
Some High School	5	6	16		27	28%
Completed High School	3	5	4		12	12%
Some College		1	5		6	6%
Completed College			3		3	3%
Total	**24**	**21**	**47**	**5**	**97**	**100%**

Farm size

The land area used by farmers for coconut production in Himbubulo Weste and Magsaysay mostly ranged from 0.5 hectare to less than 2.0 hectares (Table 6). Forty two percent grew coconuts in farms with an area of 1.0 hectare or less while 44% operate farms with areas between 1.1 to 2.0 hectares. There were more households (34%) in Himbubulo Weste using an area of 0.5 hectare or less than in Magsaysay (8%). It was also noted that 19% of the households in Magsaysay grow coconuts in an area larger than 2.0 hectares.

Table 6. Farm size, Himbubulo Weste and Magsaysay, Guinayangan, Quezon, 2020

Farm Size	Himbubulo Weste		Magsaysay		Total	%
	Frequency	Percent	Frequency	Percent		
0.5 ha or less	10	34%	2	8%	12	22%
0.51 to 1.0 ha	4	14%	7	27%	11	20%
1.1 to 1.5 ha	5	17%	4	16%	9	17%
1.51 to 2.0 ha	10	34%	5	19%	15	27%
2.1 ha or more			5	19%	5	9%
No farm			3	11%	3	5%
Total	29	100%	26	100%	55	100%

Household income

In 2020, 38% of the households in Himbubulo Weste and 63% in Magsaysay fell below the poverty line (PhP 56,210.00 per annum), based on combined household income from various sources (Table 7).[5] At the other end of the income scale, 17% of the households in Himbubulo Weste received an income of more than PhP 200,000.00. In contrast, the income of households in Magsaysay did not exceed PhP 200,000.00. In general, almost half (47%) of the households in the two barangays were considered poor while 22% were slightly above the poverty threshold.

[5] USD 3.20 per day (World Bank estimate) @ PhP 48.00/USD x 365 days

Table 7. Annual household income, Himbubulo Weste and Magsaysay, Guinayangan, Quezon, 2020

Annual Income (PhP)	Himbubulo Weste		Magsaysay		Total	%
	Frequency	%	Frequency	%		
< 56,210	11	38%	15	58%	26	47%
56,211 to 100,000	7	24%	5	19%	12	22%
100,001 to 150,000	3	10%	4	15%	7	13%
150,001 to 200,000	3	10%	2	8%	5	9%
200,001 to 250,000	1	3%			1	2%
> 250,000	4	14%			4	7%
Total	29	100%	26	100%	55	100%

Almost half (49%) of the income earners depended on coconut farming as their source of livelihood (Table 8). Income from coconuts came from selling copra and mature nuts. The average incomes in Himbubulo Weste was PhP 52,839.00 and about PhP 60,834.00 were generated by the Magsaysay households. In terms of off-farm income, skilled and unskilled employment appeared to be an important source of income in Himbubulo Weste. About 25% of the household members were employed in those categories. On the average, skilled workers earned a total of PhP 106,933.00 while unskilled laborers received PhP 171,000.00 per annum. In Magsaysay, working as a casual laborer was also a good source of income where the income received in 2020 was about PhP 16,769.00.

Table 8. Sources of household income, Himbubulo Weste and Magsaysay, Guinayangan, Quezon, 2020

Sources of Income	Himbubulo Weste				Magsaysay				Total	%
	Frequency*	%	Range	Average	Frequency*	%	Range	Average		
Income from coconut farming	27	52%	4,056 to 282,300	52,839	19	46%	5,000 to 188,000	60,834	46	49%
Income from fishing/game hunting	0	0%			1	2%	3,000	3,000	1	1%
Income from nonfarm business	5	10%	1,000 to 10,000	5,800	0	0%			5	5%
Income from casual labor	5	10%	3,000 to 15,000	9,100	13	32%	2,000 to 96,000	16,769	18	19%
Income from skilled employment	9	17%	24,000 to 576,000	106,933	0	0%			9	10%
Income from unskilled employment	4	8%	48,000 to 432,000	171,000	6	15%	1,500 to 12,000	6,875	10	11%
Others (pension, 4Ps payouts, etc.)	2	4%	24,000 to 84,000	54,000	2	5%	2,600 to 16,200	9,400	4	4%
Total	52	100%			41	100%			93	100%

* Multiple responses

Intercropping fruit trees and black pepper with coconuts as a CSV intervention (Agroforestry)

Planting of intercrops started in 2018 until 2020. In Himbubulo Weste, coffee ranked number one in terms of the total number of trees planted (2,406 trees) by the households (Table 9). This was followed by banana (1,227 suckers) and guyabano (1,031 trees). In Magsaysay, cacao trees were the largest (4,307 trees) and they accounted for about 69% of the total population of fruit trees in the area. Coffee was ranked second with a population of 943 trees. There were no growers of papaya and marang in the village. Taking the tree population in Himbubulo Weste and Magsaysay together, cacao, coffee, banana, and guyabano had the largest population count among the other choices of planting materials.

Image 4. Cacao diversification. Source: IIRR

Table 9. Number of living trees planted by year, Himbubulo Weste and Magsaysay, Guinayangan, Quezon, 2018 to 2020

Plant	Himbubulo Weste					Magsaysay					Total	Percent
	2018	2019	2020	Sub-Total	Percent	2018	2019	2020	Sub-Total	Percent		
Coffee	655	475	1276	2,406	33%	255	235	453	943	15%	3,349	25%
Cacao	302	200	370	872	12%	2127	965	1215	4,307	69%	5,179	38%
Guyabano	306	285	440	1,031	14%	32	46	69	147	2%	1,178	9%
Rambutan	348	84	108	540	7%	48	40	39	127	2%	667	5%
Mangosteen	16	302	10	328	4%	1	0	1	2	0.03%	330	2%
Jackfruit	209	18	16	243	3%	9	6	0	15	0.24%	258	2%
Durian	0	0	17	17	0%	1	0	1	2	0.03%	19	0%
Papaya	0	0	13	13	0%	0	0	0	0	0%	13	0%
Lanzones	21	1	25	47	1%	5	1	5	11	0.18%	58	0%
Calamansi	276	10	42	328	4%	105	10	0	115	2%	443	3%
Banana	517	280	430	1,227	17%	12	14	149	175	3%	1,402	10%
Marang	0	2	0	2	0%	0	0	0	0	0%	2	0%
Black pepper	246	0	37	283	4%	170	120	120	410	7%	693	5%
Total	**2,896**	**1,657**	**2,784**	**7,337**	**100%**	**2,765**	**1,437**	**2,052**	**6,254**	**100%**	**13,591**	**100%**

Expected revenue from the intercrops

The intercrops present in the two villages, being perennials (excluding banana and papaya), have not generated revenues for the households at the time the study was conducted. To determine the potential income that can be earned from the intercrops, a set of assumptions related to the trees' fruit bearing capacity were used as basis for the estimates. The assumptions included data on yield per tree, number of years to reach fruit bearing stage, productive life span, as well as farmgate price of the fruits when sold (Table 10). Furthermore, this study assumed that the yield per tree of all perennials will increase by 5% annually.

Table 10. Assumptions used in estimating revenue for fruit trees and black pepper, Himbubulo Weste and Magsaysay, Guinayangan, Quezon

Plant	Yield per tree (Kg)	Farmgate price (PhP/Kg)	Productive life (Years)	Years to reach productive stage	Comments
Coffee	2 (green beans)	150	50	5	
Cacao	6 (wet beans)	30	25	5	
Guyabano (Soursop)	38.6	20	25	5	
Rambutan	48	30	25	5	Female trees 57%
Mangosteen	21.2	50	25	8	
Jackfruit	70	27	25	5	
Durian	27	37	25	5	
Lanzones	40	70	25	5	grafted seedlings
Calamansi	75	31	25	5	
Banana (Saba)	14.35	14	1	10 to 15 mos	
Papaya	18	15.4	3	8 mos	
Marang	60	12	25	5	
Black pepper	1.5	120	12 to 20	4	

Table 11 presents an overview of the estimated revenue from the intercrops for the period 2018 up to 2025 and ten years hence (2035) in Himbubulo Weste and Magsaysay. The perennials are expected to have a productive life span of over 25 years, thus, projecting up to 2035 falls within that timeframe. The projection shows that by 2025, all trees planted (except Marang) between 2018 to 2020 were assumed to be bearing fruits that can be sold

commercially. The highest projected earners in Himbubulo Weste by 2035 would be calamansi (PhP 1.41 M), guyabano (soursop) (PhP 1.17 M) and coffee (PhP 1.07 M). Calamansi had the highest expected yield per tree. The projected income from calamansi started at PhP 641,700.00 in 2023 and with a 5% increase in yield per year, would reach PhP 1.41 M by 2035. Guyabano and coffee trees had the largest tree population in the village. Coffee also had the highest farmgate price among the intercrops that were planted thereby contributing further to a relatively high income. Additional trees reaching their fruit bearing age accounted for the increases in revenues of fruit trees from 2023 to 2025.

Among the trees planted by the households in 2018, only banana and papaya would have yielded fruits which were assumed to be sold the following year. In fact, the estimated revenue in banana showed an increase from PhP 103,865.00 in 2019 to about PhP 166,144.00 in 2020. By 2025 up to 2035, the revenue was estimated to have reached PhP 246,504.00. On the other hand, the estimated revenue for papaya was pegged at PhP 3,604.00 in 2019 until 2035. In the absence of the actual number of papaya fruits that were harvested, a conservative estimate assumed that each tree produces 18 kilograms of papaya priced at PhP 15.40 per kilogram.

In Magsaysay, cacao beans generated an estimated amount of PhP 382,860.00 in revenue in 2023 and was projected to increase to PhP 931,550.00 by 2035. This was followed by coffee with an estimated revenue of PhP 76,500.00 in 2023 and PhP 438,871.00 by 2035. Increases in income between 2023 to 2025 were due to additional trees reaching their fruit bearing age. When combined, the total estimated revenue in the two barangays by 2025 will be PhP 5.11 Million and will increase to PhP 8.52 Million by 2035.

Table 11. Estimated revenue from intercrops, Himbubulo Weste and Magsaysay, Guinayangan, Quezon

9	2018	2019	2020	2021	2022	2023	2024	2025	2035
Revenue H. Weste Agroforestry									
Coffee green beans	0	0	0	0	0	196,500	339,000	721,800	1,066,427
Cacao wet beans	0	0	0	0	0	54,360	90,360	156,960	231,901
Guyabano	0	0	0	0	0	236,232	456,252	795,932	1,175,954
Rambutan	0	0	0	0	0	126,522	157,194	196,812	290,781
Mangosteen	0	0	0	0	0	0	0	0	948,462
Jackfruit	0	0	0	0	0	395,010	429,030	459,270	678,551
Durian	0	0	0	0	0	0	0	16,983	25,092
Lanzones	0	0	0	0	0	58,800	61,600	131,600	101,871
Calamansi	0	0	0	0	0	641,700	664,950	762,600	1,412,477
Banana	0	103,865	160,117	246,504	246,504	246,504	246,504	246,504	246,504
Papaya	0	3,604	3,604	3,604	3,604	3,604	3,604	3,604	5,324
Marang	0	0	0	0	0	0	1,440	1,440	2,128
Subtotal Revenue Fruit Trees	0	107,469	163,721	250,108	250,108	1,959,232	2,449,934	3,493,505	6,185,471
Black pepper	0	0	0	0	43,740	43,740	47,340	47,340	47,340
Sub-Total H. Weste	0	107,469	163,721	250,108	293,848	2,002,972	2,497,274	3,540,845	6,232,811
Revenue Magsaysay Agroforestry									
Coffee green beans						76,500	147,000	282,900	438,871
Cacao wet beans						382,860	411,810	630,510	931,550
Guyabano						24,704	60,216	113,484	167,668
Rambutan						38,880	72,000	103,680	153,183
Mangosteen									2,987
Jackfruit						17,010	28,350	28,350	41,886

9	2018	2019	2020	2021	2022	2023	2024	2025	2035
Durian						999	999	1,998	2,952
Lanzones						14,000	16,800	30,800	45,506
Calamansi						244,125	267,375	267,375	395,035
Banana		5,023	7,835	37,769	37,769	37,769	37,769	37,769	37,769
Subtotal Revenue Fruit Trees		5,023	7,835	37,769	37,769	836,847	1,042,319	1,496,866	2,217,405
Black pepper				30,600	52,200	73,800	73,800	73,800	73,800
Sub-Total Magsaysay	0	5,023	7,835	68,369	89,969	910,647	1,116,119	1,570,666	2,291,205
TOTAL REVENUE (php)	0	112,491	171,556	318,477	383,817	2,913,619	3,613,393	5,111,511	8,524,016

Costs involved in planting and raising the intercrops

All costs considered under the analysis were cash costs since the object was to measure the cash benefits generated by the CSA interventions and determine whether these amounts were able to pay for the cash that were required to operate them. Thus, labor in planting the seedlings which were done by family members were not included in the analysis. The relevant costs were the cost of seedlings and basal fertilizer because these were part of the investment cost to establish the fruit trees. In Himbubulo Weste and Magsaysay these costs ranged from PhP 123,926.00 to PhP 623,559.00 between 2018 and 2020 (Table 12). The cost of fertilizer, which represents the operating cost was PhP 32,690.00. This amount was assumed to be a constant annual expense from 2021 onwards. By convention, price increases due to inflationary effects are not reflected in the Base Case annual cashflows. The increases or decreases in prices only appear in succeeding cashflow tables when changes in the market situation are analyzed (termed as Sensitivity Analysis) to determine if they would affect the viability of the project (or the CSA interventions).

Table 12. Costs involved in raising fruit trees and black pepper, Guinayangan, Quezon

Cost	2018	2019	2020	2021 onwards
Establishment cost of fruit trees and black pepper				
Himbubulo Weste				
Cost of seedlings	87,075	548,855	172,400	
Cost of basal fertilizer	76,744	74,704	76,712	
Subtotal	163,819	623,559	249,112	
Magsaysay				
Cost of seedlings	154,180	115,930	187,175	
Cost of basal fertilizer	8,276	7,996	8,052	
Subtotal	162,456	123,926	195,227	
Operating cost (fertilizer)				
Himbubulo Weste				19,120
Magsaysay				13,570
Subtotal				32,690
Total cost	326,275	747,485	444,339	32,690

Projected net income from raising fruit trees and black pepper

Table 13 shows the projected net income that can be received by Himbubulo Weste and Magsaysay households when all intercrops have reached their fruit bearing age, ie., between the years 2023 to 2025. A total of PhP 2.09 Million can be earned by the households in the two villages by 2023. This is expected to increase to PhP 4.46 Million by 2025 as more trees and black pepper reach the fruit bearing age.

Households in Himbubulo Weste were projected to generate about PhP 1.5 Million in gross revenue in 2023. This was expected to grow to as much as PhP 3.26 Million by 2025. Households in Magsaysay, on the other hand, were to gain about PhP 0.62 Million in 2023 and will increase their earnings to PhP 1.23 Million by 2025.

Table 13. Projected net income from fruit trees and black pepper, Guinayangan, Quezon

Item	2023	2024	2025
Gross revenue			
Himbubulo Weste	2,002,972	2,497,274	3,540,845
Magsaysay	910,647	1,116,119	1,570,666
Subtotal	2,913,619	3,613,393	5,111,511
Maintenance costs			
Himbubulo Weste	19,120	19,120	19,120
Magsaysay	13,570	13,570	13,570
Subtotal	32,690	32,690	32,690
Net Income	2,880,929	3,580,703	5,078,821

Raising native pigs as a CSV intervention

Backyard raising of native pigs was another intervention adopted by the villagers to improve climate resilience. Thirteen and 8 households in Himbubulo Weste and Magsaysay, respectively, opted to raise native pigs (Table 14). Backyard raisers in Himbubulo Weste produced a total of 28 pigs in 2018 and by 2020, there were 102 heads. Per household, the number of hogs produced in 2018 ranged between 1 to 7. By 2019, hog production was between 1 to 19 heads while in 2020, the swine population ranged from 1 to 32.

In Magsaysay, the total heads raised was 37 in 2018 ranging from 1 to 17 heads per household. The following year, totoal number of heads was 40 and increased to 83 heads in 2020. The range per household was 1 to 7 heads in 2019, and 3 to 28 heads in 2020.

In terms of heads sold, Himbubulo Weste was able to sell 64 hogs in 2020. This was a huge increase from only 8 and 13 heads in 2018 and 2019. Magsaysay sold relatively fewer hogs in 2019.

In Himbubulo Weste, the average selling price increased from PhP 1,674 per head in 2018 to PhP 1,831.00/head in 2020 as gilts and hogs for lechon instead of piglets were sold. The piglets commanded lower prices than gilts. In Magsaysay, the average price per head increased from PhP 1,674.00 in 2018 to PhP 3,400.00 in 2019 as one household sold a boar which was priced at PhP 5,000.00. However, the average price decreased to PhP 1,778.00/head in 2020 since more piglets were sold at a lower price. Thus, fluctuations in the average selling prices were largely dependent on the type of hogs sold such as gilt or weanling or for lechon.

Table 14. Profile of backyard native pig raising in Himbubulo Weste and Magsaysay, Guinayangan, Quezon, 2018 to 2020

Item	Himbubulo Weste	Magsaysay
No. of households raising native pigs in 2020	13	8
Total heads raised		
2018	28	37
2019	78	40
2020	102	83
Total heads sold		
2018	8	21
2019	13	2
2020	64	17
Ave. farmgate price of hogs (PhP/head)		
2018	1,265.00 Weanling: 1,000, Lechon: 1,530	1,674.00 Weanling: 1,500 Gilt: 2,400 to 3,000
2019	1,273.00 Gilt: 1,000 to 1,900 Lechon: 1,530	3,400.00 Weanling: 1,500 Lechon: 1,900 Boar: 5,000
2020	1,831.00 Weanling: 1,000 to 3,000 Gilt: 5,500 Lechon: 2,767	1,778.00 Weanling: 1,500 to 2,500 Gilt: 3,000

Costs incurred in raising native pigs

Households in Himbubulo Weste collectively spent a total of PhP 84,314.00 in 2018 for commercial feeds (Table 15). This increased to PhP 200,800.00 in 2020 as the litters grew in number. Noncash costs were not considered in determining the cash income of the households. Nevertheless, they were presented in this section of the report to provide a holistic picture of the costs involved in native pig production. Forage and depreciation were valued at PhP 32,892.00 in 2018. While use of forage is encouraged among swine raisers, only one household out of 13 reported that they were feeding their hogs with forage. Noncash cost (particularly forage since depreciation cost is constant)) decreased in 2019 and 2020 as the number of heads raised by that single household decreased. The rest were using commercial feeds.

Magsaysay households spent PhP 46,535.00 on commercial feeds in 2018. This slightly decreased to PhP 44,363.00 in 2019 and increased to PhP 101,820.00 in 2020 as the number of litters grew. Value of noncash costs ranged from PhP 12,219.00 to PhP 20,547.00 between 2018 to 2020. Noncash costs were relatively larger in Magsaysay than in Himbubulo Weste since more families (3 out of 8 households) were combining forage with commercial feeds in that village.

Table 15. Costs in raising native pigs, Guinayangan, Quezon, in PhP, 2018 to 2020

Cost (PhP)	Himbubulo Weste	Magsaysay	Total
Cash cost: Commercial Feeds			
2018	37,779	46,535	84,314
2019	81,861	44,363	126,224
2020	98,980	101,820	200,800
Noncash cost: Forage, Depre. Cost			
2018	18,367	14,525	32,892
2019	13,767	12,219	25,986
2020	11,879	20,547	32,426
Total Cost			
2018	56,146	61,060	117,206
2019	95,633	58,582	154,215
2020	110,859	122,367	233,206

Gross revenue and ret cash income from native pigs

Gross revenue from an initial sale of eight native pigs in Himbubulo Weste increased from a total of PhP 10,650.00 in 2018 to PhP 117,202.00 in 2020. The number of households selling native pigs and the number of heads sold increased after two years of operation (Table 16). A similar trend was observed in Magsaysay where revenue increased from PhP 34,800.00 in 2018 to PhP 77,000.00 in 2020.

The Net Cash Income earned by households in Himbubulo Weste and Magsaysay was derived by taking the difference between the Gross Revenue and the Cash Cost of the number of swine sold per year. The analysis showed that, in 2018, the Gross Revenue of the 2 swine producers in Himbubulo Weste who sold only eight heads out of the 28 pigs that they raised was relatively low compared to their Total Cash Cost. The Total Cash Cost was PhP 10,794.00 while the Gross Revenue was computed at PhP 10,120.00. A loss amounting to PhP 642.00 was experienced during the initial year of operation. The Net Cash Income improved in 2019 and 2020. However, the Operating Profit Margin Ratio of the hog sellers in

2019 was merely 18% signifying that the compensation that they received for their own labor and money spent for commercial feeds was only 18% of their gross sales. The OPMR improved in 2020 to a ratio of 0.47 or 47%. This means that the eight households that sold hogs were able to keep 47% of their Gross Revenue as profit. The remaining portion of the Gross Revenue, 82% in 2019 and 53% in 2020 were absorbed by their Cash Expenses. Sales to Production ratio was highest in 2020 at 63%. It is also interesting to note that the breakeven prices of hogs in 2019 and 2020 were lower than the average selling prices and, therefore, a profit was realized during those years. This was not the case in 2018 where the hogs were sold at an average price of PhP 1,265.00 which was lower than the breakeven price of PhP 1,349.00.

In Magsaysay, all the households that sold native pigs made a profit in 2018 to 2020. Net Cash Income was PhP 7,904.00 in 2018 and the following year it was PhP 13,446.00. The ratios of profit to Gross Revenue (OPMR) ranged from 25% to 66%. The average selling price in 2019 gave the highest margin of PhP 2,241.00 from the breakeven price which led to the higher OPMR of 66%.

Table 16. Net Income of households from native pigs, Himbubulo Weste and Magsaysay, Guinayangan, 2018 to 2020

Item	Himbubulo Weste			Magsaysay		
	2018	2019	2020	2018	2019	2020
Number of heads raised	28	78	102	37	40	83
Number of heads sold	8	13	64	19	6	9
Selling price/head (PhP)	1,265	1,273	1,831	1,674	3,400	1,778
Gross Revenue	10,120	16,550	117,202	31,800	20,400	16,000
Cash cost/hd x No. heads sold (PhP)	10,794	13,644	62,105	23,896	6,954	11,041
Total cost/hd x No. heads sold (PhP)	16,042	15,939	69,559	31,355	8,787	13,269
Total Net Cash Income (PhP)	-674	2,906	55,097	7,904	13,446	4,959
Total Net Income based on Total Cost	-5,922	611	47,643	445	11,613	2,731
Breakeven price based on Cash Cost	1,349	1,050	970	1,258	1,159	1,227
Breakeven price based on Total Cost	2,005	1,226	1,087	1,650	1,465	1,474
Operating Profit Margin Ratio		18%	47%	25%	66%	31%
Expense Ratio		82%	53%	75%	34%	69%
Sales to Production Ratio	29%	17%	63%	51%	15%	11%
No. of households selling	2	3	9	3	3	3
No. of households that earned a profit	0	1	8	2	3	3

Collective economic benefits generated by the CSV approach

The combined benefits from raising fruit trees, black pepper as well as native pigs were compared against the costs of setting up and maintaining these enterprises to determine their financial viability (Table 17). A discounted annual cashflow from 2018 to 2035 involving the estimated revenues (representing the benefits) and investment as well as operating expenses (representing the costs) was used as the basis for the financial analysis. The investment costs for fruit trees and black pepper included the costs of seedlings and basal fertilizer. For native pig production, the investment costs were the cost of pigpen construction and the cost of new piglets. The Benefit-Cost Ratio (BCR) and Net Present Value (NPV) were applied to measure viability using a discounting rate of 9%[6]. A BCR of 9.2 was generated indicating that the benefits from 2018 until 2035 from the CSV project were 9.2 times greater than the associated costs. Similarly, the NPV value that was obtained was positive (NPV (9%) = 26,130,668), which means that the projected benefits would be able to pay for the establishment and operating costs incurred in the implementation of the interventions such as raising fruit trees and black pepper as intercrops and swine production in the project areas.

[6] Asian Development Bank uses 9% as the opportunity cost of money used in economic development projects in Asia.

Table 17. Base case for fruit trees, black pepper, and native pigs, Guinayangan, Quezon, in PhP, 2018 to 2035

Year	2018	2019	2020	2021	2022	2023	2024	2025	2035
CASH INFLOW									
Revenue H. Weste Agroforestry	0	107,469	169,748	250,108	293,848	2,002,972	2,497,274	3,540,845	6,232,811
Revenue Magsaysay Agroforestry	0	5,023	7,835	68,369	89,969	910,647	1,116,119	1,570,666	2,291,205
SUBTOTAL REVENUE Agroforestry	0	112,491	177,583	318,477	383,817	2,913,619	3,613,393	5,111,511	8,524,016
Revenue H. Weste Native Pigs	10,650	16,550	117,202	117,202	117,202	117,202	117,202	117,202	117,202
Revenue Magsaysay Native Pigs	27,000	18,500	16,000	16,000	16,000	16,000	16,000	16,000	16,000
SUBTOTAL REVENUE Native Pigs	37,650	35,050	133,202	133,202	133,202	133,202	133,202	133,202	133,202
TOTAL CASH INFLOW	37,650	147,541	310,785	451,679	517,019	3,046,821	3,746,595	5,244,713	8,657,218
CASH OUTFLOW									
Expenses H. Weste Agroforestry									
Cost of seedlings	87,075	548,855	172,400						
Basal fertilizer	76,744	74,704	76,712						
Fertilizer (Fruit trees and black pepper)	0	0	0	19120	19120	19120	19120	19120	19120
Subtotal Expenses Agroforestry H. Weste	163,819	623,559	249,112	19,120	19,120	19,120	19,120	19,120	19,120
Expenses Magsaysay Agroforestry									
Cost of seedlings	154180	115930	187175						
Basal fertilizer	8276	7996	8052						
Fertilizer (Fruit trees and black pepper)	0	0	0	13570	13570	13570	13570	13570	13570
Subtotal Expenses Agroforestry Magsaysay	162,456	123,926	195,227	13,570	13,570	13,570	13,570	13,570	13,570
Total Expenses Agroforestry	326,275	747,485	444,339	32,690	32,690	32,690	32,690	32,690	32,690
EXPENSES Native Pigs									
H. Weste									
Cost of constructing pigpens	23,000								

Year	2018	2019	2020	2021	2022	2023	2024	2025	2035
Cost of commercial feeds	37,779	81,861	98,980	98,980	98,980	98,980	98,980	98,980	98,980
Cost of new piglets	32,500	3,000							
Subtotal H. Weste	93,279	84,861	98,980	98,980	98,980	98,980	98,980	98,980	98,980
Magsaysay									
Cost of constructing pigpens	36,380								
Cost of commercial feeds	35,607	35,176	98,720	98,720	98,720	98,720	98,720	98,720	98,720
Cost of new piglets	18,000	16,700	16,700						
Subtotal Magsaysay	89,987	51,876	115,420	98,720	98,720	98,720	98,720	98,720	98,720
Total Expenses Native Pigs	183,266	136,736	214,400	197,700	197,700	197,700	197,700	197,700	197,700
Total Expenses Agroforestry and Native Pigs	509,541	884,221	658,739	230,390	230,390	230,390	230,390	230,390	230,390
NET CASH FLOW	-471,891	-736,680	-347,954	221,289	286,629	2,816,431	3,516,205	5,014,323	8,426,828
NPV (9%)	26,130,668		BCR(9%)	9.2	Benefits	29,308,070	Costs	3,177,402	

Planting of fruit trees and black pepper by those households that opted to try both interventions seemed to generate a larger net cashflow than by just raising pigs. It was noted that the stream of positive net cashflows by the households were attained because of the revenue from the intercrops. Oftentimes, these were used to subsidize the cost of raising the native pigs.

If the costs of land preparation, planting, and seedlings including the construction of pigpens and the cost of piglets will be considered as the investment of the communities for the project, the sum would be equivalent to PhP 2,052,501.00. Based on the stream of annual Net Cashflow, this amount of investment can be recovered in three years counting from January 2021 to December of 2023. By 2023, the perennials would have started to bear fruits and these could be harvested and sold to buyers.

Two scenarios were considered to test the sensitivity of the BCR and NPV to changes in the assumptions regarding revenue and costs. Scenario 1 examined the response of the financial measures to a 30% reduction in Total Revenue beginning 2022 for fruit trees, black pepper and native pigs. Several factors can trigger a reduction in revenues. A possible instance is the occurrence of unfavorable climatic and soil conditions as well as the onset of fruit diseases which could result in a decrease in fruit yield. Decrease in revenue for native pigs could happen if the enterprises are affected by the Asian Swine Flu as well as a downward shift in consumer demand for native pigs. Scenario 2, on the other hand, examined how the BCR and the NPV would react to a 30% decrease in revenue coupled with a 20% increase in costs starting in 2022.

Scenario 1: 30% decrease in revenue starting 2022

With a 30% reduction in total revenue, the cashflow under Scenario 1 resulted in a lower BCR of 4.2 when compared to the 9.2 ratio under the Base Case (Table 18). However, the BCR was still significant since the benefits from the CSA interventions were still 4.2 times greater than the associated costs. As expected, with benefits greater than costs, the calculated NPV remained positive. Therefore, the CSA interventions could still generate positive benefits despite the 30% decrease in revenues.

Table 18. Scenario 1: 30% reduction in revenue from fruit trees, black pepper, native pigs

Year	2018	2019	2020	2021	2022	2023	2024	2025	2035
CASH INFLOW									
Revenue Agroforestry and Black Pepper	0	112,491	177,556	318,477	317,539	2,798,625	4,334,553	4,261,129	452,942
Revenue Native Pigs	37,650	35,050	133,202	93,241	65,269	45,688	31,982	22,387	632
TOTAL CASH INFLOW	37,650	147,541	310,758	411,719	382,807	2,844,314	4,366,535	4,283,516	453,574
CASH OUTFLOW									
Expenses Agroforestry	326,275	747,485	444,339	32,690	32,690	32,690	32,690	32,690	32,690
Expenses Native Pigs	183,266	136,736	214,400	197,700	197,700	197,700	197,700	197,700	197,700
TOTAL CASH OUTFLOW	509,541	884,221	658,739	230,390	230,390	230,390	230,390	230,390	230,390
NET CASHFLOW	-471,891	-736,680	-353,981	181,329	152,417	2,613,924	4,136,145	4,053,126	223,184
BCR	4.2		Benefits	13,488,185					
NPV	10,315,415		Cost	3,177,402					

Scenario 2: 30% decrease in revenue and 20% increase in costs starting 2022

Under the Scenario 2 conditions, where revenue dropped by 30% and costs shot up by 20%, the BCR was scaled down to 1.3 (Table 19). This means that the CSA interventions could still withstand the impact of market downturns but just barely. However, it was noted that beyond Year 2030, gross revenue would not be able to cover the cash costs. Negative Net Cashflows would be evident from 2030 to 2035 due to a continuous decrease in revenue coupled with the increases in cost.

Image 5. Coffee-cacao intercropping. Source: IIRR

Table 19. Scenario 2: 30% decrease in revenue and 20% increase in cost, Fruit trees, black pepper, native pigs

Year	2018	2019	2020	2021	2022	2023	2024	2025	2035
CASH INFLOW									
Revenue H. Weste Agroforestry	0	107,469	163,721	250,108	227,569	1,887,978	3,053,600	2,661,443	228,415
Revenue Magsaysay Agroforestry	0	5,023	7,835	68,369	89,969	910,647	1,280,953	1,599,686	224,527
SUBTOTAL REVENUE Agroforestry and Black Pepper	0	112,491	171,556	318,477	317,539	2,798,625	4,334,553	4,261,129	452,942
Revenue H. Weste Native Pigs	10,650	16,550	117,202	82,041	57,429	40,200	28,140	19,698	117,202
Revenue Magsaysay Native Pigs	27,000	18,500	16,000	11,200	7,840	5,488	3,842	2,689	16,000
SUBTOTAL REVENUE Native Pigs	37,650	35,050	133,202	93,241	65,269	45,688	31,982	22,387	119,882
TOTAL CASH INFLOW	37,650	147,541	304,758	411,719	382,807	2,844,314	4,366,535	4,283,516	572,824
CASH OUTFLOW									
Total Expenses Agroforestry	326,275	747,485	444,339	32,690	42,497	55,246	71,820	93,366	1,287,128
Total Expenses Native Pigs	183,266	136,736	214,400	197,700	257,010	334,113	434,347	564,651	7,784,193
Total Expenses Agrofor and N. Pigs	509,541	884,221	658,739	230,390	299,507	389,359	506,167	658,017	4,590,394
Net cashflow	-471,891	-736,680	-353,981	181,329	83,300	2,454,955	3,860,368	3,625,499	-4,017,570
NPV (9%)	605,371		BCR(9%)	1.3		Benefits	13,383,258	Costs	9,937,348

Households' cashflow with and without the CSV Project

What is missing in the analysis is a grip on how the communities benefitted from the CSV Project in monetary terms. A simple analysis was done by generating the 2020 total gross household income from farming (initially excluding native pigs, fruit trees, and black pepper) and other non-farm sources of livelihood, the total annual expenses that were incurred for the household needs and farm operation, as well as the net income obtained from these two sets of data. This was considered as the income of the community without the CSV project. It was then compared with the resulting net income when the annual Gross Revenues and expenses from raising native pigs and growing fruit trees and black pepper were added. The projected income and expenses for fruit trees and black pepper for the year 2025 were used in the analysis. All perennials that were planted are expected to be bearing fruits by that year (Table 20). The analysis revealed that the community as a whole have the opportunity to increase their cash position when the CSA interventions are already in full operation. Taking Himbubulo Weste and Magsaysay together, the Net Income increased by PhP 1.73 Million when revenues and expenses in swine production and fruit trees and black pepper farming were added. This amount represents the total gains of the community from the CSV Project.

Table 20. Income of all households with and without CSA intervention, in PhP, Himbubulo Weste and Magsaysay, Guinayangan, Quezon, 2020

Item	Himbubulo Weste and Magsaysay		
	With*	Without	Difference
Total Gross Revenue	7,754,878	5,649,833	2,105,045
Total Cost	4,695,469	4,053,430	642,039
Net cashflow	3,059,409	1,325,977	1,733,432

*Data for fruit trees and black pepper are 2025 values

Social benefits established by the CSV project

In addition to evaluating the financial performance of the CSV project, this study determined the social benefits arising from its implementation. The social benefits that were examined were: economic empowerment, contribution to knowledge, inclusiveness, social learning, and capacity to support other stakeholders.

Economic empowerment

Economic empowerment as defined earlier refers to "enabling poor people to think beyond immediate daily survival and to exercise control over resources and life choices". A strategy adopted by the CSV project to achieve this task was to increase the household income of beneficiaries through the adoption of climate-smart agriculture interventions. The results of several financial parameters such as the BCR and NPV proved that planting fruit trees, black pepper and raising native pigs are economic activities which are effective in attaining economic empowerment. With increased income, the household beneficiaries would be able to become self-reliant, resilient, and empowered.

The benefits of planting fruit trees as intercrops could be fully realized by the households a few years from now. Household income will be increased by then. Raising native pigs did not always result in a positive effect in household income. While some households generated profits from selling hogs, others were not successful. There were households whose expenses in raising pigs were much higher than the price that they received from the buyers. On some occasions, households refused to sell their pigs because of the relatively low price offered by the buyers. They would rather keep them until such time that prices were up. Key informant interviews also revealed that the satisfaction that households get from raising native pigs did not lie solely on profits but also on their perception that they have "live" assets in their backyards that they could liquidate when the need arises. One interviewee likened the hogs to bank deposits that multiply in number and could be withdrawn when needed. This pervading perception could be considered as part of the economic empowerment benefit that is generated by the CSV project.

Another indicator of economic empowerment was household food security. Table 21 is a summary of the survey conducted in Guinayangan and Ivisan was measured household food

security. While the analysis was unable to establish direct association of food security with the effect of the CSV project, the data provided insight on the general outlook of the communities regarding food security of the family. The years 2019 and 2020 were taken into consideration to input the effect of the COVID-19 pandemic in the analysis. Responses for 2019 represented the pre-pandemic perception of food security and 2020 reflected the pandemic year. The respondents were asked to answer a set of questions to determine whether they were food secure, mildly insecure, moderately insecure, and severely insecure. Numeric indicators were assigned to each question to determine the level of food security among households. Questions with responses of Zero (0) were rated Food Secure, 1 or Rarely as Mildly Insecure, 2 or Sometimes as Moderately Insecure, and 3 or Often as Severely Insecure. The result of the survey revealed that majority of the households in Guinayangan and Ivisan considered themselves to be food secure or just mildly insecure. In other words, these households worried less about food supply for the family even for a longer period of time. Being food secure also referred to the capacity of the household to provide sufficient quality of food in terms of variety and preferences. Furthermore, the quantity or the amount of food intake by the members of the households were also satisfactorily met.

By comparison, a larger percentage of households in Guinayangan, Quezon felt more food secure than those living in Ivisan, Capiz. In Guinayangan, households from Himbubulo Weste and Capuloan Tulon felt more food secure than households in Magsaysay.

The COVID-19 pandemic triggered and heightened food insecurity among the households in Guinayangan and Ivisan. The prolonged lockdowns in 2020 enforced by the Philippine government because of the pandemic forced the closure of many commercial establishments and, therefore, many wage earners were displaced and found themselves jobless. There were very limited job opportunities for hired labor outside the farm. The households feared that, with the lockdown and home quarantine in their communities, they would not be able to freely tend to their farms. They also worried about shortage of food supply and hoarding which happened as a result of panic buying. With limited or no income during the pandemic, lack of food for the family became one of their fears.

Table 21. Levels of household food insecurity, Guinayangan, Quezon and Ivisan, Capiz, 2019 and 2020

Location	Food Secure		Mildly Insecure		Moderately Insecure		Severely Insecure	
	2019	2020	2019	2020	2019	2020	2019	2020
Guinayangan, Quezon								
Himbubulo Weste	82%	77%	16%	7%	2%	16%	0%	0%
Magsaysay	62%	45%	24%	24%	14%	31%	0%	0%
Capuloan Tulon	87%	62%	11%	25%	3%	11%	0%	3%
Ivisan, Capiz								
Malocloc Sur and Balaring	32%	26%	35%	30%	29%	37%	6%	7%

Contribution to knowledge

The CSV Project acts as catalyst in the implementation of the programs aimed at improving household resilience. This is an important task which requires, among others, the Project's capability to contribute towards knowledge sharing.

Contribution to knowledge was evaluated based on the efforts exerted by the CSV Project to organize and conduct training courses, workshops, and other activities that would add knowledge leading towards desired objectives. Training courses which shared techniques in goat raising, rice intensification, native pig raising, fruit tree farming, and food processing (Table 22) were conducted prior to the start of the project. In addition, a number of activities aimed at capacity building in project sites in collaboration with the local government units and farmer/community groups were also held. Funds were allocated by IIRR to implement these activities aimed at improving knowledge and skills of the project beneficiaries.

Table 22. List of activities initiated by the CSV Project to improve climate change resilience through knowledge sharing

Training courses, Workshops Sponsored by IIRR	Year Implemented	Location		
Goat Raising		H. Weste	Magsaysay	
Systems for Rice Intensification	2017	H. Weste		
Cococoir making	2017			
Raising native pigs	2014, 2017	Magsaysay	H. Weste	C. Tulon
Native pig disease management	2016, 2018	Magsaysay	H. Weste	C. Tulon
Cacao and coffee farming	2018	Magsaysay		
Fruit trees farming	2017	H. Weste		
Food processing	2018, 2019	C. Tulon		
CSA/ CSV orientation workshop with target government officials/ decision makers	2019			
Strengthening of leadership and governance of the community/farmer groups	2017			
Capacity-building trainings on CC, CRA, Community-based adaptation	2016			
Village-level orientations and planning workshops in target project sites	2016			
Community-based Information campaigns and sensitization activities	2016			
Site-based knowledge-sharing utilizing farmer-centered extension approaches	2017			
Capacity building of farmer learning groups utilizing farmer-to-farmer extension approaches	2016			

Inclusiveness

Social inclusion was defined in this study as the "removal of institutional barriers and the enhancement of incentive to increase access of individuals and groups to development opportunities". Attendance in training courses and meetings initiated by the CSV project and by other institutions as well as membership in village organizations were used as indicators of gender inclusiveness (Table 23). Participation in these activities was found to be gender neutral. Either the husband, the wife or both were allowed to attend these activities in the villages that were surveyed, except in the case of Ivisan where only the husbands attended the training courses. Note, however, that in other instances such as attending meetings and

membership in village organizations, none were dominated by either male or female members of the household even in Ivisan.

Table 23. Household representation by type of activity, Guinayangan and Ivisan, 2020

Activity	Husband		Wife		Husband and Wife		Total	%
	Frequency	%	Frequency	%	Frequency	%		
Attendance in training courses								
Himbubulo Weste	6	29%	15	71%			21	100%
Magsaysay	7	41%	10	59%			17	100%
Capuloan Tulon	9	36%	16	64%			25	100%
Ivisan	13	100%	0	0%			13	100%
Subtotal training courses	35		41				76	
Attendance in meetings								
Himbubulo Weste	9	45%	11	55%			20	100%
Magsaysay	7	54%	4	31%	2	15%	13	100%
Capuloan Tulon	6	25%	14	58%	4	17%	24	
Ivisan	3	21%	11	79%			14	
Subtotal meetings	25		40		6			
Membership in village organizations								
Himbubulo Weste	1	11%	5	56%	3	33%	9	100%
Magsaysay	5	50%	2	20%	3	30%	10	100%
Capuloan Tulon	8	21%	25	64%	6	15%	39	100%
Ivisan	3	25%	9	75%			12	100%
Subtotal village organizations	17		41		12		70	
Total	77	35%	122	56%	18	8%	217	100%

In terms of income earning activities and domestic work, the study showed that farming and livestock rearing were mostly shared by both husband and wife (Table 24). In Himbubulo Weste, the households with a shared responsibility in farming was 57% and 70% for livestock rearing. In Magsaysay, 61% of the households reported that farming is a combined effort of the husband and wife while livestock rearing is a shared responsibility in 61% of the households. A similar observation was found in Capuloan Tulon and the Ivisan barangays of Malocloc Sur and Balaring. Farming and livestock raising was a shared function between husband and wife in 55% and 76%, respectively, of the households in Capuloan Tulon. In

Ivisan, 46% of the households shared work in farming and 43% in livestock production. Majority of those who were employed outside the farm were the husbands in the three barangays of Guinayangan while off-farm employment in Ivisan was not a common source of income among the farmers. Running a business was also gender neutral. Tending to the business was either a husband, wife, or a shared task. Domestic work mostly belongs to the women in the household although shared responsibility or the husband doing the work was also reported.

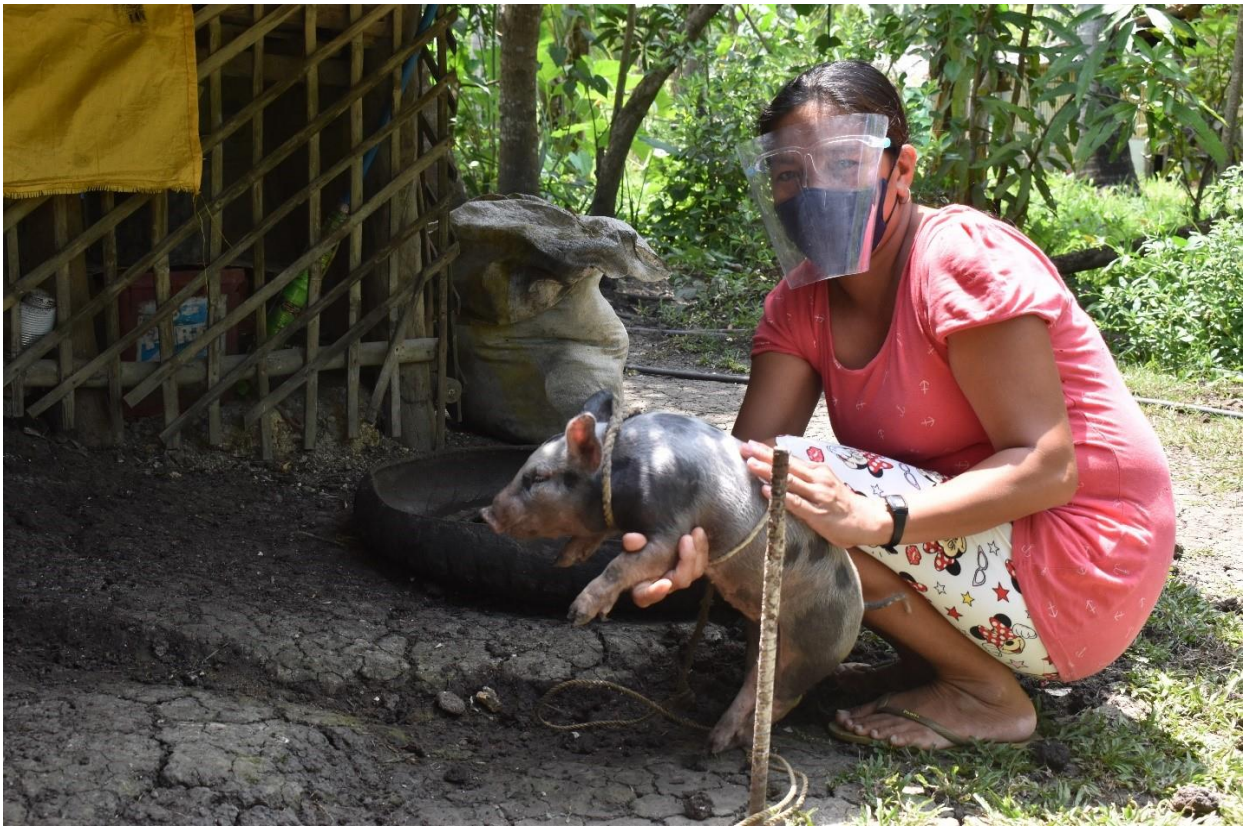

Image 6. Housewife of Mr. Victor Garcia tending to a piglet raised at their backyard, Capuloan Tulon, Guinayangan, Quezon. Source: IIRR

Table 24. Inclusivenss in domestic and income earning activities, Guinayangan and Ivisan, 2020

Activity	Husband		Wife		Husband and Wife		Total	%
	Frequency	%	Frequency	%	Frequency	%		
Guinayangan								
Himbubulo Weste								
Farming	29	32%	10	11%	52	57%	91	100%
Livestock Rearing	18	20%	9	10%	62	70%	89	100%
Business	9	36%	11	44%	5	20%	25	100%
Unskilled/skilled employment	11	69%	4	25%	1	6%	16	100%
Domestic work	13	14%	56	59%	26	27%	95	100%
Subtotal	80	25%	90	28%	146	46%	316	100%
Magsaysay								
Farming	6	30%	1	5%	13	65%	20	100%
Livestock Rearing	4	22%	3	17%	11	61%	18	100%
Fishing or game hunting							0	
Business					2	100%	2	100%
Unskilled/skilled employment	10	83%	1	8%	1	8%	12	100%
Domestic work	5	20%	9	36%	11	44%	25	100%
Subtotal	19	33%	13	23%	25	44%	57	100%
Capuloan Tulon								
Farming	11	38%	2	7%	16	55%	29	100%
Livestock Rearing	5	15%	3	9%	26	76%	34	100%
Fishing or game hunting	6	75%			2	25%	8	100%
Business	3	27%	6	55%	2	18%	11	100%
Unskilled/skilled employment	16	94%	1	6%			17	100%
Domestic work	3	9%	24	69%	8	23%	35	100%
Subtotal	33	31%	34	32%	38	36%	105	100%
Ivisan								
Malocloc Sur and Balaring								
Farming	4	31%	3	23%	6	46%	13	100%
Livestock Rearing	5	36%	3	21%	6	43%	14	100%
Fishing or game hunting	2	100%					2	100%
Business	3	43%	3	43%	1	14%	7	100%
Unskilled/skilled employment			1	100%			1	100%
Domestic work	1	33%	2	67%			3	100%
Subtotal	11	41%	9	33%	7	26%	27	100%

Engagement of village/community/local leaders

The CSV project gained the support and cooperation of the local leaders in the project sites. Barangay captains and councilmen extended assistance to the CSV project in their localities from inception, planning, and organization stages. They have continued to do so up to the present to ensure that the household beneficiaries could avail of any, if not all institutional services in the communities. Assistance came in the form of helping project organizers in calling meetings with the community members, allowing project organizers to use the Barangay Halls as venue for the meetings, and endorsing the project as a legitimate activity in their locality. They were also actively involved in organizing training courses for the communities as well as acting as participants to these training activities. At the municipal level, the Office of the Municipal Agriculturist (OMA) of Guinayangan, Quezon also indicated that it has allocated funds in its annual budget to support the CSV project. It also established a Demonstration Farm where all CSA practices are showcased for farmers and visitors alike. The OMA of Ivisan, on the other hand, reported that their office provides OMA technical staff to serve as resource persons in training courses sponsored by the CSV project.

Instituting support system mechanisms

The partnership that was established by the CSV project with the local government units has strengthened government support for the farming community. The incorporation of a budget to assist project activities ensures that technical assistance to farmers involved in the project has been institutionalized. This assistance includes extension services to farmers, inclusion as participants to training courses organized by the local government units, and logistical support such as sourcing out planting materials for agroforestry as well as establishment of forage gardens for native pigs. The barangay council and the OMAs are also helping in scaling up the CSV approach to other nearby barangays.

The CSV project also established Farmer Learning Groups (FLGs) as a venue where farmers can share experiences and concerns regarding CSA options that they have adopted. The groups serve as sounding boards where farmers help other farmers through their own experiences and information that they have previously acquired.

Capacity to support other stakeholders

The capacity of households to support other families in the village when assistance is required was evaluated using willingness to lend money to others as indicator. Majority (79%) of all households expressed willingness to provide loans to others (Table 25). There was a larger percentage of households in Himbubulo Weste (93%) that were willing to assist others financially. There was a low percentage of households in Ivisan that were willing to loans or financial assistance. The survey also determined how many of the households had actually lent money to relatives, friends or neighbors that requested financial assistance. The results showed that majority (73%) had actually lent money to others thereby confirming that the households during the three-year period of project implementation became financially better-off and, therefore, were more capable to help others.

Table 25. Capability to help other stakeholders by providing loans, Guinayangan, Quezon and Ivisan, Capiz, 2020

Question	Yes		No		Total	
	Frequency	%	Frequency	%	Frequency	%
Are you or any member of your household capable of lending money to a relative, neighbour, or friend?						
Guinayangan, Quezon						
Himbubulo Weste	27	93%	2	7%	29	100%
Magsaysay	20	77%	6	23%	26	100%
Capuloan Tulon	28	70%	7	18%	35	100%
Ivisan, Capiz						
Malocloc Sur and Balaring	10	59%	7	41%	17	100%
Total	85	79%	22	21%	107	100%
Between the years 2018 to present, did you lend money to a relative, neighbour, or friend for any purpose?						
Guinayangan, Quezon						
Himbubulo Weste	24	83%	5	17%	29	100%
Magsaysay	15	58%	11	42%	26	100%
Capuloan Tulon	30	75%	5	13%	35	100%
Ivisan, Capiz						
Malocloc Sur and Balaring	9	53%	8	47%	17	100%
Total	78	73%	29	27%	107	100%

Environmental sustainability

A broad definition of environmental sustainability is the ability to "meet the resource and services needs of current and future generations without compromising the health of the ecosystems that provide them" (Morelli, 2011). This further implies that activities that do not pose a threat to the availability of natural resources and ecosystem services to human beings could be considered sustainable. Some issues that threaten environmental sustainability include (Sutton, 2004):

1. Emission of greenhouses gases into the atmosphere that can cause climate change;
2. Discharge of polluting by-products into the environment; and
3. Depletion or destruction of natural resources.

Honeyman (1991) identified opportunities that could make swine production to be environmentally sustainable. Of relevance to small-scale native pig production are 1) feeding with increased use of forages and by-products, and 2) nutrient cycling through improved handling of manure. The use of forages reduces the carbon footprint in raising the animals by minimizing the use of feeds that utilize ingredients that enhance emission of greenhouse gases (GHG) or use chemical fertilizers to grow them. Secondly, using pig manure as substitute for chemical fertilizers in food production is another synergistic approach to farming that makes swine production sustainable. Excessive use of chemical fertilizers causes acidification of the soil which decreases soil cohesion making it vulnerable to soil erosion. In addition, soil acidity reduces the growth of soil microbial which are partly responsible for nutrient release to be absorbed by the plants.

Hog production is environmentally sustainable over ruminant livestock (cattle, goat, sheep) because they do not produce excessive amounts of methane gas in their digestive system. Native pigs or hogs in general also pose less threat to the environment when GHG emission is concerned.

Agroforestry or the planting of trees as intercrops enhances the sequestration of CO2, a greenhouse gas, from the environment. CO2 is one of the predominant GHGs in the

atmosphere which is responsible for 50-60% of the global warming from GHGs produced by human activities (Miller, 1998). Trees also contribute to nutrient cycling when leaves and branches decay and are converted to nitrogen that enhances soil nutrient content. Trees are also known to absorb and store water that decreases water run-off thereby minimizing soil erosion in the uplands (Krieger, 2001). The root system of trees anchor soil particles to minimize soil erosion (Nasi, et al., 2002).

The two interventions, planting fruit trees and black pepper as intercrops and native swine production were implemented in the villages not only to increase household income. These were also viewed as means to achieve a bigger objective. Environmental sustainability of the agricultural farms would guarantee that the families in the villages and their future generation, would enjoy clean air and good agricultural harvest from land with good soil quality. The study revealed that, between the two interventions, the raising of native pigs seemed to miss an ingredient in performing its role in environment protection. Most households did not take advantage of the availability of forage in feeding their livestock. Instead, they relied heavily on commercial feeds, a practice that should have been minimized not just for profit but also for environmental sustainability.

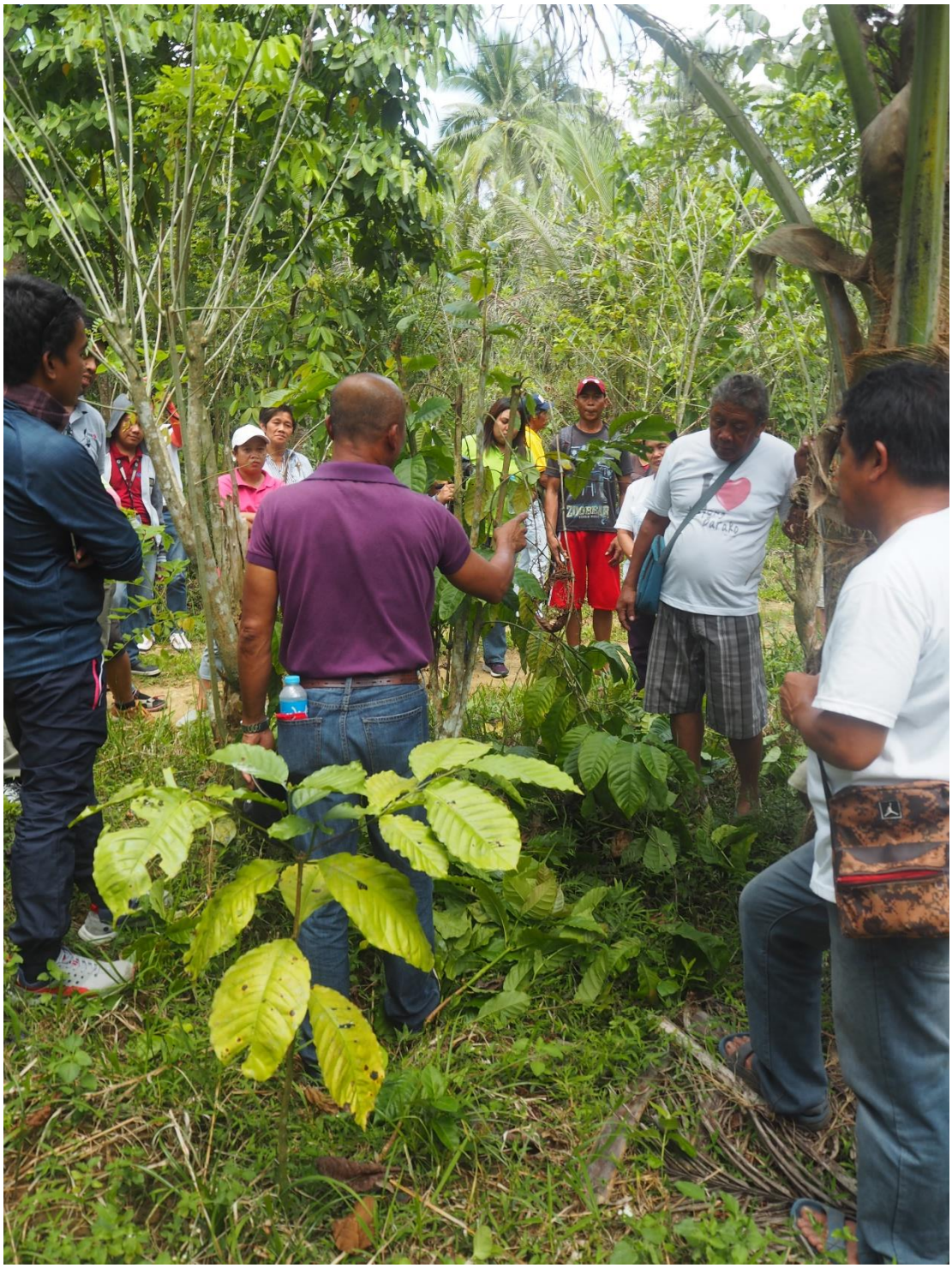

Image 7. Intensified coconut systems supporting the enhanced sequestration of carbon, improving livelihoods, and reducing risks to climate variability and extreme weather events. Image source: IIRR

Conclusion and recommendations

The Cost-Benefit Analysis interviewed 90 households in the Municipality of Guinayangan, Quezon and 17 households in the Municipality of Ivisan, Capiz who adopted agriculture interventions under the Climate-Smart Village (CSV) Project. Specifically, the targeted beneficiaries for the analysis of the overall CSV approach were the villages (Barangays) of Himbubulo Weste and Magsaysay; while for the analysis of social benefits, households in Malocloc Sur and Balaring (Ivisan) and Capuloan Tulon (Guinayangan) were included as part of the cost benefit analysis of raising native pigs[7]. Following the established system of implementing the CSV approach, pre-project activities were conducted to identify and develop a portfolio of technologies which included planting fruit trees and black pepper and raising native pigs. The actual field implementation, i.e., planting of trees and raising the hogs started in 2018.

Majority of households in both Guinayangan and Ivisan municipalities were living below the poverty level. Their annual income was less than PhP 56,210.00, a huge portion of which was derived from engaging in farming activities. Most households were composed of three to seven members who have limited educational attainment. The adult population that made up a large portion of the age bracket were mostly elementary and high school graduates. The households owned or contracted land that were less than two hectares. The above profile is typical of a marginalized family engaged in the agriculture sector. The demographic details can be used as additional information in the analysis of both economic and social implications of the project. An increase in the income of the household beneficiaries would likely improve their financial status if there were fewer members in the household. The high percentage of member within the workforce category is also an advantage since there would be more persons contributing to the family income. Furthermore, a relatively highly educated household implies better and more income generating opportunities, thus, additional income for the family. The CSV Project focused on these household beneficiaries to help them improve their income. The Project's vision of teaching them to become agents

[7] See Manilay et al. (2021) for more information on the cost benefit analysis of raising native pigs part of the study.

of change in making agricultural practices become environmentally sustainable would be made possible through the implementation of the CSA interventions.

The cost benefit analysis studied the financial and social benefits to the community of a portfolio of climate-smart interventions which included planting of fruit trees and black pepper as well as native pig production. The analysis determined whether the benefits gained from the combined effects of the interventions surpassed the costs associated with their implementation. These were determined by applying measures of financial viability namely, the Benefit Cost Ratio (BCR) and Net Present Value (NPV) using a discount rate of 9%.

The analysis showed that the combination of planting fruit trees and black pepper as well as native pig production are viable when they are integrated with the main sources of livelihood of the village of Himbubulo Weste and Magsaysay. A Benefit-Cost Ratio of 9.2 was obtained showing that the combined Gross Revenues earned by the communities were 9.2 times greater than the Total Cash Costs. The adopted technologies are expected to be financially beneficial to the families in the two barangays. However, the Sensitivity Analysis based on a 30% decrease in Gross Revenue, resulted in a drop in the BCR to 3.7 from the original value of 9.2 while the NPV remained to have a positive value. Nevertheless, the sum of the discounted benefits still exceeded the sum of the discounted costs. The second sensitivity test involving a scenario where there is a combined 30% decrease in Gross Revenue and a 20% increase in costs again caused a decrease in BCR to 2.1. Based on the results of the two tests, it can be concluded that the villages will continue to financially benefit from the CSA interventions despite facing possible threats in the market. The amount invested by the community members in implementing the CSA interventions are expected to be recovered within three years after 2020.

Not all households chose to raise swine in addition to planting fruit trees and black pepper. However, the study showed that diversifying farm production should be encouraged and practiced by more households. It could even be replicated in Guinayangan and in other locations. The households that planted fruit trees and also opted to raise pigs would have generated a relatively higher income by 2023 onwards. Nevertheless, just planting fruit bearing trees would immediately be beneficial. The bananas and papayas that were planted

in 2018 provided additional revenue as early as 2019. In the same manner, native pigs reproduce within a year and, therefore, can generate income a few months after when the litters are sold. Such farm diversification could help the households maintain a steady and reliable income even if one of the crops failed or incurred losses. It serves as a cushion to minimize loss of livelihood for the family.

Social benefits were generated by the CSV project. Specifically, the study identified that economic empowerment, social inclusiveness, and contribution to knowledge were catalyzed by the activities initiated by the CSV project. In addition, the project established social support mechanisms including access to local government assistance and the capability and willingness of the community to help each other.

The CSA options that were adopted are considered environmentally sustainable. They do not pose alarming threats that can harm the environment but rather they can enhance conditions such as sequestration of CO2 in the atmosphere, minimizing run-offs and soil erosion, as well as increasing soil nutrient content.

More than the projected financial gains from the CSV Project is the deeper understanding of what is relevant to the household beneficiaries themselves. Efforts to understand the priorities and needs of the villagers at the initial stage of the Project was helpful in ensuring that the CSA interventions are what they really require. More can be achieved if the feedback mechanism will be continued while the Project is still on-going so that problems being faced by the households can be discussed and resolved together and new learnings can be shared.

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Information Resources

1. Cost-Benefit Analysis of Native Pigs as a Climate-Smart Agriculture Option in the Philippines
   Manilay, Alessandro; Monville-Oro, Emilita; Barbon, Wilson John; Ruba, Christine Dianne; Vidallo, Rene; Rosimo, Magnolia; Cabriole, Marie Aislinn; Gummadi, Sridhar; Gonsalves, Julian; Rondon, Marco
   Date: 2021-07-26
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