Cost-Benefit Analysis of Native Pigs as a Climate-Smart Agriculture Option in the Philippines

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Abstract

The Climate-Smart Village (CSV) approach is one of the initiatives that was developed to address the impact of climate change on marginalized rural households, and one of the climate-smart agriculture (CSA) options implemented in the Philippines was raising native pigs. A cost-benefit analysis (CBA) was conducted to assess the financial benefits of raising native pigs by determining the net income generated by the village households. A total of 52 households from Guinyangan, Quezon and Ivisan, Capiz were interviewed as survey participants while, village and municipal officials acted as key informants. Our findings showed that majority of the households surveyed generated positive net income in raising native pigs. However, 2020 profits decreased possibly due to the effect of the COVID-19 pandemic. The study also revealed the reliance of producers in commercial feeds instead of maximizing the available forage; keeping of livestock as inventories resulting to additional costs; and the lack of record keeping practices and absence of a price monitoring system causing the producers to be dependent on the prices offered by the buyers. Thus, providing education and training support on monitoring and assessing costs of raising pigs, and marketing assistance would be valuable to the households.

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Acronyms

CBA	cost-benefit analysis
CSA	climate smart agriculture
CSV	climate smart villages
ER	expense ratio
OPMR	operating profit margin ratio

Introduction

Changes in weather patterns and occurrences of extreme weather conditions have become global trends as a result of climate change. In Southeast Asia, increases in ambient temperature, prolonged rainfall patterns, droughts, and extremely strong typhoons are now a common phenomenon. These climate changes greatly affect farming communities whose livelihoods are dependent on agricultural production. To help alleviate this problem, a number of development programs and projects are currently being implemented which incorporate climate adaptation options for farmers. These options call for a combined initiative by various institutions as well as the stakeholders in the communities. The efforts focus on an integrated strategy that directs technological and institutional interventions towards a resilient and environmentally sustainable food production system. In this way, farming communities are able to adapt to climate change effectively.

The Climate-Smart Village (CSV) approach is one of the initiatives that was developed to address the impact of climate change on marginalized rural households. It is a process that helps transform farming communities into climate resilient sites by identifying and instituting agricultural technologies and farming systems that can enhance productivity, increase farm income, and withstand the effects of climate change (Aggarwal, et al., 2018). There is no ideal or fixed package of interventions. 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 approach is composed of a series of steps, namely: 1) Baseline assessment, 2) CSV design 3) Creating evidence, and 4) Scaling. Baseline assessment involves activities aimed at generating information such as agricultural vulnerabilities to climate change at the household/village level, climate data, existing agricultural practices, and natural and socio-economic resources. These data are used as input to the next step (CSV design). CSV design focuses on the development of a package of practices and technologies that are acceptable to the stakeholders and are adapted to the available resources and to the general conditions of the village or households. Once developed, these are promoted for adoption at the village level. These initial two steps apply a consultative approach where stakeholders in the community are involved in the identification and

development of the package of technologies to be adopted. The third step, Creating Evidence, is the evaluation of the identified agriculture options after they have been adopted. 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 agroecological characteristics. The last step, Scaling, involves the promotion of agriculture options found successful in Step 3 on a wider scale.

The International Institute for Rural Reconstruction (IIRR), in collaboration with the International Development Research Center of Canada as well as local government units in 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. Specifically, the one of the options adopted in the Municipality of Guinyangan, Quezon and Municipality of Ivisan, Capiz was the raising of native pigs.

Following the CSV process of Creating Evidence, a Cost-Benefit Analysis (CBA) was conducted in 2021 to determine whether the agricultural interventions were able to achieve the objective of increasing household resilience to climate change through increased farm income and generation of 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 benefits that the rural households and the villages as a whole have gained and will generate in the coming years from the adoption of raising native pigs as a climate-smart agriculture interventions.

Cost-benefit analysis

The Cost-Benefit Analysis was conducted to evaluate the financial performance of raising native pigs in Barangay Capuloan Tulon in the Municipality of Guinayangan, Quezon as well as in Barangay Malocloc Sur and Balaring in the Municipality of Ivisan, Capiz at the household level by gathering data on revenue and costs to estimate the net income.

Primary data was collected through personal interviews with the respondents. The number of households interviewed was determined using the Krejcie and Morgan equation for determining sample size.[1] 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, and the resulting number of households are presented in Table 1.

Image 1. Native pigs in Ivisan, Capiz. Source: IIRR-Philippines

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[1] Krejcie and Morgan equation:

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

Country	Location	No. of Households
Philippines	Ivisan, Capiz: Malocloc Sur Balaring	 11 6
	Guinayangan, Quezon: Capuluan Tulon[2]	35
Subtotal		52

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. 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.

Costs were classified into cash and noncash items to differentiate between costs where there was an actual exchange of money for the goods and from production inputs that were freely obtained. The former would include the purchase of feeds, and cost of materials used for the construction of pigpens. The noncash items referred to were family labor and forages as feeds. Family labor is often not viewed as a cost by people in the villages who have no other economic or income-generating activity to engage in. As such, the number of hours put into raising livestock are not perceived as opportunity costs. In the same manner, forages that freely grow around the house or in adjacent fields are not considered as economic goods by the villagers. However, in the context of an economic analysis, these production inputs were assigned corresponding market values in order to account for all production factors. Thus, the Cost and Return Analysis derived profit with and without the Noncash Costs. Net Cash Income was determined by subtracting the Net Cash Cost from the Gross Revenue. On the other hand, Net Income was estimated by subtracting Total Cost, ie., Cash plus Noncash Costs, from the Gross Revenue. The Net Cash Income was interpreted as disposable income and payment for family labor and forage. The Net Income, on the other hand, was derived to determine the profitability of the

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[2] 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.

interventions when the cost of all factors of production are considered. Profit is solely disposable income.

Financial indicators such as Breakeven Prices and profitability ratios were applied in addition to determining net income to evaluate the financial performance of the households. The Breakeven Price (BEP), which is equivalent to the production cost per unit of the good, was used to determine whether the market price obtained by the households for the farm produce that they sold exceeds the per unit cost to produce the good. Selling below the BEP means that the households are selling their goods at a price that is lower than their production cost and are, therefore, incurring losses.

BEP = Total cost/Number of goods produced
or
BEP = Total cash cost/Number of goods produced

The profitability ratios that were used were:
1. Operating Profit Margin Ratio (OPMR) = Net Income (Before taxes and interest charges)/Gross Revenue

The Operating Profit Margin Ratio reflects the percentage of profit the farmer retains out of the gross revenue. In equation form it is expressed as:
OPMR = [Net Income/Gross Revenue] x 100

A high percent value is preferred over a lower one. For instance, an OPMR of 0.65 or 65% means that a farmer keeps 65% of his gross earnings as profit while the remaining 35% pays for his operating expenses. On the other hand, an OPMR of 0.10 or 10% means that the farmer only retains 10% of his gross income as profit while 90% goes to operating expenses. The farmer who gets a 10% OPMR is at a disadvantaged position. His profit will remain small unless he lowers his operating costs. On the other hand, the farmer with a 65% OPMR is better off because he was able to minimize expenses to 35% of gross income.

2. Expense Ratio
Expense ratio is the flipside of Operating Profit Margin Ratio. It determines the proportion of the Gross Revenue that was used to pay for operating expenses. High percentage rates, eg., 90%, indicates that 90% of revenue has been eaten out by operating expenses. It can direct management to cut down on costs in order to increase profits.

3. Sales to Production Ratio (S/P Ratio)

The Sales to Production Ratio is a technique used to measure the turnover rate of production in terms of the volume of sales per unit time. In this study, the method was applied to determine the turnover rate of hogs produced versus the number of hogs sold per year. A 100% turnover rate is ideal, therefore, sales performance is measured against the ideal rate.

Financial performance of raising native pigs

Backyard raising of pigs is commonly practiced among low-income households in the rural areas of the Philippines. Native or crossbreeds are typically raised by these households because these types of pigs have a high level of resistance to diseases and they can feed on forage and kitchen scraps. They can be "kept loose, tethered or confined in pens made of local materials" (Mesia, et al., 2018).

Image 2. Native pigs in pens made of local materials. Source: IIRR-Philippines

Description of Households Raising Native Pigs

Capuloan Tulon, Municipality of Guinayangan, Quezon Province

Number of persons per household

Thirty five households in Capuloan Tulon with a total of 164 members were included in the study. An average of 4 to 6 members was common among the households as

reported by 68% of the respondents. There were 23% that belonged to households with only 1 to 3 members. About 9% of the respondents had 7 to 9 household members (Table 2).

Table 2. Number of persons in a household, Capuloan Tulon, Guinayangan, 2020

Persons per household	Frequency	Percent
1 to 3	8	23%
4 to 6	24	68%
7 to 9	3	9%
Total	**35**	**100%**

Age distribution of household members

Majority (48%) of the members of the 35 households in Capuloan Tulon were relatively young. They belonged to the 19 years old and younger age bracket. There were 26 (22%) household members in the 20 to 39 years old category (young adults) while 40 members (25%) were aged between 40 to 59 years old. The remaining members (5%) were senior citizens (Table 3). The age distribution among the households indicates that family labor is readily available within the 20 to 69 years old age bracket. This is one of the factors why hired labor is rarely utilized in performing work related to raising native pigs.

Table 3. Age of household members, Capuloan Tulon, Guinyangan, 2021

Age (Years)	Frequency	Percent
0-9	44	26%
10-19	36	22%
20-29	18	11%
30-39	18	11%
40-49	21	13%
50-59	19	12%
60-69	7	4%
70-79	1	1%
Total	**164**	**100%**

Educational attainment

The survey on educational attainment showed that 5% of the household members had some college education or completed a college degree. Three wives and 5 sons/daughters belonged to this category. Forty percent were either still finishing high school or have completed the secondary level of education. The remaining household members (56%) were either too young to go to school, at the nursery or primary school level, or have completed their primary school education. The

educational attainment of the husband ranged from having some primary (elementary) education to completing a secondary (high school) education. In comparison, the education of wives ranged from having some primary education to ompleting a college degree (Table 4).

Table 4. Educational attainment by household member, Capuloan Tulon, 2020

Educational Attainment	Husband	Wife	Son/ Daughter	Son-in-law	Grand child	Parent	Nephew Niece	Parent in law	Total	Percent
Below school age			8		3				11	7%
Nursery or Kindergarten			8				1		9	6%
Some Elementary School	8	2	29		2		2	1	44	27%
Completed Elementary Sch.	11	6	7				1	1	26	16%
Vocational Trng. Certificate	1								1	1%
Some High School	6	9	25				1		31	19%
Completed High School	9	12	10	1		2			34	20%
Some College		2	5						7	4%
Completed College		1							1	1%
Total	35	32	82	1	5	2	5	2	164	100%

The relatively low educational attainment among the adult household members pose a concern if education were to be used as an agent of change towards effective understanding of agricultural interventions to mitigate climate change. Furthermore, the wives in the households were found to be more highly educated than their male counterparts. This situation can be a positive indication that the women in the village are capable of doing not only household chores but also roles which could maximize their full potential in achieving household resilience.

Area of farm land

The main source of income of most household beneficiaries in Capuloan Tulon is mostly farming. Access to land for agricultural production provides the opportunity for families to intensify and/or diversify production to enhance income and household food security. The area of land being used for farming by the 35 households ranged from less than 0.5 to more than 2 hectares (Table 5). More than one-third (37%) of the households were using an area of more than 2 hectares. This was followed by households (20%) that were farming in 0.5 hectare or less of land. Other households were using 0.51 to 1.5 hectares of land (31%). Four (12%) of the

households were not engaged in farming. More than 60% of the households do not own the land that they farm while 25% reported land ownership.

Table 5. Area of land being farmed, Capuloan Tulon, Guinayangan, 2020

Area of farm land	Frequency	Percent
Not farming	4	12.0%
0.5 ha or less	7	20.0%
0.51 to 1.0 ha	6	17.0%
1.1 to 1.5 ha	5	14.0%
1.51 to 2 ha	0	0.0%
2.1 ha or more	13	37.0%
Total	**35**	**100%**

Malocloc Sur and Balaring, Municipality of Ivisan, Capiz Province

Number of persons per household

The households with 1 to 3 members made up the majority of the 17 households that were interviewed in Ivisan. This was followed by households with 4 to 6 members (29%) and lastly, the households with 7 to 9 members (12%) (Table 6). A total of 61 individuals (young and adults) lived in the 17 households that were interviewed.

Table 6. Number of persons in a household, Ivisan, Capiz, 2020

Number of persons per household	Frequency	Percent
1 to 3	10	59%
4 to 6	5	29%
7 to 9	2	12%
Total	**17**	**100%**

Age distribution

Thirty three percent of the 61 household members belonged to the child and teenage bracket (0 to 19 years old), while 26% were senior citizens (60 to 90 years old) (Table 7). Eighteen percent were young adults (20 to 39 years old), while 22% were in the older adult bracket (40 to 59 years old). The high number of the older household members shows that there are more able-bodied individuals who could be gainfully employed or provide labor for family-managed livelihoods.

Table 7. Age range of household members, 17 households, Ivisan, Capiz, 2020

Age Range (Years)	Frequency	Percent
0 to 9	8	13%
10 to 19	12	20%
20 to 29	6	10%
30 to 39	5	8%
40 to 49	7	11%
50 to 59	7	11%
60 to 69	6	10%
70 to 79	8	13%
80 to 89	2	3%
Total	**61**	**100%**

Educational attainment

The level of educational attainment among the households in Ivisan revealed that 46% of the members were taking up or completed elementary education. Another 34% were either in high school or have completed high school education. About 8% of the household members were taking up a college course or completed a college degree (Table 8).

Table 8. Educational attainment by type of household member, Ivisan, Capiz, 2020

Educational Attainment	Head	Wife	Son/ Daughter	Son- /Daughter- in-law	Grand child	Parent	Other Relative	Total	Percent
No Formal Education					2			2	3%
Nursery or Kindergarten			2					2	3%
Some Elementary School	5	4	3		2			14	23%
Completed Elementary School	5	4	3	1			1	14	23%
Some High School	3		9		2			14	23%
Completed High School	3	1	2	1				7	11%
Some College		1	2		1			4	7%
Completed College	1	1	1			1		4	7%
Total	17	11	22	2	7	1	1	61	100%

Area of farm land

Forty seven percent of Ivisan households farmed on lands with an area not exceeding 0.5 hectare (Table 9). Other households used land with areas slightly larger than 0.5 hectare while two households were not into agricultural production.

Table 9. Area of land farmed by 17 households, Ivisan, Capiz, 2020

Farm Size (hectare)	Frequency	Percent
0.5 ha or less	8	47%
0.51 ha to 1.0 ha	3	18%
1.1 to 1.5 ha	1	6%
2.1 ha or more	3	18%
Not farming	2	12%
Total	**17**	**100%**

Profile of the Native Pig Enterprise Project in Capuloan Tulon (Guinayangan), and in Malocloc Sur and Balaring (Ivisan)

Average number and value of heads raised, sold and consumed at home

The backyard native pig growers in Capuloan Tulon, Guinayangan raised pigs not only as a means of livelihood but also to be consumed at home and during special occasions. It was also noted that not all pigs raised by the household in a year were sold. In 2018, an average of 18 heads were raised by each household (Table 10). Of the total number of heads raised, an average of 12 hogs were sold and consumed. The following year, an average of 15 heads were raised per household where an average of 14 heads were sold. In 2020, an average of 15 heads were also raised where an average of six pigs per household were sold. The average Gross Revenues from 2018 to 2020 exhibited a decreasing trend, ie., the PhP 32,928.00 average earnings went down to PhP 13,860.00. The exhibited downward movement was drastic and especially evident in 2020. From an average of 15 heads that were produced, only six heads were sold. The COVID – 19 pandemic limited activities in the communities and, therefore, sales volume decreased.

In Ivisan, the native pig growers raised an average of 9 heads per household in 2018. Three were sold at an average gross earnings of PhP 13,428.00. In 2019, an average of four hogs were sold with an increased gross revenue of PhP 22,484.00. For 2020, each household sold an average of four heads with an average value of PhP 20,600.00.

Use of forage and kitchen scraps as feeds

One advantage of growing native pigs over the imported breeds is their ability to feed on forage more than commercial feeds. Raisers are, therefore, able to operate their pig farm with minimal cost.

Image 3. A local Feeding trichantera to native pigs in Guinyangan, Quezon. Source: IIRR-Philippines

Table 10. Hogs raised, sold and consumed at home, Capuloan Tulon, Guinayangan and Malocloc Sur and Balaring, Ivisan, 2020

Year	Hogs raised		Hogs sold and consumed at home			
	Guinayangan	Ivisan	Guinayangan		Ivisan	
	No. of heads		No. of heads	Value (PhP)	No. of heads	Value (PhP)
2018	18	9	12	32,928	3	13,428
2019	15	10	10	31,766	4	22,484
2020	15	11	5	13,860	4	20,600

In Capuloan Tulon, 28 (80%) households reported that they fed forage mostly to adult pigs while weanlings were fed with commercial feeds in combination with forage to help them grow and gain weight faster (Table 11). There were 5 (14%) households that only use commercial feeds for their livestock. They believed that the pigs gain more weight when fed with commercial feeds and would command better prices when sold.

Similarly, in Bgy. Malocloc Sur and Balaring of Ivisan, 17 (41%) households used commercial feeds for their animals. The remaining 10 (59%) households used a combination of forage and commercial feeds.

Table 11. Feeding practices of households, Capuloan Tulon, Guinayangan and Malocloc Sur and Balaring, Ivisan, 2020

Location	Commercial Feeds		Forage		Feeds and Forage		Total	%
Capuloan Tulon	5	14%	2	6%	28	80%	35	100
Malocloc Sur & Balaring	7	41%	0	0%	10	59%	17	100
Total	**12**	**23%**	**2**	**4%**	**38**	**73%**	**52**	**100**

Costs involved in backyard raising of native pigs

The costs in raising native pigs may be categorized into two types – cash and noncash costs. The cash costs included expenses for commercial feeds and vaccines. Weanlings were usually given starter feeds that are sold commercially before they were fed with forages and food scraps. However, the study revealed that some households also fed their fatteners with commercial feeds. Marketing costs, eg., delivery and handling costs, were found to be insignificant since a large majority of the buyers picked up the hogs from the households.

Noncash expenses are those expenses that are recorded in a profit and loss statement but do not involve an actual cash transaction. The noncash costs in raising native pigs were the economic values attributed to forages fed to the animals and family labor in raising the pigs.

Cash cost: Cost of commercial feeds

The average amount spent by the Guinayangan and Ivisan households on commercial feeds are presented in Table 12. Feed cost directly varied in relation to the number of hogs raised. The 2019 and 2020 cost of feeds in Guinaangan were lower than the 2018 value because the total number of heads raised in the more recent years were slightly lower than the 2018 production. In contrast, an upward trend in the cost of feeds was observed in Ivisan due to an increase in the number of hogs raised.

Table 12. Average cost of feeds by number of hogs raised, Guinayangan and Ivisan, 2018 to 2020

Year	Guinayangan		Ivisan	
	Cost of feeds (PhP)	Ave. number of hogs	Cost of feeds (PhP)	Ave. number of hogs
2018	30,026	18	14,849	9
2019	20,107	15	15,886	10
2020	15,518	15	15,960	11

Noncash cost: Labor cost, value of forage, and depreciation cost

Most backyard pig production does not require hired labor. Family members normally provide the manpower needed in raising the animals. The general activities involved in this enterprise are gathering forage, preparing the feedstuff, feeding, and cleaning the pigpen or yard where the pigs are kept. In the study areas, feed preparation and feeding were done twice a day. Gathering forage and cleaning the pigpen, on the average, were done 5 times a week.

Image 4. Feeding native pigs in Ivisan, Capiz. Source: IIRR-Philippines

Cost of labor was estimated by determining the time spent per day per household and the frequency of doing the tasks per month of feeding the hogs, preparing the

feeds (chopping leaves, mixing starter feeds with water), gathering the forage, as well as cleaning the pigpens or the backyard and then applying the wage rate (PhP 249.00/day) for agricultural labor. An average cost by task performed was obtained based on the sum of the costs generated per household. The raw data on time spent and frequency of performing the task that were obtained from Capuloan Tulon, Malocloc Sur and Balaring were combined to get an average cost that is representative of the three barangays. The results are shown in Table 13. The average cost per year per household was estimated to be PhP 10,875.00. Cost per head of pigs was derived by dividing the average cost with the average number of heads per year. The labor cost per household for 2018, 2019 and 2020 were calculated based on the cost per head and the corresponding hog population of each household.[3] Forages that are usually fed to native pigs are madre de agua, sweet potato and taro (gabi) tubers, banana pulp and vegetable scraps. Forages, in the absence of an appropriate market price, were valued using the average cost of family labor to gather forages. This was computed to be PhP 3,600.00/year.

The depreciation cost of pigpens was derived using the Straight Line Method. Pigpens made of concrete and GI sheets were assigned a lifespan of 10 years. The ones made of nipa or bamboo materials were given a shorter lifespan of three years. The average depreciation cost in Capuloan Tulon ranged from PhP 718.00 to PhP 755.00 for 2018 until 2020. In Ivisan, the depreciation cost was PhP 1,011.00 for 2018 and 2019 and PhP 824.00 in 2020.

Table 13. Labor cost per year by type of work in raising native pigs, Guinayangan and   Ivisan, 2020

Farm Activity	Ave. minutes per day	Ave. days per year	Labor Cost (PhP/year/household)
Prepare feeds & feeding	30	365	5,475
Gather forage	30	240	3,600
Clean pigpen	15	240	1,800
Total	105		10,875

Source: Key informant interview of selected households raising native pigs

$$\text{Labor cost }_{A(2019)} = \frac{[\text{No. of heads raised }_{A(2020)} \text{ x Ave. labor cost}]}{\text{Ave. number of heads raised in 2020}}$$

[3]

Net income from raising native pigs

Table 14 presents the financial indicators to determine the financial performance of households engaged in native pig production in Capuloan Tulon (Guinayangan), and Malocloc Sur and Balaring (Ivisan). As previously discussed, both Cash Costs and Noncash Costs were considered to determine profit. The Net Income based on cash cost was obtained by subtracting the Cash Costs from the Gross Revenue while the Net Income based on total Cost was derived by subtracting Total Costs (which includes Noncash Costs) from the Gross Revenue. The Net Income based on Cash Cost (or Net Cash Income) is the measure of the monetary reward derived from managing an enterprise. In the case of native pig raising, it represents returns that can be used as disposable income as well as payment to family labor since this is not deducted as cost. Negative Net Incomes communicate that the households did not get anything in return for the time and effort the family spent in running the enterprise nor did they receive any disposable income. In Capuloan Tulon, the households earned an average of PhP 13,202.00 in Net Cash Income in 2018 after deducting the Cash Cost of PhP19,726.00 from the Gross Revenue. It slightly increased in 2019 as average sales volume increased while average Cash Costs decreased. The downward movement of cash costs, which was mainly expenses for commercial feeds, was due to the decrease in the volume of production from an average of 18 heads in 2018 to 15 heads in 2019. Net Cash Income significantly decreased in 2020 in line with the slump in sales volume due to the COVID-19 Pandemic. The Net Income based on Total Cost was negative in 2018 since Total Cost (which included noncash costs) was larger than Gross Revenue. Net Income based on Total Cost during the succeeding years were positive but relatively smaller than values of Net Income based on Cash Costs. Thus, production of native pigs would barely become financially sustainable if the total cost of all production inputs would be considered.

Table 14. Net income from raising native pig based on cash cost and total cost, average values per household, in PhP, Guinayangan and Ivisan, 2018 to 2020

Item	Guinayangan			Ivisan		
	2018	2019	2020	2018	2019	2020
Number of heads raised/household	18	15	15	9	10	11
Number of heads sold/household	12	14	6	3	4	4
Selling price (PhP/head)	2,744	2,269	2,310	4,476	5,621	5,150
Gross revenue (PhP/household)	32,928	31,766	13,860	13,428	22,484	20,600
Cash cost/hd x no. heads sold	19,726	18,334	6,267	4,166	5,325	5,116
Total cost/hd x no. heads sold	41,241	31,281	12,051	3,087	4,290	3,871
Net income based on cash cost	13,202	13,432	7,593	9,262	17,159	15,484
Net income based on total cost	-8,313	485	1,809	1,907	2,859	2,728
Breakeven price based on Cash Cost	1,674	1,310	1,044	1,389	1,331	1,279
Breakeven price based on total cost	3,499	2,234	2,008	2,569	2,762	2,422
OPMR	40%	42%	55%	69%	76%	75%
Expense Ratio	60%	58%	45%	31%	24%	25%
Sales to Production Ratio	66%	91%	40%	33%	40%	36%

The efficiency of how the household managed swine raising was measured by determining the Operating Profit Margin Ratio (OPMR). The average OPMR [4] of the village enterprise in 2018 was 40% based on the Net Cash Income, indicating that households that generated a profit, on the average, retained 40% of their gross earnings as payment for their labor and money invested in the production of hogs. The rest of the revenue covered the cost of operation. Comparing the 2018 OPMR with the ratios obtained in 2019 and 2020 showed that OPMR increased to 42% in 2019 and 55% in 2020. These ratios revealed that, the households on the average, were able to keep a larger amount of profit when compared to the the amount they received in 2018. In other words, they received a higher payment for the effort and funds used in running the family business.

The inverse of the OPMR is the Cost to Revenue Ratio (or Expense Ratio) which shows how much of the operating expenses have eaten up the Gross Revenue. The ratio in 2018 (60%) was higher in comparison to the 2019 and 2020 ratios which means that the households, on the average, spent more for commercial feeds in relation to their Gross Income. The Expense Ratio in 2020 decreased to 45% indicating that the households were able to keep their expenses low to increase profit. The latter years where the values have decreased indicates that the households were able to keep their expenses low to increase revenue. In essence, it implies that higher returns to family resources could be attained if costs could be minimized further.

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[4] OPMR = [Net income based on Cash Costs/Gross Revenue] x 100

The positive effect of the increase in sales volume in 2019 on Net Cash Income can be demonstrated by deriving the Sales to Production Ratio (S/P Ratio) between 2018 to 2019. In 2018, the S/P Ratio was 66% which indicates that 66% of the number of hogs produced were sold. In contrast, there was a higher S/P Ratio in 2019 (91%), ie., despite a decrease in the volume of production, households were able to sell a larger number of heads that they produced during that year. On the other hand, when the COVID-19 pandemic occurred, the slump in sales was brazenly highlighted by the S/P Ratio when it registered a low measure of 40%, ie., less than half of the total production was sold in the market.

In the villages of Ivisan, Gross Revenue exhibited an increase from 2018 to 2019. This was brought about by a slight increase in the average number of heads sold as well as an increase in the average selling price of pigs from PhP 4,476.00/head to PhP 5,621.00/head. The Expense Ratios from 2018 to 2020 showed that the average prices gained an increasing leverage over the Cash Costs thereby resulting in better Net Incomes. Values of OPMR were much higher than the ratios generated by Capuloan Tulon. The ratios indicate that households were retaining 69% or more of their Gross Revenues as profits from raising native pigs. However, their S/P Ratios, which ranged from 33% to 40%, were much lower than in Guinayangan. This means that they were only able to sell 33% to 40% of their swine production in the Ivisan market. The relatively lower S/P Ratio in 2020 substantiates the claim that COVID-19 has affected the native pig market not only in Guinayangan, Quezon but also in Ivisan, Capiz. The breakeven price (BEP) represents the point at which cost per head is equal to the selling price per head of swine. The household neither losses or gains if a market transaction occurs at this point. Selling the hogs at a price above it results in generating a profit while selling below the BEP would result in losses for the seller. The BEP shown in Table 13 is an average value. Each household has a BEP based on the Cash Costs incurred. The BEP per household widely ranged from PhP 1,044.00 to PhP 1,674 per head between 2018 to 2020 in Capuloan Tulon and from PhP 1,279.00 to PhP 1,389.00/head in Ivisan.

Comparative Analysis of Household Income With and Without Native Pigs

Sources of household income

Household income in Capuloan Tulon mainly came from coconut farming, fishing, and off farm activities such as running small businesses and off-farm employment. About 36% of the households depended on selling copra and/or mature coconuts for their source of income (Table 15). This was followed (20%) by household members that derived income from casual labor (off farm piece work). Sixteen percent

depended on retirement pensions and conditional cash grants from the government. Some households also generate income from nonfarm microbusinesses (eg., micro grocery stores) (13%) and from fishing/game hunting (10%). Others worked as skilled or unskilled employees (eg., laundry woman, janitorial service) (5%). From among the sources of income, it was evident that a larger number of household members draw their income from coconut farming, casual labor, as well as pensions and conditional cash grants.

Table 15. Sources of income of households, Capuloan Tulon, Quezon, 2020

Source of Income	Frequency*	Percent	Average (PhP/Yr)	Range (PhP/Yr)
Income from coconut farming	29	36%	61,590	1,800 to 270,200
Income from other farm activities (rice production)				
Income from fishing/game hunting	8	10%	27,213	500 to 72,000
Income from nonfarm business	10	13%	68,715	15,000 to 157,750
Income from casual labor	16	20%	29,888	1,000 to 172,800
Income from skilled employment	1	1%	33,600	
Income from unskilled employment	3	4%	60,200	2,400 to 216,000
Others (pension, 4Ps payouts, etc.)	13	16%	43,726	1,600 to 264,600
Total	80	100%		

*Multiple responses

In the case of Ivisan, sales from copra and mature nuts from coconut trees was the source of income for 21% of the income-earning household members. Eleven percent also earned money by intercropping their coconut farms with vegetables. Other sources of income were fishing or game hunting (9%), nonfarm businesses (15%), off farm casual labor (15%), skilled and unskilled employment (10%), and retirement pension or cash grants for low income families (19%) (Table 16).

Table 16. Sources of income of households, Ivisan, Capiz, 2020

Source of Income	Frequency	Percent	Average	Range
Income from coconut farming	10	21%	7,850	1,500 to 19,200
Income from other farm activities	5	11%	31,200	10,000 to 63,000
Income from fishing/game hunting	4	9%	10,050	8,000 to 13,200
Income from nonfarm business	7	15%	20,658	3,000 to 50,000
Income from casual labor	7	15%	42,643	8,000 to 126,000
Income from skilled employment	2	4%	97,500	3,000 to 192,000
Income from unskilled employment	3	6%	9,667	8,000 to 12,000
Others (pension, 4Ps payouts, etc.)	9	19%	17,500	500 to 54,000
Total	47	100%		

Household income and the poverty threshold

The annual gross income (excluding revenue from native pigs) of 43% of the Capuloan Tulon households did not exceed PhP 56,210.00. This amount is the

equivalent in Philippine Peso of the World Bank's poverty threshold (2018) of USD3.20 per capita per day for the lower-middle income countries. This shows that this group of households were living below the poverty line[5] (Table 17). However, there was still a small percentage (11%) of households that barely surpassed the poverty threshold. Combining these households with the poorer ones increases the households that were close to the poverty level, ie., from 43% to 54% of the total households. This data confirms that the CSV project is catering to its intended beneficiaries which are the marginalized members of the community. On the other end of the income spectrum, there were about 25% of the households that earned more than PhP 200,000.00. Income from raising native pigs was excluded to highlight the financial status of households without the intervention.

Table 17. Annual household income, various sources, Capulon Tulon, Guinayangan and Malocloc Sur and Balaring, Ivisan, 2020

Annual income per household	Guinayangan		Ivisan	
	Frequency	Percent	Frequency	Percent
<56,210	15	43%	10	58%
56,211 to 100,000	4	11%	2	12%
100,001 to 150,000	3	9%	3	18%
150,001 to 200,000	4	11%	1	6%
200,001 to 250,000	5	14%	1	6%
250,001 to 300,000	4	11%		
Total	**35**	**100%**	**17**	**100%**

The households in Ivisan were relatively poorer compared to the Guinayangan households. More than half (59%) of the surveyed households fell below the poverty line based on their reported income. The remaining households (41%) were above the poverty threshold where 2 households reported a gross annual income of more than PhP 150,000.00 in 2020 (Table 17). In terms of the value of the gross income, the Ivisan households reported much lower earnings not exceeding PhP 250,000.

Effect of raising native pigs on household income

The effect of raising native pigs on household income was analyzed to ascertain whether the CSV project is benefitting the households financially. This was done by comparing household income without native pigs versus the income wherein costs and returns from raising the hogs were included. Income without native pigs was the

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

combined earnings from coconut farming, fishing, nonfarm business, and off-farm employment of households that sold native pigs in 2020. Income data on raising native pigs from the same year were the ones added to make the comparison. The average costs that were used in the analysis were the relevant cash costs with and without the native pigs. This included expenses for household/family maintenance, coconut farming, and loan amortizations. Feed costs were considered when native pigs were included. The result of the comparison showed that the average gross income of the households in Guinayangan increased from PhP 120,113.00 to PhP 132,486.00 in 2020 from raising native pigs (Table 18). However, the increase in income was accompanied by an additional cost of about PhP 15,941.00. As a result, the average net income decreased by PhP 3,568.00 due to the increase in average costs. In Ivisan, household expenses were, in general, larger than income even without incorporating the native pig data in the household cashflow. The average net income that was obtained without the native pigs was negative PhP 69,890.50. Adding the native pig data decreased the net income to an average of negative PhP 70,429.00.

Table 18. Average household income with and without native pigs, Capuloan Tulon, Guinayangan, and Malocloc Sur and Balaring, Ivisan, 2020

Capuloan Tulon	Without Native Pig	With Native Pig	Difference
Average gross income	120,113	132,486	12,373
Average costs	78,050	93,991	15,941
Average net income (PhP)	42,063	38,495	(3,568)
Malocloc Sur and Balaring			
Average gross income	79,860	96,842	16,982
Average costs	149,751	167,271	17,520
Average net income (PhP)	(69,890.5)	(70,429)	(538)

While the average figures may show a negative income, a closer analysis of net income of individual households revealed that not all failed to generate a positive net income from raising native pigs. Majority (51%) of the 35 households in Capuloan Tulon were gainers in 2020 while only 7% were losers (Table 19). The rest (32%) had no sales for the year. In 2019, 54% were gainers while losers were only 14%. In 2018, the gainers were 69% of the native pig raisers. Similarly, in 2020, 64% of the 17 households in Ivisan earned a profit from selling native pigs compared to 18% who failed to breakeven. The remaining households (18%) did not make a sale. In 2019 and 2018, 71% and 53% were gainers. The losers were a minority while the rest failed to make a sale.

Table 19. Number of gainers and losers among households raising native pigs, Guinayangan and Ivisan, 2020

	Gainers		Losers		No Sales		Total	
	Freq	%	Freq	%	Freq	%	Freq	%
Guinayangan								
2018	24	69%	4	11%	7	20%	35	100%
2019	19	54%	5	14%	11	32%	35	100%
2020	18	51%	6	7%	11	32%	35	100%
Ivisan								
2018	9	53%	2	12%	6	35%	17	100%
2019	12	71%	1	6%	4	23%	17	100%
2020	11	64%	3	18%	3	18%	17	100%

Narrative Cases

Case 1: Two households that generated positive profits from raising native pigs from 2018 to 2020

Mr. Renato Ilagan (Figure 3) is a resident of Capuloan Tulon and has been raising native pigs since 2018. His hog enterprise has been profitable within that time period. In 2018, he sold 11 heads and earned a net income of PhP 30,800.00. The following year, he earned PhP 31,000.00 from selling 31 heads of hogs. In 2020, Mr. Ilagan made a profit of PhP 34,368.00 from selling 12 heads of native pigs at PhP 3,364.00 per head. His production cost was relatively low at approximately PhP 500 per head which was used to buy commercial feeds for the weanlings. (He feeds adult pigs with forage such as water spinach, trichantera, and vegetable leftovers.) Mr. Ilagan tries to minimize his expenses on commercial feeds and mostly rely on forages and kitchen scraps to get a good profit. He also haggles with the buyers to get a good selling price. He only sells if the price offered by the buyer would give him a good profit.

Image 5. Mr. Renato Ilagan with his native sow. Source: IIRR-Philippines

Case 1 is the ideal outcome of adopting native pig raising to supplement income of the household to achieve the goal of increasing resilience to climate change. In both cases, the hog raisers tried to minimize their production cost to attain a large profit

margin. Furthermore, being able to haggle for a better price or look for a buyer who would offer a good price is an effective way to improve profits.

Case 2: Two households that generated negative profits for several years from raising native pigs

Mr. Honorio Paderon from Capuloan Tulon, Guinayangan, Quezon lost Php 3,800.00 in 2018 from selling 5 heads of native pigs. In 2020, he lost PhP 2,360.00 from selling one weanling. (No sales was reported in 2019.) The weanling that he sold in 2020 was bought at a price of PhP 1,800.00 but his production cost for one head of hog turned out to be PhP 4,160. This was based on a total cash cost of PhP 12,480.00 per year for the purchase of commercial feeds which he combines with forage to maintain 3 heads of pigs. His interview revealed that he was not aware that he was selling his pigs at a loss since he does not keep a record of his expenses. He was confident that he was earning some profit from raising native pigs and, therefore, continue to raise them.

Ms. Mariquita Maquirang from Ivisan, Capiz similarly reflects the perception given by Mr. Honorio Paderon that she is earning a profit from raising native pigs despite the fact that it is the opposite. The Cost and Return Analysis conducted by this study showed that she lost PhP 2,458.00 for selling one gilt at PhP 7,000.00. Her cash cost or breakeven price, however, was PhP 9,458. In 2019, she sold 2 gilts for PhP 5,220/head but the computed breakeven price was PhP 5,408.00/head. The following year (2020), she lost PhP 1,408.00 by selling one gilt for PhP 4,000.00 while the production cost/head was actually PhP 5,408.00. The interview revealed that she did not fully equate profit with the amount that she gets from selling hogs. As long as the sow gives birth to new litters, this is considered as profit gained. This, however, is a short-sighted perception because, with new litters come expenses for commercial feeds. Thus, she is caught in a vicious cycle of selling at a loss every year.

Case 2 highlights the importance of maintaining an updated a record of income and expenses and knowing how to compute for the breakeven price even for small enterprises like backyard raising of native pigs. Applying these simple methods of financial management can make a difference in improving household income.

Teaching backyard raisers simple accounting methods should, therefore, be a requirement before starting project implementation.

Case 3: Use of 100% commercial feeds in raising native pigs

The raising of native pigs is commonly encouraged because these local breeds can be fed with forages which are abundant in rural areas. Use of these free resources as inputs can minimize production costs and help reduce the carbon footprint in swine production. Dependence on commercial feeds does not conform with the recommended practices for environmental sustainability in hog production. Mr. Roy Mendoza, Sr. from Capuloan Tulon, Guinayangan, a beneficiary of the CSV project, has been operating his native pig enterprise using 100% commercial feeds. He spent PhP 67,770.00 on commercial feeds in 2020 to feed 6 heads of pigs. In the previous year, he purchased PhP 79,065.00 worth of feeds for seven heads of pigs. When asked why he does not combine forages and kitchen scraps with commercial feeds, he reasoned out that the latter keeps the animals healthier and make them grow fatter as compared to feeding them solely with forages and food scraps. Fatter/healthier pigs command better prices when it is time to sell them. He also claimed that he still makes a profit despite a 100% dependence on commercial feeds. A Cost and Return Analysis conducted on his enterprise revealed the contrary. In 2018, he lost PhP 60,570.00 after selling 6 heads of pigs and PhP 10,095.00 in 2019 after selling one head. No sales were reported for 2020.

The case of Mr. Mendoza does not follow the conditions necessary for a successful implementation of the CSV intervention despite his claim of profit. His income was not only lower but he even incurred losses from 2018 to 2020 as revealed by the Cost and Return Analysis. From the point of view of project implementers, there should be an economic value that can be attached to the outcome of the intervention if it is to be considered effective. However, it appears that, for Mr. Mendoza, there is an intrinsic value associated with owning several heads of pigs which he could sell anytime (even without a profit) should there be a need for cash. Assigning a numeric value to Mr. Mendoza's feeling of self-reliance is a challenge to project evaluators. The failure of the beneficiaries to understand the broader impact of the CSA interventions is a major setback in achieving the desired outcome of the Project. In this case Mr. Mendoza did not fully comprehend that raising pigs in his backyard is

another means of increasing income by following recommended practices geared towards building resilience to climate change. This could be another "dole out" mentality common among beneficiaries of development projects. To prevent such wrong preconception, project implementers should be able to fully explain to the intended beneficiaries the project's expected outcomes.

Conclusion

The Cost-Benefit Analysis interviewed 35 households in the village (barangays) of Capuloan Tulon, Municipality of Guinayangan, Quezon and 17 households in the villages of Malocloc Sur and Balaring, Municipality of Ivisan, Capiz. Specifically, these families adopted agriculture interventions under the Climate-Smart Village (CSV) Project. 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 initial stage also included measures to prepare the community in understanding the goals of the project and to provide technical knowledge so that the CSV technologies to be adopted would be properly implemented. The actual field implementation, ie., 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 of change in making agricultural practices become environmentally sustainable would be made possible through the implementation of the CSA interventions.

The Cost and Return analysis of raising native pigs showed that majority of the households financially gained from adopting the enterprise. In Capuloan Tulon, Guinayangan, the average Net Cash Income per household was PhP 13,202.00 in 2018 and continued to increase to PhP 13,432.00 in 2019. However, Net Cash Income drastically decreased in 2020 to PhP 7,593.00 when sales volume plummeted possibly due to the COVID-19 pandemic. In Ivisan, the average profit in 2018 was PhP 9,262.00 and continued to improve in 2019 by reaching an average of PhP 17,159.00. The 2020 profits also decreased to PhP 15,484.00 possibly due to the effect of the pandemic. The Operating Profit Margin Ratio exhibited an increasing trend in all the barangays covered by the study. In Capuloan Tulon, OPMR increased from 40% in 2018 to 55% in 2020 indicating that expenses on feed costs decreased. In Malocloc Sur and Balaring, OPMR were comfortably at high values ranging from 69% to 76%. This performance was brought about by the relatively high selling prices and lower cost of production. Earnings were lower in Capuloan Tulon because expenses in relation to revenues were higher. The Expense Ratios in Capuloan Tulon ranged between 45% to 61% against the 24% to 35% of Ivisan. Profits were achieved when expenditures on commercial feeds were minimized and when the hogs were sold at a price higher than the unit cost of production. Households that were unable to generate profits failed to limit production costs to a minimum.

Native pig production could have been a more profitable enterprise if the households did not rely heavily on commercial feeds. The households should have maximized the use of free forage in feeding their livestock. This would have improved their incomes significantly. Another observation was the limited number of hogs sold by the households relative to hogs produced. The study revealed that from 2018 to 2020, there were only a few households that sold their hogs every year. Many kept their livestock as inventories. Keeping the pigs longer than their marketable age would mean more costs incurred to feed them. In addition, being able to determine the breakeven price for their pigs would be advantageous to the households to avoid

selling at a loss. Several households that were interviewed revealed that they were not aware of their breakeven prices and just depended on gut feel in deciding whether the prices offered to them would be enough to make them earn a profit. Determining accurate values of the breakeven price can be made systematic if the CSV project could encourage the households to keep records of expenses (even sales) and teaching them the arithmetic of computing for the breakeven price. The study also revealed that the swine producers have no system of monitoring the market price of native pigs and are dependent on the prices offered by the buyers. A price monitoring system on current prices of native pigs can be developed by the swine producers to keep them abreast of prices instead of simply relying on the prices offered by buyers. Knowing the current prices can make them more persuasive in haggling for better prices. The LGUs should be able to assist the swine producers in developing a price monitoring system.

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.
Likewise, developing and utilizing training materials on how to monitor and assess costs of raising pigs, and providing marketing support would also be beneficial to the households.

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