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Establishing a Viable Enterprise Using Free-Range Chicken Production Technology in Bataan, Philippines

Abigail G. Abuan[1*], Davedsonn C. Fetalvero[1], Cherlyn U. Gripo[1], Hermogenes M. Paguia[1], Gregorio J. Rodis[1], Ruby Anne P. Rosario[1], Manuel A. Abuan Jr.[1], Sander T. Agtunong[1], Jony G. Icalla[1]

[1]College of Agriculture, Bataan Peninsula State University, Abucay Campus, Abucay, Bataan, Philippines.

Abstract

The study aims to establish a viable enterprise for 2 years, funded by DA-ACEF, to increase the production of F1 free-range chicken, increase adoption of the technology developed by Tarlac Agricultural University, and enhance beneficiaries' capacity. A total of six technology packages at both on-station and on-farm sites,ncluding FRC housing, FRC breeding, FRC brooding, FRC ranging, FRC feeding, and FRC health management.

BPSU supported farmers from different cooperatives: 2 females and 2 males (on-farm) located in Tuyo, Balanga City, and Gabon, Abucay, and one (on-site) in BPSU, with a breeder house, 114 breeders, feeds, madre de agua plants, incubators, and training. Both sites were 100% adopted the developed technologies and improved practices focused on breeder, grower house, brooding, ranging area, feeds, alternative feeds, concoctions, and eggshell calphos. The on-site produced fertilized and unfertilized eggs, hardened chicks, and growers and layers as a payback scheme for "passing the gift" for the second batch of beneficiaries. The first and second batches of beneficiaries attended a total of three training sessions. Production performance of free-range chickens from both on-station and on-farm sites was analyzed using the Statistical Tool T-Test: Two-sample assuming equal variances. Significant results were obtained for average egg production and mortality rate ($P<0.05$). On-station and on-farm sites showed no significant differences in average egg sales, feed consumption, or feed cost ($P>0.05$). Financial analysis assumptions for the selling price per tray are Php 230-250, Average Annual Sales Volume of Php 519, 661.01, Annual Net Income is Php 185, 921.70, Investment cost is Php 401, 901.00, and ROI is 2.16 years with a rate of return on capital of 55.71% per station. In conclusion, the project increased free-range chicken production in the community, adopted technology, and capacitated farmer beneficiaries. The sustainability plan for the project implemented a payback scheme to fully utilize stocks and inputs and achieve a positive return for free-range chicken growers.

Keywords:

Free-Range Chicken, madre de agua, incubator, on-farm, on-site

*Corresponding Author: agabuan@bpsu.edu.ph Tel: +63 9092073975

INTRODUCTION

The initiative aims to address the protein shortage in the Philippines caused by African Swine Flu (ASF), which forced many swine growers, both large and small, to stop operations. As a result, pork supply dropped, and food security was affected. To address this, Secretary of Agriculture William Dar directed the Department of Agriculture-Bureau of Agricultural Research (DA-BAR) to seek proposals, especially from State Universities and Colleges (SUCs), for poultry-based projects. The goal is to promote alternative protein sources and maintain good nutrition during the pandemic. One proposal will use technology developed by Dr. Ma. Asuncion G. Beltran of Tarlac Agricultural University (TAU) to evaluate if it can work as a business in Bataan.

Free-range chicken farming fits well with local conditions because chickens naturally look for food by scratching the ground. Dr. Beltran and her team at Tarlac Agricultural University created technology to help local farmers invest and earn more. With this technology, trainers can easily teach farmers the skills needed to manage free-range chickens properly. This project helps maintain steady protein production and supports higher incomes for farmers.

In the province, some individuals breed free-range chickens and sell them to other farmers who raise them for their own consumption. There was no available data in the market supply and demand of free-range chicken that was conducted and recorded. However, the potential of raising the species is appropriate to promote and begin introducing to the market, since most Filipinos prefer to eat freely range animals, especially health enthusiasts. There were also food industries in the province, such as restaurants and supermarkets, that could sell the products. During these trying times of the pandemic, most consumers prefer to consume healthy foods with their family.

The products that were produced by the beneficiaries, both on-station and on-farm sites, will be marketed in different niches, such as having their own stall, online selling, restaurants, supermarkets, hotels, barbecue houses, and meat shops, which are available in the city where most of Bataeños visit to buy basic needs and enjoy food with their families. Farmers may use various market strategies to market their products, such as the farmer-to-trader market, where most Filipinos probably sell their products. With this, farm gate sales are low, as an introductory promotion to generate regular income from farmers to the retail market, from which small and big retailers can sell their products in supermarkets and even restaurants. Beneficiaries could also sell through farmers to buyer groups, a system that is not well developed in the country; however, it could work for niche markets such as free-range chicken, organic poultry, and native chicken farming. Using the system, health-conscious buyers can pool resources together and purchase poultry products from a reliable supplier (Poultry Manual, 2017).

The poultry industry in Bataan Province has been producing 29.7 million broilers per year and maintaining a population of 189,650 laying chickens, according to 2018 data from the Office of the Provincial Veterinarian. These birds require an estimated feed consumption of 63,476 tons, expected to increase by more than 10% in the coming years, most of which is for the broiler sector, distributed by major poultry integrators. Given this ongoing situation, the increase in product prices for human consumption will continue, as feed raw materials are in high demand. The prices of commercial feeds increase by 6-10 percent annually due to rising

import prices for raw materials such as corn and soybeans. The animal raisers of the province, however, have no option but to sustain their operations at higher production costs and lower profits. Thus, raising free-range chickens is an option to feed and supply the province's growing population, to support backyard raisers of native chickens, and to provide an opportunity to bring their products to market. The project beneficiaries were selected based on their capacity and willingness to participate in the project, as per coordination with their Municipal Agricultural Officer. They were also selected based on their experience as animal growers and the availability of land and resources.

Objectives of the Study

The main objective of the project is to develop a viable enterprise using free-range chicken production technology.

Specifically, the study aims to:

1. To increase the production of F1S of free-range chicken;
2. To increase the adoption of free-range chicken production technology developed by Tarlac Agricultural University;
3. To enhance the capacity of selected beneficiaries in the management of the free-range chicken enterprise.

REVIEW OF RELATED LITERATURE AND STUDIES

Free Range Chickens Production

Free-Range Chickens are modern chickens that grow freely, free to roam or raised in a pasture, and can naturally exhibit their behavior of scratching to get food, sunshine, and exercise. Free-Range is a production system that raises chickens in a confined environment while allowing the birds to exhibit their natural behavior and access forage, grasses, insects, and sunlight. Free-range production classified into a) pasture-raised, a method of production in which adult birds (layers) are kept on pasture 12 months of the year, in an outdoor area mainly covered with living vegetation. The birds have access to the pasture through exits from fixed or mobile houses and, if present, covered verandas. They are kept indoors at night to protect them from predators. Still, it is prohibited to keep them indoors continuously for more than 14 consecutive days without access to pasture. b) Traditional free range is a method of production that exceeds the minimum requirements (e.g., harvest age) for free range production.

The mandate of the Department of Agriculture is to increase the production of native animals, such as native pigs and chickens, as a source of protein, which, compared to domesticated breeds, do not require costly management. Women and children can easily raise chickens. In rural areas, households mostly raised different poultry species for home consumption only. Nowadays, some people raise free-range chickens and other strains that can produce more eggs and higher-quality meat. Their passion for raising animals drives them to invest and turn it into an enterprise. The development of technologies (Beltran, MAG 2020) helped disseminate information and encouraged many to invest in free-range chickens, particularly in Tarlac.

Conducted Studies in Free Range Chickens

Several studies on free-range chicken were conducted at TAU in recent years (2016-2019). On animal health development, studies on: 1) Anthelmintic Efficacy of Kakawate (Gliricidia Sepium), Guava (Psidium Guajava), and Neem Tree (Azadirachta Indica) Crude Leaf Extracts in Free-Range Chicken; 2) Effects of Fermented Oregano, Lemon Grass, and Pepper against respiratory infection in free range chicken; 3) Efficacy of kakawate leaves, Neem Tree Leaves, and Tobacco Leaves Against External Parasitism in Free Range Chicken. For nutrition research: 1) Utilization of azolla and duckweeds as alternative feeds for free-range chicken;2) Production of Natural Calphos for Egg Production for Breeder Chickens. For breeding: 1) Comparison of the efficiency of Using Native chicken and locally made incubators in hatching eggs. For economic analysis studies: 1) Yield or Produced eggs per Free Range Chicken, 2) FRC Cost and Return Analysis of Raising Free Range Chicken, 3) Initial Effects of the Project to the Beneficiaries, and 4—extension of Technologies for Free-Range Chicken through Capability Building for Farmers. The TAU research output, which yielded positive results, was shared with the beneficiaries by the TAU project team.

A study published in the journal Poultry Science divided 600 chickens into three groups: those raised completely indoors, those given outdoor access with artificial shelters, and those given outdoor conditions shaded by willow trees. Researchers found that birds with outdoor access and natural shelter had juicier, more tender, and better-textured meat. The researchers believe that the amount of exercise free-range chickens get daily helps develop their muscles, resulting in better flavor and texture.

Equipping farmers/beneficiaries and other stakeholders with the necessary knowledge, skills, aptitudes, and technologies for free-range chickens is essential. Below are the current practices of the farmers and alternative technologies that have already been tested, and given the farmers options to mix and match the technologies they need to adopt to increase their production of eggs and chicks.

Resource speakers tapped by the ATI in a seminar among farmers in Ifugao explained that promoting the technology for FRCP represents a paradigm shift in the livestock industry, and that, before engaging in it, one needs basic scientific knowledge and technology. These technologies needed in FRCP include housing and supplies, breeds and their characteristics, brooding, growing and lighting management, laying management, feeds and feeding, alternative feeds, care of eggs and incubation, vaccination, alternative health management, common diseases, treatment and control, and recording (Codamon, Philippine Information Agency). Five breeds in the Philippines are good for FRC farming, including the Australorp, Rhode Island Red, Light Sussex, Blue Isbar, and Plymouth Rock. Still, there are also cross-breeds for the raiser to choose from, such as the Sasso Brown Chicken, Asil Chicken, Naked Chicken, and the Black Cemari Turken. In the study conducted in Ifugao, 50 FRC layers sold for meat at P250/head can produce 9,856 eggs a year and a computation was made that a farmer can have a net gain of P21, 584.00/year with a total gross sale of P81, 49200/year from the P12, 500 for the 50 heads of hens and P68, 992.00 for the 9,856 eggs sold at P7.00 per 'piece and deducting the estimated total expenses involved amounting to P59, 908.00 also for the whole year. Farmers will realize higher profits in the succeeding years since they will no longer spend on housing and other facilities, and the more chickens they raise, the higher their income will be (JDP/DBC- PIA CAR, Ifugao).

Impact of the Technology

Based on the conducted studies of Beltran (2015, the developed technologies of raising Free Range Chickens provide a positive impact, such as (1) Free range chicken FRC raising is considered a demand-driven project where the beneficiaries included women and children who can easily manage the management. Additionally, it improves the total livelihood of the household; (2) FRC raising improved food production where women produce food for people within the community that produce available and affordable eggs and meat, especially food served in the table in daily basis; (3) FRC raising improved the family nutrition from eggs which considered as complete food that boiled, fried and omellettes, salad and used also in cosmetics; (4) There is an increase in the production of eggs through the use of artificial incubators which in need due to by nature FRC species does not naturally brood the eggs. (5) The TAU established a demonstration farm where they raised free-range chickens, which is a good venue for farmers to learn by seeing, for easier adoption by farmers in the field. They also establish more forage species for natural feeds established as a source of seeds and frag species for farmers to plant; (6) Use of ethno- botanicals for the health and disease management of free- range chicken was tested using different fermented products like fermented plant and fruit juices. The effects of fermented oregano, lemon grass, and pepper on respiratory infections in free-range chickens were very beneficial. Likewise, the study evaluated the efficacy of kakawate leaves, neem tree leaves, and tobacco leaves, which aim to reduce external parasitism in free-range chicken during the laying period; (7) There is improvement of family income and combat of poverty. A positive net income Php 21,584.00 was seen from production of eggs from 50 heads of chicken per production cycle per farm family was realized;(8) Alternative and doable technologies for farmers was developed such as a) Alternative technology on housing management; b) Alternative technology of brooding management; c) Alternative technology on nutrition and feeding; d) Alternative technology on breeds and breeding Management; e) Alternative technology on growing and laying management; f) Alternative technology on poultry health management; g) Simple recording management; h)Add-on enterprises on free- Range chicken production for farmers' livestock, and the Agricultural Training Institute for regional and national implementation.

MATERIALS AND METHODS

Criteria for Selection of Project Sites and Beneficiaries

Selection of Project Sites

The project sites were selected based on the following general/indicative criteria:

a. High chicken density;
b. Accessibility;
c. Recognized the chicken production as feasible and a source of income; and
d. Presence of support system.

At least two (2) community-based sites were selected for the establishment of the free-range chicken communities, one in the municipality of Abucay and the other in Balanga City.

Selection of Beneficiaries

Among the two organizations, a total of 4 farmers served as adopters of the project and produced and managed free-range chickens. The project team utilized the developed TAU technology to increase production in Bataan.

The farmers were selected based on the following criteria:

a. Willingness to participate in the project and attend trainings;
b. Willingness to construct housing and establish forage strata;
c. Positive receptivity to innovative technologies; and
d. Have some knowledge and understanding of chicken management practices.

The project team assisted farmer beneficiaries throughout the project's implementation.

a. Facilities- construction materials for the breeder house were purchased and provided to the target beneficiaries, and materials for the fence to secure the area.
b. Equipment- an incubator and agricultural supplies (planting materials for feeding free-range chickens) purchased for the production of eggs and the feeding of beneficiaries.
c. Human Resources- a Research Assistant, project staff, and a hired caretaker to work directly on the project. They assisted in implementing the project at BPSU and with 4 selected beneficiaries.
d. Inputs- tocks and feeds were provided for initial production, and in time, chickens laid eggs; farmer beneficiaries purchased feeds to sustain production. Moreover, an established forage demo area served as an alternative feed source.
e. Operations: The project's operations were led and implemented by the BPSU project team. The project team conducted monitoring and held focus group discussions during the project's implementation.
f. Outbound logistics. Collected fertilized eggs are stored and incubated to produce chicks, while unfertilized eggs are sold and consumed. The collected eggs are sold and consumed, and the rest are hatched and raised as breeders. As members of the organization, the farmer beneficiaries are selling their products. Moreover, the farmer beneficiaries are required to engage in a "passing the gift" scheme to make it sustainable.
g. Marketing and Sales- Both farmer beneficiaries and BPSU engaged in marketing, sales, and dissemination/promotion.
h. Services and Trainings- technical assistance was provided, including hands-on training with a printed guide on raising free-range chickens and a detailed training recording system. Printable forms were given to beneficiaries to properly account for and record all the activities and production performance of the free-range chickens.

Involvement of LGU's and RFO's in the implementation of the project

The LGUs of the target municipalities enter into an MOA (Memorandum of Agreement) with BPSU to legally bind both parties to the conduct and implementation of the project, specifying the roles and responsibilities of the target beneficiaries and BPSU.

Agency Counterparts

a. ***BPSU***- the counterpart of the BPSU in the project was the utilization of vehicles in the implementation of the project and technical support.
b. ***Target Beneficiary***- the target beneficiaries provided an area for establishing and constructing the project's housing. They also provided areas to establish forage and range for the collection of alternative feeds and for ranging to maintain their natural behavior. Moreover, the target beneficiaries shouldered the labor of constructing the housing and the fence in their areas.

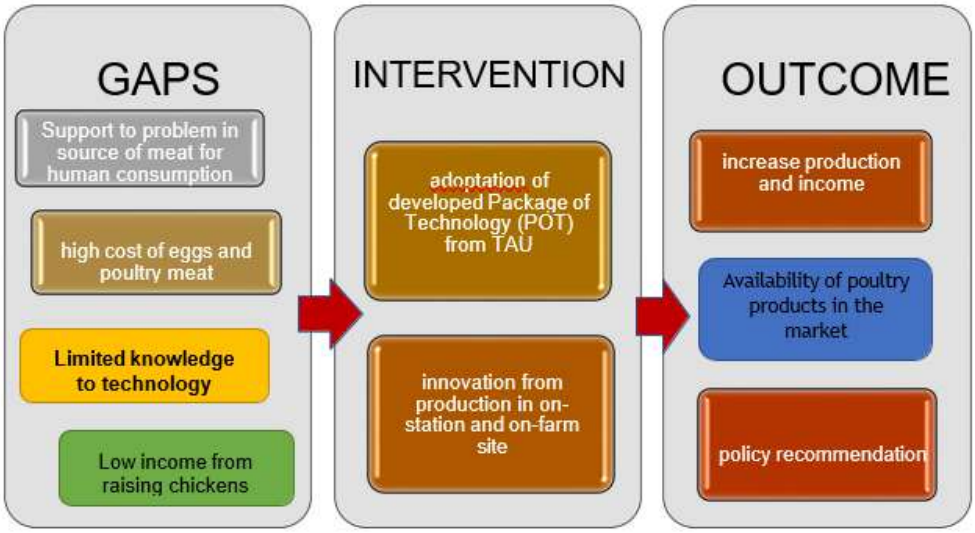

Figure 2. Conceptual Framework of the Project

As shown in Figure 2, the project's conceptual framework primarily focused on adopting the technology developed by Tarlac Agricultural University for raising free-range chickens. The main goal of the project was to produce free-range chickens as an enterprise for the target beneficiaries, ensuring sufficient egg and poultry meat production in the community and throughout Bataan. The project aims to provide farmers with an income source and may increase income among free-range chicken growers in the province.

Capacity Building for Farmer Beneficiaries. The BPSU will facilitate training for the first and second batches of beneficiaries to equip them to manage and produce free-range chickens, with a focus on the various technologies developed.

Rolling-out of Free-Range Chicken Technology. After they have received the breeders, the beneficiaries shall use the six (6) technologies. The technologies are the following: 1) Free range Chicken (FRC) Housing Management; 2) Free Range Chicken Breeding Management; 3) FRC Brooding Management; 4) FRC Ranging Management; 5) FRC Feeding Management; 7) FRC Health and Vaccination Management. The farmer beneficiaries adopted all the technologies, since they are all technically and commercially viable.

The establishment of forage strata will be a basic requirement for selecting an association as the beneficiary. The availability of raw materials for chicken feed will be

sustainable by teaching them to establish and manage a forage area to ensure a continuous supply even during dry months.

Monitoring and Evaluation by the Research Team. Recording is one of the most important factors in assessing an enterprise's actual situation. The research team trained the beneficiaries to use forms and to record their activities, and reiterated the importance of records in all their activities. The monitoring status also serves as the basis for the research team in preparing their reports and monitoring the project's progress. Upon recording, the beneficiaries may use other strategies and techniques that are most applicable to them and share them with the next beneficiaries. The research team provided a common system for recording to facilitate the consolidation of reports from farmer beneficiaries.

The project team members conducted regular monitoring with the farmers. The project team created a group chat (GC) to facilitate communication between team members and beneficiaries.

A focus group discussion was conducted to facilitate a meeting and address concerns and issues, in the interest of both parties and the project's success.

Data Gathering on Animal Performance. The project team conducted regular monitoring and provided technical assistance. Data on production performance, farm inputs, and sales were collected monthly using devised monitoring forms. The project team collected data from farmer beneficiaries at the on-farm site, which was consolidated and compared with that from the on-station site.

Performance of Free-Range Chicken on-station and on-farm sites was recorded and analyzed during the study. All data are encoded in MS Excel and computed to obtain average and mean values. The following data were collected and analyzed using the T-Test MS Excel Statistical Analysis Tool Pak for one-tailed and two-tailed tests, assuming that the management practices (on-site and off-site) have equal variances:

a) Egg Production Percentage, %
b) Sales of Egg, Php
c) Feed Consumption, kilogram
d) Feed Cost, Php
e) Mortality Rate, %

Payment of Loans by the beneficiaries. The "passing the gift" method was the scheme for introducing free-range chickens. The association will then serve as the trainers in their community, assisting recipients in properly raising and managing the animals. In coordination with the MAO and the first batch of beneficiaries, the second batch was selected and trained before the distribution of egg stocks for production. The basic requirement was the following:

a) active member of the association;
b) with available area and housing for the chickens;
c) with available area for ranging and forage development;
d) attended the training;
e) financially can support the feed cost and other expenses; and
f) pass the gift to other interested member of their association.

RESULT AND DISCUSSION

Results and Discussion of Objective 1. To increase production of F1s of dominant CZ breed;

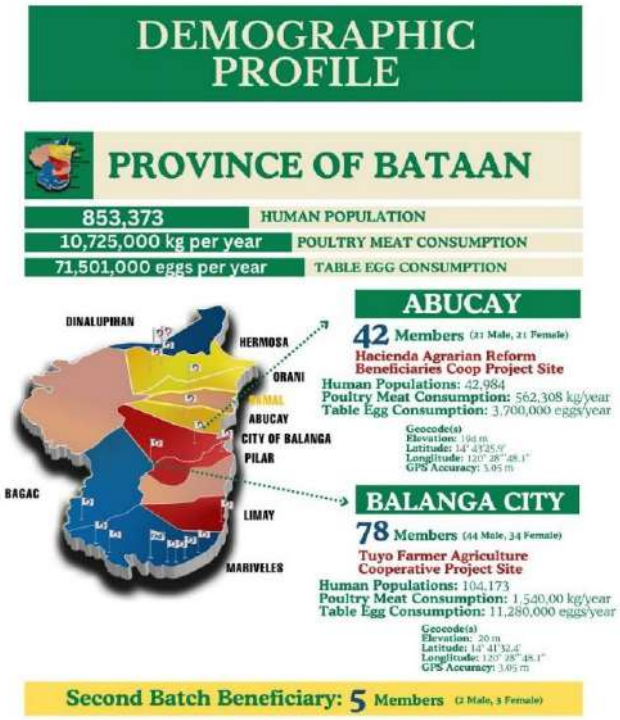

Figure 3. Demographic Profile of Farmer Beneficiaries

Based on Figure 3, the province had a total population of 853,373, and consumption of meat and eggs was 10,725,000 kilograms per year and 71,501,000 eggs per year, respectively. (PSA, 2020). The values show an increasing population and the ASF situation, which the project can address by providing consumers with a protein source through the raising of free-range chickens. The farmer-beneficiaries from the first and second batches were from Abucay and Balanga City, with 42 (21 male and 21 female) and 78 (44 male and 34 female), respectively. The association is the Hacienda Agrarian Reform Beneficiaries Cooperative from Abucay and the Tuyo Farmer Agricultural Cooperative from Balanga City. The second beneficiaries who received "passing the gift" were 5 (2 males and 3 females) from different associations other than the first selected associations, due to another member's unreadiness to receive the project. Furthermore, the map shows the locations of the farm sites with their geo-tags. Of the 4 first-batch beneficiaries, 5 farmer beneficiaries were validated and selected, accounting for 100%. However, due to problems encountered during the study, especially in feed costs and others, the BPSU project team decided to support the production of chicks and to produce ready-to-lay chicks for the second batch of beneficiaries. Under this arrangement, the BPSU and the farmer beneficiaries also stipulated in the MOA that they would produce chicks and distribute them to interested members of the association, for a value equal to the initial stocks they received.

Purchased and Distribution of Initial Stocks

The BPSU Abucay Campus on the station site and the (4) farm sites received a stock (100 female and 14 males) of free-range chicken breeders. The on-station site produced chicks and hardened chicks for a payback scheme.

Passing the Gift to Second Batch of Beneficiaries

A total of 205 were released as of July 31, 2024, for the second batch of beneficiaries, aged 3 to 4 months, and are continuously producing to support the farmer's first batch of beneficiaries' payback schemes. A contract stipulated in the MOA between BPSU and the first batch of farmer beneficiaries as their payback scheme. They will produce 500 chicks to disperse to interested members of their association, provided they attended a seminar on free-range chicken management at the BPSU Abucay Campus, to inform them of the high cost of producing breeders and other inputs.

Results and Discussion of Objective 2. To increase the adoption of free-range chicken production technology developed by Tarlac Agricultural University.

Housing Management

A total of 5 breeder house units, measuring 12 x 3 meters, were constructed at on-station (BPSU) and on-farm sites (Balanga City and Abucay). BPSU provided the construction materials, and the farmer beneficiaries covered the labor costs to build the house, including the cost of the fence materials. The breeder house was designed for 110 birds and included a waterer, a drinker, a light, perches, a nest box, and a curtain for protection against heavy rain and wind. The house is of the elevated type to properly manage excreta and prevent contamination of eggs (PNS/BAFS 262:2018) ICS 65.020.30.

Breeding Management

A total of 561 F1 stocks, comprised of 96 breeder females (Dekalb Brown and Brown Nick) and 65 breeder males (Brown Nick), were provided to the on-station and on-farm site beneficiaries from BPSU. The chickens raised for egg production (fertilized and unfertilized), meat, and hard eggs. A ratio of 1:7 (male-to-female) seduces the project. However, to maximize resources, the production of unfertilized eggs provides sales and funds to purchase feed costs. The breeds Dominant CZ and Dekalb brown are classified as Hybrid layers and can be grown in cage-free environments (PNS/BAFS 312:2021). As of June, the total ending inventory of stocks on-station and on-farm sites was (78) and (57), respectively, from the beginning stocks of 100 female breeders per station.

Brooding Management

On-station site farm established brooding management for producing chicks using a brooder box with waterer and feeder, an incandescent and ceramic light as a heat source, a temperature and RH checker, and rice hull as litter material (Beltran, MAG.2020).

As of June 30, 2024, a total of 212 chicks (100%) have increased in the population and are in the brooding house until 35 days before they are grown to the grower house. The farmer beneficiaries in Abucay were able to use their incubator and prepared brooder box for the first time in June. Moreover, from March to June, one beneficiary produced 80 hardened chicks incubated from an outside source, accounting for 80% of the increase in production.

Ranging Management

A range area on both sites where free-range chickens roam during the day and acquire Vitamin D directly from the sun without limiting their natural behavior, such as pecking, foraging, perching, nesting, dust bathing, preening, and fighting. However, during rainy days, the free-range chickens were fully confined in the housing to ensure their safety and health, in accordance with PNS/BAFS 296:2020. Access to the range area shall be available during daylight hours, unless prevented by bad weather or by veterinary advice. Included in the inputs provided to the farmer beneficiaries are fence materials to secure the stocks and area for ranging, and an established forage area.

Feeding Management

The on-station produced feeds for layers, chicks, and growers using formulated layer 1, layer 2, booster, and grower diets. Alternative feeds we used for the layer breeders: 100 g of feed, 20 g of fresh madre de agua leaf meal, and azolla. For the on-farm site, the farmer beneficiaries purchased commercial feeds near their areas. Alternative feeds such as madre de agua leaves, azolla, malunggay leaves, rejects vegetables, and banana were fed to the breeder by the raisers, which are locally available and environmentally enriched based on the (PNS/BAFS 312:2021) and (Beltran, MAG 2020).

Health Management and Protocol

The established vaccination schedule is essential to ensure optimal protection. The study aims to prevent and control infectious diseases that have the potential to cause substantial harm to the health, welfare, and financial stability of poultry projects, to reduce morbidity and mortality rates in poultry populations, and to improve overall flock health and productivity.

Vaccination Program

Poultry vaccination programs are essential for maintaining the health and productivity of chicken flocks. This health program aims to prevent and control infectious diseases that can significantly impact poultry health, welfare, and economic viability.

As part of the program of the free-range project established by the Bataan Peninsula State University (BPSU) – Abucay Campus in collaboration with the Department of Agriculture (DA) – Agricultural Competitiveness Enhancement Fund (ACEF), all brooder and grower chickens ar vaccinated of ND and IB and all the farm breeders administered with vaccines against ND (Lasota Strain), IB, Fowl pox, Coryza and Mycoplasma. The said program has led to positive outcomes, including reduced disease incidence, improved flock health, enhanced productivity, and lower medication costs.

Health Management

In general, poultry are highly susceptible to environmental changes, particularly extreme weather conditions. On the farm, extreme weather conditions have been encountered, which resulted in a disease challenge. Some of the grower chickens showed signs of respiratory problems, such as nasal discharge, labored breathing with drooping wings, decreased feed intake, and lethargy.

The disease challenge had adversely affected the flock's health and productivity, resulting in almost 100% morbidity and more than 50% mortality in a batch of grower

chickens. Thus, implementing effective interventions, such as maintaining optimal environmental conditions, adhering to biosecurity measures, and following medication and vaccination, can mitigate these challenges. Regular monitoring and early intervention are crucial to ensuring the flock's well-being and productivity.

Mortality Report

Presented in Table 2. Mortality Report of the breeders on-station and on-farm site.

Table 3. Average Mortality Report on Breeders.

Year	On-Station Site	On-Farm Site
2023	10	17
2024	11	25

On-station recorded 10 and 11 breeders in 2023 and 2024, respectively. However, on the farm site, there were 17 and 25 mortalities in 2023 and 2024. Although Table 3 suggests a slightly significant mortality rate (not exceeding 5%), the primary contributing factor is likely adverse weather conditions. By implementing the recommended measures promptly, we can reduce losses and improve overall poultry welfare on the farm.

Production Performance of Free-Range Chickens on-station and on-farm site

Presented in Table 4, is the production performance of free-range chicken on both stations.

Parameter	On-Station	On-Farm	P-Value
Average Egg Production, %	72.91%	50.66%	P(T<=t) one-tail 0.000413 P(T<=t) two-tail 0.000413
Average Egg Sales, (monthly, Php)	103,790.00	100, 189.25	P(T<=t) one-tail 0.226709 P(T<=t) two-tail 0.453419
Average Feed Consumption, (monthly, kilogram)	246.59714	319.2857	P(T<=t) one-tail 0.0616023 P(T<=t) two-tail 0.1232047
Average Feed Cost, (monthly, Php)	144,622.08	104,823.41	P(T<=t) one-tail 0.38991233 P(T<=t) two-tail 0.77982466
Average Mortality Rate, (monthly, head)	2.00	3.16	P(T<=t) one-tail 0.00916013 P(T<=t) two-tail 0.01832025

Presented in Table 4 is the production performance of free-range chicken in on-station and on-farm sites. The values obtained significant differences in average egg production and mortality rate, and no significant difference among the values for average egg

sales, average feed consumption, and average feed cost. The egg production values obtained at the on-farm site were lower than the standard values for laying percentage, which is greatly affected by the changes in feeds. Quality of feeds provided to the free-range chickens that must conformed in accordance with the provision stated in Philippine National Standard on Animal Feed Ingredients and Philippines National Standard on Code of Good Animal Feeding stated that all chickens shall receive adequate quantities of feed and nutrients daily to enable them to maintain good health, meet physiological demands and avoid metabolic and nutritional disorders that may affect the egg production and their health (PNS/BAFS 296:2020). The average egg-laying of 72.91% at the on-station site met the free-range chicken standard of 71-79% and produced 260-290 eggs/year. However, the lower percentage obtained from the farm site was below standard, due to many factors in the practices, such as feeding, lighting, and the health condition of breeders (Beltran, MAG.2020).

The mortality was due to adverse conditions during rainy and summer months that also influenced the quality of eggs produced and caused morbidity, leading to death. The mortality rates did not exceed 5% at both sites and were lower than the 9-10% observed in a year (Beltran, MAG.2020).

Table 5. Summary of Income Report per Beneficiary.

BENEFICIARY	Year	Total Sales, Php	Total Expenses, Php	Net Income
Abucay 1	2023	54,327.00	71,776.00	-17,449.00
	2024	55,280.00	68,340.00	-13,060.00
Abucay 2	2023	41,188.00	46,908.00	-5,720.00
	2024	49,400.00	47,780.00	1,620.00
Balanga 1	2023	48,326.00	49,400.00	1,442.34
	2024	46,883.66	49,064.60	335.40
Balanga 2	2023	40,865.00	43,623.42	-2,758.42
	2024	51,542.00	44,918.60	6,623.40

The income reports for Abucay and Balanga beneficiaries reveal varying financial performances from 2023 to 2024. Abucay Beneficiary #1 experienced a net loss in both years, totaling ₱17,449 in 2023 and ₱13,060 in 2024, despite increased sales. The expenses for this beneficiary exceeded the revenue generated in both years. Similarly, Abucay Beneficiary #2 recorded a loss of ₱5,720 in 2023 but turned a small profit of ₱1,620 in 2024, indicating improved expense management and higher sales.

On the other hand, Balanga Beneficiary #1 maintained a positive, small net income. It earned ₱1,442 in 2023 and a slight reduction to ₱335.40 in 2024, reflecting nearly equal sales and expenses. Balanga Beneficiary #2 improved significantly, overcoming a loss of ₱2,758.42 in 2023 to achieve a profit of ₱6,623.40 in 2024, driven by a substantial increase in sales and better control over expenses.

The financial analysis of the free-range chicken production project indicates that the business model is economically viable, with a net income of ₱1,859,216.96 over ten years and a 55.71% rate of return on capital. The consistent revenue from egg and chick sales, along with occasional income from culled chickens, outweighs the fixed and operational costs, making the project profitable in the long run. However, individual performance among the

project's beneficiaries varies. While all beneficiaries saw sales growth from 2023 to 2024, Abucay Beneficiary #1 continued to operate at a loss, whereas Abucay Beneficiary #2 turned a small profit in 2024. Similarly, Balanga Beneficiary #1 recorded a small profit in both years, while Balanga Beneficiary #2 posted a significant turnaround from a loss in 2023 to a profit in 2024.

The steady sales growth across all beneficiaries reflects strong market demand for free-range chicken products, but controlling costs will be essential for maximizing profitability. While the startup model shows promise, especially in generating steady revenue, optimizing feed, medicine, and operational expenses will be crucial to improving the net income of beneficiaries currently facing losses or low profits. Overall, the project has the potential for long-term success with better cost management strategies.

Results and Discussion of Objective 3. To enhance capacity of selected beneficiaries on the management of free-range chicken enterprise

The project team and the first batch of beneficiaries attended a Training of Trainers at TAU, Camiling, Tarlac, on January 30-31, 2023, facilitated by Dr. Ma. Asuncion G. Beltran, focused on various technologies. Pre-test and post-test were administered to participants to assess their knowledge of growing free-range chickens and to acquire knowledge from the lectures of the assigned speakers. (Beltran, MAG 2020). The project's farmer beneficiaries conducted an actual demonstration of different concoction-making techniques. A farm visit was scheduled during this period, during which farmers and the project team visited the beneficiaries' free-range chicken farms.

The second training, conducted on April 23, 2024, by the project team at the BPSU Abucay Campus, was entitled "Operation and Management of Incubator" and was attended by the first and second batches of beneficiaries. Moreover, the project purchased an incubator unit (a setter and a hatcher). It gave it to the farmer beneficiaries, and the project team provided an

The last training was conducted on April 29-30, 2024, at BPSU Abucay Campus for the management and production of the DA-ACEF second batch of beneficiaries. The first batch attended the said training. Hands-on training in concoction making (DA-ATI.2021), during which the first batch of beneficiaries learned to prepare the concoction following the ingredients and procedures. A farm visit was also conducted on the second day of the training, during which participants had a hands-on opportunity to observe candling, release chicks from the hatcher, and place them in brooder boxes. They also visit the breeder house for egg production and the forage demonstration areas of Madre de Agua and Azolla. Overall, the BPSU provided 100% training to capacitate the farmer beneficiaries from the first to the second batch.

Sustainability Framework Plan

Presented in Plate 24, the Sustainability Framework Plan for Free-Range Chicken Raising through the FRC enterprise enabled beneficiaries to earn income. They invested it as capital to support operations and expand the project. The BPSU will propose research and extension projects related to the first project to continuously assist, monitor, and evaluate the project until the beneficiaries can accomplish the dispersal of the "passing the gift" scheme.

To sustain the project, it is on a station site, with usproduce sales covering feed expenses. The project team initially requested support from the university's Research and Development Office to sustain research output by submitting project-related proposals. Creating an association among the farmer beneficiaries is one of the plans, and research and extension projects to continuously support them until they can implement and complete the "passing the gift" scheme. For the marketing aspect, the project team and farmer beneficiaries will establish a local market hub for the produce in coordination with the LGU, DTI, and other sectors. A collaboration with a private partner or institution is also a plan to strengthen production and expand the project's linkages. Moreover, during this time, the produce was sufficient to value-add to the market by producing secondary products and to be fully utilized on both on-station and on-farm sites. After three to five years of raising free-range chickens, the project's impact assessment will focus on beneficiaries' earnings/profitability and on how the project helps each beneficiary.

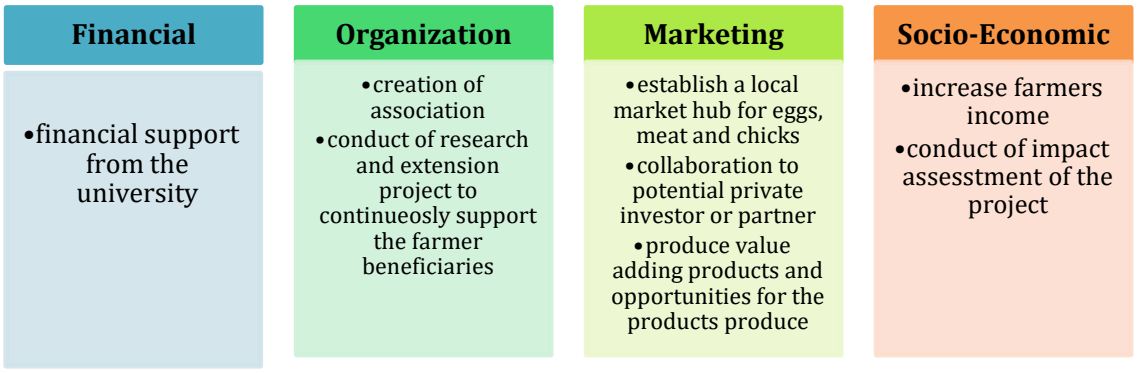

Figure 4. Sustainability Plan of Free-Range Chicken Production

Best Practices on the production and management

The projects, both on-station and on-farm, focused on site best practices, including the provision of stocks and construction materials for housing. Additionally, the technology on housing management was adopted and improved using an elevated type of housing for free-range chicken breeders to ease the management following the basic requirement for space and availability of equipment such as feeders and waterers, nesting areas, and the provision of materials needed to let stocks exercise their natural behavior, such as perching, pecking, and preening. Provision of nest box on the back side of the house and use of brooder box to secure the chicks from rodents and other animals, and usage of different sources of heat, such as incandescent bulbs and ceramic bulbs. Utilization of different alternative feed additives for feeding stocks, use of an improvised chopper for madre de agua, use of social media to promote and sell products, and use of group chat for ease of communication. Strict compliance with simple bio-security measures. Provision of an incubator to the beneficiaries and planting materials for the forage area.

Challenges met during the implementation of the project

During the implementation of the project, there are different challenges encountered in both on-station and on-farm sites:

a. health condition of the stock and the stocks for farmer beneficiaries;
b. processing of procurement;
c. unavailability of stocks, raw materials and the high price; and

d. uncontrolled factors such as high inflation rate and weather conditions.

Conclusion

Based on the above findings and the project's achievements, the study concluded that the number of farmer beneficiaries engaged in free-range chicken raising increased by 100% from the first to the second batch. The different technologies developed by BPSU, including on-site and on-farm field and intervention stations, were produced at both sites to reduce labor intensity and improve production through farmers' practices and strategies. The project team capacitated beneficiaries from the first and second batches through lectures, practical demonstrations, and on-farm exposure. Moreover, in general, free-range chicken is a viable enterprise when good husbandry practices are in place.

Recommendation

The project team recommends the continuation of the project into research cum extension to further study the potential of the free-range chickens into its optimum production performance and to develop other research output that utilized by the farmer beneficiaries such as developing feeds for different stages, conduct of value chain analysis of the free-range chicken by-products other than eggs, production of madre de agua as feed ingredients for feeds, and development of products which can be transfer to farmer beneficiaries and other interested groups or association or individuals. Moreover, to assist the farmer beneficiaries from the first to the second batch in their production and management until they comply with the requirements of the gift scheme, and to monitor their milestones.

Conflict of interest

The authors have no conflicts of interest to declare between the team members and the funding agency.

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