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Research Article

Determinants for Increased Efficiency of Sitio Busngol Farmers Association Highland Vegetable Production in Puerto Princesa City

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ABSTRACT

Highland vegetable farming is the cultivation of vegetables in high-altitude regions to take advantage of the unique climatic conditions found at higher elevations, such as cooler temperatures, greater rainfall, and more fertile soil. In 2020, a successful pilot production of highland vegetables in Puerto Princesa City was conducted by local government in partnership with the Sitio Busngol Farmers Association (SBFA). Recently, the farmers are able to produce significant amount of bell pepper, cabbage, cauliflower, broccoli, celery, lettuce, chines cabbage, onion leaves, and snap beans. A good indication that the location has a potential of producing an ample amount of the commodity to sustain the demand of the city and to decrease its dependency in Cordillera region. Thus, this study examined the determinants for increased efficiency of the farmers in producing highland vegetables by assessing their profile and farming practices in relation to the Good Agricultural Practices (GAP) for Fruits and Vegetable Farming – Code of Practice of the Philippines. Further, this study examined the relationship between their total harvest and farming practices. This study used descriptive correlational quantitative research design to attain the objectives and answer the research questions. A researcher-made questionnaire underwent content validation and reliability testing with an alpha coefficient of .917 (Excellent). Ten (10) member farmers of SBFA served as respondents of the study. Using Pearson Correlation Coefficient, there is a strong positive relationship between the Total Harvest of the farmers and their farming practices in terms of Source of Irrigation Water and Management, Post-Harvest Handling and Storage, and Transport and Marketing respectively as evidenced by their p-values.

Keywords: *Agricultural practices, Farming, Irrigation, Production, Water and management*

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Introduction

Highland vegetable farming refers to the cultivation of vegetables in high-altitude regions, typically mountainous or hilly areas. This type of farming takes advantage of the unique climatic conditions found at higher elevations, such as cooler temperatures, greater rainfall, and often more fertile soil. This often includes the cultivation of crops such as potatoes, carrots, cabbage, broccoli, and lettuce. This type of farming can be a profitable venture for small and marginal farmers, providing them with a reliable source of income and contributing to rural economic development. Moreover, by growing vegetables locally, highland farming can enhance food security and reduce dependence on imported produce, ensuring a steady supply of fresh vegetables for nearby communities.

In the Philippines, Cordillera Administrative Region remains the country's biggest producer of highland vegetables that supply 82.9% of the local market requirements in the National Capital Region and in other regions of Luzon, Visayas, and Mindanao. (Philippine Statistics Authority, 2017).

The adoption of highland vegetable farming is notable in many regions in the country. In 2020, pilot production of Highland Vegetables in Puerto Princesa City was first implemented in partnership with the Sitio Busngol Farmers Association (SBFA). Busngol farmers' pilot production of highland vegetables has proven to be successful to those who are engaging in this crop production who already knew proper planting techniques and care. At present, the farmers are already producing cabbage, cauliflower, broccoli, and snap beans. Sitio Busngol is exhibiting a potential to decrease the dependency of Palawan for Highland vegetable products from traditional sources such as Cordillera province. (Palawan News, 2021). SBFA is located at Sitio Busngol, Barangay Santa Lourdes, which is 17Km away from the heart of Puerto Princesa.

However, the production output of these farmers is not enough to cover the demand for these vegetables in the city. Majority of the highland vegetables available in the market are still from the Cordilleras. This could be due to the fact that the farmers in the locale are new to growing highland vegetables and still practicing traditional methods. In a study of Haji and Anderson (2016), it was discovered that large-scale farmers who use GAP or Good Agricultural Practices, were more successful in enhancing productivity and income. GAP is a set of standards for the safe and sustainable production of crops and livestock to help farm owners maximize yields and optimize business operations while also minimizing production costs and environmental impact (SafetyCulture, 2024). In the Philippines, officials of the Department of Agriculture and its Bureau of Plant Industry (BPI) encouraged farmers across the country to subject their farms to certification for GAP (Philippine Information Agency). To date, there are 342 GAP-certified farms in the Cordillera Administrative Region (HeraldExpress, 2023).

Thus, the researcher intended to assess the determinants for increased efficiency of the farmers in producing highland vegetables by assessing their profile and farming practices in relation to the Philippine National Standards - Good Agricultural Practices (GAP) for Fruits and Vegetable Farming – Code of Practice (PNS/BAFS 49:2021). Further, this study examined the relationship between their total harvest and farming practices. The attainment of these objectives led the researcher to come up with proposed interventions essential to increasing efficiency of the farmers in highland vegetables production in the future.

Methods

This study used descriptive correlational quantitative research design to attain the objectives and answer the research questions. This study examined whether there is significant relationship between the total harvests of the respondents and the farming practices to identify the determinants for increased efficiency in highland vegetable production. A researcher-made questionnaire was utilized as the main instrument in gathering the needed data. The instrument underwent content validation and reliability testing with an alpha coefficient of .917 (Excellent). Moreover, due to

the time constraint, there were only ten (10) farmers out of 30 active members of Sitio Busngol Farmers Association (SBFA) that served as respondents of the study.

Results and Discussion

Part I. Profile of the Highland Vegetable Farmers

Table 1. Frequency Distribution of Respondents According to Age

Indicators	Counts	Percentage	Rank
30 – 45	4	40.00 %	1
46 - 60	6	60.00 %	2
TOTAL	**10**	**100.00%**	

According to the age distribution of the respondents, a significant number falls within the age range of 46 – 60 years old. According to Southeast Asian Regional Center for Graduate Study and Research in Agriculture (2023), the average age of Filipino farmers ranges from 55 to 59 years old. Also, experts predict the Philippines will face a critical shortage of farmers in 10 to 12 years that will threaten food security.

Table 2. Frequency Distribution of Respondents According to Sex

Indicators	Counts	Percentage	Rank
Female	2	20.00%	2
Male	8	80.00 %	1
TOTAL	**10**	**100.00%**	

The highland vegetable farming in the locality is dominated by male farmers (80%). In developing countries, it was said that women make a remarkable contribution to the agriculture industry, but it is assumed that in rural areas, they had fewer opportunities compared to men (Haji and Anderson, 2016).

Table 3. Frequency Distribution of Respondents According to Educational Attainment

Indicators	Counts	Percentage	Rank
Primary Level	4	40.00%	2
Secondary Level	5	50.00%	1
Tertiary Level	1	10.00%	3
TOTAL	**10**	**100.00%**	

It is observable that only 1 (10%) of the farmers was only able to reach tertiary level. This coincides with the study findings of Briones (2017) which shows that the agricultural sector has the smallest educated workforce among the basic sectors with one-third of which did not complete primary school.

Table 4. Frequency Distribution According of Respondents to Farm Land Area

Indicators	Counts	Percentage	Rank
1.00 Ha or less	1	10.0 %	5
1.01 – 2.00 Ha	3	30.0 %	1
2.01 – 3.00 Ha	2	20.0 %	3
3.01 – 4.00 Ha	2	20.0 %	3
4.01 – 5.00 Ha	2	20.0 %	3
TOTAL	**10**	**100.00%**	

Almost all (90%) of the respondents are utilizing a land are of more than one hectare for farming highland vegetables, while all of them owns the land (ancestral domain). Same findings were observed by Abdulai et. al. (2017) that majority of the farmers were cultivating their own land ranging from 10,000sqm. to 15,000 sqm. In cultivating this land area, the farmers disclosed that their initial capital was very minimal with a rough estimate of less than 5,000 pesos as their farm equipment, and materials were all provided by the Office of the City Agriculture and the LGU of Puerto Princesa. Moreover, the farm sites of the farmers are situated on the top of the hills and/or on the sides of the mountains. Thus, during harvest seasons, farmers use sleds and carabaos, or manually carry the vegetables from the farm sites to their storage facility.

Table 5. Frequency Distribution According of Respondents to Highland Vegetables Grown

Indicators	Counts	Total Harvest in Kg (Approx.)	Rank
Bell Pepper	7	850	6
Broccoli	8	1390	4
Cabbage	6	7000	1
Cauliflower	8	1350	5
Celery	2	100	8.5
Chinese Cabbage	4	3300	2
Lettuce	4	100	8.5
Onion Leaves	4	250	7
Snap Beans	10	2260	3

***Multiple Response*

The farmers plant nine (9) different vegetables with snap beans, broccoli, cauliflower, cabbage, and bell pepper as the top five (5) prevalent species. Cabbage dominates the production output of the farmers at an approximate of 7,000 kg. These production outputs of the respondents lead them to a net profit of more than 10,000 pesos. Cabbage is now grown throughout the world with approximately 70,862,165 metric tons total production in 2020 (FAOSTAT, 2022).

Part II. Farming Practices

Table 6. Descriptive Table of the Farming Practices of Respondents

Indicators	Mean	Descriptive Rating
Farm Site Selection and Management		
1. The appropriateness and soil characteristics are assessed for the proposed use.	2.70	Barely Practiced
2. Management of site activities conforms to environmental legislations covering air, water, noise, soil, biodiversity and other environmental issues.	3.60	Always Practiced
3. A property lay-out map within the site is prepared to indicate the locations of the crop production, handling area, sources of water, tools and equipment, etc.	2.20	Not Practiced
Total	2.83	**Barely Practiced**
Planting Material Selection		
1. Yield quantity and quality are set as the basic considerations in selecting planting materials.	3.50	Always Practiced
2. Varieties to be grown are selected based on market requirements, grower preference and adaptability to the locality.	3.30	Always Practiced

Indicators	Mean	Descriptive Rating
3. The seeds and planting materials are sourced and procured from the Accredited Seed Growers or Plant Nursery Operators.	3.80	Always Practiced
Total Mean	**3.53**	**Always Practiced**
Soil Management and Conservation		
1. Crop rotation is integrated in production practices to improve/maintain the soil structure.	3.80	Always Practiced
2. Use crop suitability maps to plan crop rotation and production programs.	3.00	Barely Practiced
3. The use of chemical fumigants and alternatives to sterilize soils and substrates is justified.	3.70	Always Practiced
Total Mean	**3.50**	**Always Practiced**
Fertilizers and Soil Additives		
1. Apply fertilizers based on the quantitative information on soil nutrient based on soil analysis.	3.20	Barely Practiced
2. Fertilizers and soil additives are judiciously selected and duly registered fertilizers were only used.	3.50	Always Practiced
3. Organic fertilizer materials are treated prior to application to reduce or eliminate pathogens in manure, bio-solids and other natural fertilizers.	2.90	Barely Practiced
Total Mean	**3.20**	**Barely Practiced**
Source of Irrigation Water and Management		
1. Water testing is done and conducted at a frequency appropriate to the degree of potential risk from the water supply to assess the risk of contamination.	2.80	Barely Practiced
2. An alternative water source is developed or necessary water treatment is planned if contamination or shortage happened.	2.40	Not Practiced
3. The irrigation system is checked for operational efficiency during each use	2.50	Not Practiced
Total Mean	**2.57**	**Barely Practiced**
Crop Protection		
1. Agricultural chemicals used are registered for the cultivation of the specific vegetable and procured from licensed suppliers.	4.00	Always Practiced
2. The person responsible for application possess the relevant trainings and experience, and duly accredited by a competent authority.	3.40	Always Practiced
3. A rotation strategy for chemical application and other crop protection measures are employed to avoid the development of pest resistance.	2.80	Barely Practiced
Total Mean	**3.40**	**Always Practiced**
Harvesting		
1. Appropriate maturity indices are considered as bases in determining the harvest time.	3.10	Barely Practiced
2. Appropriate harvesting technique is employed to optimize the quality and other desired characteristics of produce.	3.80	Always Practiced
3. Containers used for harvesting are cleaned before use and liners are utilized to protect the produce, particularly when containers have rough surfaces.	3.20	Barely Practiced
Total Mean	**3.37**	**Always Practiced**
Post-Harvest Handling and Storage		

Indicators	Mean	Descriptive Rating
1. The produce are treated with approved protocols to minimize disease development and loss of quality.	3.10	Barely Practiced
2. The produce are stored in a facility with controlled and monitored temperature.	2.80	Barely Practiced
3. Measures are taken to prevent the introduction of pests and diseases within the handling, packing and storage areas.	2.90	Barely Practiced
Total Mean	**2.93**	**Barely Practiced**
Transport and Marketing		
1. Produce are transported in controlled atmosphere containers at suitable temperatures and relative humidity to retain quality and marketability.	3.00	Barely Practiced
2. Modified atmosphere packaging (MAP) is used to retain freshness, extending the shelf life of vegetables.	2.20	Not Practiced
3. Produce are transported and brought to the market based on demand to avoid over supply and wastage.	3.20	Barely Practiced
Total Mean	**2.80**	**Barely Practiced**
Farm Sanitation and Waste Management		
1. Facilities used for production, packing, handling and storage of produce is designed and constructed according to building and sanitation standards	2.40	Not Practiced
2. Domestic and farm animals are excluded from the production site and areas where produce is harvested, packed and stored.	3.50	Always Practiced
3. There is an established operational waste management plan in accordance with the environmental regulations.	3.00	Barely Practiced
Total Mean	**2.97**	**Barely Practiced**
Farmer Capacity and Welfare		
1. Farmers are equipped with appropriate knowledge and proper training relevant to good agricultural production practice.	3.50	Always Practiced
2. Farmers have the necessary skills to enable them to perform packing operations and handling vegetables to minimize chemical or physical contamination.	3.30	Always Practiced
3. Understandable and verbally communicated handling practices are made to the farmers to minimize the risk of injury and danger.	3.40	Always Practiced
Total Mean	**3.40**	**Always Practiced**
Farm Tools and Equipment Management		
1. Agricultural tools are calibrated as necessary and farm equipment are maintained in good working condition and checked by a technically competent person before each use.	3.10	Barely Practiced
2. Containers used for harvesting, handling and packing produce are not used for hauling or storing agricultural chemicals, cleaning chemicals, plant or other debris, tools, etc.	3.60	Always Practiced
3. Equipment, reusable harvesting containers, harvesting tools are regularly cleaned and disinfected.	2.90	Barely Practiced
Total Mean	**3.20**	**Barely Practiced**
Documentation and Records		
1. Pre-production activities, receipts and other proof of purchase of materials, equipment, necessary chemicals, and other inputs are recorded to monitor expenses.	2.40	Not Practiced

Indicators	Mean	Descriptive Rating
2. Production schedules and outputs are well recorded to track input to output conversions.	3.40	Always Practiced
3. Sales invoice, transaction records and inventory management documents are well maintained and monitored to track income and overall performance.	2.80	Barely Practiced
Total Mean	2.87	Barely Practiced
Grand Mean	**3.12**	**Barely Practiced**

***Legend**: 1.00 – 1.75 (Not Aware); 1.76 – 2.25 (Not Practiced); 2.26 – 3.25 (Barely Practiced); 3.26 – 4.00 (Always Practiced)*

In assessing the farming practices of the respondents, it can be observe that in terms of Farm Site Selection and Management, farmers do not have a property lay-out map within the site *(Mean=2.20, Not Practiced).* With regards to Farm Irrigation Water and management, an alternative water source is not developed and irrigation system is not checked *(Mean=2.20 and 2.50, Not Practiced).*

In terms of Transport and Marketing, the use of modified atmosphere packaging (MAP) to retain freshness, extending the shelf life of vegetables is not practiced *(Mean =2.20).* With regards to Farm Sanitation and Waste Management, compliance to building and sanitation standards of farm facilities is also not practiced *(Mean =2.40)*. Lastly, farmers do not practice recording of pre-production activities and receipts *(Mean =2.40).*

Part III. Relationship of the Total Harvest and the Farming Practices

Table 7. Correlation Matrix of the Relationship between Total Harvest and Farming Practices

	Pearson's r	***df***	***p-value***
Correlation of Total Harvest and Source of Irrigation Water and Management	0.748	8	0.0128
Correlation of Total Harvest and Post-Harvest Handling and Storage	0.643	8	0.04479
Correlation of Total Harvest and Transport and Marketing	0.633	8	0.0495

Relationship of the Total Harvest and the Farming Practices. Using *Pearson Correlation Coefficient*, there is a strong positive relationship between the Total Harvest of the farmers and their farming practices in terms of Source of Irrigation Water and Management, Post-Harvest Handling and Storage, and Transport and Marketing respectively as evidenced by their p-values.

Digging deep to the Source of Irrigation and Water and Management, during the data gathering, the respondents raised concerns about the water supply in their farm. According to them, they stopped planting high-value vegetables due to water shortage and drying out of the springs where they get their irrigation water. According to Abdulai et al. (2017), majority of the farmers were cultivating their own land and depend on watershed, rain and springs/rivers to irrigate their farms. Generally, most farmers have difficulty in farming due to the lack of water supply to irrigate their crops and to the high elevation of the farm lands. However, Izzi, Deniso, and Veldwisch (2021) encourage a farmer-led irrigation development focused on catalyzing private infrastructure development as they found that many highland vegetable farmers in the CAR invested in their own irrigation systems and facilities without external support. They also shoulder maintenance costs by themselves.

When it comes to Post-Harvest Handling and Storage, the farmer stated that the only postharvest treatment conducted was cutting excess leaves and other parts using a cutter that sometimes lead to damages or rejects. After the treatment, they put the produce in plastic crates, rattan baskets, or plastic bags accompanied by banana leaves, and stored in a shed with uncontrolled temperature or humidity. This coincides with the findings of Antolin et. al., (2014) that farmers use crates, plastic bags,

laundry tub and pail as a container of the vegetables and are hauled to a shed where they are sorted, washed and packed. Cleaning is usually done by wiping with soft damp cloth or cotton to remove dirt and reduce the field heat to maintain the quality. The fruits are packed in polyethylene plastic bags lined with either banana leaves or newspapers at the bottom.

With regards to the Transport and Marketing, the farmers stated that the produce are only transported in a controlled atmosphere containers at suitable temperatures and relative humidity to retain quality and marketability when it is the KADIWA and Gintong Butil Farm who bought the vegetables. However, oftentimes, they deliver their produce to the nearest public market (7-8 km from the farm) via "*Habal-habal"* or Top-down Tricycle that leads to bruises and wilting of some vegetables that lowers its marketability. One of the respondents even said that they were not able to sell almost 10% of the vegetables due to bruises and wilting. Moreover, the farmers are very adoptive to agricultural technologies as are not using any packaging that may protect the coating of the produce and retain its freshness. The increasing rate of technological advancement in the agricultural sector, has resulted in increased efficiency and productivity (Ugochukwu, 2018).

The postharvest losses of perishable crops (highland Vegetables) in the Philippines are about 20-30%. These postharvest losses occur during harvesting, trimming, packing, and repacking, during hauling and transport. In the trading centers, the primary source of postharvest losses is during trimming, sorting, and packaging. During hauling, improper practices of hauling and loading to trucks are usually done by porters and dead loading from people on top of the commodity during transport especially during short distance travel. Excessive trimming of leafy vegetables when price is low leads to high postharvest loss. (DA-PRDP, 2019b).

In Benguet and Mountain Province, the highland vegetables are hauled using "thick laced" bamboo basket and the use of tramline for some areas that are far from the road and no accessible road. The transportation of highland vegetables from the farm to LTVTP and BAPTC is through the use of Elf, Ford Fiera, and other SUVs. Normally, the vegetables are carefully arranged in the vehicles bed until full capacity then covered with canvass if the vehicle is open. After the different packinghouse operations have been done vegetables will be carried by a kariton to a waiting ten-wheeler truck for transport to Metro Manila and nearby provinces (DA-PRDP, 2019b).

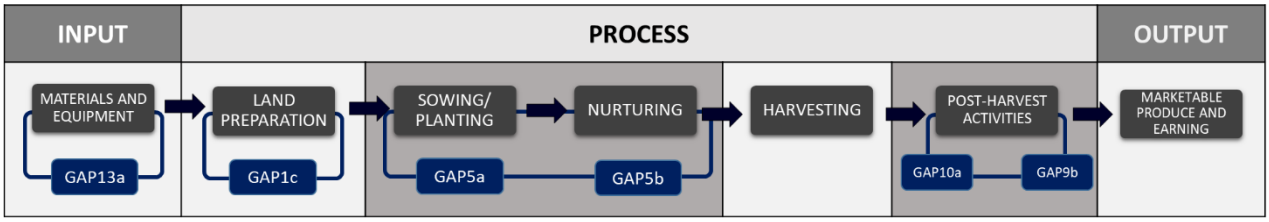

Figure 1. IPO Framework of critical regions as determinants for increased highland vegetable production

Whereas:

- *Activities involved in the highland vegetable production (Adopted from Management Prac tices on Organic Vegetable Production published by Agricultural Training Institute of DA CAR.*
- *"Not practiced" farming practices based on GAP for Fruits and Vegetable Farming – Code c Practice of the Philippine National Standards.*
- *Identified critical regions in the farming activities involved in the highland vegetable prc duction based on the established relationship between total harvest and the farming prac tices.*

Conclusion

Highland Vegetables farming in Sitio Busngol, Barangay Sta. Lourdes is viable venture for the farmers as evidenced by the number of their total harvest and declared income from the activity. The farmer barely practice recording of transactions and activities. This initiative is quite essential in a conduct of any type of business to track financial activities and performance for a better management of income. Moreover, in the advent of technological advancement in farming, the farmers of SBFA are still utilizing traditional practices such as using banana leaves as packaging of vegetables and using woven baskets as container of the harvests. Further, their production output and efficiency is determined by some of the key areas of farming such as their practices in management of irrigation water, postharvest handling, storage, packaging and delivery.

Proposed Interventions

Based on the developed IPO Framework showing the identified areas for improvement tagged as critical regions in the process, following interventions are being proposed:

1. ***Integrated Knowledge and Technology Transfer through Capacity Planning and Extension Programs***

   A more comprehensive assessment on problems and constraints that hurdle farmers in improving productivity, quality and continuity that important in determining required trainings must be the starting point of the intervention. After that, the conduct of collaborative extension programs is highly recommended to capacitate the farmers on the key areas that are currently not practiced by them.

   To begin with, the government should tap business operations field experts from the higher education institutions to conduct seminars and workshops on the importance of basic and proper documentation and recording of transactions. In this way, the farmers will understand how crucial this is in tracking their overall financial performance in farming.

   Secondly, intervention on the proper post-harvest handling of vegetable. The farmers should be equipped with the appropriate but economic ways to properly handle their produce to minimize rejected produce or even eliminate wastage. Extension work is needed to show that postharvest procedures are as important as production techniques. It is not enough to produce good quality commodities through variety improvements and proper regulation of soil and climatic factors. The whole process from planting until the harvested products reach the consuming public must be a mutual undertaking. The success of maintaining the harvest-fresh quality of produce demands control of each step in the system, and each step depends upon the previous one (Pantastico and Bautista, 1976).

   Farmers must be fortified with location-specific and cost effective postharvest technologies post-harvest activities such as grading, sorting, treatment, and packaging. Without proper grading, sorting, packaging and other post-harvest handling will lead to high waste and rejected product which ultimately increase costs and lower income (Menegay and Darmono, 2007). Moreover, additional operations might be included in the system such as trimming, pre-cooling, storage, disease and insect control treatments, as well as prepackaging. A systems approach or an integrated improvement program covering all postharvest operations and procedures is necessary to guarantee success. Improvement of only one operation may prove ineffective (Limbaga et al., 2022).

2. ***Establishment of Tramline System for Hauling Highland Vegetables***

   The farmers are growing their vegetables on the terraces of mountain slopes and on top of the hills, and are accessible only by foot trails. Basically, the farmers of SBFA manually haul their vegetables from the gardens to their sorting and storage facility. During this activity, farmers encounter postharvest losses due to wilting and mechanical damage such as puncture, bruising, or abrasion. Losses on account of delays in transporting the vegetables and mechanical damage due to slipping of haulers while traversing steep and rugged slopes can reach as high as 5% (Rapusas, 2006).

To eliminate the losses encountered by the farmers in hauling, it is recommended that the government assist the association in establishing a tramline system. In fact, the same strategy was initiated in the Municipality of Atok, Benguet Province by the BPRE in collaboration with the DA's regional field unit in CAR. After a year of monitoring, positive results were recorded such as significant reduction in the time requirement for hauling produce, reduced handling losses, and increased productivity (Rapusas, 2006).

3. ***Improvement of Irrigation System***

The biggest problem raised by the farmers is water supply and irrigation system from the springs to their gardens due to the high elevation of their farm lands. In a study of Izzi, Deniso, and Veldwisch (2021), they recommended a farmer-led irrigation development focused on catalyzing private infrastructure development as they found that many highland vegetable farmers in the CAR invested in their own irrigation systems and facilities without external support, and even shoulder maintenance costs by themselves.

That could be due to the fact that majority of the farmers in CAR are already established in the highland vegetables farming. However, farmers in Sitio Busngol are still in their development stage. With that, it is recommended to the government to help the farmers in dealing with irrigation problems by providing large water tanks at where the farmers could store water during rainy season that they can use whenever there is a water shortage. Additionally, a centralized solar powered irrigation pumps may be established as the farms are not yet reached by electricity from local power provider. This will help the farmers to irrigate their gardens that are situated in higher elevations.

4. ***Integration of Good Agricultural Practices (GAP)***

Moreover, it is recommended that the farmers with the help of the agriculture office of the local government adopt the good agricultural practices (GAP) and be certified to increase their efficiency. GAP is a set of standards for the safe and sustainable production of crops and livestock to help farm owners maximize yields and optimize business operations while also minimizing production costs and environmental impact (SafetyCulture, 2024). In a study of Haji and Anderson (2016), it was discovered that large-scale farmers who use GAP or Good Agricultural Practices, were more successful in enhancing productivity and income. The performance of the GAP-trained farmers showed that the farmers can gain positively and are more profitable than non-GAP trained farmers (Limbaga et al., 2022).

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