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Demographic Evaluation of Pili Farmers and Their Production Capacity in Bicol Region, Philippines

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Philippines is known for the vast plantation and seat of one of the most valued crops, the Pili nut. A study was conducted to determine the demographics of 192 Pili farmers and their production capacity from selected provinces of Bicol region, Philippines. Purposive sampling technique was used in selecting the respondents with structured interview, focused group discussion and key informant survey conducted to gather data. Results of the study showed that demographic parameters such as gender, age, educational attainment, income and family structure are important and necessary information in order to understand the production capacity of Pili farmers. Pili production is generally profitable with high financial return of 127% to farmers. Farm areas in the region are sufficient where farmers can grow Pili to satisfy the local and global demand for this high-value crop. The financial stability and income of Pili key players can be increased given the proper attention and investment in production processes. The valuable support and assistance of the government especially local government units is crucial to ensure the optimistic future for the

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Pili industry. Likewise, it is imperative to address all the critical needs of farmers not only in the production process but in the various links along the supply chain as well in order to raise the overall sector revenue and household income of Pili farmers. In doing so, the country is assured of a more dynamic, sustainable and competitive Pili industry.

Keywords: Demographics; production capacity; Pili farmers; Pili industry.

1. INTRODUCTION

Bicol region is known for the vast plantation and seat of one of the most valued crops, Pili (*Canarium ovatum*). Dubbed as the Bicol's "tree of hope", the utilization and commercialization of Pili has grown enormously owing to its wide usefulness and wide array of products that can be derived from it.

"The Philippine Statistics Authority (PSA) reported that the historical average of pili production area from 2008-2017 is 2,249 hectares with major locations in Sorsogon, Albay and Negros Occidental accounting for 60.1%, 15.1%, 9.0%, respectively. In terms of production, the historical average from 2008-2017 is 7,129 metric tons valued at PhP (Philippine peso) 324.41 million pesos. The major producers are Sorsogon (55.6%), Albay (25.3%), and Northern Samar (10.4%). The historical averages on yield was 43.30 kgs./bearing tree for years 2008-2017 and the provinces with highest yield are Northern Samar (127.05 kgs./bearing tree), Albay (74.19 kgs./bearing tree), and Western Samar (67.48 kgs./bearing tree)" [1].

"The information in terms of cost and return on Pili production is remarkable as well. In 2016, PSA reported that the average cost of pili nut production amounted to PhP29,319.00 per hectare. Average yield per hectare was 3,192 kilograms equivalent to gross receipts of PhP140,895.00. Net returns reached PhP111,576.00 per hectare. On a per kilogram basis, production cost averaged PhP9.19 while farm gate price was estimated at PhP44.14. Net profit-cost ratio was 3.81" [2]. However, there was a decrease in production in the succeeding years. Domestic production of pili nut declined by an average of -9.5 % from 2019 to 2021. From 7.16 thousand metric tons in 2019(and it), it decreased to 5.86 thousand metric tons in 2021 (PSA, 2021).

With the available historical data at hand, there is a need to determine the socio-economic profile of Pili producers, in relation to the cost associated with Pili production and provision of prescriptions to increase the income of families. Research interest should not only focus on products derived from Pili but on the people behind its farming, the production and farmers as well [3]. While valuable information is available on pili production, socio-economic status and characteristics of Pili producers in the Bicol region is still a researchable area and needs serious attention as it affects agricultural production. Therefore, it is for this reason that this study was undertaken.

2. REVIEW OF LITERATURE

"Pili production is one of the promising industries in the Bicol region. Realizing this, the Department of Agriculture Regional Office V (Bicol) turned over a newly constructed building worth P3 million pesos funded under the High Value Commercial Development Program to Mt. Mayon Pili Producers Multi-Purpose Cooperative (MMPPC) in June, 2019. As stipulated in the memorandum of agreement between the DA and the cooperative, the latter shall use the building for its commercial pili processing operations. It shall take the lead and supervise the operations and management of the facility and shoulder the corresponding expenses" [4].

The recognition of Pili as crucial to the economy is further strengthened by the filing of a Senate Bill for the enhancement of the Pili industry. Senate Bill No. 2103, filed by Sen. Chiz Escudero seeks to develop pili as a marketable global product with the support of government through research, technology, and marketing. He pointed out that aside from its kernel, the pili tree's by-products have various uses which can be marketed. Under the bill, the Pili Research and Development Center will conduct research on the production and marketing of pili nuts by-products and the center will be attached to Sorsogon State University. The proposed agency is also mandated to provide technical assistance and support to pili farmers and other stakeholders in the Bicol region [5].

"Now and before, Pili stands out as one of the high value crops in Bicol. Previous studies point

to the fact that Pili production is enormous and abundant in the region. Total regional production was 6.18 thousand tons, which is a 13% increase from the 5.5 thousand tons production in 2010. Pili production is profitable with a net return per hectare of Php (Philippine peso) 84,233 or a net return-to-cost ratio of 2.49. Producing one kg of pili fruit costs about Php 11.00 or Php 35,222 per hectare" [6].

"This is further corroborated by a similar study with findings that harvesting of pili nuts is realized on the 6th to 8th year. Harvests of 1 hectare pili plantations will give an estimated annual net income of PHP50,000. Processing of pili into various handicrafts and food will give substantial and stable income to the whole members of the family" [7].

With the considerable number of farmers engaging in pili production in the Bicol region, there is a pressing need to continue the conduct of research and development activities. Research and development (R and D) should focus on analyzing the drivers and barriers to stakeholder engagement, Industry developments, capacity building, working with chain and industry 'champions' to identify specific market opportunities. The development of new products and linkage of these opportunities back to the smallholder farming systems is also crucial [8,9].

"Socio-economic parameters such as family size, age structure, education, social participation, income, experience in production, size and nature of ownership of enterprise among others, are important information which need to be carefully and systematically gathered in order to adopt new technologies and push for their participation in development schemes sponsored by various agencies" [10].

Towards this end, a study was conducted where gender was considered as one of the demographic characteristics that most affected farming practices [11]. Considering the female-dominated farmer population of farm samples analyzed, policy and development initiatives that focus on improving sustainable farming practices, it should closely consider the gender dynamic to allow for the participation of female farmers given their other time-consuming productive roles. Socio-economic factors such as gender and education may influence farmer hygiene practices. It further concluded that these characteristics should therefore be considered when planning farmer support interventions.

Similarly, another study found that socio-economic characteristics such as education level, income from agriculture, farmer cooperative and credit were determinant factors for most of the agricultural practices that were considered [12]. Understanding of these factors is essential for the formulation and implementation of intervention strategies aimed at improving the quality of life of these communities and to preserve and manage human, social, agricultural and financial capital.

"As always, socio-economic characteristics play an important role in any agricultural undertaking. One study concluded that the specific socio-economic circumstances of farmers, agro-ecological conditions of land and institutional factors need to be considered in the development of measures and policies that aim to encourage farmers to adopt additional land management practices to enhance sustainable agricultural production" [13]. Likewise, similar study identified that the most significant factors shaping the quality of Integrated Soil Fertility Management (ISFM) included gender, age, household size, land, off-farm earnings, yield, members involved in farming, farming experience, education level, and farm size [14].

3. MATERIALS AND METHODS

Respondents were identified based on the list of Pili producers and farmers/growers from the Department of Agriculture, Bicol region. Secondary data were also gathered from other agencies/institutions which may have relevant data for the project. Likewise, data were gathered from publications of various government offices, private institutions, previous researches/thesis/dissertations, journals and articles. Respondents were selected from Camarines provinces, Albay and Sorsogon in the Bicol region. Purposive sampling technique was used in selecting the respondents and survey-questionnaire was prepared and used to gather data from the field. A structured interview was developed including all relevant queries needed to accomplish the objectives of the study. The collected primary data was tabulated and descriptive statistics for different socio-economic variables were calculated using appropriate statistical tool such as frequency and percentages. Focused group discussion and key informant survey were likewise conducted. Other important data were gathered through ocular inspection and observation.

4. RESULTS AND DISCUSSION

A total of 192 pili farmers and growers from the 4 provinces of Camarines Sur, Camarines Norte, Albay and Sorsogon served as respondents for this survey. The highest number of respondents come from Albay and the least from Camarines Norte with 41% and 2%.

Table 1. Number of respondents by province

Province	No. of Pili growers	Percentage
Albay	80	41
Cam Norte	3	2
Cam Sur	36	19
Sorsogon	73	38
Total	192	100

Fig. 1 shows the socio-economic characteristics of the Pili growers. Of the total, 78% were males and 22% were females. It can be gleaned that there are more males who are into Pili farming than women.

This is in consonance with the national statistics reported by the Philippine Statistics Authority. Male agricultural workers comprised 33.2 % of the total male employment in the Philippines in 2016. In the same year, the females employed in agriculture shared only 17.3 % of the total female [15]. Furthermore, information on the employment of male and female agricultural workers indicates gender differences in the use of agricultural labor. The country's employed persons in agriculture numbered 8.31 million males and 2.76 million females in 2016. At the regional level, Bicol region reported 651,000 and 190,000 male and female workers respectively.

Compared to European countries, report showed increasing trend with the number of women farmers slowly increasing in recent years. The most recent data reported by Eurostat suggests that, on the average, 29% of farms across the EU are managed by a woman [16]. While it was noted that the number of women in farming is increasing, a previous research study found that women's participation in agricultural production is not high to a large extent such as that in Nigeria [17]. "This confirm such because there were few challenges women encounter such as land acquisition, problem of loans, aids and grants. The findings further affirm that indeed, women to a large extent are sidelined as a result of cultural norms and values of the society" [17]. "But this was in stark contrast to a study which highlights the high level of physical involvement by women in agricultural activities in Vanuatu [18]. Women participate in many aspects of the production and postharvest of food and cash crops, contradicting some common beliefs about their role in agriculture in Vanuatu. However, despite high levels of participation by women in agricultural activities, they are less involved in decision-making processes. Further, women are highly involved in growing, harvesting and selling food crops, but they do not tend to decide (by themselves) on how these activities are conducted or prioritized" [18]. "In order to encourage women participation in agriculture, it was recommended that all resources must be made available to them in order to be productive farmers. For those women or female farmers who want to get involved in mechanized system of farming, government should be able to assist women by giving them monthly resources like fertilizers and other farming facilities" [17].

In terms of age, more than half of them are already old with 44% belonging to the age above 60 years and 30% within the age range of 51-60 years old (Fig. 2). It further shows that there are no young Pili growers who are below 20 years old.

While most Pili growers are already old (above 60 years old), they still belong to the functional literate class of Filipinos. According to the results of the 2019 Functional Literacy, Education and Mass Media Survey (FLEMMS), it reported that about 91.6 % Filipinos 10 to 64 years old were functional literate in 2019. This translates to around 73.0 million out of 79.7 million in the same age group who are considered literate on a functional level. Moreover, looking at the sex-disaggregated data on labor force of the Philippine Statistics Authority, it gives the composition of population aged 15 years old and above as those contributing to the production of goods and services in the country and not those below or younger than 20 years old. Apparently, this includes those who are involved in agricultural farming. In 2016, the total number of labor force was recorded at 43.36 million with males in the labor force estimated at 26.52 million while females figured to 16.84 million. Labor force participation rates (LFPRs) stood at 77.6 % for males and 49.3 % for females [15].

In terms of educational attainment, most of the respondents are elementary and high school graduates reflecting a high percentage of 34% and 26%, respectively (Fig. 3). These educational attainment of farmers can qualify

them to be functionally literate and productive in their respective farms. The Philippine Statistics Authority (PSA) defines functional literacy as the level of literacy which includes not only reading and writing but also numeracy skills that would enable people to cope with the daily demands of life. Generally, functional literacy rates among the population of 10 to 64 years old across sexes and age groups were higher in 2019 than in 2013. In 2019, females indicated higher functional literacy rate (92.9%) than males (90.2%). Among age groups, 20 to 24-year-old (96.0%) Filipinos had the highest functional literacy rate in 2019, while those aged 60 to 64 years old (84.8%) had the lowest [19]. For the number of family members within the household or household size, Fig. 4 shows that the highest range for household size is between 4-6 members with 47% followed by 1-3 members with 30%.

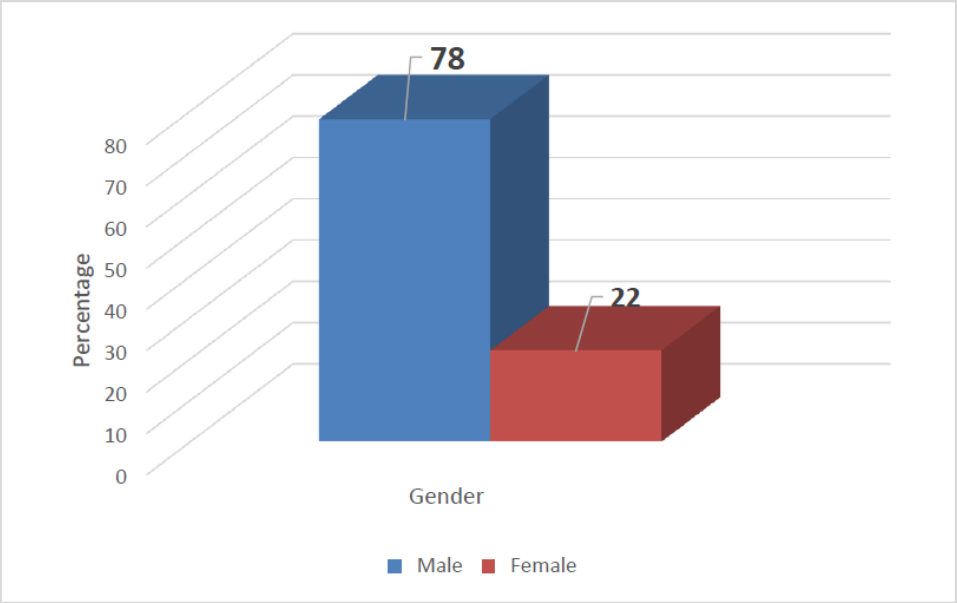

Fig. 1. Gender classification of Pili farmers, Bicol Region, Philippines

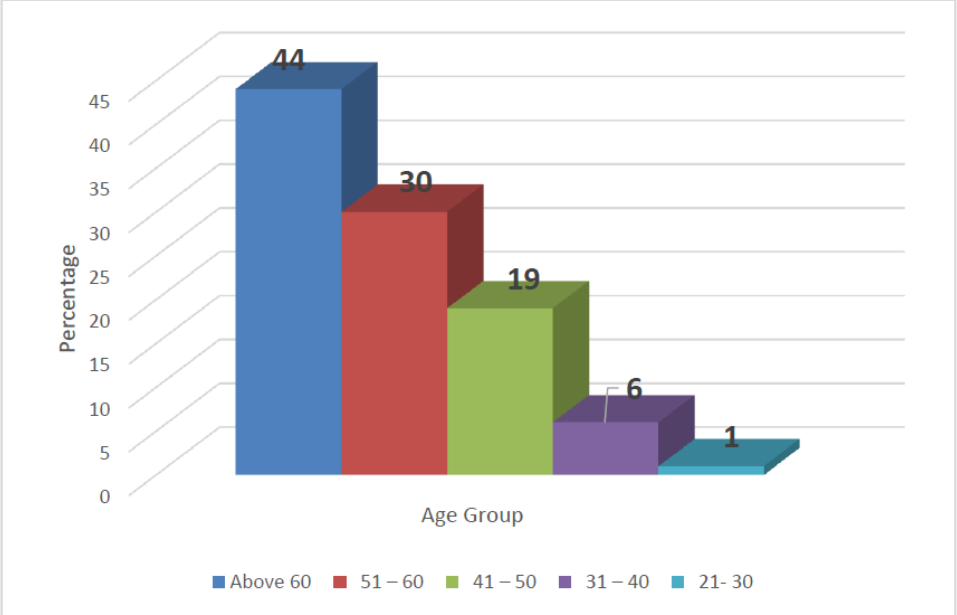

Fig. 2. Age group of Pili farmers, Bicol Region, Philippines

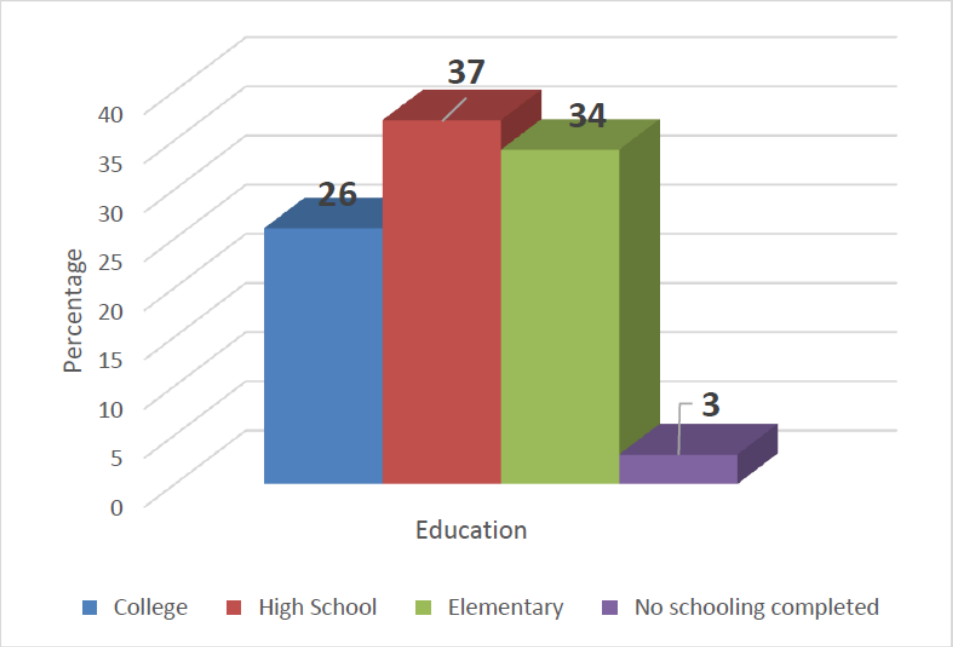

Fig. 3. Educational attainment of Pili farmers, Bicol Region, Philippines

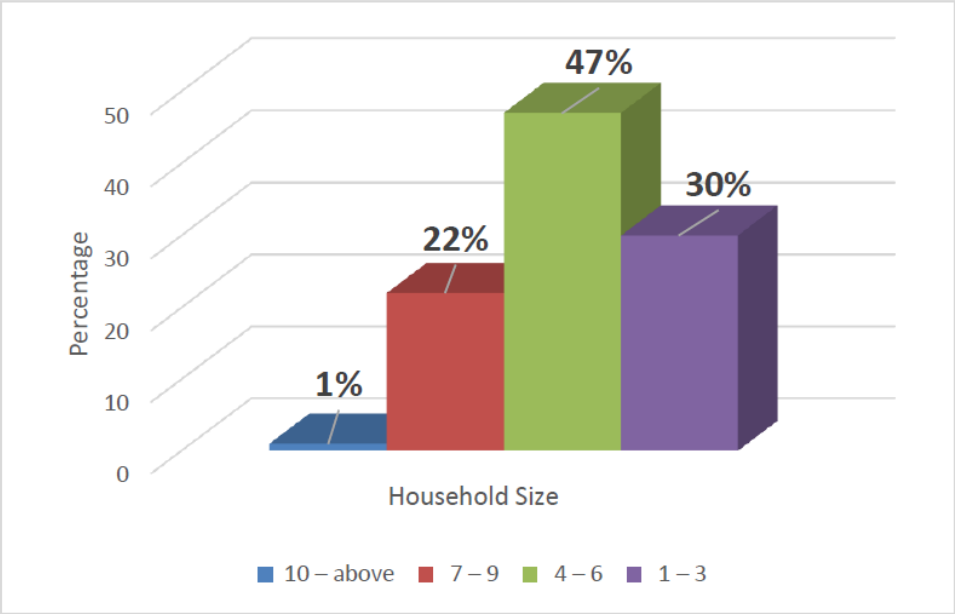

Fig. 4. Household size of Pili farmers, Bicol Region, Philippines

Over-all, socio-economic parameters of respondents play a critical role in Pili production. A research study conducted posited the importance of socio-economic characteristics of farmers in any research and development activity. It was concluded that these characteristics must be taken into account as they serve as bases in the formulation, designing and successful implementation of developmental programs [10]. This was further corroborated by a study suggesting that the principal socio-economic factors, education level, income from agriculture, access to credit and the level of cooperative membership play a determinant role in the adoption of sustainable practices for agricultural work [12]. The findings further demonstrate the need to critically identify the socio-economic factors of the small farmer households, their relationships, challenges and hindrances. The information obtained from the

small farmer households indicate that it is relevant to incorporate processes that enable assessing simultaneously a variety of indicators in order to identify the best practices in the different agricultural production systems. Similarly, a research study revealed that socio-economic factors such as household size, plot size, farming experience, off-farm income had a significant impact on agricultural crop production [13]. Furthermore, a study on Integrated Soil Fertility Management (ISFM) suggests that efforts should consider farmers' knowledge, age, labor availability, education, training, income, land distribution, and gender dynamics as important socio-economic parameters. Whereas education, farming experience, training, and gender can influence farmer explicit knowledge and in some decision-making in ISFM, land distribution, labor, and income structures are proxy measures for resource availability which can moderate access to ISFM resources and knowledge [14]. Finally, gender was highlighted and given primary importance as a socio-economic parameter that most affect farming practices [11].

Respondents were asked relative to the nature of their farming activity and result of the survey showed that majority of them purely devote themselves to Pili farming (95%) and just a small number are into both Pili farming and processing (5%) (Table 2). When asked about how long have they been involved to Pili farming, 28% of the responses are above 40 years followed by 11 to 20 years of farming with 22%. The shortest number of years involved in Pili farming is 10 years and below and 18% of the respondents are in this category. Farm experience has a great deal of effect on farm productivity. A study concluded that farming experience contributed in the productivity in farming systems [20]. In terms of farm size, majority of them (62%) own between 1 to 5 hectares of farmland with 41% owning 1-3 hectares and 21% farming an area of 3-5 hectares. Of the total farm size, they were also asked how much would be devoted to Pili farming. Half of the respondents or 50% with 1-3 hectares responded that they devote it to Pili farming and 31% of those owning less than a hectare use it for Pili farming and growing other crops.

Table 2. Farm and farming information of Pili farmers, Bicol Region, Philippines

Variables/Province	Cam Sur	Cam Norte	Albay	Sorsogon	Total	%
Nature of farming activity						
Pili farming	33	3	74	73	183	95
Pili farming and processing	3	0	6	0	9	5
Total	36	3	80	73	192	100
Years in farming						
Above 40 years	2	0	29	22	53	28
31 – 40	4	0	19	12	35	18
21 – 30	7	1	7	11	26	14
11 – 20	17	0	13	13	43	22
10 years and below	6	2	12	15	35	18
Total	36	3	80	73	192	100
Total farm size (in hectares)						
Above 9	7	2	9	7	25	13
7.1 – 9.0	2	0	7	5	14	7
5.1 – 7.0	5	0	11	9	25	13
3.1 – 5.0	4	0	15	21	40	21
1.0 – 3.0	17	1	34	26	78	41
Less than 1 hectare	1	0	4	5	10	5
Total	36	3	80	73	192	100
Area planted with Pili (in has.)						
Above 9	0	2	5	1	8	4
7.1 – 9.0	1	0	2	0	3	2
5.1 – 7.0	3	0	8	0	11	6
3.1 – 5.0	1	0	11	3	15	8
1.0 – 3.0	24	1	36	35	96	50
Less than 1 hectare	7	0	18	34	59	31
Total	36	3	80	73	192	100

Table 3 provides a comparative analysis of sources of income in the 4 provinces in the Bicol Region. Result of the analysis showed that 67% of the respondents have other sources for their main income. These include monthly pension, income from sari-sari store, sale of coconuts, income from rent, jeepney driving, sale of furniture, welding, swine raising, honorarium and financial assistance for senior citizens. This is followed by salary at 19% for their main income source since some of the respondents are receiving their monthly regular salary from the government or from private entity. Only a small number (3%) get their main income from sale of Pili products. Even for the secondary income source, it can be gleaned that more than half (68%) also rely on other form of business for their income and only a small percentage (5%) is into sales of Pili products.

Pili farmers have considerably other major sources of income and fail to realize the big income of Pili plantation not only from Pili nut but from other products as well. This was highlighted by a previous study conducted by Catelo (2014). It suggested that Pili pulp oil production in the Philippines is competitive and hence manifests considerable economic potential. It has both employment and income effects that any similar program on inclusive growth aims to generate.

The average annual production sales and volume for Pili per hectare is shown in Table 4. The total sales are pegged at Php 28, 904.00 and the production cost is Php 6,108.00 giving a net income of Php 22,796.00. While early result showed that Pili production is not the main or secondary source of income, a farmer who will venture on Pili production will get a good income and is indeed, a profitable business venture. A statistical report published by the Philippine Statistics Authority reported that the return on investment for Pili production is 381% (Updated Average Cost of Production, Sept 2017). The historical account on Pili production in the country was progressively increasing. At the national level, average Pili production was estimated at 6.45 thousand metric tons from 2019 to 2021. For exports, 60 metric tons in 2019 and 55 metric tons in 2020 were recorded. In 2021, the volume of pili nut exports settled at 23 metric tons. On the average, total net food disposable was 6.35 thousand metric tons during the reference years. However, there was an observed decrease comparing the production in 2019 and 2021. It was 7.04 thousand metric tons in 2019 and declined to 5.78 thousand metric tons in 2021 (PSA, 2021).

Even in other Pili by-products, previous studies showed positive and encouraging result. Results of a study revealed that producing locally one kg of pili pulp oil costs PhP 599 [6]. This is almost half the cost of importing olive oil - a close substitute - from Spain estimated at PhP 1,310/kg. In terms of domestic resource cost, there exists comparative (economic) advantage in pili pulp oil production. This positive result is further made possible due to the availability of research-based transferrable technologies on product development, varietal characterization and propagation, The Philippine Pili industry is on the right track towards attaining our goal of upgrading the value chain of pili to boost the pili industry in the region [21].

Table 3. Comparative analysis of income source

Variables	Cam Sur	Cam Norte	Albay	Sorsogon	Total	%
Salary	237,600	33,000	56,781	95,579	422,960	19
Farming	56,889	-	57,937	33,445	148,271	7
Sales of Pili Products	21,334	-	37,857	9,000	68,191	3
Sales of other Products	-	-	60,000	-	60,000	3
Remittance from family	-	-	24,600	6,000	30,600	1
Others: _____	506,062	90,000	327,768	556,219	1,480,049	67
Total					2,210,071	100
Ave. annual income (secondary source)						
Salary	36,000	-	59,800	-	95,800	9
Farming	30,215	33,000	28,057	21,428	112,700	10
Sales of Pili Products	9,100	-	35,350	5,551	50,001	5
Sales of other Products	-	-	-	-	-	0
Remittance from family	-	-	95,557	-	95,557	9
Others:	224,600	90,000	298,200	132,000	744,800	68
Total					1,098,858	100

On this note, there is vast economic and investment opportunities for Pili farmers. "The opportunities identified in the Pili prospects and potential report include financing on production and post-harvest/processing/ packaging facilities and equipment, nursery establishment/ development, establishment of orchard/ plantation, farms infrastructure development (i.e. pili processing plant/centers, farm technology centers), establishment of buying station for export and domestic market, establishment of e-marketing or e-commerce inputs provider" [22].

Table 4. Average annual production sales and volume for Pili per hectare

Sales	
Seedlings	
440 pcs * Php 15/pc	6,600
Pili Nuts	
272 kls * Php 82/kl	22,304
Total	28,904
Production Cost	
Land Preparation	1,593
Planting Stocks & materials	1,508
Clearing/weeding/pruning	1,980
Harvesting	922
Other expenses	105
Total	6,108
Net Income	**22,796**

At the global level, there is also evidence of investment opportunities as well as unfulfilled domestic demand in some countries. Supply of nuts has been a problem in the past with stringent processing requirement to freeze all raw product within 24 hours, limiting access to market for wild harvested nuts and nuts from remote islands. In the Solomon Islands there are market opportunities in the domestic food service and retail sectors [8]. There is however, a need for close coordination and partnership between farmers and the government. In Malawi for instance, the challenge of improving per person crop production and income for farm households will be achieved if there is close integration between plant breeders, farmers, and

5. CONCLUSION AND RECOMMENDATIONS

The study evaluated the demographic and socio-economic profile of Pili farmers and farmer-processors in the four provinces in the Bicol region. In terms of economic analysis, the total Pili seedlings and Pili nut sales is Php (Philippine peso) 28,904.00 and the production cost is Php 6,108.00 giving a net income of Php 22,796.00. Pili production is generally profitable with the high financial return of 127% to farmers. There are various opportunities and prospects for pili production. Likewise, there is an increasing demand for pili-based products however, the supply is still inadequate at the domestic and global market since there are just a few Pili farmers who venture into Pili processing. There is also sufficient area of farms where farmers can grow Pili to satisfy the local and global demand for this high-value crop.

Based on the findings of this study, recommendations include provision of trainings and workshops to enhance capability of Pili farmers especially on processing to make their products globally competitive; strengthen Pili farmers' groups/cooperatives to increase their access to technical and financial assistance from government and non-government organizations and increased access and availability of processing facilities that will allow Pili farmers to increase their farm processing and productivity level. A longitudinal research is also recommended to include additional socio-economic data and information of farmers to arrive at more conclusive results. Likewise, more studies using quantitative models to analyze the socio-economic determinants that can influence Pili production is recommended.

The future of Pili industry is very optimistic with Pili farmers and growers sustaining the need and demand for more quality Pili products. Financial stability and income of Pili key players can be increased with the proper investment in production, processing and marketing systems procedures. It is therefore, imperative to address all the critical needs of stakeholders engaged in the various links along the supply chain in order to raise the overall sector revenue and household income of Pili farmers. In doing so, the country is assured of a more dynamic, sustainable and competitive Pili industry.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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