Chapter

The Dynamics of Taro (*Colocasia esculenta*) through Value Chain Analysis and Crop Accounting in Partido District, Camarines Sur, the Philippines

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Abstract

This paper scrutinizes and evaluates the value chain of taro in Partido district, Camarines Sur, the Philippines. Taro (Colocasia Esculenta) is rich in carbohydrates and also a good replacement for wheat flour. However, it is well-known to farmers for its ability to produce a reasonable yield in poor soil conditions with less or no farm inputs. It is this reason why Taro is often grown by resource-limited farmers and regarded as a good source of food security. To tap its full potential, this study was conducted to understand and analyze the flow of Taro. This study employed participatory techniques, crop accounting, and financial analysis. The Taro value chain has varied gender roles, according to this study. It also highlighted why, despite having a choice, farmers frequently chose the less profitable transaction path. It also solved the mystery of low productivity in this locale as compared with the national production. The results also showed the cost build-up of Taro and the profitability of each player in the chain. Farmers usually end up at a 22% profit-to-cost ratio by selling the harvest to the middleman, while sellers usually end up at a 47% profit-to-cost ratio. The existing entry barriers in each chain were also identified with the researchers' recommendations on how to possibly eliminate or mitigate them. This extensive analysis can be valuable to stakeholders in the Taro value chain in the area, as well as government entity and non-governmental organizations in developing initiatives or projects on behalf of the players.

Keywords: Taro, value chain analysis, crop accounting, productivity, the Philippines

1. Introduction

Taro (Colocasia Esculenta), locally known as Natong or Linsa, is the most widely cultivated species of several plants in the Araceae family. It is thought to be native to Southern India and Southeast Asia but is widely naturalized [1–4]. The majority of taro

research has focused on its anatomy, biology, and physiology. As a result, a wide spectrum of taro value chain evaluations, including agricultural accounting and financial analysis, is required. Other value chain players, such as intermediaries, processors, and sellers were included in this analysis to account for the dynamics of the value chain beyond the hands of the farmers. Furthermore, no research on the taro value chain has ever been done in this exact location, making this study even more unique and significant.

The term "value chain" refers to a series of activities through which items move in order and gain value at each stage [5–7]. It encompasses the entire range of operations from production to consumption [8]. Taro is a tropical perennial plant that is primarily farmed for its edible starchy corm and as a leaf vegetable. It's a common food in African, Oceanic, and Indian cultures, and it's said to be one of the first cultivated plants [9]. The plant can be used as a sweetener in beverages, candies, and pastries, and can also be used as a substitute for wheat flour. It's also a resilient crop that provides farmers with a steady income. It's one of the few staple crops that can be farmed on a small budget and in difficult conditions where other crops would fail. In the tropical zone, it is also high in carbohydrates and a good source of calories.

The Philippines' taro plantation area is shrinking, with a total size of 14,992.84 hectares as of 2020. However, in Camarines Sur, where the Partido district is located, the area of plantation remains nearly constant at 281 hectares. In terms of taro production in the country, it is normally declining, although it grew in 2020 to 107,422.18 tons. The production of taro in Camarines Sur is dropping, with a total of 2,433.53 tons, and the province ranks second in the Bicol area after Albay. Taro output in the Bicol region is relatively low and limited in comparison to other regions and provinces. From 2015 to 2020, the farmgate price of taro in the Philippines is PhP15-25.00, whereas it is PhP16-26 in Camarines Sur. From 2014 to 2020, the retail price of taro in the Philippines is PhP29-49.00, while it is PhP42.00-48.00 in the province of Camarines Sur [10, 11]. Currently, there is no specific policy in the country in general or in the district in particular regarding the potential expansion of taro production. As a result, the goal of this study was to produce data that could be used as input for efficient and productive taro cultivation and distribution throughout the district. Achieve long-term productivity and sustainability, it is also in consonance with the UN Sustainable Development Goals (SDF), specifically Goal No. 1 No Poverty and Goal No. 2 Zero Hunger. It may also be indirectly related to Goal No. 12 Responsible Consumption and Production [9]. In Asia, taro cultivation is important because the crop serves as a staple food that ends the hunger of many households. In Oceania, taro cultivation is important because it plays a significant role in the national food security that alleviates poverty. In the Pacific islands, taro cultivation draws substantial attention on cultural aspects and socio-economic dominance [12–16]. Taro cultivation is important in Solomon Island because it is part of daily diet and custom [17]. In the Philippines, the plant is vital as a source of food and is also being cultivated for domestic purposes [18–20]. According to the UN Food and Agriculture Organization 2018, taro cultivation increases food security and enhances the livelihood of low-income households amidst climate change when sustainable utilization and conservation of the crop are made. Taro is an agricultural crop that can greatly contribute to gross value added in agriculture of a country when utilized properly [21]. The output of the study aims to eliminate poverty and reduce hunger in the district through the efficient utilization and production of taro. Considering the foregoing, value chain analysis is needed to understand how these potentials and contributions to the economy travel from their origins to the market.

2. Research methods

2.1 Materials

The analysis was carried out in 2020, during the emergence of CoVid-19 in the region but before the impact of three major typhoons that hit the region in the same year, destroying taro output severely.

Key informant interviews (KII) and focus group discussions (FGD) were undertaken in order to acquire primary data. Furthermore, document review was oriented to collect extensive data that might be used to compare study findings to current assertions on a certain issue. Because there are no existing records of taro players in the Partido district, a purposive technique using snowball sampling was utilized to find the responders.

The investigation includes every recognized, operational, and identifiable entity of farmers, merchants, and middlemen. Ten producers (planters/farmers), seven middlemen and processors, and twelve sellers of the commodity responded. Other major informants who contributed significantly to the study's completion were Municipal Agriculturists, Local Government Unit (LGU) officials, Department of Trade and Industry (DTI) employees, and Department of Agriculture (DA) officers. In order to collect data, the researcher employed a structured questionnaire as the major tool.

The preliminary inquiry was first carried out in conjunction with the Municipal Mayor's Office in several municipalities within the Partido area. The researcher worked with several officials to find the respondents after determining possible barangays. Crop accounting spreadsheets were used to construct summaries of pertinent accounting information using Stata and Excel.

2.2 Methods

To evaluate the roles and relationship dynamics of participants in the network, a value chain analysis and value chain mapping were conducted. Crop accounting techniques were utilized to assess, account for, and examine productivity, logistics, and marketing costs, value-added, and returns.

The profitability of total activity in each chain was determined using the Return on Revenue (ROR) method. It calculated the association between net income and revenue generated by the activity. The Gross Profit Rate (GPR) was computed to examine the link between cost of sales and gross revenue in determining the degree of company risk. The Cost to Revenue Ratio (EC/R) was calculated to examine each player's expected income in a certain transaction chain.

Furthermore, the profit-to-cost ratio was utilized to analyze the overall attractiveness of the activity by measuring the interaction between the profit generated and the costs expended. The value-added in each chain was computed to determine the activity's liquidity.

The equations and formulae below were used [22]*:*

$$\text{Gross Sales} = \text{Quantity Sold x Unit price;} \tag{1}$$

$$\text{Cost of Goods Sold} = \text{Direct Materials} + \text{Direct Labor} + \text{Variable Overhead Costs} + \text{Fixed Overhead Costs;} \tag{2}$$

$$\text{Gross Margin}\,(\text{in pesos}) = \text{Sales} - \text{Cost of Goods Sold; and} \tag{3}$$

$$\text{Gross Margin Percentage} = \text{Gross Margin} / \text{Sales x } 100; \tag{4}$$

$$\text{Value Added}\,(VA) = \text{Costs incurred} - \text{selling price}; \tag{5}$$

$$ROR = \frac{netincome}{grossincome}; \tag{6}$$

$$GPR = \frac{grossincome}{grossrevenue}; \tag{7}$$

$$\frac{EC}{R} = \frac{TotalExpenses}{grossrevenue}; \tag{8}$$

$$ProfittoCostRatio = \frac{Profit}{Costs}. \tag{9}$$

3. Results and discussion

3.1 Socio-demographic profile of each player and level of involvement of farmers in the taro value chain in Partido district, the Philippines

The table shows that the average age of the farmers is 55.3 years old and that the majority are in the age bracket of 41–50. As compared with the result of the PSA study which revealed an average age of 48, it can be interpreted that this study does not present any notable difference against the PSA's as far as age is concerned. The average age for middlemen/processors and sellers is 42 and 52.70, respectively and the majority of the respondents are also in the bracket of 41–50. **Table 1** also shows that 60% percent of the farmers are male, 85% of middlemen are male and 58% of the sellers

Profiles	Taro farmers	Taro middlemen & processors	Taro sellers
Count of entity	10	7	12
Gender	Male	Male	Female
Marital status	Married	Married	Married
Average age	55.3	42	52.75
Average monthly family income (PhP)	9,800.00	13,400.00	15,625.00
Family size	7	8	6
Highest educational background	High School	High School	High School

Table 1.
Players in the taro value chain's socio-demographic characteristics (Partido district, the Philippines).

are female which reflects the different gender roles in production and marketing. The findings of the study are congruent with the results as corroborated in Cassava post-harvest systems. Women are responsible for marketing while men are responsible for farming [23]. However, this study does not deal with the issues about gender involvement in technology along with the VC, specifically the level of gender involvement in Taro processing when commercialization and mechanization increase.

The level of farmers' income was found below the country's poverty threshold (5.41 × Php 1,813 = PhP9,800) while sellers' income hovers above the threshold (8.25 × Php 1,813 = Php 14, 957 & 8.618 × 1,813 = 15,625). It indicates that taro farmers are resource-limited which a typical scenario is because taro can be grown with less or no farm inputs [14]. On the other hand, taro sellers live slightly above the poverty threshold. It's also worth noting that both actors have significantly more family members than the country's average household size of 5.2 individuals. Both players have the same civil status and educational attainment model classes.

3.2 Identification of value chain characteristics pertaining to the relationships of participants from farmers to purchasers using farm to market analysis

Farmers, middlemen/processors, and sellers make up the Taro VC in Partido, Camarines Sur. The sellers' prices are frequently cheaper than the middlemen's. The majority of farmers sold their produce to the intermediary since it was profitable and the crop is perishable. Fresh taro tubers decay in 2 to 3 weeks, therefore selling it at a lesser price but in bulk is preferable to selling it (to sellers) at a much higher price but in pieces. Unlike the farmer-to-intermediary value chain, where only the middleman determines the price, the seller-to-market value chain contains a number of variables that might influence Taro's price.

3.3 Profitability and liquidity of the players through crop accounting and financial analysis

3.3.1 Costs and returns of taro farmers

Based on transaction path 3 and 4 (please refer to **Figure 1**), switching buyer from middleman to seller will yield a substantially greater profit; that is, from 3.395 to 9.651 profit-to-cost ratio. However, other factors are present such as bulkiness of harvest, which it is likely that great portion of the harvest will not be sold and set aside to rot. The resulting loss to farmers can likely outweigh the benefit of a higher price. This provides little or no options to farmers but to sell it to middlemen even though it will

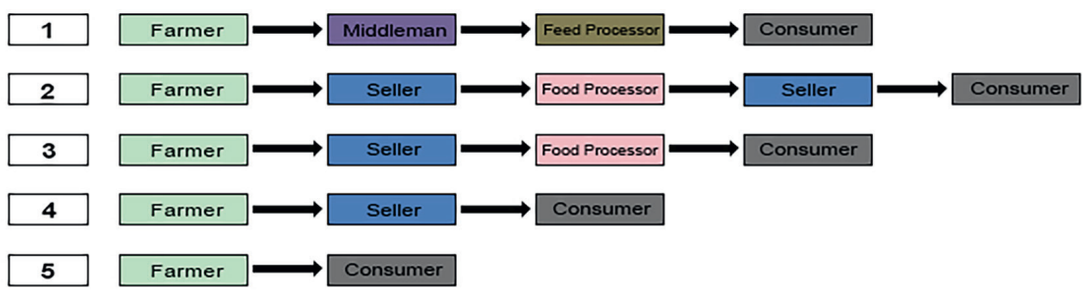

Figure 1.
Distinct taro value chain transaction paths in partido district, the Philippines.

Items	Per hectare			Per farm	Per Kg.	Cost/ kg.	Percentage
	Quantity	Unit	Value (₱)				
Production	727.732	kg.	25,526.655	67,262.737	35.077		
Area harvested 2.64 hac.							
EXPENSES							
Materials (Input Stage)							
Planting Materials			314.253	828.056	0.432		
Fertilizers			15.275	40.250	0.021	0.453	6%
Labor (Production Stage)					–		
Hired Labor			3,276.630	8,633.919	4.503		
Rentals - Machinery			610.859	1,609.614	0.839		
Rentals - Animals			283.882	748.028	0.390	5.732	74%
Others (Production Stage)					–		
Land Rentals			217.263	572.488	0.299	0.080	1%
Transportation (Logistics Stage)					–		
Transportation of Materials (to Farm)			25.021	65.929	0.034	0.034	0%
Transportation of Harvest (Farm to Coop)			1,064.948	2,806.138	1.463	1.463	19%
Total Expenses			5,808.130	15,304.422	7.981	7.763	100%
Gross Returns			25,526.655	67,262.737	35.077	35.077	439%
Net Returns			19,718.525	51,958.314	27.096	27.314	
Net Profit to Cost Ratio			3.395	3.395	3.395	3.519	

Table 2.
Average production costs and returns of taro farmers (Partido district, the Philippines).

result to, if not loss, lesser profit. It implies that in **Figure 1**, transaction paths 2, 3, and 4 are more profitable to farmers, yet they often choose transaction path 1.

The study also revealed that farm production averages 2,727.730 kilograms per hectare, which is too far below the quantity a result of the study conducted by PSA. This could be due to the non-application of organic fertilizer [14]. In fact, the respondent with the highest production per hectare was the only one using fertilizer. It is followed by the two respondents having the highest time spent per week in Taro farming (**Table 2**).

Taro sellers, on the other hand, exhibit a reasonable profit of Php39.218 per kilogram of Taro tubers or 9.56 margin-to-cost ratio. It can also be noted in the figure that logistics, a non-value-adding activity, takes up much of the portion of the total cost

Items		Sales/quarter (₱)	Per kg.	Cost/kg.	Percentage
Production		**17,106.030**	**45.000**		
Average sale per quarter: kg.	280.134				
EXPENSES					
Direct Materials (Input Stage)					
Taro Tubers		1,103.728	3.940	3.940	68%
Marketing Costs (Marketing Stage)		–	–		
Rentals - Place of Operation		27.033	0.097		
Pasada		20.465	0.073		
Payment to Municipal Office		71.006	0.253	0.423	7%
Transportation (Logistics Stage)		–	–		
Transportation of Harvest (Farm to Seller)		397.579	1.419	1.419	25%
Total Expenses		1,619.812	5.782	5.782	100%
Gross Returns		17,106.030	45.000		778%
Net Returns		15,486.218	39.218		
Net Profit to Cost Ratio		9.561	6.782		

Table 3.
Average production costs and returns of sellers (Partido district, the Philippines).

for farmers and sellers. This is due to the bulkiness and low value of Taro tubers which cannot take substantial expenses without suffering a net loss.

3.3.2 Costs and returns of taro sellers

Taro merchants, on the other hand, appear to maximize profit, earning PhP24.38 per kilogram of taro produce, or 303% gross returns. Farmers have the largest gross returns, followed by sellers, processors, and intermediaries, according to the prior and subsequent financial statements. Furthermore, it appears that taro intermediaries do not necessarily advance in the district, thus the actors are mostly farmers and merchants. Middlemen must outsource and transact other root crops or agricultural items other than taro since their revenues are lesser (**Table 3**).

3.4 Taro value chain diagram

According to **Figure 2**, farmers typically engage with two types of traders: sellers, processors, and intermediaries. There have been instances where they have sold it straight to customers; however, this occurs seldom and in extremely little quantities. Sellers, on the other hand, can sell it directly to customers or to food processors, depending on the price agreed upon. This is most common in the markets of central Goa, San Jose, Tigaon, and Lagonoy, where marketing activities take place twice a week. Taro processing begins when taro is sold to a customer or a food processor, as indicated by the dark green part of the map.

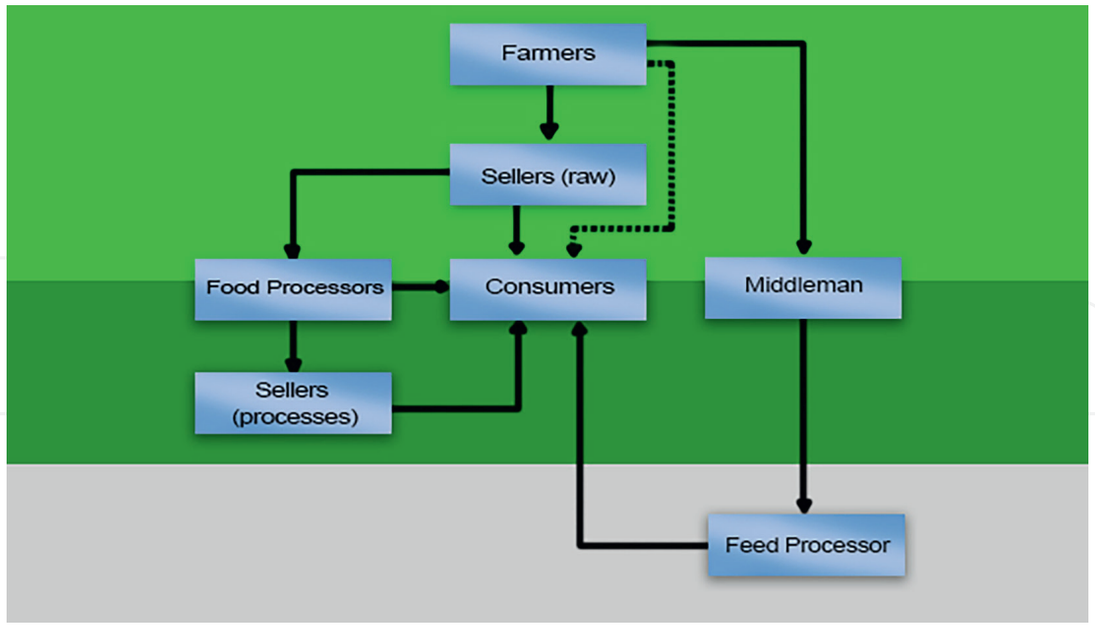

Figure 2.
Diagram of the Taro value chain in the Partido District, the Philippines.

During the data collection, it was discovered that the intermediary was acting in two roles: as an assembler and as a processor. Farmers sell raw Taros, which are then processed into food and/or culinary additives. Taro is transported from the farm to the storage facility using the middleman's vehicle. Granulation is the process of cutting tubers into little pieces using a granulating machine. Then it's dried for 2 to 3 days on a drying pavement or in a drying facility. It is sold to a feed processor outside of the Municipality of Goa after processing, as indicated by the gray part of the map.

The distribution of Taro in Partido, Camarines Sur is also depicted in **Figure 1** as transaction pathways. The main line of the local Taro value chain, Transaction Path 1, provides minimal returns to growers. The most profitable transaction paths for farmers are 2, 3, and 4, with path 2 being the longest and least sorted. Sellers, on the other hand, have three options: transaction 2, 3, or 4, all of which give an acceptable and equal return.

3.5 The taro value chain's assets, liabilities, interest, revenue, and costs

In a structured interview by the researchers with the respondents of this study, the only accounts they recognized for the asset section are cash, receivables, machinery and equipment, loan receivables, supplies, and furniture and fixture. For the liability section, accounts payable only. For the equity section, they have an unrestricted fund which they used in farming operations or in selling activities, they also recognized expenses (outflows), such as transportation expense/logistics, expenses, miscellaneous expenses, rentals, registration expenses, fertilizers expenses, and tubers expense. They only have sales income for income/revenues (inflow). They do not, however, account for non-cash expenses, hence depreciation was calculated using the straight-line approach rather than the diminishing balance method. Crop accounting analysis was used to assess all of the accounts concerned.

3.6 Existing taro value chain entry constraints

Since the location is located in the Philippines' super typhoon capital zone, typhoons are the natural entry barriers. Most of the farmers claimed that they have lower production than the previous harvest. They attributed it to the poor soil condition which is typical to the Taro farmlands when the soils are not properly managed or used. This study revealed that all of the respondents employ conventional tillage which is not a sustainable farming practice and can adversely affect Taro production. This practice can increase the initial year of farm production; however, it destroys the soil composition and kills the microorganisms, which nourishes Taro in times of nutrient depletion, by exposing it to the scorching sun [14].

Most of the farmers also identified the lack of capital as their major difficulty in farming Taro. This also resulted in a lower farm yield because of the inability to buy the necessary farm inputs. As stated earlier, only one respondent used fertilizer and produced the highest yield. It is due to the fact that, in addition to its ability to produce a reasonable yield on low-fertility soils, Taro responds very well to fertilization. Being aware of their capital deficiency, most of the respondents recommended financial support as a key to improving their Taro production.

Farmers also complained that the low price of the product is their major marketing difficulty. This finding is in consonance with the study conducted and data provided by authoritative agencies [24, 25]. On the other hand, sellers complained that instability of price is their major difficulty in marketing Taro. It is primarily due to several factors that can lead to price determination. However, their recommendation was on the provision of a proper place of operation. Sellers in the market have no permanent location and have to find their own place every time they want to sell goods. They usually conduct their marketing activities under their makeshift tents which poses a big problem when bad weather comes.

3.7 Assess the accounting practices applied by each player in the value chain.

In this part, the researcher determined whether the players maintained financial records of their transactions, the books being maintained, and the time basis for keeping a record. It also includes the accounting method used in recording, the accounting system, the bookkeeping system, the financial statements being prepared, and the time interval in preparing the financial report. Apparently, most of the players are not keeping accounts or financial transactions. They simply record their income and expenses but they did not keep this record in the long run.

3.8 Propose accounting enhancement program for different players of the value chain for University Extension

Necessary mechanisms should be proposed to improve the recordkeeping and financial reporting practices of the players. Based on the documentary analysis, most respondents are not maintaining financial records. Thus, accounting enhancement program for different players in the value chain is proposed. It is proposed by the researcher to maintain book of accounts because chronological records of transactions that explain economic event happening in the organization will be monitored, the accounts being affected and the amount of it. They also need to maintain general ledger because it is the master set of accounts that summarized all transactions occurring within the organization. However, the balance between cost and benefit should be considered.

4. Conclusions

Those who live below the poverty line usually engage in taro farming, while those who live just over the poverty line mainly engage in marketing. Men are associated with manufacturing, whereas women are associated with marketing. Farmers frequently choose the less profitable transaction path due to the perishability of the crop. Agriculture and processing technology are both deficient and unavailable. It is consequently advised that the governments and NGOs' efforts and activities for farmers to achieve higher production levels be shifted. Low production indicates that the taro industry in the Partido district is not being fully utilized. As a result, government funding should be made available to help farmers obtain the farm supplies they need to increase productivity. Apart from that, it may be deduced that logistics, as a non-value-adding component, has reduced returns while providing no advantages. As a result, a technical mechanism can lower or eliminate non-value-added costs.

Crop accounting is based on past expenses, but it does not account for the implications of imputed costs. As a result, it is suggested that a study be conducted that includes family labor. Another suggestion is to provide transportation infrastructure and amenities, as inefficiency in logistics is difficult for the chain's players to pay. The farmers advocated for financial assistance and the provision of processing machinery, while the sellers advocated for an appropriate operating location and training workshops. In the creation and implementation of government policies and NGOs' initiatives, entry barriers should be considered. Players' financial accounts are not kept up to date. As a result, it is strongly advised that participants keep financial records using simple bookkeeping. The institution may offer an accounting upgrading program to aid the players with their recordkeeping procedures.

Acknowledgements

This project was funded by Partido State University (ParSU) – College of Business and Management (CBM), and the Research & Development Office (R&D). The authors express their heartfelt thanks to *Pres. Raul G. Bradecina, Prof. Patricia Candelaria, Dean Rina A. Abner, Dir. Luisa Lanciso, and Prof. Rolan Jon G. Bulao* for holistic support. Likewise, to *Dean Arlene Inocencio, Dr. Dickson Lim, and Dr. Alellie Sobreviñas* of De La Salle University (DLSU) – School of Economics (SOE), for statistical and econometric methods. The researchers also convey their great appreciation

DOI: http://dx.doi.org/10.5772/intechopen.106853

to *IntechOpen* for the opportunity. Furthermore, *Mark Rey*, the research enumerator, deserves special commendation for his generous support. *To God be the glory!*

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References

[1] Rashmi DR, Raghu N, Gopenath TS, Palanisamy P, Bakthavatchalam P, Karthikeyan M, et al. Taro (Colocasia esculenta): an overview. Journal of Medicinal Plants Studies. 2018;**6**(4):156-161

[2] Srinivas T, Nedunchezhiyan M, Misra RS. Marketing of taro in India. NSCFT Proceedings. 2011;**2011**:609-612

[3] Kolchaar K. Economic Botany in the Tropics. Bangalore, India: Macmillan; 2006

[4] Suminarti NE, Ariffin GB, Rayes ML. Effect of fertilizer application and plant density on physiological aspect and yield of taro (Colocasia esculenta (L.) Schott var. Antiquorum). International Journal of Agricultural Research. 2016;**11**(1):32-39

[5] Hempel E. Value Chain Analysis in the Fisheries Sector in Africa. 2010. [Accessed: July 25, 2017]

[6] Trienekens JH. Agricultural Value Chains in Developing Countries A Framework for Analysis. 2011. [Accessed: July 10, 2017]

[7] Webber M, Labaste P. Using Value Chain Approaches In Agribusiness and Agriculture in Sub-Saharan Africa. 2008. [Accessed: July 28, 2017]

[8] Hellin J, Madelon M.. Guidelines for Value Chain Analysis. 2006. [Accessed: July 20, 2017]

[9] United Nations Sustainable Development Goals (UNSDGs). 2020. Available from: https://www.un.org/sustainabledevelopment/poverty/

[10] Philippine Statistics Authority. Area, Volume, Cost and Returns of the Taro Production in the Philippines. 2018.

[11] Philippine Statistics Authority Open Statistics. Cost and Returns of the Taro Production in the Philippines. 2020

[12] Akwee PE, Netondo G, Kataka JA, Palapala VA A Critical Review of the Role of Taro Colocasia esculenta L. (Schott) to Food Security: A Comparative Analysis of Kenya and Pacific Island taro germplasm. Scientia Agriculturae. Pakistan. Available from: www.pscipub.com/SA. E-ISSN: 2310-953X, P-ISSN: 2311-0228 2015.

[13] FAOSTAT. Chicago, USA: FAO; 2008. Available from: www.fao.org/ag/agpc/gcds/ [Accessed: July 20, 2017]

[14] FAO. Save and Grow: Taro. Food and Agriculture Organization of the United Nations. 2013. Available from: http://www.fao.org/3/a-i3278e.pdf [Accessed: July 5, 2017]

[15] FAOSTAT. 2017. Food and Agriculture Organization of the United Nations. Available from: http://www.fao.org/faostat/en/#data/QC/visualize [Accessed: July 22, 2017]

[16] Onwueme I. Taro cultivation in Asia and the Pacific. RAP Publication. 1999;**16**:1-9

[17] Liloqula R., Saelea J., Levela H.. Traditional taro cultivation in the Solomon Islands. 1993

[18] Kreike CM, Van Eck HJ, Lebot V. Genetic diversity of taro, Colocasia esculenta (L.) Schott, in Southeast Asia and the Pacific. Theoretical and Applied Genetics. 2004;**109**(4):761-768

[19] Matthews PJ, Agoo EMG, Tandang DN, Madulid DA. Ethnobotany and ecology of wild taro (Colocasia esculenta) in the Philippines:

Implications for domestication and dispersal. Senri Ethnological Studies. 2012;**78**:307-340

[20] Villanuev MR, Tupas, PR. Taro Production in the Philippines – Its Prospects and Problems 1. 2021

[21] Food and Agriculture Organization of the United Nation. Conservation and Sustainable Utilization of Underutilized Taro to Increase Food Security and Improve Livelihoods of Marginalized Communities Faced with Climate Change.pdf. 2018

[22] Onsay EA. Productivity value chain analysis of cassava in the Philippines. In: IOP Conference Series: Earth and Environmental Science. Bristol, England and Philadelphia, United States: IOP Publishing; 2021

[23] Martin A, Forsythes L, Butterworth R. Gender implications of developing cassava postharvest systems. Expert Consultation on Cassava Processing, Utilization, and Marketing. 2008

[24] Meridian Institute. Innovation for Agricultural Value Chain in Africa: Applying Science and Technology to Enhance Cassava, Diary, Maize Value Chain. 2009. [Accessed: July 20, 2017]

[25] Philippine Statistics Authority Open Statistics. 2004. Available from: https://openstat.psa.gov.ph/