Analysis of added value on the porang supply chain in Klangon Village, Madiun District

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Abstract. Porang (Amorphophallus muelleri Blume) is a leading export commodity in Klangon Village, Saradan Subdistrict, Madiun District. Until now, this commodity continues to be developed because it has become the main income for the people in this area. This study purpose to map the porang supply chain as well as to analyze its value chain which includes socio-economic and contributions between the business actors involved in the porang supply chain in Klangon Village, Saradan Subdistrict, Madiun District. The research activity was carried out in Klangon Village, Saradan Subdistrict, Madiun District in March – April 2021. The method used was the Hayami method. The results showed that the current profit level of porang business for each kilogram from the largest to the smallest are farmers 80.26%, wholesalers 67.57% and collectors 22.80%. The wholesalers sell porang chips, therefore their added value is greater than the farmers and collectors. The amount of added value successively from farmers, collectors and wholesalers are IDR. 8433/kg, IDR. 3000/kg, and IDR. 62000/kg. Based on this analysis, it proves that post-harvest handling in converting fresh porang into chips can increase added value, and currently the added value is still owned by wholesalers. Efforts to increase added value and profits at the farm level can be done through increasing post-harvest handling capacity into more valuable forms such as chips and flour.

1. Introduction

Porang is a superior commodity in Klangon Village, Saradan Subdistrict, Madiun District which has high price and as the one of farmer income as well as a source of welfare for the people of this village. The demand for porang products in Indonesia continuously increases, especially to meet export needs [1,2]. The increasing of demand has also led to increase the public interest in cultivating, including post-harvest handling. So far, the Porang produced from Klangon village has good quality, so it is good to be developed optimally. However, its supply chain performance still needs to be improved to make it more efficient. The lack marketing information and low bargaining position of farmers are the main problems of porang development[3].

Agroindustry is an organization that connects suppliers (suppliers) with customers/retailers, whose function to integrate the two institutions so that they are synergistic and can ensure speed and accuracy in product distribution. The relationship between suppliers, agro-industry, and retailers will form a supply chain or called as Supply Chain Management (SCM). SCM is a series of approaches implemented to efficiently integrate suppliers, entrepreneurs, warehouses, and other storage areas, so that the resulting products can be distributed to consumers with the right quantity and quality, at the right location, and at the right time at a cost-effective and satisfying consumer needs [4]. Several studies on supply chains include
strawberry SCM [5]; Soybeans [6] as well as web-based ones carried out by Skom [7] for general agricultural products.

The porang supply chain that applies in Klangon village, Saradan Subdistrict, Madiun District has several patterns, the first pattern is that farmers sell porang to collectors, from collectors (middlemen) porang are sold to traders, then traders sell them to factories or sent it to several cities such as Semarang, Surabaya, Bandung, and others. In addition, porang are also exported to foreign countries such as China, Thailand, Vietnam, Japan and Korea in the form of chips (dried porang). The second pattern is the farmers sell their porang directly to traders, and then the traders sell it to factories or exporters. There are three kinds of commodities that are sold or traded, namely chips (dried porang), bulbil/frog and fresh products.

The concept of added value is a change of value that occurs due to the treatment of an input in a production process. The flow of increasing value-added agricultural commodities occurs in every supply chain from upstream to downstream, starting with the farmers and ending with final consumers. The added value of each member of the supply chain varies depending on the input and treatment by each member of the supply chain [8]. The value chain involves processes and actors, is a chain of activities that transform commodities into products that are more valuable to customers [9,10]. Quantitative added value is calculated from increased productivity, while qualitative added value is added value from increased employment opportunities, knowledge and skills of human resources. Several studies on VCM in processed agricultural products include soy milk [11]: aloe vera crackers [12]; dodol salak [13]; dairy industry [14]; IKM meat [15] and various other products on the IKM scale conducted by [16]. Research on VCM to analyze the sustainability of a manufacturing business has also been developed in other countries, including those conducted in the Czech Republic [17] and chili value added analysis [18].

The next added value occurs in the downstream sector which involves the processing industry. Perishable and bulky commodities require proper handling or treatment, so that agricultural products are ready for consumption. These treatments include processing, packaging, preservation and quality management to increase use or create added value so that the value of agricultural products will increase. Some added values that cannot be calculated numerically include job opportunities that are open to the manufacturing industry and increased job opportunities. The purpose of this study is to map the porang supply chain as well as to analyze its value chain which includes socio-economic contributions between the business actors involved in the porang supply chain in Klangon Village, Saradan Subdistrict, Madiun District.

2. Materials and methods
This research was conducted in Klangon Village, Saradan Subdistrict, Madiun District in March – April 2021. The location of the research activity was chosen based on the consideration that Klangon Village is the center of porang production in Madiun District. Primary data were obtained directly from the results of interviews, recording, filling out the google-form and field observations. Respondents in the study were farmers, collectors, wholesalers, and officers from the Madiun District Agriculture Service. Meanwhile, secondary data were sourced from the Central Java Province Quarantine Agency, Madiun District Agriculture Service, local village office, Forest Village Community Institute (LMDH), related agencies and various research literature. The data collected was data on porang farming in Madiun, porang farming actors, porang processing industry, porang export data and porang supply chains.

The framework used to describe the supply chain uses the Food Supply Chain Network framework which was adapted by Vorst [19]. There are four main elements in the FSCN framework, including supply chain structure, supply chain business processes, network management and supply chain resources. This study uses supply chain management theory which theoretically can be stated as a fundamental philosophical approach to the creation of value chain management that is focused on consumer demand. The essence of supply chain management is the flow of products and information that is expected to bridge consumer demand and the relationship between actors in the marketing system.

This case study research uses a qualitative approach and data collection is carried out through in-depth interviews with resource persons. There were several sources who were interviewed including farmers, middlemen, suppliers and the Klangon Village government who became the object of this study. The
questions in this interview are closed and open so that they are more flexible and open up space for new themes or issues that arise in the interview process that are interesting to explore further.

Determination of the sample for the number of farmers, the number of collectors and wholesalers using purposive sampling. The number of samples is adjusted to the research objectives. For this reason, the number of farmer partners analyzed were 6 farmer partners, 3 collectors and 2 wholesalers. These three supply chain nodes were selected based on their good performance according to the extension workers at the location.

Value added analysis using the Hayami method. According to Hayami Methods [20], there are two ways to calculate added value, namely added value for processing and added value for marketing. The concept of added value is the development of value that occurs because of the input that is treated in a commodity [20,21,22]. The amount of added value is obtained from the reduction of raw materials. The amount of added value is obtained from the reduction of raw materials and other input materials to the value of the resulting product, including labor.

Value Added = f(K, B, T, U, H, h, L)
where: K = Production capacity; B = Raw materials that used; L = Labor used; U = Labor wage; H = Output price; h = price of raw materials; L = Input value.

3. Results And discussion

3.1. General condition of porang farmers in Klangon Village
The results of the field survey regarding the general condition of Porang farmers in Klangon village are as shown in Figure 1 below. In the figure, it can be seen that porang farmers generally have high school education as much as 66.7% and the others are D3 (16.6%) and junior high school (16.7%). The condition of the educational strata at the farmer level is certainly quite good, especially in terms of ease of communication and technology transfer. The ownership of land for porang farming in general, they lease from Perhutani, and the others are their own and cooperation with the owners of capital. Meanwhile, porang cultivation for most of the farmers are the main occupation (66.7%), and the farming cultivated land are more than 2 ha.

Figure 1. General condition of porang farmers in Klangon village
3.2. Porang supply chain in Klangon Village

The pattern of porang supply chain management in Klangon village, Saradan Subdistrict, Madiun District is shown in Figure 2 below. The figure showed that farmers can make porang sales transactions through middlemen or directly to traders or collectors.

![Figure 2. Porang supply chain pattern in Klangon Village](image)

Based on Figure 2 above, in Klangon village there are two models of the porang supply chain management system, namely:
a) Model 1: Farmers – Middlemen – Wholesalers/Big Collectors – Factories – Exporters  
b) Model 2: Farmers – Wholesalers/Big Collectors – Factories – Exporters  

These two models go hand in hand and are highly dependent on good relations between porang supply chain actors. The supply chain is an activity related to the flow and transformation of goods or services from the stage of supplying raw materials to the final product to the consumer. [5]

3.3. Porang farming system analysis

Farming is defined as an activity that organizes production facilities and technology in a business related to agriculture. The goal of farming is to obtain the highest possible production at the lowest possible cost.

Porang is a type of plant that grows in forests, but in the past few years, porang plants have been widely cultivated as monoculture in open land. The conditions for growing porang are at the altitude of about 0 - 700 masl, but the best height for porang planting is between 100 - 600 masl. The condition of the soil that is not muddy, fertile and has a sandy loam texture, and no weeds of any kind is the most suitable for planting porang. Shade plants for porang are suitable in the form of teak, mahogany, sono, etc., with a shade density of 40% - 60%. [24,25]. The cost of porang farming system as shown in Table 1.

### Table 1. Cost of porang farming system in Klangon Village, 2021

| No | Activities                                             | Unit  | Quantity | Cost per unit (IDR/unit) | Total cost (IDR/Ha) |
|----|-------------------------------------------------------|-------|----------|--------------------------|---------------------|
| 1  | Land lease                                            | Ha    | 1        | 1,300,000                | 1,300,000           |
| 2  | Land preparation                                     | Man-days | 15      | 100,000                  | 1,500,000           |
| 3  | Porang tuber seeds (Planting distance 1 x 1 m)       | seed  | 10000    | 400                      | 4,000,000           |
| 4  | Fertilizer (organic, phonska, SP, urea)              | package  | 1      | 3,000,000                | 3,000,000           |
| 5  | Planting 10,000 tuber seeds                          | Man-days | 7      | 100,000                  | 700,000             |
| 6  | Cultivation and Fertilization (year 1st)             | Man-days | 8      | 100,000                  | 800,000             |
| 7  | Cultivation and Fertilization (year 2nd)             | Man-days | 8      | 100,000                  | 800,000             |
| 8  | Cultivation and Fertilization (year 3rd)             | Man-days | 8      | 100,000                  | 800,000             |
| 9  | Harvesting                                            | Man-days | 7      | 100,000                  | 700,000             |
| 10 | Transportation                                       | 1 trip | 1       | 500,000                  | 500,000             |
|    | **Total**                                            |       |         |                          | **14,100,000**      |
The added value of porang farming lies in the production of bulbil as additional income. The average production of bulbil per hectare is 50 kg. Revenue of porang farming system can be seen in Table 2.

### Table 2. Revenue and income from porang farming per hectare in Klangon Village, 2021.

| Activities | Unit | Quantity |
|------------|------|----------|
| Revenue    |      |          |
| 1. Production of porang in one tree (a) | kg | 2 |
| 2. Number of trees per hectare (b) | ha | 10,000 |
| 3. Price of tubers per kg (c) | IDR | 10,000 |
| 4. Revenue from tubers (d=axbxc) | IDR | 200,000,000 |
| 5. Revenue if in year 1 only 70% can be harvested (e=dx0.7) | IDR | 140,000,000 |
| Cost incurred (from Table 1) (f) | IDR | 14,100,000 |
| Income at harvest 1 (year 3) (g=e-f) | IDR | 125,900,000 |
| Additional income from porang farming |      |          |
| 1. Bulbil production/ha (h) | kg | 50 |
| 2. Price of bulbil/kg (i) | IDR | 350,000 |
| 3. Additional income from selling bulbil (j=hxi)/ha | IDR | 17,500,000 |

The income from porang farming carried out by farmers generates a fairly large profit, which was IDR 125,000,000/ha. In addition to the profit from the sale of bulbs, farmers also get additional income from the sale of bulbils, which is IDR 17,500,000. The results of this study are in line with previous research which states that porang farming produces large enough profits so that it is feasible to be developed [26].

### 3.4. Analysis of added value at every node of the supply chain

The Farmers sell porang usually as a fresh product, as well as at the collector level. However, at the wholesale level, porang is sold as a dried chip. In Table 3 below, the added value for porang production per hectare is presented, assuming all porang production are bought entirely by collectors, and the production is converted into dried chips with a yield of 13% at the wholesale level. The added value at the farm level is still higher at IDR 8,433.3/kg, when compared by the added value received by collectors of IDR 3,000/kg. This is of course very reasonable, considering the risks borne by farmers are very large. However, the added value received by wholesalers is much higher than the added value received by farmers and collectors, which is IDR 42,000/kg. This is because wholesalers sell their products as the dried chips, and the current selling price of the dried chips is about of IDR 62,000/kg. Based on this analysis, it can be seen that selling porang as the dried chips is much more profitable, although there is an additional cost for peeling, drying and packaging with an additional cost of IDR 7,000/kg for the additional process. This proves that post-harvest activities will increase the added value.

The value added ratio is obtained from the difference between farmers’ income and production costs that must be incurred and from these three supply chain actors, the highest value added ratio is received by farmers at 84.33%, then wholesalers 67.74%, and collectors 23.08%. Based on this analysis, it can be said that the current supply chain, the largest added value is still owned by farmers, so it can be said that the current supply chain is still good.

As in the value-added analysis above, the profit analysis at each supply chain actor is presented in Table 2 above. The highest profit received by wholesalers is IDR 41,892.86/kg, then the profit received by farmers is IDR. 8,026.19/kg and the collector received IDR 2,964.29/kg. The value of profits at the farmer level is highly dependent on the cultivation land area, productivity per hectare and the prevailing price, while at the collectors and wholesaler level the value of profits is highly dependent on the ability of receiving raw
materials and the selling price. The level of profit received by each supply chain actors in succession from the largest are 80.26% farmers, 67.57% wholesalers and 22.80% collectors.

Table 3. Analysis of added value at each supply chain node with Hayami

| No | Description                        | Unit  | Farmers | Collector | Wholesaler |
|----|------------------------------------|-------|---------|-----------|------------|
| 1  | Total production/output (A)        | Kg.   | 14000   | 14000     | 1820       |
| 2  | Raw material input (B)             | Kg.   | 14000   | 14000     | 14000      |
| 3  | Labor input (C)                    | Man-days/ha. | 57     | 5         | 15         |
| 4  | Price of output (F)                | IDR/kg. | 10000  | 13000     | 62000      |
| 5  | Labor cost (G)                     | IDR/HOK | 100000 | 100000    | 100000     |
| 6  | Production cost (H)                | IDR/kg. | 1566.67 | 10000     | 13000      |
| 7  | Others input (I)                   | IDR/kg. | 0       | 0         | 7000       |
| 8  | Conversion factors (D=A/B)         |       | 1       | 1         | 1          |
| 9  | Coefficient direct Labor (E=C/B)   | Man-days/kg. | 0.0041 | 0.0004    | 0.0011     |
| 10 | Output value (J=D x F)             | IDR/kg. | 10000  | 13000     | 62000      |
| 11 | Added value (K=J-H-I)              | IDR/kg. | 8433.33 | 3000.00   | 42000.00   |
| 12 | Added value ratio L=K/J x 100%     | %     | 84.33   | 23.08     | 67.74      |
| 13 | Indirect revenue (M=E x G)         | IDR/kg. | 407.14  | 35.71     | 107.14     |
| 14 | Part of direct labor (N=M/K x 100%)| %     | 4.83    | 1.19      | 0.26       |
| 15 | Profit (O=K-M)                     | IDR/kg. | 8026.19 | 2964.29   | 41892.86   |
| 16 | Level of profit (P=O/J x 100%)     | %     | 80.26   | 22.80     | 67.57      |

4. Conclusions

The added value at the farmer level is still higher i.e., IDR 8433.3/kg., when compared to the added value received by collectors of IDR 3000/Kg, but the added value received by wholesalers is much higher than the added value received by farmers and collectors, which is IDR 42000/kg., because traders already sell it as dried chips. The level of profit received by each supply chain actors in succession from the largest is 80.26% farmers, 67.57% wholesalers and 22.80% collectors. The porang supply chain in Klangon village is still working well and providing good benefits to the farmers, so it is hoped that this condition will continue and the farmers can produce quality porang.

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