

Determining the Profit Margin of “Patchouli Oil” Supply Chain: A Case Study in Indonesia

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Abstract— Patchouli oil is a type of oil obtained from the extraction of patchouli leaves and dried stems. In this study, the extraction process, also known as distillation, is conducted by Small and Medium Enterprises (SMEs) in West Pasaman, Indonesia. Patchouli oil must go through several steps before being by manufacturers, such as farmers, intermediaries, collectors. The interview and survey conducted show that SMEs are currently declining in West Pasaman due to the low selling price of patchouli oil while the production cost is high that declined farmers. Most traders do not add value to the product as they only collect patchouli oil and pass it on to next stages. This study aims to determine the production cost and profit margin of each stage in the supply chain of patchouli oil. Data were collected by interviewing the stakeholders, i.e., patchouli farmers, SMEs refining patchouli oil, collectors, and exporters. The production cost determined using traditional costing method. The results indicate that farmers obtain IDR 1.236 per day, while traders and collectors obtain respectively IDR 10.000 and IDR 3.833 a day. Surprisingly, the intermediary traders obtain the highest profit margin although they do not contribute to the added value of the product.

Keywords— patchouli oil; costing; supply chain

I. INTRODUCTION

Oil essence, also known as the etheric oils or oil fly or volatile oil, can be produced by several types of plant, such as Lemongrass, cinnamon, patchouli, cloves. The oil can be obtained from the roots, stems, leaves, and flowers of the plants through extraction [1]-[3]. Essential oils have the following properties: (a) volatile at room temperature without decomposition, (b) have a bitter taste (pungent taste), (c) soluble in organic solvents and insoluble in water. Essential oils are used to produce cosmetics, perfumes, antiseptics, medicines, “flavoring agent” for food, beverages, cigarettes, and aromatherapy [4]-[7]. The quality of the oil essence is affected by the quality of the plants and the processes used to produce the oil [8]-[10].

Pogostemoncablin (*Lamiaceae*) or patchouli is a bushy herb which is a member of the mint family and hails originally from Indonesia, Malaysia, and the Philippines. This plant is known in Indonesia as “nilam” or “dilem”. Patchouli (*Pogostemoncablinbenth*) is one of the plants that produce essential oil and one of the essential export commodities of Indonesia. Among all types of the exported

oil essence in Indonesia, patchouli accounts for 60%. In the global market, 90% of the patchouli oil traded internationally comes from Indonesia.

Patchouli is an industrially valued aromatic, medicinal plant that has a huge demand for its oil essence [11]. It is widely used in flavor and fragrance industries as well as in pharmaceuticals.

Patchouli oil is one of the most critical base materials used in perfumery with its strong fixative property. Thus, the stable smelling oil extracted from leaves is used in perfumes, incense, detergents, and hair conditioner [11], [12]. Patchouli is found in many famous perfumes. At present, farmers are showing interest towards patchouli cultivation at large scale mainly in tropical and sub-tropical countries [11].

Patchouli oil is produced in various regions in Indonesia including West Pasaman in West Sumatera. Patchouli oil is obtained from the extraction of patchouli leaves and dried stems. Fig. 1 shows patchouli from West Pasaman. The extraction process is called distillation. Distillation is done by small and medium enterprises (SMEs) in West Pasaman. Patchouli farmers either sell dried patchouli directly to the distillers or perform distillation themselves. Distillers and

farmers supply patchouli oil to traders or collectors who sell it to exporters. Patchouli oil goes through many steps before being used by manufacturers. There is an additional price at each stage. The price is high at exporters level and low at farmers level.



Fig. 1 Patchouli from West Pasaman Indonesia

The interviews and surveys conducted show that SMEs are currently in a declining condition in West Pasaman due to low selling price of patchouli oil while the production cost is high. This condition is contradictory to the selling price at exporters level. Many intermediaries make patchouli oil price at farmers level uncertain as collectors and exporters determine the selling price. Several steps must be complied with before manufacturing. This condition weakens the position of farmers. Most traders do not add any value to the product as they only collect patchouli oil and pass it on to the next level.

This study aims to determine the production cost and profit margin of patchouli oil production at each stage of the supply chain. The most profitable and contributing actors in each stage can readily be determined after calculation. This research can help the government to improve patchouli oil business.

II. MATERIAL AND METHOD

A. Material

1) *Product Costing System*: Costing system helps companies to determine the cost of a product related to the revenue for each production. Two standard costing systems are used: direct costing (DC) or traditional system and activity-based costing (ABC). In the traditional system, it can be seen that the costs involved are usually straightforward, namely labor costs and material costs. However, over time, some costs can be classified as direct costs. These costs include the cost of repairs, maintenance, utilities, and so forth. The cost system will charge an indirect cost to an unrepresentative allocation base. Activity-Based Costing (ABC), as a cost calculation method that creates a cost group for each event or transaction within an organization that serves as a cost driver. Overhead costs are then allocated to products and services based on the events or transactions of the resulting product or service. ABC assigns the manufacturing costs of a product based on the activities required to produce the items [13].

Traditional costing and its application in manufacturing environments have been widely discussed. Some researchers used traditional costing to calculate life-cycle cost (LCC) [14], [15]. Traditional costing used to calculate LCC estimation for robot systems in an early production planning phase [16], also for sustainable coal consumption an energy

production in India [17]. In agriculture also determined production cost of palm empty fruit bunch conversion to bio-oil [18], analyzed the cost production of pineapple at farmers using traditional costing [19]. Some scholars have conducted research related to cost in the supply chain [20]. Applied activity-based costing in a supply chain environment in a large European company of facade components. This research shows the significance of identifying the inter-firm cost saving opportunities and offering a first stage in measuring the appropriateness of the projected model.

2) *Indonesia Patchouli Oil*: The following 2014 Statistic Year Book shows a five-year statistics of Patchouli Oil in Indonesia:

TABLE I
PATCHOULI OIL IN INDONESIA

Year	Production (Ton)	Area (Ha)
2010	2200	24500
2011	2900	28600
2012	2600	31200
2013	2100	28200
2014	2100	28300

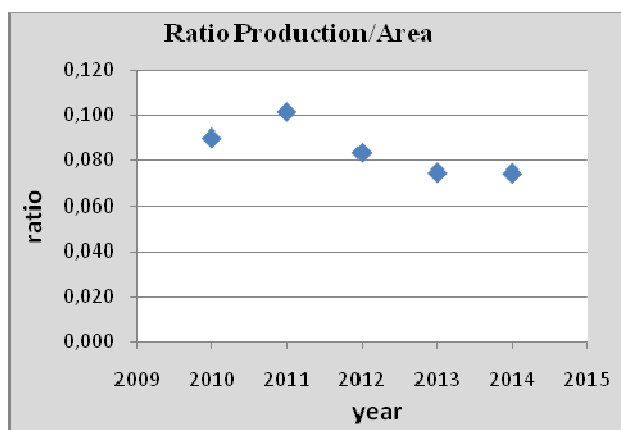


Fig. 2 Production per area ratio

Fig. 2 shows the fluctuation of patchouli oil production ratio per area. 2011 has the highest value. Production decreased in the years 2013, 2014 and 2015. Overall, it can be concluded that the amount of patchouli oil production has decreased, while the used land increased. This is caused by the unstableness of the price of Patchouli oil price and its lack of quality standard and the use of inappropriate technology.

B. Method

Data were collected directly through interviews with the stakeholders involved. Five farmers, three SMEs industries as patchouli oil refiners, two collectors and one exporter were interviewed. The farmers and the SMEs are located in West Pasaman while the collectors and exporters are in Padang.

The data on all components of the costs involved were taken through in-depth interviews. Before determining the production cost, it is necessary to identify patchouli oil supply chain.

This paper uses traditional costing to determine the production cost of patchouli oil at each stage of the supply chain. Traditional costing is used because the calculation of the production cost can only be carried out for one type of production while financing is not imposed on the types of products and activities. Overhead is a cost component that is difficult to control compared with other cost components such as raw material costs and labor costs. However, it can be done by elaborating on all the cost components involved.

1) *Production Cost*

Farmers Level

$$PC1 = AC + EC \tag{1}$$

$$AC = sc + fc + lc + ov \tag{2}$$

- Sc = 15 seed/m²*IDR500
- = (ss/15 seed/m²)*IDR500
- fc = ss/100m²*IDR 9000

$$EC = kc + rc \tag{3}$$

- Rc = IDR 20.000*numbers of extraction
- kc = IDR 40.000* numbers of extraction
- lc = Rp 100.000*numbers of labour*working days

Where:

- PC1 = production cost at farmers level
- AC = Agriculture cost
- EC = Extraction cost
- Sc = seed cost
- fc = fertilizer cost
- lc = labour cost
- ss = size of area
- ov = overhead cost

Traders Level

$$PC2 = tc + PC1 \tag{4}$$

Where:

- PC2 = production cost at traders level
- tc1 = transportation cost at traders level

Collector Level

$$PC3 = tc2 + sc + PC1 \tag{5}$$

Where:

- PC3 = production cost at collectors level
- tc2 = transportation cost at collectors level

2) *Profit Margin*

$$PM1 = SP1 - PC1 \tag{6}$$

$$PM2 = SP2 - PC2 \tag{7}$$

$$PM3 = SP3 - PC3 \tag{8}$$

Where:

- PM1 = profit margin at farmers level
- PM2 = profit margin at traders level
- PM3 = profit margin at collectors level
- SP1 = selling price at farmers level
- SP2 = selling price at traders level
- SP3 = selling price at collectors level

A. *Result*

1) *Patchouli Oil Supply Chain:* Patchouli oil supply chain was designed based on interviews and surveys with farmers, SMEs, traders, collectors and exporters in West Pasaman and Padang. The supply chain is designed by determining the activities performed by each actor to determine the cost they require and the cost data necessary to calculate the production cost.

The oil essence derived from the stems and dried leaves. After harvest, patchouli will be dried for about three days, after clean up, the stems and leaves are cut into small pieces. The next step is refining, farmers gather dry patchouli and put it in at 50 kg packing, then enter into distiller and compact it. The distillation process takes approximately 7-8 hours. The tools used for distillation are privately owned by groups of farmer groups or hired. The amount of patchouli oil obtained for each refining from one size of drum varies between 8 oz - 1.2 oz. According to farmers variations occur because of the quality of soil and seeds of each patchouli.

Farmers sell their patchouli oil either to traders who come directly to refineries or collectors located further away. Traders sell to collectors, who, in turn, sell to exporters located in Medan or Padang. Exporters export to various perfume companies, pharmaceuticals, and cosmetics overseas. Patchouli oil supply chain is shown in the figure below:

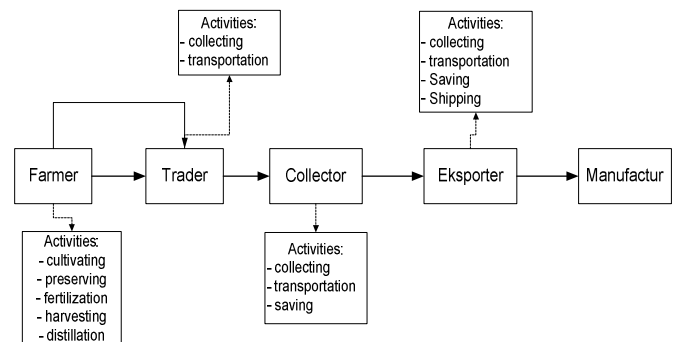


Fig. 3 Patchouli oil supply chain

Activities for each actor are:

Farmers:

- **Cultivating;** This activity starts from the preparation of areas, seeds, relocation of seeds, plantation, fertilization, harvesting. Seeds are obtained from cuttings and then relocated to the ready area for planting or planting.
- **Preserving;** This point is related to the activity that can increase the fertility of plants such as using of new technologies and fertilizers.
- **Fertilization;** This activity consists of applying fertilizers on plants. Fertilizers can be applied monthly after the plants are one month old.
- **Harvesting;** Patchouli harvesting can be done after patchouli is 6-8 months old, next harvest is after three months. Replanting patchouli can be done after it is three years old.

- Distillation; After harvest, patchouli is dried and distilled. Refining is a process of extracting oil from dry stems and leaves by using water unmixed with oil.

Traders:

- Collecting; This activity is done by collecting patchouli oil from farmers.
- Transportation; Transportation is needed when collecting patchouli oil from farmers in some areas.

Collectors:

- Collecting; Patchouli oil is collected from farmers and collecting traders.
- Storing; Patchouli oil is collected and stored until it reaches the amount of three tons and then delivered.

Export:

- Collecting; Patchouli oil is collected from traders and collectors.
- Transportation; Transportation is required to transport patchouli oil to various regions both at home and overseas.
- Storing; Patchouli oil is stored for some time to collect the quantity required before shipping.
- Shipping; Patchouli oil is sent to various regions within and outside the country.

2) *Profit Margins for Farmers*: One hectare ideally contains 15,000 Patchouli seeds obtained by steam system. The price of one steam of patchouli is IDR 500. The dry leaves and stems are cost IDR 5,000 to IDR 6,000/kg. The dry leaves and stems are distilled to produce patchouli oil. Usually, wet leaves drop 70% to the dried leaves. The interviews reveal that 1 hectare can yield 70-80 times distillation, one distillation produces an average of 1 kg of oil. Production cost at farmers level is calculated by using the equation formula 1, which consists of two types; agriculture and distillation costs. Both can be calculated by using the formula that refers to equation 1 and equation 2. The Result of the calculation cost at farmers level can be seen in Table 2 and 3.

TABLE II
COST OF AGRICULTURAL PROCESS

Component Cost	Price (IDR)	Units	Total (IDR)
Seeds	500	15000 seeds	7,00,000
Fertilizer	9,000	30 kg	270,000
Labor costs	100,000	2 members, 4 days	800,000
Overhead costs	500,000	-	500,000
Total			9,070,000

TABLE III
COST OF DISTILLATION PROCESS

Component Costs	Prices (IDR)	Units	Totals (IDR)
Fuel Costs	40,000	80	3,200,000
Rental Costs refiners	20,000	80	1,600,000
Total			4,800,000

The total production cost of one hectare is IDR 9,070,000 + IDR 4,800,000= IDR 13,870,000. The selling price of

patchouli oil is around IDR 460,000-480,000/Kg. The selling price per hectare is IDR 37,600,000. Profit margin using equation. 6 for farmers in one hectare is IDR 23,730,000.

3) *The Profit Margin for Traders*: There is an IDR 10,000-20,000/kg price difference between farmers and traders. The selling through intermediaries is IDR 460,000/kg while it is IDR 470,000 to IDR 480,000 if sold through collectors. The profit margin using equation.7 for traders is IDR 10,000-20,000/Kg.

4) *Profit Margin for Collectors*: The purchasing price of collectors to farmers or intermediaries ranges from IDR 460,000 to IDR 480,000. The quality of patchouli oil determines the purchasing price. The Patchouli oil that contains Patchouli-Alcohol (PA) <30 is purchased at IDR 480,000 categorized quality, while that of PA> 30 is purchased at IDR 460,000 categorized quality 2. While the selling price at exporters follows the international price, which is estimated to IDR 700,000 /Kg.

B. Discussion

This study determines the costs required for the supply chain management of patchouli oil. Two main approaches have been proposed in accounting that support a structured decision-making process: DC (Direct Costing) and ABC (Activity Based Costing). The use of traditional costing method within a company that produces more than one type of product may cause difficulties in presenting accurate production costs. This is because charging overhead is based on the unit of production, of each type of product, while the proportion of resources absorbed by each product type is different.

Direct costing or traditional system creates higher distortions when there are sophisticated production structures, with a wide range of products or services that require the assignment of a large number of general costs [20]. Conventional methods can distort production cost per unit, where the product with a more complicated level of processing costs the same or even lower product with a less complicated level of workmanship. Therefore, this method is less able to provide accurate information in decision making. Activity Based Costing was developed to answer the limitations of the method, the conventional needs of management will be the cost of goods manufacturing information able to reflect the consumption of resources in various activities to produce the cost of goods manufactured accurately. Implementation of Activity Based Costing will be relevant when factory overhead costs are the most dominant and multiproduct costs.

An advantage of using traditional based costing is that it aligns with generally accepted accounting principles. Despite its many weaknesses, many companies consider traditional method still relevant to use because it is easy to audit and implement as it does not use much cost driver in the allocation of factory overhead costs, making it easier for managers to calculate. Although the ABC costing technique was considered entirely accurate in calculating production cost, this study used traditional costing for several reasons: 1) There is only one type of production, 2) the difficulties in exploring the costs per activities, 3) the management used is very simple, and 4) there is no standard cost for each activity.

Fig. 4 shows a comparison of production cost, selling price and profit margin for third actors. Highest production cost occurs on collectors, followed by traders and farmers. The selling price increased from farmers to collectors. Profit is the difference between price and cost. Farmers followed by collectors and traders obtain the largest profit margin. The profit earned does not include workload and working time, it is only based on the selling price and cost.

Fig. 5 shows the proportion of profit earned by each actor. It shows that the proportion of farmers has the most prominent profits, followed by collectors and traders. However, if considered in more detail, farmers obtain less benefit.

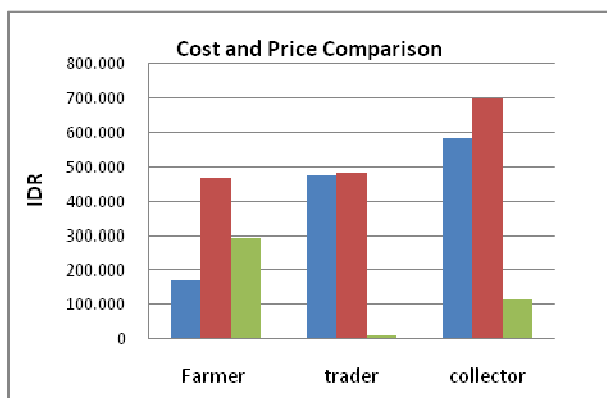


Fig. 4 Production cost, selling price and profit margin for third actors

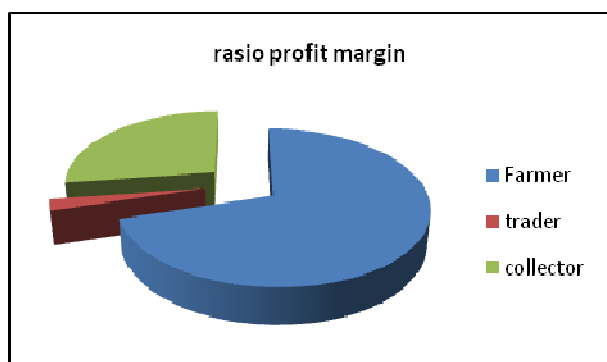


Fig. 5 The proportion of profits earned

TABLE IV
PROFITS EARNED BY EACH ACTOR

Components	Farmer	Trader	Collector
working days	245 days	1 day	30 days
profit/day	IDR 1.236	IDR 10.000	IDR 3.833

Table 4 shows the amount of profit earned by each actor within a working day. The biggest profit is obtained by traders, followed by collectors and the farmers. This study proves that traders obtain more than other players.

Some cases of agribusiness in Indonesia reveal that farmers are the actors who get the lowest profit with a huge sacrifice compared to other players. Agricultural products purchased at farms are usually cheaper than those sold on the regular market. Before reaching the market, they usually go through one to three intermediaries; each intermediary takes more profit. This condition is almost the same with buying agricultural products in supermarkets and traditional markets.

Agricultural products sold on regular markets are usually maintained in good quality and well packed, which increases their prices. Applying little marketing strategy makes people shift to shopping at supermarkets.

The level of knowledge of farmers in Indonesia is still relatively low if compared with their overseas counterparts. This does not help them to have strong bargaining power. They are forced to sell products through intermediaries because they want to get money directly and quickly. If they sell to wholesalers or consumers directly, it would require additional costs such as transportation, packaging, and saving.

IV. CONCLUSION

The current supply chain shows that the highest profit margin is obtained by the intermediary traders, without adding any value to the product. Eliminating actors such as traders could stabilize the price at every level. It is crucial that the government enact measures and policies that would eliminate intermediaries in agricultural business, especial patchouli oil sale. A one-door sale system whereby patchouli farmers sell their product to one vendor only without any temporary traders, if possible directly to exporters would be more beneficial to farmers. The government must control local purchase price of patchouli oil to comply it with international price standards. Further studies are needed to determine how to distribute optimal profit for each actor.

ACKNOWLEDGMENTS

The author is grateful to Lembaga Pengelola Dana Pendidikan (LPDP) for supporting this research under grant Beasiswa Unggulan Dosen Indonesia 2016.

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