# PERFORMANCE ANALYSIS OF SUPPLY CHAIN AND VALUE CHAIN OF COFFEE PLANTATIONS IN EMPAT LAWANG REGENCY, SOUTH SUMATRA OF INDONESIA

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# PERFORMANCE ANALYSIS OF SUPPLY CHAIN AND VALUE CHAIN OF COFFEE PLANTATIONS IN EMPAT LAWANG REGENCY, SOUTH SUMATRA OF INDONESIA

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**ABSTRACT**
The study was conducted to measure the performance of the smallholder coffee supply chain and value chain starting from village collectors, sub district collectors, and wholesalers in Empat Lawang Regency. This study uses a qualitative descriptive analysis. Respondents consisted of 40 coffee farmers who were selected by simple random sampling, and 14 traders consisting of 8 village collectors, 4 sub-district collectors and 2 wholesalers, who were selected purposively. Data were analyzed using the Supply Chain Operation References (SCOR) model approach and statistical analysis of the Analytical Hierarchy Process (AHP) as well as value chain concept analysis. Based on the results of the research on the smallholder coffee supply chain system at level-1 the value of the Inconsistency Ratio of institutional actors of village collector traders, sub-district collectors, and wholesalers respectively was 0.091, 0.070, 0.099 which showed all values less than 0.1 indicating that the results of the weighting of the criteria Plan, Source, Make, Deliver, Return are acceptable. At level-2 the Inconsistency Ratio sub-criteria Reliability, Responsiveness, Agility, Cost, Asset in each institutional actor of village collector traders, sub-district collectors, and wholesalers respectively are 0.094, 0.091, 0.081 which means it is accepted because the value is less than 0.1. Level-3 shows that the final results of the best supply chain performance values are 0.208 wholesalers, 0.123 village collectors, and 0.034 sub-district traders. For the smallholder coffee value chain, there are three value chain networks for wet and dry processed coffee products and for coffee powder products, there are two value chain networks.

**KEY WORDS**
Supply chain, value chain, SCOR model, AHP.

The agricultural sub-sector that has a fairly large potential contribution in Indonesia is the plantation sub-sector (Martauli, 2018). Based on the plantation sub-sector, coffee is an important commodity in an effort to support the national economy (Junaidi, Y., & Yamin, M., 2010). Coffee is one of the eight main commodities of Indonesian plantations which are very promising commodities where most of the coffee cultivated is robusta coffee and arabica coffee (Maridelana, et.al., 2014). Coffee is also one of the plantation commodities that has an important contribution in generating foreign exchange and has the second largest plantation area (Kusmiati, A., & Windiarti, R., 2011).

The role of coffee agribusiness has at least two important things, namely, first from the production side, it is a contributor to the economy through the production base of raw materials and the base of employment. Second, in terms of trade, agricultural products are widely traded and become superior commodities other than petroleum (Sahat, et.al., 2016). Therefore, the sustainability of coffee marketing is largely determined by the sustainability of coffee production in the field. Therefore, there are institutions that distribute the results of people's coffee plantations. From the activities carried out by farmers and institutional actors, a pattern of actors participating in the supply chain emerges.

Several actors who participate along supply chain activities lead to performances that have their respective levels of needs between farmers and institutional actors, thereby creating added value in each process (Bidarti, et.al., 2019). So that the chain patterns that occur will affect the profits obtained in each link (Ramirez, et.al., 2019).

Empat Lawang Regency is one of the largest coffee-producing regencies in South Sumatra, where the quality of the production of smallholder coffee farmers has been recognized. The Indonesian government also encourages the coffee industry to improve coffee quality and its ability to compete in the international market (Andoko, et.al., 2020).

However, the marketing chain that occurs in addition to being needed for distribution activities and meeting consumer needs is also needed to make marketing chains occur more efficiently along the chain process. Based on the description above, the purpose of this study is to analyze the performance of the smallholder coffee supply chain in Empat Lawang Regency and analyze the value chain of community coffee plantations in Empat Lawang Regency.

## METHODS OF RESEARCH

The design of this study refers to the research objective, namely how the performance of the supply chain and value chain of plantation coffee in Empat Lawang Regency. Therefore, this study uses two methods, the main method: Descriptive method is a method that provides a systematic, factual and accurate description or painting of the facts, properties and relationships between the phenomena investigated (Nazir, 2009). Descriptive method is used to describe how the performance of the smallholder coffee supply chain in Empat Lawang Regency by using supply chain performance measurement indicators. The second method is the SCOR (Supply Chain Operation Reference) model to measure the performance of the supply chain. Also a descriptive method to describe the value chain of smallholder coffee plantations in Empat Lawang Regency using the value chain concept.

In the smallholder coffee supply chain, the stage of determining the institutional actors who become respondents uses purposive sampling, where these institutional actors starting from village collectors, sub district collectors, and selected wholesalers are seen as having a close relationship with the goal. research and is considered to have competence in obtaining information about the supply chain and value chain performance of smallholder coffee plantations in Empat Lawang Regency. For supply chain performance testing is completed using the Supply Chain Operations Reference (SCOR) model. According to John Paul (2014) the SCOR model is hierarchical. Level-1 is a type of process for identifying the scope of the supply chain. Level-2 is the category of processes that configure the supply chain. Level-3 shows process elements, identifies supply chains, inputs or outputs, indicators and best practices.

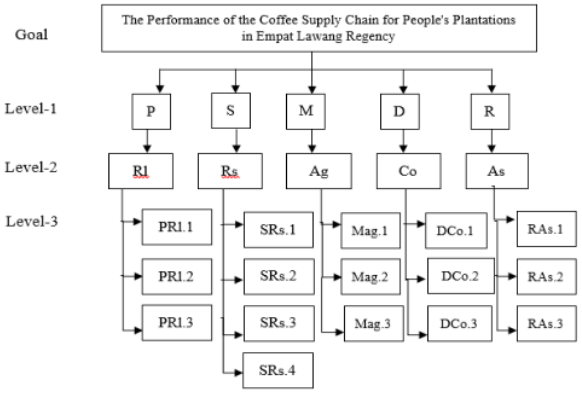


Figure 1 – AHP Hierarchy Development Model with SCOR Model

Based on the Supply Chain Council (2012), performance measurement can be done using a level-1 matrix. In this study, the level-1 matrix refers to the SCOR model, namely determining the goals of supply chain performance. The level-2 matrix also provides performance indicators for smallholder coffee supply chains in Empat Lawang Regency. Matrix level-2, namely performance attributes presented the criteria used to measure the performance of performance attributes consisting of reliability, responsiveness, agility, cost, assets. Then for the level-3 matrix, detailed performance indicators that already exist at level-2 are presented. At this stage the SCOR model explains the flow of input sources, inputs, processes, outputs, and output destinations along with the processes that occur in it. Supply Chain Council (2012). The data processing in the research is by developing the Supply Chain Operations Reference (SCOR) model where the criteria and sub-criteria have been determined and calculated using the Analytical Hierarchy Process (AHP) method starting from the level-1 matrix to the level-3 matrix.

Figure 1 is the process of developing the AHP hierarchy with the SCOR model starting from the Goal, namely the performance of the smallholder coffee supply chain in Empat Lawang Regency. Level-1 business processes represented by capital letters are plan (P), source (S), make (M), deliver (D), and Return (R). Level-2 performance attributes are presented by adding one letter for all level 2 processes, namely Reliability (RI), Responsiveness (Rs), Agility (Ag), Cost (Co), Asset (As). Level-3 performance indicator matrix is represented by adding one point followed by a unique number, namely for order fulfillment (PRI.1), delivery quantity accuracy (PRI.2), perfect condition order (PRI.3), order fulfillment cycle time (Srs. 1), packaging cycle time (Srs.2), delivery scheduling cycle time (Srs.3), processing cycle time (Srs.4), upper supply chain adjustment (Mag.1), lower supply chain adjustment (Mag.2), upper supply flexibility (Mag.3), labor cost (Dco.1), production cost (Dco.2), delivery cost (Dco.3), cash cycle time (Ras.1), length of debt repayment (Ras. .2), and length of receipt of debt (Ras.3).

## RESULTS AND DISCUSSION

*Mapping the Coffee Supply Chain Network of People's Plantations in Empat Lawang Regency*. In processing people's plantation coffee in Empat Lawang Regency, there are three types of products, namely wet coffee, dry coffee, and coffee powder. Wet-processed coffee products and dry-processed coffee products sold by coffee farmers range from IDR. 16,000 to IDR. 18,000 per kg depending on the quality of the coffee during the buying and selling process. As for coffee powder products sold by farmers, it ranges from IDR. 40,000 to IDR. 45,000. The following is a network of plantation coffee supply chains in Empat Lawang Regency.

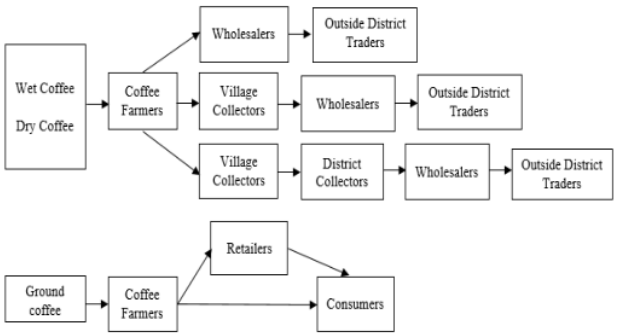


Figure 2 – Coffee Supply Chain Network of People's Plantations In Empat Lawang Regency

Figure 2 is the process of the occurrence of a smallholder coffee supply chain network that is carried out from upstream to downstream so that the product reaches consumers and

there are three forms of processed coffee products, namely dry processed coffee products, wet processed coffee, and coffee powder. According to Rantung, *et.al.* , (2016) supply chain networks occur because there is cooperation between business actors ranging from farmers, collectors, traders, and consumers. First, there are three smallholder plantation coffee supply chain networks for wet-processed and dry-processed coffee products:

- Farmers → Wholesalers → Wholesalers;
- Farmers → District Collector Traders → Wholesalers → Outside District Traders;
- Farmers → Village Collectors → District Collectors → Wholesalers → Outside District Traders.

Products marketed in the form of *green beans* because it is much more durable for the storage process. Second, the processing of people's plantation coffee into coffee powder has two supply chain networks.

- Farmers → Retailers → Consumers;
- Farmer → Consumer.

The product forms marketed along the supply chain network are all in the form of coffee powder. In marketing coffee powder, farmers only make when there is an order because the nature of the coffee powder product is not durable.

*Analysis of the performance of the coffee supply chain for smallholder plantations in Empat Lawang Regency.* The initial stage of this assessment is to provide questionnaires to village collectors, sub-district traders, and wholesalers who have been selected according to the criteria and are qualified to answer all questions. This assessment can determined the process of smallholder coffee supply chain activities in the supplier network phase. The weighting at each level-1, level-2, level-3 is done by comparing in pairs. Pairwise comparisons of the weighting of each level were obtained from the results of distributing questionnaires to institutional actors, namely village collector traders, sub district collector traders, and predetermined wholesalers. The first calculation, the weighting is done at level-1 based on the five levels of the SCOR model, namely Plan, Source, Make, Deliver and Return. The results of the level-1 weighting are in Table 1.

Table 1 – The Results of Weighted Perspective Level-1

| Institutional actors | Perspective | Weight | Total | *Inconsistency Ratio* |
|---|---|---|---|---|
| Village Collectors | *Plan*<br>*Source*<br>*Make*<br>*Deliver*<br>*Return* | 0.238<br>0.242<br>0.114<br>0.160<br>0.215 | 1 | $\lambda_{max}$ = 5.406<br>CI = 0.102<br>IR = 1.12<br>CR = 0.091 |
| District Collectors | *Plan*<br>*Source*<br>*Make*<br>*Deliver*<br>*Return* | 0.350<br>0.110<br>0.056<br>0.367<br>0.117 | 1 | $\lambda_{max}$ = 5.315<br>CI = 0.079<br>IR = 1.12<br>CR = 0.070 |
| Wholesalers | *Plan*<br>*Source*<br>*Make*<br>*Deliver*<br>*Return* | 0.089<br>0.310<br>0.081<br>0.144<br>0.376 | 1 | $\lambda_{max}$ = 5.445<br>CI = 0.112<br>IR = 1.12<br>CR = 0.099 |

Table 1 show that the Inconsistency Ratio of each institutional actor starting from village collectors, district collectors, and wholesalers is 0.091, 0.070, 0.099 respectively. This indicates that the weighting results of the five level-1 criteria of the SCOR model, namely Plan, Source, Make, Deliver, and Return are acceptable because the Inconsistency Ratio value does not exceed the maximum value limit of 0.1. Next, calculate the second weighting at Level-2. The results of the calculation of the level-2 weighting can be seen from Table 2.

Table 2 shows that the Inconsistency Ratio shows that all values show a value less than 0.1, which means that the weighting results from level-2 are acceptable. Furthermore, the results of the calculation of the level-3 weighting can be seen in Table 3.

From the results of the performance assessment of the smallholder coffee supply chain in Empat Lawang Regency in Table 3, the first highest score in the assessment is the

wholesaler with a final score of 0.208. The highest weight for wholesalers in this assessment is Return with a weight of 0.376; Source with a weight of 0.310; Deliver with a weight of 0.144; Plan with a weight of 0.089; and Make with a weight of 0.081. The value of this weight indicates that wholesalers pay great attention to the transfer of goods (assets) considering the risks that may arise, including defects in the products delivered, ordering, and returning working capital. Rapid asset cycle management also has an impact on the returns obtained. This statement is in line with the results of Setiadi's research (2018) that proper asset management and the shorter the cash-to-cash cycle have an impact on a company's money turnover, the faster the return of money from sales, and the better the supply chain performance produced.

Table 2 – The Results of Weighted Dimension Level-2

| Institutional actors | Dimension | Weight | Total | *Inconsistency Ratio* |
|---|---|---|---|---|
| Collectors in village | *Reliability*<br>*Responsiveness*<br>*Agility*<br>*Cost*<br>*Asset* | 0.113<br>0.141<br>0.228<br>0.138<br>0.380 | 1 | $\lambda_{max}$ = 5.423<br>CI = 0.105<br>IR = 1.12<br>CR = 0.094 |
| Collectors in district | *Reliability*<br>*Responsiveness*<br>*Agility*<br>*Cost*<br>*Asset* | 0.287<br>0.159<br>0.111<br>0.265<br>0.178 | 1 | $\lambda_{max}$ = 5.408<br>CI = 0.102<br>IR = 1.12<br>CR = 0.091 |
| Wholesalers | *Reliability*<br>*Responsiveness*<br>*Agility*<br>*Cost*<br>*Asset* | 0.205<br>0.165<br>0.205<br>0.220<br>0.205 | 1 | $\lambda_{max}$ = 5.362<br>CI = 0.091<br>IR = 1.12<br>CR = 0.081 |

Table 3 – The Results of Weighted Key Performance Indicators (KPI) Level-3

| Institutional Actors | | Village Collectors | District Collectors | Wholesalers |
|---|---|---|---|---|
| Perspective/Key Performance Indicators (KPI) | | Weight | Weight | Weight |
| Plan | | 0,238 | 0,350 | 0,089 |
| Order fulfillment | PRI.1 | 0,633 | 0,325 | 0,120 |
| Delivery quantity accurancy | PRI.2 | 0,106 | 0,235 | 0,331 |
| Perfect condition order | PRI.3 | 0,260 | 0,440 | 0,549 |
| Source | | 0,242 | 0,110 | 0,310 |
| Cycle order fulfillment time | SRs.1 | 0,425 | 0,361 | 0,435 |
| Cycle order time | SRs.2 | 1,000 | 0,531 | 0,577 |
| Delivery scheduling time | SRs.3 | 1,000 | 0,507 | 2,531 |
| Cycle processing time | SRs.4 | 1,000 | 1,000 | 1,000 |
| Make | | 0,144 | 0,056 | 0,081 |
| Top supply chain adjustment | MAg.1 | 0,333 | 0,241 | 0,224 |
| Down supply chain adjustment | MAg.2 | 0,333 | 0,211 | 0,190 |
| Top chain flexibility | MAg.3 | 0,333 | 0,548 | 0,586 |
| Deliver | | 0,160 | 0,367 | 0,144 |
| Labor cost | DCo.1 | 0,333 | 0,589 | 0,072 |
| Production cost | DCo.2 | 0,333 | 0,252 | 0,697 |
| Delivery cost | DCo.3 | 0,333 | 0,159 | 0,232 |
| Return | | 0,215 | 0,117 | 0,376 |
| Cycle cash time | RAs.1 | 0,286 | 0,193 | 0,332 |
| Debt payment time | RAs.2 | 0,140 | 0,083 | 0,081 |
| Dept acceptance period | RAs.3 | 0,574 | 0,724 | 0,587 |
| Final Score | | 0,123 | 0,034 | 0,208 |
| Rating | | 2 | 3 | 1 |

Second, village collectors with a final score of 0.123. The highest weight was obtained by village collectors from the highest value being Source with a weight of 0.242; Plan with a weight of 0.238; Returns with a weight of 0.215; Create with a weight of 0.144; Send with a weight of 0.160. This shows that village collectors pay more attention to product order fulfillment to maintain product inventory levels because the level of competition for smallholder coffee village collectors in Empat Lawang Regency is quite tight and has many competitors. According to Guritno et al., (2015) the fulfillment of orders for a product (source)

in the supply chain is influenced by various unexpected factors, making it difficult to ascertain the time of completion and one of the factors is fluctuations in the number of products to be shipped.

Third, district collectors with a final value of 0.034. Furthermore, the highest weight obtained by sub-district collectors is Deliver with a weight of 0.367; Plan with 0.350 weights; Returns with a weight of 0.117; Source with a weight of 0.110; and Make with a weight of 0.056. From the value of each weighting at the district collectors, it shows that they pay more attention to the process costs that occur during product delivery activities. The costs that occur in the supply chain represent a large part of a business. According to Setiadi (2018), the cost variable in the delivery process is very important for the company because the company's main goal is to benefit from costs that occur in the supply chain which at least have an effect on increasing efficiency values. Purnomo (2015) also stated efforts to improve supply chain performance by implementing better inventory management, thereby minimizing stock outs in warehouses. sometimes, the supply chain of smallholder coffee district collectors in Empat Lawang Regency is very difficult because the village collectors know that the market price of plantation coffee is higher if selling to wholesalers, the sub-district collector traders often experience loss from potential sellers and the price is offered slightly far from the price offered by wholesalers.

*The Value Chain of Smallholder Coffee in Empat Lawang Regency*. The value chain is all activities carried out starting from production to the distribution stage in sequence from changing inputs to outputs that have added value. In the research on mapping the value chain of smallholder coffee, there are three stages, starting from mapping the actors involved in the value chain, mapping the sales volume of each actor along the value chain and mapping product values at each level of the value chain.

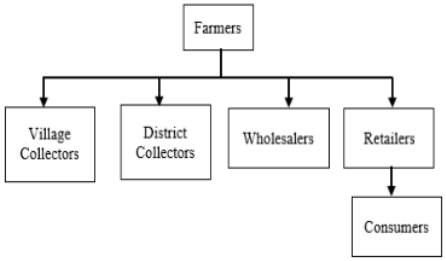


Figure 3 – Mapping Actor Coffee for People's Plantation in Empat Lawang Regency

Figure 3 shows that the value chain of processed coffee products of smallholders in Empat Lawang Regency and the institutional actors involved depend on the type of processed product needed:

1. Coffee Farmer. Coffee farmers are the main actors involved in the coffee value chain of the People's Plantation in Empat Lawang Regency with an average coffee plantation area of 0.5-1 Ha. In 2020 coffee production experienced a decline due to changing weather and the Covid-19 pandemic which caused the people's economy to be uncertain so that it had an impact on the purchase of fertilizers and pesticides;
2. Village collectors. Village collector traders are institutional actors who buy farmers' crops on a small scale because they have limited capital. Village collectors usually buy wet-processed and dry-processed coffee by visiting farmers directly during the coffee drying process;
3. District collectors. Sub-district collector traders are institutional actors who buy processed coffee in the form of dry processed coffee on a large enough scale and on average have a dry-processed coffee milling machine business so that coffee farmers sell their coffee directly to sub-district collectors;
4. Wholesalers. Wholesalers are the highest institutional actors along the coffee value chain of the Empat Lawang community. Wholesalers also have a big role in

determining coffee prices, purchasing coffee on a large scale, both wet-processed and dry-processed coffee. Wholesalers also play a role in marketing people's plantation coffee to traders outside the district, such as to Lampung and Surabaya;

5. Retailer. Retailers are small home-scale traders who market coffee products in the form of coffee powder to end consumers.

The results of the Mapping Actor research are the same as the research by Listyati, et.al., (2017) entitled Analysis of Farming Business and Robusta Coffee Trading Chains in Bengkulu which states that the institutional actors involved are farmers, village collectors, district collectors, wholesalers, and exporters.

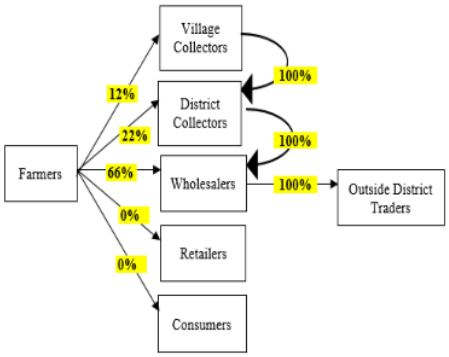


Figure 4 – Mapping the Volume of People's Plantation Coffee in Empat Lawang Regency

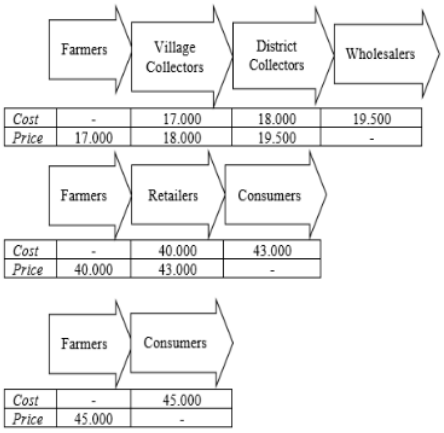


Figure 5 – Mapping Value of People's Plantation Coffee in Empat Lawang Regency

Figure 4 show the Mapping Volume of smallholder coffee products in Empat Lawang Regency, showing that smallholder coffee production in a year is only one harvest process which usually starts from July to August. The volume of farmers' coffee production sold to village collectors is 12% and 100% of village collectors' income is sold to collectors. Furthermore, farmers who sell to sub-district collectors are 22% and 100% of the proceeds from the purchase of coffee products are sold to wholesalers. Furthermore, farmers who sell processed coffee products to wholesalers are 66% with the proceeds from these purchases 100% being sold to traders outside the district with the aim of Lampung and Surabaya. Furthermore, sales from coffee farmers in the form of coffee powder processed products sold to retailers and end consumers show 0% because the raw materials commonly used are leftover coffee cherries which are not included in the calculation of the harvests sold by

farmers. From the explanation above, it shows that all coffee harvests from community plantations in Empat Lawang Regency are all sold outside the region and very little is used to increase added value.

Figure 5 shows that the price received by each institutional actor in each value chain of smallholder coffee in the Empat Lawang Regency is different. This shows that before reaching a price agreement, each institutional actor plays a role in negotiating prices in each value chain network. This statement is in line with the results of research (Soka, et.al., 2017) that before carrying out the purchase process, you must negotiate prices and check product prices on the market first. In the first value chain, the products sold are wet-processed coffee products and dry-processed coffee products.

The cost received by farmers is IDR. 17,000.00/Kg from village collector traders, the fee received by village collectors is IDR. 18,000.00/Kg from sub-district collectors and sub-district collectors spends IDR. 18,000.00/Kg. the cost received by the sub-district collectors is IDR. 19,500.00/Kg from the wholesalers and the wholesalers spend IDR. 19,500.000/Kg. The results of the research on coffee prices are almost the same as those of Listyati, et.al., (2017) which shows that the average price of coffee beans in Bengkulu is IDR. 18,500.00/Kg. The results of research by Wahyu E and Anik Suwandari (2012) in Sumberbulus Village, Ledokombo District, Jember Regency indicate that the price of people's coffee received from the sale of green been coffee bean products is an average of IDR. 15,250/Kg.

The second and third value chains of the products sold are coffee powder processed products. In the second value chain, the cost received by the farmer is IDR. 40,000.00/Kg from the retailer and the retailer incurs a cost of IDR. 40,000.00/Kg, the cost received by the retailer is IDR. 43,000.00/Kg from the final consumer and issued by the final consumer in the amount of IDR. 43,000.00/Kg. in the third value chain the cost received by the farmer is IDR. 45,000.00/Kg from the final consumer, the final consumer incurs a cost of IDR. 45,000.00/Kg.

The explanation shows that the differences that occur along the first value chain in the form of wet-processed coffee products and dry-processed coffee products from the prices received by farmers to the prices issued by wholesalers are between IDR.1.000,00-IDR.1.500.00/Kg due to competition between institutions is very tight so that institutional actors must be smart in playing prices to attract farmers to sell to them. Furthermore, the differences that occur along the second and third value chains are in the form of coffee powder products from the price received from farmers, retailers and costs incurred by the final consumer of IDR 2,000. Furthermore, the reason for the difference in the selling price of coffee powder farmers through retailers is slightly lower than selling directly to final consumers because retailers will resell the coffee powder products.

## CONCLUSION

Based on the results and discussion in this study, it can be concluded that the performance of the smallholder coffee supply chain in Empat Lawang Regency, respectively, is the institutional actor of wholesalers, village collectors, and sub district collectors. The smallholder coffee value chain in Empat Lawang Regency has three value chain networks for wet-processed and dry-processed coffee products, as well as coffee powder products, there are two value chain networks. The price for wet and dry processed coffee is determined by the buyer, while the price for coffee powder is determined by the seller and the price in the market.

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