Estimating the Benefit of Robusta Coffee Production in Semarang and Banjarnegara

Tasneem Hasan*,[1], Paputsara Supamoon[1], Noveliska Br Sembiring[2] and Adi Djoko Guritno [2]

[1]Department of Agribusiness, Faculty of Agriculture, Chiang Mai University, Thailand
[2]Department of Agro-industrial Technology, Faculty of Agricultural Technology,
Universitas Gadjah Mada, Jl. Flora No.1 Bulaksumur 55281, Indonesia
Email: tasneemhas@gmail.com*

Abstract

Indonesia is one of the top world coffee producers with a production level reached 654,120 metric tons in 2017, dominated by Robusta. In that country, 96% of coffee plantation area is cultivated by small-scale farmers. Besides improving the welfare of farmers and allowing a soil erosion reduction, the cultivation of the coffee plant, especially those grown by small-scale farmers, requires a study on the economic aspects of its supply chain, which provides an estimation of the coffee production benefits. Therefore, the research aims to analyze the economic aspects of upstream activities in the coffee supply chain and present the scenario through the five years of profitability. To achieve the research aims, surveys and observations were carried out on small-scale coffee farmers in Banjarnegara, a district in Central Java Province with soil erosion in the past, and Semarang, a district in the same province with a high area of coffee plantation. Data collection was carried out on three parties, namely farmers, collectors, and traders, by focusing on the income share and market channel. Later, the scenario of coffee production which is constructed by the benefit value calculation of the representative of a farmer with a high level of productivity was presented in the paper. We conclude that the progress on the development of Robusta coffee production scenario, when integrated with crop production systems can significantly improve industry preparedness, benefit, and productivity. The scenario used cost and benefits values and simulated the growth of the coffee tree with crops (in Banjarnegara). The additional result of coffee supply chain formula's showed that crop forecasting offers substantial benefits of coffee growers and industry through five years of increased profitability.

Keywords: *Coffee Supply Chain, Cost and benefits scenario, Market channel, Robusta coffee*

1. INTRODUCTION

Indonesia is internationally known as a top coffee industry in the world, produced over 654,120 metric tons of coffee beans in 2017 (International coffee organization, 2018). The industry is significantly influenced by seasonal variations and extreme climatic events. The success of the coffee industry depends on its possibility to increase land's production and its high productivity. Coffee plantations currently cover over 1 million hectares of Indonesia's territory, with over 96% of the cropland being tilled by small-scale producers. Robusta coffee product is available in the lowland areas of Southern Sumatra and Java. Java is the one of the largest islands in the archipelago but also produces coffee, especially Robusta. The island is renowned for its gourmet coffee. In the Java area is sub-divided into 3 areas namely East Java, Central Java and West Java. From statistical data in the year 2014 found that the areas of Central Java have coffee 18,665 Tones. This special Robusta coffee was grown in Mountain Kelir Area, Central Java, Indonesia (Realsa agro, 2015). Semarang district is one of the coffee production area in Central Java that has been produce Robusta coffee more than 75 years and provided over 30 tons annually (By observation, 2018). In addition, there are new coffee growers (less than 10 years) in Banjarnegara district which is also located in Central Java. The Robusta coffee is cultivated since some of farmers are obtain some contribution by the government in 2009. The main aim of government suggestion is decrease the soil erosion happened is the

past and improves income of farmers in Banjarnegara district. However, the best solution of persuasion is showing the way to get benefit from growing coffee production. Therefore, this study is not only aim to study cost and benefits of supply chain in a good coffee production area as Semarang, but also to present the estimated profitability scenarios of new coffee growers with crops. The requirement of study on economic aspect of coffee supply chain is important to prove an ideal of coffee production model including cost and benefit of coffee production and market channel. The initial simulated results are encouraging and assuring while the model successfully picks up the increasing benefit year by year. Furthermore, refinement and improvement of the model are ongoing to provide more reliable and comprehensive outputs at times of production.

2. MATERIALS AND METHODS

A Cost-Benefit Analysis (CBA) was conducted to examine the costs and benefits of the coffee production, comparing two target areas that similar condition, including temperature and altitude. To ensure efficiency in resource allocation and to achieve maximum gains in social welfare, it may be necessary to use evaluation procedures that provide systematic and careful assessment of all costs and benefits relevant to projects. CBA needs to take into account all related costs and benefits, including those that are indirect and intangible. In addition to common cost items such as labor and capital, a comprehensive evaluation of this type of project will take into consideration the potential of combining crops and main plant as coffee in the same plantation. CBA is an economic framework that evaluates the benefits and costs of a project to support effective decision making and resource use. The technical sections of this economic study will follow the main 3 parties in coffee supply chain including farmer, collector and trader.

The Benefit-Cost Ratio (BCR) is calculated by dividing the proposed total cash benefits of a project by the proposed total cash costs of the project. Prior to dividing the numbers, the net present value (NPV) of the respective cash flows over the proposed lifetime of the project taking into account the

terminal values, including salvage /remediation costs are calculated. BCR are most often used in capital budgeting, to analyze the overall value for money of undertaking a new project. However, the cost-benefit analyses for large projects can be hard to get right. The equation 1 provides a mathematical components to calculate benefit cost ratio. In this study, the calculation of benefit cost ratio is focus several years beginning of coffee plantation in Banjarnegara district.

$$BC\ ratio = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+i)^t}} \qquad (1)$$

Productivity of the coffee producers was measured for showing their ability to produce goods. Productivity may also be defined as an index that measures output (coffee products) relative to the input (labor, materials, energy, etc., used to produce the output). There are two major ways to increase productivity, specifically (1) increase the numerator (output) or (2) decrease the denominator (input). A similar effect would be seen if both input and output increased in which output increasing faster than input; or if both input and output decreased in which input decreasing faster than output. A productivity ratio can be computed for a single plantation.

A case scenario is a made-up situation or problem using real-life constraints and affects in order to discuss and predict how a certain situation could turn out in the real world. By testing the potential outcomes of a problem, those problems are sometimes easier to avoid and solve. In this case study, a scenario is focus on the raising benefit of coffee plantation. Case scenario is also a great way to present the possibility of others crops that can gain more income during the beginning of coffee plantation.

Data were collected from primary and secondary sources. Data are obtained from the representative of coffee farmers in two target areas. In Semarang district, there were eight representative farmers who have coffee managing experience more than ten years. The number of respondents in Banjarnegara were five persons who have less than ten years of experience. The cost and benefit analysis were

calculated using weight average of total products from respondents.

3. RESULTS

3.1 The Upstream Supply Chain of Robusta Coffee

The supply chain is the sequence of activities and processes required to bring a product from its raw state to the finished goods sold to the consumer. The upstream of Robusta coffee product supply chain are created follow the activities to distribute the product from farmers to trader.

3.1.1 The Upstream of Coffee Supply Chain In Semarang District

In Semarang district, the coffee famers usually work on area of plantation around one or two hectares. They do harvesting start from July until September to pick both red and green cherries. Many farmers do some primary processing of cherries with dry method to produce green bean including drying, milling and hulling themselves. Figure 1 shows the supply chain of coffee product in Semarang district which has several parties. There are many famers provide coffee product as cherry and green bean. The collectors and farmer group collected coffee product from farmers and process to be coffee green bean. There are some traders in this upstream who buy the coffee bean from collectors and do differentiation activity to provide big quantity of coffee product for the exporters. In addition, there are also some traditional markets and café that buy coffee bean and coffee powder from the farmer group.
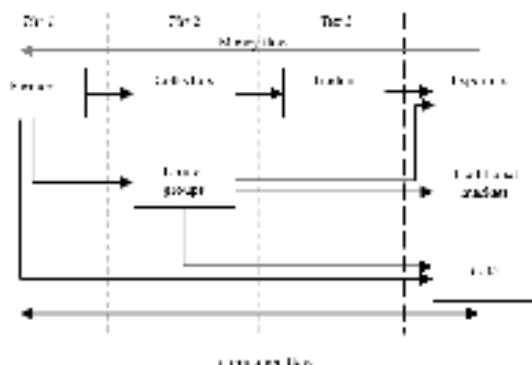

Figure1. The coffee supply chain in Semarang district

3.1.2 The Upstream of Coffee Supply Chain in Banjarnegara District

In Banjarnegara district, the coffee famers usually work on a small area of plantation that less than one hectare. The harvesting season is start from July until August. They do selection focus on red cherries. All of farmers must sale the product to only one collector in the same area without processing of cherries. The collector does process and provide the coffee green bean to the traditional market and some café in the same district.

The upstream of coffee supply chain in 2 target areas is difference. Due to the high quantity and variety of coffee products providing, the supply chain in Semarang district is more complex and has many parties in this chain.
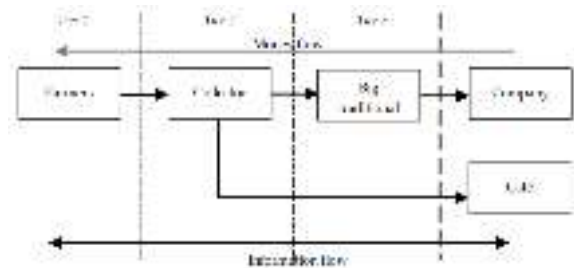

Figure 2. The coffee supply chain in Banjarnegara district

3.2 The market channel of Robusta coffee product

The market channel is means by which products such as cherries, green beans and powders are sold to customers. Coffee products in both of target areas are sold through various types of purchasers. The whole picture of coffee market channel is created by the distribution routes of three main tiers involved and the income share of its each channel are shown in Figure 3 and 4.

3.2.1 The coffee market channel in Semarang district

The coffee product distribution routes start from farmers that sold to two main purchasers such as collectors and a farmer group. here are three mains coffee products available in the area which are cherry, green bean and powder. After harvesting, some of farmers decided to sell 14.8% of cherry directly to correctors in the same area. Apart from Cherry, there is 85.2% of total

product has been processed to be coffee green bean in either wet or dry process and sell to the farmer group that works as a collector in the same district. The farmer group has collected coffee green bean from group members and also farmers from others sub district. The coffee green bean product was separated to different places distribution. The high quality of coffee green bean product has been sold to the position of exporter and for the rest has been sold to the traditional market. The last activity of farmer group is process 1.3% of coffee green bean to be powder as a final product in the name of their group. The powder of coffee from the group has been distributed to some café around central Java.
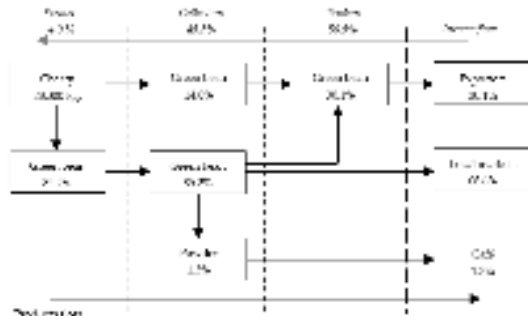

Figure 3. The coffee market channel in Semarang district

3.2.2 The coffee market channel in Banjarnegara district

In Banjarnegara district, the coffee farmers have no choice for selling their product since there is only a collector available in the area with fixed price. All the cherry products are sold to a collector to process green bean and sell separately to the traditional market and café. Almost of the green bean product from the traditional market has been sold to a company that provide fixed price with grading. There is also powder which is processed by a collector and has been sold to the café in the same district. In terms of income share, Figure 3 and 4 show the increasing portion of income along the supply chain. The holding income in traders is higher than collectors and farmers due to the larger number of products being handled.
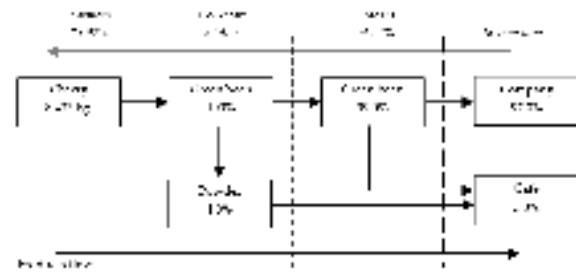

Figure 4. The coffee market channel in Banjarnegara district

3.3 Cost and benefit of Robusta coffee production

The comparison of cost and benefit of coffee production in both of target area is to prove advantage and disadvantage of management activities until getting the coffee product. The total cost is classified as variable and fixed cost for whole one year production. In Semarang district, the advantage of using cost is located in labors session including fertilizing, harvesting, processing and tree handling. Due to the good management and the right timing of handling coffee trees, it is able to use the less number of days and labors needed. The advantage of using cost of materials for farmers in Banjarnegara district is a small quantity of fertilizer need per tree. The good nutrition is already existed in the soil since the farmers has been done vegetable crops before decided to cultivate the coffee. When considering the total cost, it was found that the elements coffee production need fixed factors including tax and device depreciation of machine and equipment that affect ratio of fixed cost to be 2.9% of total in Semarang and 0.2% in Banjarnegara as shown in Table 1.

The prices per kilogram of cherry for both target areas are different price from start and end of harvesting season. To indicate the benefit of production, in this study was used the average price that calculated by quantity of product each price obtained. In Banjarnegara, the net benefit of product could be negative value because of high total cost. In order to enhance the benefit, farmers should control the labors cost by strengthening the labors management and tree handling activities.

Table 1. Cost and benefit of Robusta coffee production in Semarang and Banjarnegara district

| Lists | Production cost (Rp./kg) | | | | | |
| | Semarang | | | Banjarnegara | | |
	Monetary	Non-Monetary	Total	Monetary	Non-Monetary	Total
Variable cost	5,158.53	3,113.80	8,272.34	7,369.05	7,123.61	14,492.66
			97.1%			99.8%
1. Materials	3,484.52	-	3,484.60	2,428.25	-	2,428.25
			40.9%			16.8%
2. Labors	1,283.92	2,966.13	4,250.05	4,764.00	7,123.61	11,887.61
			49.9%			81.8%
3. Other cost	390.09	147.68	537.77	176.80	-	176.80
			6.3%			1.2%
Fixed cost	**77.92**	**169.32**	**247.24**	**60.42**	**17.58**	**78.00**
			2.9%			0.2%
Cherry production cost	**4,651**	**2,182**	**6,833**	**7,429**	**7,141**	**14,571**
Cherry Net Benefit			862			(9,071)[1]
Green bean production cost	**5,236**	**3,283**	**8,520**	-	-	-
Green bean Net Benefit			18,480			

[1] Number in ( ) means negative value

3.4 The scenario of estimating benefit of Robusta coffee production

The final step of comparison the results of the aggregate costs and benefits quantitatively is determines if the benefits outweigh the costs. If so, then the rational decision of coffee cultivation in Banjarnegara is to go forward with the project.

The scenario in Figure 5 show the total cost of all activities of cultivation including vegetables and coffee when its start to be plant together in the same plantation. In terms of benefits, it show the net benefit when it was calculated by each of products price obtained. However, the net benefit of all products could be negative value in starting period because of non-monetary cost including opportunity cost, depreciation and their own labor during plantation management especially for vegetable crop handling activities. Moreover, the coffee tree cannot produce the product in first two years and it influence the negatively benefit. The first harvesting of cherries is start in July of year three and it improve the value of benefit. The progress on the development of Robusta coffee production scenario, when integrated with crop production systems can significantly improve industry preparedness, benefit, and productivity. The additional result of formula

showed that crop forecasting offers substantial benefits of coffee growers and industry through five years of increased profitability.
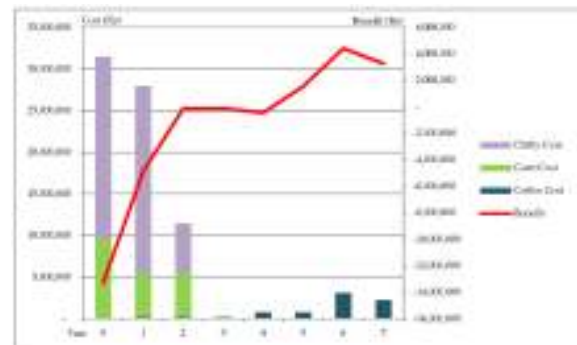

Figure 5. The scenario of estimating benefit of Robusta coffee production

For the rational decision, the calculation of benefit cost ratio is requested to prove the overall value for money of undertaking a new project. The study found that the net present value (NPV) thought 5 years of coffee production is Rp. 4,435,900 and the internal rate of return (IRR) is 92%. The benefit cost ratio is 1.13. It is proved that the project is economically satisfaction; the project will deliver a positive of Net Present Value and high internal rate of return.

CONCLUSIONS

There are many parties involved along supply chain base on the activities of process and distribution. The cost benefit analysis is a key decision-making tool that helps determine whether a planned action or expenditure is literally worth the price. In terms of economics, one of solutions to increase benefit is control the cost of management including labors using factor. The progress on the development of Robusta coffee production scenario, when integrated with crop production systems can significantly improve industry preparedness, benefit, and productivity. The scenario used cost and benefits values and simulated the growth of the coffee tree with crops (in Banjarnegara). The additional result of coffee supply chain formula's showed that crop forecasting offers substantial benefits of coffee growers and industry through five years of increased profitability.

ACKNOWLEDGEMENT

REFERENCES

International Coffee Organization. 2018. *Trade statistics table report 2018: Total quantity of coffee by exporting countries* [Internet]. Available from: http://www.ico.org/trade_statistics.asp. Accessed on 9 August 2018.

Teguh, W Misnawi, J. 2018. Challenges of Sustainable Coffee Certification in Indonesia. In: International Coffee Organization Seminar (ICO Seminar) 2012. [Internet]. Available from: http://www.ico.org/event_pdfs/seminar-certification/certification-iccri-paper.pdf. Accessed on 9 August 2018.

Irfan, A. Indonesia Coffee Market. 2018. Chairman of Association of Indonesia Coffee Exporters and Industries. Proceedings of Association of Indonesia Coffee Exporters and Industries Conference, 7 November 2014, Bali, Indonesia. [Internet]. Available from: file:///C:/Users/Administrator.KKDV2-20140929K/Downloads/Indonesiancoffee.pdf . Accessed on 14 August 2018.

Ratna, L and Samsul, M. 2013. Pola Keterkaitan Sentra Produksi Dan Sentra Pengolahan Komoditas Perkebunan di Kabupaten Banjarnegara. *Jurnal Teknik PWK*, Volume 2, Number 4.

Farid, T. Instructor, Department of Energy and Mineral Engineering, The Pennsylvania State University. Geo-Resources Evaluation and Investment Analysis. Benefit Cost Ratio. [Internet]. 2018. Available from: https://www.e-education.psu.edu/eme460/node/608 [Accessed: 16 August 2018]

Tevfik F. Nas. 2018. *Cost-Benefit Analysis: Theory and Application*, 2nd edition. Lexinglon Books.