Analysis of agribusiness performance of top five vegetable farming in East Java

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Abstract. East Java Province is one of vegetable-producing areas; however, performance of vegetable production has not been identified. The performance will be an important indicator of regional agricultural economic development of the region. This paper aims to provide farm analyses of leading vegetable farming in East Java Province. East Java Province is one of the potential production areas for vegetables. Secondary data were collected from the Agricultural District Services of Malang, Blitar and Kediri in 2018. Five vegetables namely chilies (big and small), eggplant, yard-long bean, and tomato, which were considered leading commodities in the region, were selected for these analyses. A factor share approach, which is commonly used for financial analysis of farming systems, was employed in this study. Other financial analytical approaches were also used to alternate selection criteria. As a deterministic approach used in this study, a sensitivity analysis was conducted to determine the profitability of each vegetable commodity. The results show that chili and tomato are more labor-intensive, at which suitable for regions with an abundance of rural labor. Each vegetable has a positive profit, and thus recommended grow vegetables to increase households' income. Big-chili is superior in terms of absolute profit, and it is recommended that big-chili can be used as the main crop. In terms of R/C-ratio and factor share, eggplant is superior, it is recommended that eggplant can be used as an alternative crop.

1. Introduction
Production of vegetables plays an important role in Indonesian economy, as the production of vegetables provides income and employment [1]. High value agricultural products here are defined as products that are typically non-durable, that are specifically high-value, and marketed through specialized markets. The importance of vegetables in Indonesia has been growing to some extent for both exports and domestic consumption [2,3]. While hunger remains closely associated with poverty, malnutrition affects both the poor and more prosperous populations through lack or excessive intake of an imbalanced diet [4]. Vegetables also contribute to mitigation of hunger and malnutrition at household level [5,6,7,8].

Diversification into vegetables would provide benefits for landless farmers by enhancing employment and production [9]. The benefits gained by poor in rural sub-urban continuum via economic development and conservation of the food and nutrition availability. The diversification has also potential of empowering the poor by accessing to decision-making processes and improving capacity for communal accomplishment and diminishing vulnerability to any shocks over accumulation of wealth. Therefore, diversifying farm into vegetables was able to play a significant role in alleviating poverty and securing food and nutrition in Indonesia.
Vegetable crops have an essential role in breaking the cycle of poverty through increased production and higher income and malnutrition through a more balanced nutritious diet [4,5]. They are suitable for production in small plots and are labor-intensive, thus offering a unique opportunity for smallholder farmers to diversify production and to generate employment for enhanced incomes for all participants in the value chain. The production of vegetables was able well to be targeted for domestic and overseas marketing commodities because vegetables are high-value cash crops that fulfill daily needs.

Vegetables can be grown as a home garden for additional home consumption. A vegetable home garden does only need a small piece of land to fulfill the vegetable need of households. As the major of nutritious sources in the menus, offering a wide-range of essential micro-nutrients consisting of iron, zinc and pro-vitamin A, vegetable crops are able to prevent rural and suburban households from malnutrition disorders [10]. Meanwhile the globally traded vegetables, such as onion and tomato, are frequently more common, there is a requirement to intensify the utilization of locally indigenous vegetables that have huge potentials for daily nutrition, in order to make diversification of production and consumption using locally indigenous vegetables, and to enlarge the use of crops as crops that generate cash.

The horticultural products are potential commodities, particularly for five leading vegetable crops grown in the region. These include chili, cucumber, eggplant, tomato, and shallot [11]. The production of such vegetables is not only for local consumption, but the production surplus has been delivered to other provinces. Even, one of the regions is one of the leading chili suppliers that play an essential role in determining national economies [12,13]. This condition indicates that the vegetable sector contributes to employment in other regions through the vegetable supply chain [14,15].

The current problem in East Java is that lack of information related the performance of vegetable production. Without such information, it is quite risky and difficult to formulate and plan appropriate strategies related to improvement of vegetable production performance. This paper attempts to provide farm business analysis of leading vegetable farming in East Java, which is one of the potential production areas for vegetables.

2. Materials and methods
Data were collected from Malang, Kediri and Blitar Regencies, East Java Province in 2018. This sector is the primary backbone of the economy of the district (excluding municipal region). Five vegetables: big-chili, small-chili, eggplant, yard-long bean and tomato, which are considered leading commodities in the regions, were the focus of analyses. This study employed factor share approaches, which is commonly used for financial analysis of the farming system [16]. In this analysis, the factor shares for labor; aggregate material costs consisting of seed, fertilizers, manure, irrigation, pesticide, staking, mulching, and land that includes interest rates were figured. In estimating the factor shares, the cost of labor of applying inputs was aggregated into the total cost of labor.

Let a production function in producing a single output $Q$ using vector of inputs $X$, labor $L$, and land resource $A$, be mathematically expressed as:

$$Q = f(X, L, A)$$

(1)

The factor shares of material inputs ($S_X$), labor ($S_L$) and land ($S_A$) can be respectively expressed as:

$$S_X = \frac{P_X}{P_Q} \times 100$$

(2)

$$S_L = \frac{wL}{P_Q} \times 100$$

(3)

$$S_A = \frac{rA}{P_Q} \times 100$$

(4)
where \( P \) is the prices of the material inputs in the prevailing market, \( P_Q \) is the price of output at the prevailing market, and \( r \) is the prevailing rental cost of land at the time. Profit, or return to the management \( (S_M) \) is expressed as follows:

\[
S_M = 100 - (S_X + S_L + S_A)
\]

Return to the management or profit can be negative or positive. The higher the value of the profit, the better the farm management.

As a deterministic approach of the factor share, a sensitivity analysis was conducted to determine the profitability of each vegetable commodity. The sensitivity analysis is conducted to measure how sensitive the profit or return to management to any changes in production and its prevailing price. The sensitivity analysis is conducted using both price \( (P_{BEP}) \) and production \( (Q_{BEP}) \) break-even-points (BEP) concept, which is formulated as follows:

\[
P_{BEP} = \frac{TC}{Q}
\]

\[
Q_{BEP} = \frac{TC}{P_Q}
\]

where \( TC \) is the total cost, \( Q \) is production, \( P_Q \) is the price of the product, a bar over variable represents no-change. Sensitivity analysis is measured by the percentage difference between BEP and prevailing product price or current production. The higher percentage difference represents less sensitive farming. In other words, the closer BEP is to prevailing product price (or current production), the more sensitive farming to change.

### 3. Results and discussion

Table 1 shows the financial performances of vegetable farming of five crops. Costs of production are broken down into land rent, material costs and labor cost. Chili farming, both small and big ones, and tomato were labor-intensive. However, yard-long bean and eggplant were material intensive. Concerning physical production, tomato and eggplant were superior, but this does not necessarily mean that those were financially superior.

| Particulars          | Vegetable Crops (per growing season) |
|----------------------|--------------------------------------|
|                      | Big Chili | Eggplant | Y-long bean | Tomato | Small chili |
| Land rent (Rp)       | 9,200,000 | 7,700,000 | 2,500,000  | 7,700,000 | 8,750,000  |
| Material costs (Rp)  | 15,250,000| 4,801,000 | 7,390,000  | 10,077,500| 2,814,000  |
| Labor cost (Rp)      | 19,400,000| 3,960,000 | 3,000,000  | 11,330,000| 22,400,000 |
| Production (kg)      | 10,500    | 40,000    | 10,000     | 42,000   | 4,200      |
| Value product (Rp)   | 78,750,000| 30,000,000| 15,000,000 | 42,000,000| 50,400,000 |
| Total cost (Rp)      | 43,850,000| 16,461,000| 12,890,000 | 29,107,500| 33,964,000 |
| Profit (Rp)          | 34,900,000| 13,539,000| 2,110,000  | 12,892,500| 16,436,000 |

Source: data analysis form Agricultural District Services of Malang, Blitar, Kediri, 2018

Figure 1 shows the profitability of vegetable farming. All vegetables performed positive profit. These findings correspond to findings of a study in Bojonegoro, East Java [1], West Java [17,18], and other regions [12,19] showing that vegetable farming was also profitable. It can be seen that big-chili was the most profitable farming; in contrast, the yard-long bean was the least profitable farming. However, the most profitable one does not guarantee that farming is the highest performance. However, we need other indicators to determine the best commodity by using revenue-cost ratio (R/C).

Based on R/C ratio, which is shown in Figure 2, big-chili and eggplant had a similar R/C ratio, which accounted for around 1.8. It means that investing IDR 1 will gain a profit of IDR 0.8. Up to this point, big-chili farming was superior. Consistently, yard-long bean farming had the lowest R/C ratio, which accounted for around 1.2. This means that the same level of investment will only get IDR 0.2. It is therefore, the yard-long bean was inferior.
Figure 1. Profitability of vegetable farming.

Figure 3 shows a factor share of vegetable farming. We can see that eggplant and big-chili provided almost similar share for the return to management, which accounted for around 45%. This means that in comparative measures, the two of vegetables were more superior than others. Yard-long bean showed the least share of the return to management, which accounted for only 15%. Small-chili and tomato had a similar share, which accounted for about 30%. Labor indicated the uppermost share for small-chili farming, and the use of material indicated the maximum share for yard-long bean farming. Up to this point, both big-chili farming and eggplant still showed superiority in the forms of absolute and relative profitability. It should be noted that the use of agrochemicals is one of the significant contributors of material inputs, particularly for big chili [20].

The market price of products and the level of production are uncertain and fluctuating. Change in both can cause a level of profitability. Now, we need to see the sensitivity analysis of each vegetable. This is to control whether or not every farming of vegetable crop was sensitive to changes of either price of the product or level of production by operating a concept of break-even-point (BEP). Table 2 shows the value of BEP for each vegetable, and Figure 4 describes the maximum percentage change that is acceptable in the level of production or price to the BEP.

Figure 2. R/C ratio of vegetable farming.
Table 2. Sensitivity analysis using BEP.

| Particulars                      | Big chili | Eggplant | Y-long bean | Tomato | Small chili |
|----------------------------------|-----------|----------|-------------|--------|-------------|
| Expected Price (IDR)             | 7,500     | 750      | 1,500       | 1,000  | 12,000      |
| Expected Production (kg)         | 10,500    | 40,000   | 10,000      | 42,000 | 4,200       |
| Price of BEP (IDR/kg)            | 4,176     | 412      | 1,289       | 693    | 8,087       |
| Production of BEP (kg)           | 5,847     | 21,948   | 8,593       | 29,108 | 2,830       |
| % Change                         | 44%       | 45%      | 14%         | 31%    | 33%         |

Source: data analysis form Agricultural District Services of Malang, Blitar, Kediri, 2018

Figure 3. Factor share of vegetable farming.

It seems that big-chili and eggplant farming showed the high superiority in the form of sensitivity to any changes in either level of production or price of products. Any declines in either level of production or price of products by up to 40%, the farming of such vegetable crops still generates profit. Small-chili and tomato showed relatively high sensitivity because the same case as eggplant and big-chili leads to a condition of which small-chili and tomato farming no longer generates profit. The most sensitive to such changes applied to yard-long bean. The crop only accommodates fall in either price of product or level of production by 14% to be BEP.
4. Conclusions
Farming of big chili showed the highest financial performance. Currently, chili and tomato were more labor-intensive than others, such that the commodities were very suitable for regions where rural labor is abundant. With current average prevailing prices, each vegetable indicated positive profit, and thus all five vegetables are recommended to increase households’ income. Big-chili was superior concerning absolute profit, and it is recommended that big-chili can be used as the main crop. Concerning R/C-ratio and factor share, eggplant was superior.

It is recommended that eggplant can be used as an alternative crop. Small-chili and tomato can be interchangeable since it is not recommended to cultivate the same family of crops sequentially. Yard-long bean is recommended only for intercrop. In the future, when there is a structural reform in agricultural sector where the labor force moves to other sectors, smart farming with agricultural industry of 4.0 that will not rely on labor intensive can be adopted to sustain the agribusiness. In the era, technology-intensive agriculture applies.

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