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***SINTA 2***


## Analysis on Production Factors and Marketing of Corn


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## ABSTRACT

*Madura has a corn farming area of approximately 300,000 hectares wide. However, its productivity is still low, about 2.15 tons per hectare. The purpose of this study was to determine the effect of production factors and the efficiency of corn marketing channels in Pamekasan Regency. Research respondents are farmers, retailers, collectors, and wholesalers in Batu Kerbuy village and Pademawu village, Pamekasan Regency. The total respondents were 60 farmers who were determined using the random sampling method and 12 traders who were determined using the tracing sampling method. The analysis techniques used were the Cobb-Douglas function variables, farmer's share, marketing margin, and marketing efficiency. The results showed that five production variables simultaneously affected corn production. Partially, there were three variables with a highly significant effect, i.e. labor, pesticides, and fertilizers, while there were another two variables, i.e. land area and seeds, with no significant effect. There were five corn marketing channels in Pamekasan Regency, with marketing channel I being more efficient than the others.*



***Keywords****: Production Factor, Marketing, Corn*


## INTRODUCTION

From biophysical perspective, land which is potential for corn cultivation in Madura Island is relatively wide. The total area in four regencies in Madura (Bangkalan, Sampang, Pamekasan and Sumenep) is approximately 300,000 hectares with productivity number of 2.15 tonnes per hectare (BPS, 2017). This number is very low compared to the national average of corn productivity, where the number is about 5.47 tonnes per hectare (Astuti et al., 2020). The low productivity in Madura Island is caused by (1) poor land fertility, (2) low rainfall and (3) the use of local cultivars without prior selection (Amzeri, 2017).

The above conditions indicated that Madura Island has a good potential for corn development so that this commodity can be used as the main commodity for regional development. There were some considerations regarding corn commodity as the leading commodity for Madura development: (1) a wide cultivating area, (2) Corn commodity is a commodity that provides a decent profit to farmers if it is managed properly, (3) it provides business opportunities to the community, and (4) this commodity is acceptable by the community so that it can absorbs labor.

The low productivity of corn in Madura becomes a major problem for developing this commodity in the area, so that one of the main focuses in corn farming on Madura Island is increasing its productivity. One of solutions to solve this problem is replacing farmers' habit of using local cultivars that potentially give low production with the superior one that have


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high production potential and other superior characteristics (short age, grows well on sub-optimal land and long post-harvest shelf life). In addition, the use of optimal doses of fertilizers, the application of pesticides, and the application of modern cultivation techniques will increase the corn productivity in Madura.

The corn price at the farmer level in Madura Island at the harvest time is very low (Amzeri, 2018), causing low profits on farmer side. The low profit at the farmer level causes low motivation among farmers to cultivate corn which ultimately creates low productivity of corn in Madura. This condition makes the bargaining position of farmers to be weak compared to traders (Napitulu & Siboro, 2019). Many efforts to increase farmers' income can stimulate them to increase corn productivity in Madura Island. Improvement on the marketing system by increasing marketing efficiency can increase farmers' income.

Marketing efficiency can be measured by looking at the pattern of marketing channels. A long marketing channel indicates that more and more marketing agencies are involved so that the marketing efficiency is low. Complex and long marketing channels lead to high marketing margins because more and more marketing agencies are involved (Kausar & Alam, 2016). Low marketing efficiency is indicated by high marketing margins (Sondakh et al., 2017). The larger the marketing margin, the smaller the share of the price received by farmers compared to the price paid by consumers so that the income received by farmers is small (Muhaimin, 2020). Research related to the influence of production factors and the efficiency of marketing channels in Madura Island has never been done before.

Based on the above background, it is necessary to conduct a study related to the influence of production factors and the efficiency of marketing channels for corn commodities in Pamekasan, Madura. From this study, it will be seen factors that affect corn production and proportion of profit distribution of each institution in each marketing channel, the process of price formation, as well as channel alternatives that can be maximized to increase the income of corn farmers. The study aimed to: (1) determine the effect of corn production factors in Pamekasan Regency and (2) determine the efficiency of corn marketing channels in Pamekasan Regency.

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## RESEARCH METHODS

The study was conducted in Batu Kerbuy Village, Pasean Sub-district and Pademawu Barat Village, Pademawu Sub-district, Pamekasan Regency, East Java Province from July to September 2021. The study location was determined purposively based on consideration that the two sub-districts represent a large and small area of corn farming in Pamekasan Regency. Research respondents are farmers, retailers, collectors and wholesalers in 2 villages that have been determined. The respondents were selected using simple random sampling method. The number of corn farmers involved as respondents was 60 farmers (30 farmers from Batu Kerbuy village, Pasean sub-district and the other 30 farmers from Paemawu Barat village, Pademawu sub-district). The determination of corn traders was conducted using tracing sampling method, namely a sampling technique based on information from sample farmers about traders who buy corn. From the tracing results, there were selected 4 retailers, 5 collectors, and 3 wholesalers.

The types of data used in this study are primary and secondary data. Primary data were obtained from interviews with farmers, traders and Focus Group Discussion (FGD) with corn stakeholders at the sub-district and regency levels. Secondary data were obtained from the Central Bureau of Statistics of Pamekasan Regency, Agricultural Office of Pamekasan Regency, Agricultural Office of East Java Province, and scientific literatures relevant to the study's main topic to support the study results.

Cobb-Dauglas production factor analysis, coefficient of determination, and F test were used to answer research

objectives 1. Analysis of the data used to analyze the effect of production factors on production using Cobb-Dauglas. production function analysis (Wang & Fu, 2013). In general, it can be described as follows:

$$Y = bo \sum_{i=1}^{n} X_i^{bi}\, e^{\mu}$$
$$Y = bo.X_1^{b1}.X_2^{b2}.X_3^{b3}.X_4^{b4}X_5^{b5}.e^{\mu}$$

In order to simplify the calculation, the above function is transformed into the natural logarithm (ln), so that it becomes:

$\ln Y = \ln b_o + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + \mu$

Where Y is Production (kg), bo is intercept, b1-b5 is regression coefficient, $X_1$ is Land area (ha), $X_2$ is Seeds (kg/ha), $X_3$ is Labor (HOK), $X_4$ is Fertilizer (kg/ha), $X_5$ is Pesticides (ml /ha), μ is error term.

The coefficient of determination ($R^2$) is used to determine the contribution of the independent variable to the dependent variable. The formula for the coefficient of determination ($R^2$) is:

$$R^2 = \frac{sum\ of\ regression\ squares}{sum\ of\ total\ squares}$$

The F test was used to determine the effect of joint production factors towards corn production. The F test is calculated by using the formula below:

$$F = \frac{R^2/(k-1)}{(1-R^2)/(n-k)}$$

Marketing margin analysis and marketing channel efficiency analysis are used to answer research objectives 2. The analysis of marketing margin was used to determine the profits obtained by corn traders. The formula used is as follows:

$M = Hp - Hb$

Where M is Marketing margin (Rp), Hp is Seling price (Rp), Hb is Purchase price on farmer level (Rp).

Farmer's share is the value used to determine the share received by farmers. The formula used to calculate farmer's share is:

$$FS = \frac{Pf}{Pk} x100\%$$

Where FS is Percentage of price received by farmers (%), Pf is Price at the consumer level (Rp/kg), Pk is the price at the farmer level (Rp/kg).

Analysis of marketing channel efficiency was used to determine the corn marketing number in each marketing channel. The criteria for the value of marketing efficiency is < 5% (efficient) while the value of marketing efficiency is > 5% (inefficient) (Soekartawi, 1993). The formula used to calculate marketing channel efficiency is:

$$Eps = \frac{B}{NP} x100\%$$

Where Eps is Marketing Efficiency, B is Marketing cost (Rp), NP is Total Product Value (Rp).

## RESULT AND DISCUSSION

### Analysis of Corn Production Factors

Factors that affect corn production in Madura are: land area, seeds, labor, fertilizers, and pesticides. Table 1 shows that the variables of labor ($X_3$), pesticides ($X_4$), and fertilizers ($X_5$) have a significant effect on α = 1% while the variables of land area ($X_1$) and seeds ($X_2$) have no significant effect on the level of α = 5%. The form of linear regression model of the Cobb-Dauglas production function on corn farming in Pamekasan with five independent variables are:

$\ln Y = \ln (0.130) + 0.208 \ln X_1 + 0.220 \ln X_2 + 0.373 \ln X_3 + 0.302 \ln X_4 + 0.940 \ln X_5 + \mu$

The coefficient of determination ($R^2$) is a quantity that shows the magnitude of the influence of the independent variable in explaining the dependent variable (Zhang, 2017). The $R^2$ value of 0.963 indicates that the variation in the output value of corn production which can be explained by the independent variables in the model is 96.30% while the remaining 3.70% of the

output variation is explained by other variables out the model. The large value of $R^2$ indicates that there is a very strong correlation of all independent variables (land area, seeds, labor, fertilizers, and pesticides) towards the dependent variable (corn production).

**Table 1**
**Regression Analysis Results of Factors Affecting Corn Production in Pamekasan**

| Variables | Regression coefficient | | T count | Sig. |
|---|---|---|---|---|
| Ln Land area ($X_1$) | 0.208 | ns | 1.456 | 0.152 |
| Ln seeds ($X_2$) | 0.220 | ns | 1.043 | 0.302 |
| Ln labor ($X_3$) | 0.373 | *** | 3.181 | 0.003 |
| Ln pesticides ($X_4$) | 0.302 | *** | 3.487 | 0.001 |
| Ln fertilizers ($X_5$) | 0.940 | *** | 5.768 | 0.000 |
| Constant | 0.130 | ns | 0.116 | 0.908 |
| $R^2$ | 0.963 | | | |
| Adjusted $R^2$ | 0.960 | | | |
| F count | 258.616 | *** | | 0.00 |
| F table | 2.39 | | | |
| T table 1% | 2.668 | | | |
| T table 5% | 2.004 | | | |

Source: Primary Data Processed, 2021
Note: *** = significant at α=1%; ns = not significant

The results of F test show that the simultaneous test has resulted F-count results of 258.616 with a significance value (0.000) which is much smaller than α = 5%. The large and significant value of F-count indicates that the independent variables including land area, seeds, labor, fertilizers, and pesticides simultaneously have a significant effect on corn production in Pamekasan. Based on the F count value, it can be concluded that the variation of corn production in Pamekasan is determined by the factors of land area, seeds, labor, fertilizers, and pesticides.

On average, farmers' land ownership in Pamekasan is 0.67 hectares. Land area ($X_1$) has t count < t table (1.456<2.004) means that land area has no significant effect on corn production in Pamekasan. The size of the land has no significant effect on production because the cultivation system in Pamekasan Regency is still traditional or does not apply a modern cultivation system. The regression coefficient value for land area is 0.208, meaning that if the land area is increased by 1%, the corn production will increase by 0.208%. This result is in line with a study by Habib (2013) which states that land area has no significant effect on corn production. Large land ownership has a positive effect on production, where the larger the land area, the higher the corn production.

The use of seeds ($X_2$) has a t count < t table (1.043 < 2.004) meaning that the use of seeds has no significant effect on corn production with a regression coefficient of 0.220. The majority of farmers in Pamekasan still use local corn seeds. The average number of seeds planted by farmers in Pamekasan is 16.72 kg/ha, which is in accordance with the recommended number of seeds in corn farming (15-20 kg/ha). The problem is farmers tend to use of local seeds (non-superior varieties) and too wide spacing (not as recommended). The small size of local corn seeds should require more seeds quantity than the recommended quantity per hectare, but a wider spacing than the recommended one makes the need for seeds in corn farming in Pamekasan is not much. This condition causes seed input to have no significant effect on corn production in Pamekasan. The use of superior corn seeds with the recommended spacing will significantly increase corn productivity in Pamekasan. Pioke et al. (2021) showed that using

hybrid varieties in Boalemo Regency, Gorontalo Province had a significant positive effect on corn production.

Labor ($X_3$) has a value of t count > t table (3.181> 2.668) meaning that labor has a very significant effect on corn production in Pamekasan. Results of the Cobb-Dauglas production analysis show that the regression coefficient of the labor variable is 0.373, meaning that if there is an additional 1% of labor, there will be an increase in the amount of corn production by 0.373% with assumption that other variables are held constant. These results are in line with the research of Ilyas & Afandi (2016) which states that labor has a significant effect on corn production. The labor use in corn farming uses in-house labor plus non-family labor with a wage of Rp70,000/HOK. On average, the labor use for corn farming in Pamekasan is 34.601 HOK. The standard of labor use for corn commodity is 40 HOK (Cristoporus dan Sulaeman, 2009) so that more labor is needed to increase corn production.

The use of pesticides ($X_4$) has a t count value > t table (3.487>2.668) meaning that the use of pesticides has a very significant effect on corn production in Pamekasan. The results of the Cobb-Dauglas corn production analysis showed that the regression coefficient of the pesticide variable was 0.302, meaning that if there was an additional 1% of pesticide use, there was an increase in the production amount by 0.302%. Pesticides do not increase corn production directly but it can save the plant from pests and diseases so that it has optimal growth. Wahyuningsih et al. (2018) showed that the use of pesticides on hybrid corn and local corn had no significant effect on seed production in Boyolali Regency, Central Java Province.

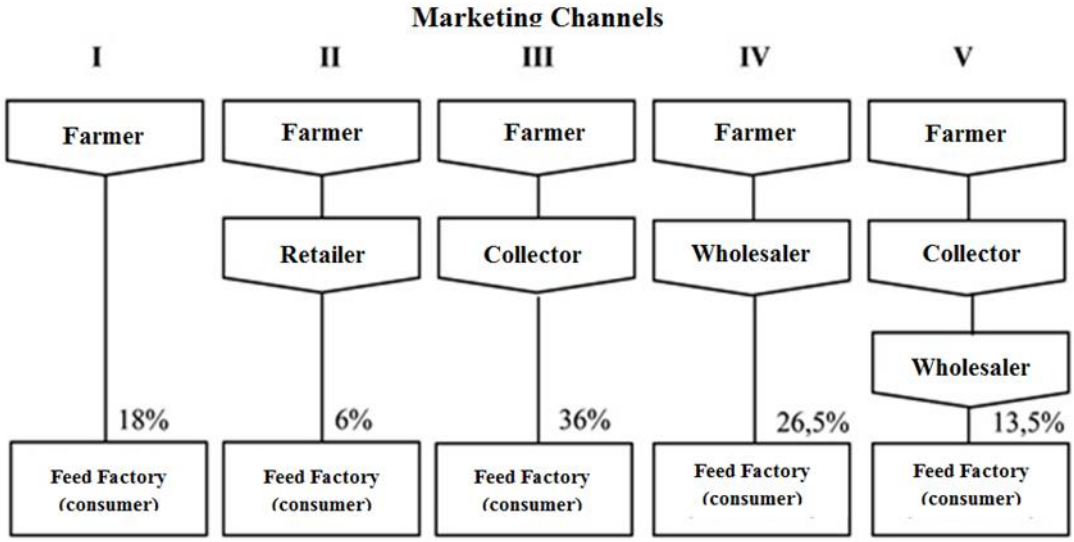
The use of fertilizer ($X_5$) has a value of t arithmetic > t table (3.487> 2.668) which means that the use of fertilizers has a very significant effect on corn production in Pamekasan. The results of the Cobb-Dauglas corn production analysis showed that the regression coefficient of the fertilizer variable was 0.940, meaning that if there was an additional 1% of fertilizer use, there was an increase in the amount of production by 0.940% with assumption that other variables were held constant. This result is in line with the study of Purwanto et al. (2015) that fertilizer has a significant effect on corn production in Buol Regency, Central Sulawesi Province. The average use of fertilizer is 308.696 kg/ha consisting of urea and NPK. The recommended dose in corn farming is 500 kg/ha with a composition of 200 kg/ha urea and 300 kg/ha NPK, so that additional fertilizer is still needed to increase corn production in Pamekasan.

**Corn Marketing Channel**

The study results showed that there were three marketing institutions involved in the corn trade of Pamekasan, namely retailers, collectors, and wholesalers. The pattern of marketing channels in Pamekasan forms five patterns, namely: (1) I: farmers - feed factories (consumers), (2) II: farmers - retailers - feed factories (consumers), (3) III: farmers - collectors feed factories (consumers), (4) IV: farmers - wholesalers - feed factories (consumers), and (5) V: farmers - collectors - wholesalers - feed factories (consumers) (Figure 1). Farmers in Pamekasan sell corn in the form of dry shells (15-16% of moisture content) in all five channels. The marketing channel that is mostly done for corn commodity in Pamekasan is the third channel by 36%; while the second channel is one at least done in corn marketing of Pamekasan, which is 6%.

***Farmer's Share***

Indicators of marketing efficiency are farmer's share and marketing margin. Farmer's share is the share received by farmers from marketing activities expressed in percent (Harviyantho et al., 2021); Jumiati et al., 2013). A high value of farmer's share indicates that the supply chain is efficient, but it does not always indicate that the marketing is working efficiently (Hidayat et al., 2017). The value of farmer's share is opposite to the value of the marketing margin, where the greater the value of farmer's share, the smaller the value of the marketing margin.




Source: Primary Data Processed, 2021

**Figure 1**
**Pattern of Corn Marketing Channels in Pamekasan**

The highest to lowest Farmer's share values were obtained from channel 1 (100.00%), channel II (87.50%), channel III (86.41%), channel IV (85.88%) and channel V (81.18%), respectively. The farmer's share value of 40% indicates that the marketing channel is efficient (Downey & Erickson, 1992). The similar value in the five marketing channels shows a value of 40% so that the corn marketing channel in Pamekasan is considered as efficient. The number of institutions involved will affect the value of farmer's share, while the value of farmer's share will ultimately affect the value of marketing margin. The highest farmer's share value is obtained from the first marketing channel, which is 100% because farmers sell directly to feed factories (consumers) so that minimize the marketing costs. The lowest farmer's share value is obtained from marketing channel V because this channel has a longer marketing chain so that it requires relatively larger marketing costs compared to the other four marketing channels. The research results of Sondakh et al. (2017) showed that there were 2 marketing channels for corn in Minahasa Regency, North Sulawesi Province with a Farmer's share value of channel I of 66.67% and channel II of 60.00%.

**Table 2**
***Farmer's Share* of Corn Marketing Channels in Pemakasan**

| Marketing Channels | Farmer's Selling Price (Rp/kg) | Selling Price (Rp/kg) | *Farmer's share* (%) |
|---|---|---|---|
| Channel I | 4,000 | 4,000 | 100,00 |
| Channel II | 3,500 | 4,000 | 87,50 |
| Channel III | 3,500 | 4,050 | 86,41 |
| Channel IV | 3,650 | 4,250 | 85,88 |
| Channel V | 3,450 | 4,250 | 81,18 |

Source: Primary Data Processed, 2021

**Table 3**
**Marketing Costs, Profits, and Margin of Five Marketing Channels in Pamekasan**

| No | Description | Channel I | | Channel II | | Channel III | | Channel IV | | Channel V | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Value (Rp/kg) | MP (Rp) | Value (Rp/g) | MP (Rp) | Value (Rp/kg) | MP (Rp) | Value (Rp/kg) | MP (Rp) | Value (Rp/kg) | MP (Rp) |
| 1 | Farmer's Selling Price | 4,000 | | 3,500 | | 3,500 | | 3,650 | | 3,450 | |
| 2 | Retailers | | | | | | | | | | |
| | - Sacks | | | 30 | | | | | | | |
| | - Packaging | | | 3 | | | | | | | |
| | - Storage | | | 4.33 | | | | | | | |
| | - Transportation | | | 80.23 | | | | | | | |
| | - Loading and unloading | | | 11.22 | | | | | | | |
| | - Market information | | | 50 | | | | | | | |
| | Total Costs | | | 178.88 | | | | | | | |
| | Selling Price | | | 4,050 | | | | | | | |
| | Profit | | | 371.12 | | | | | | | |
| 3 | Collector | | | | | | | | | | |
| | - Sacks | | | | | 30 | | | | 30 | |
| | - Packaging | | | | | 1.23 | | | | 1.23 | |
| | - Storage | | | | | 0 | | | | 0 | |
| | - Transportation | | | | | 85.2 | | | | 85.2 | |
| | - Loading and unloading | | | | | 10.2 | | | | 10.2 | |
| | - Market information | | | | | 50 | | | | 50 | |
| | Total cost | | | | | 176.63 | | | | 176.63 | |
| | Selling price | | | | | 4,000 | | | | 4,000 | 550 |
| | Profit | | | | | 323.37 | | | | 323.37 | |
| 4 | Wholesaler | | | | | | | | | | |
| | - Sacks | | | | | | | 12 | | 12 | |
| | - Packaging | | | | | | | 5.03 | | 5.03 | |
| | - Storage | | | | | | | 7.43 | | 7.43 | |
| | - Transportation | | | | | | | 60.57 | | 60.57 | |
| | - Loading and unloading | | | | | | | 12.33 | | 12.33 | |
| | - Market information | | | | | | | 53.63 | | 53.63 | |
| | Total cost | | | | | | | 150.99 | | 150.99 | |
| | Selling price | | | | | | | 4,250 | | 4,250 | 250 |
| 5 | Profit | 4,000 | | 327.37 | | 371.12 | | 449.01 | | 99.01 | |
| | Total Margin | | 0 | | 550 | | 500 | | 600 | | 800 |

Source: Primary Data Processed, 2021
Note: MP = Marketing Margin

**Marketing Margin**

Marketing efficiency can be measured from marketing margins and marketing costs in each marketing channel (Mgale & Yunxian, 2020). This efficiency can be increased by identifying the distribution of marketing costs among the various intermediaries in the marketing channel. There are three intermediaries in the corn marketing system of Pamekasan, namely: retailers, collectors, and wholesalers. Marketing costs incurred by intermediaries consist of: sacks, packaging, storage, transportation, loading and unloading, market information (Table 3). The type and level of marketing costs among intermediaries varies due to different business sizes, product handling systems, and access to feed factories (consumers). The average costs incurred by collectors, retailers, and wholesalers for marketing 1 kg of corn are Rp. 176,63, Rp. 178,88 and 150,99, respectively. Retailers incur more costs than collectors because retailers conduct more activities than collectors, namely expenses for sacks, packaging, storage, transportation, loading and unloading, and market information. Collector traders do not incur storage costs because after buying corn from farmers, the middlemen are directly sold it to wholesalers or feed factories (consumers). Wholesalers have less expenses than retailers because they spend less on buying sacks and transportation. Collector traders incur the largest transportation costs from the other two traders because the amount of corn purchased by collector traders is not too much (± 2 tones) so that the means of transportation used is pick-up which requires a higher cost. Retailers and wholesalers pay less because the capacity of corn transported is larger so that truck is considered as the proper transportation.

Marketing margins of the three intermediaries are different because each intermediary incurs different marketing costs and takes different profits. The marketing margins for retailers, collectors and wholesalers are Rp550, Rp500, and Rp600, respectively. Marketing margin for the wholesalers is the highest one because the business volume is greater than that of the other two intermediaries. In addition, wholesalers are not much involved in the process of corn processing because wholesalers receive the commodity from farmers and collectors in the form of dry-shelled corn at a low price and sell it to large feed factories at a higher price. The marketing margin of retailers is lower than that of the wholesalers because retailers sell corn purchased from farmers to small feed factories around the retail area or sell it directly to consumers in the market. The marketing margin of collectors is lower than the other two intermediaries because the business volume is small, so the collector sell it to other intermediary, namely wholesalers. In addition, collectors sell it directly to small feed factories around their area at affordable prices. Marketing costs are influenced by the number of intermediaries and marketing channels (Arbi et al., 2018). Marketing costs, from lowest to highest, are marketing channels I, IV, III, II and V (Table 6). Marketing channel I has lower marketing costs because it does not involve intermediaries in corn marketing. Marketing channel V has higher marketing costs because it involves many intermediaries (collectors and wholesalers) in corn marketing. The lowest marketing margin is found at marketing channel I because it does not involve intermediaries in corn marketing. Marketing channel V has the highest marketing margin because it involves many intermediaries in corn marketing compared to other marketing channels. This study is in accordance with the results of research conducted by (Ashari & Syamsir, 2021) in Pohuwato Regency, Gorontalo Province, where there are three marketing channels, and marketing channel III has the lowest marketing margin because farmers sell directly to exporters without intermediaries.

**Corn Marketing Efficiency**

Marketing efficiency occurs when marketing costs are small so that the marketing profits is higher than the costs (Fatmawati & Zulham, 2019). Based on the criteria of marketing efficiency, there are four corn marketing channels in Pamekasan categorized as efficient,

namely marketing channels I, II, III, and IV because they have a marketing efficiency value of < 5%. Marketing channel I is the most efficient marketing channel because it has the lowest marketing efficiency value.

**Table 4**
**Marketing Efficiency of Five Corn Marketing Channels in Pamekasan**

| Marketing Channels | Marketing Costs (Rp/kg) | Selling Price (Rp/kg) | Marketing Efficiency (%) |
|---|---|---|---|
| Channel I | 0 | 4,000 | 0 |
| Channel II | 178.88 | 4,000 | 4.47 |
| Channel III | 176.63 | 4,050 | 4.36 |
| Channel IV | 150.99 | 4,250 | 3.55 |
| Channel V | 327.62 | 4,250 | 7.71 |

Source: Primary Data Processed, 2021

## CONCLUSION

Land area ($X_1$), seeds ($X_2$), labor ($X_3$), pesticides ($X_4$), and fertilizers simultaneously affect corn production with F-count (258.16) > F-table (2.39) at α = 1%. Partially, there are 3 variables that have a very significant effect, i.e. labor ($X_3$), pesticides ($X_4$), and fertilizers ($X_5$) while the other two variables have no significant effect, i.e. land area ($X_1$) and seeds ($X_2$). Four marketing channels in Pamekasan Regency have an efficient category because they have a marketing efficiency value of <5%, namely marketing channels I, II, III, and IV. Marketing channel I is the most efficient marketing channel because it has the lowest marketing efficiency value.

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