Identification of Fertilizer Quality Factors from Distributors, Retailers and Farmers Perspective

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Abstract. Indonesia is one country in the world with a developing agricultural industry. Around 50% of Indonesian citizen is involved in the agricultural sector. Fertilizer is one important material for this industry to control the productivity of plantation or farming areas. In Indonesia, fertilizer is produced by the fertilizer industry and is distributed to the farmer through two channels: distributor and retailer. With increasing competition in the Indonesian fertilizer industry due to the presence of fertilizer products from outside the country, it is necessary for this industry to maintain the quality of its product. Identification of product quality factors becomes a critical step in managing the quality of fertilizer products. Moreover, discussion with people in the Indonesian fertilizer industry, it is substantial to know the perception of customers about quality factors for fertilizer products. This research aims to identify quality factors for fertilizer products from distributors, retailers and farmers perspective. It was found that distributors and retailers emphasized the accuracy of weight and composition from fertilizer products as prominent quality factors while farmers stressed fertilizer price and fertilizer composition as key quality factors.

1. Introduction

Indonesia is a developing agricultural country with more than 50% of its citizen are involved in the agricultural sector. The Indonesian economy is supported by exporting commodities from this industry such as palm oil, natural rubber, coffee, and chocolate [1]. The fertilizer industry is one supporting industry for agricultural sector by producing fertilizer to maintain land nutrient which in turn affecting the productivity of plantation or farming areas. Indonesia has significant fertilizer enterprises to support Indonesian agricultural industry. However, Indonesian fertilizer industry faces the increase of competition due to the appearance of fertilizer products from outside the country. Hence, it is important to maintain the quality of their products in order to keep these companies competitive [2,3].

Fertilizer is one key factor to manage agricultural productivity which becomes the reason for the high consumption of fertilizer [4]. Fertilizer plays an important role in improving food security in several ways such as sustainable intensification [5]. Although, fertilizer is a source of emission, a significant increase in fertilizer demand in the future is expected due to the increase of agricultural areas [6]. To fulfill this demand, the number of fertilizer enterprises increases in some agricultural countries such as Indonesia, China, Malaysia, and Thailand. However, the use of fertilizer in some regions is influenced by farmer decisions [7], agricultural practices [5] and type of fertilizers [4]. Hence it is important to identify fertilizer quality factors from customers’ perspective since it influences fertilizer use.
Pupuk Iskandar Muda is a leading fertilizer enterprise in Indonesia. This company is a state-owned company that focuses to produce and to distribute fertilizer for farmers. Initial discussion with people in this company indicated the desire of the company to make its products meet customer expectation. Moreover, this company has a target to distribute the right type of fertilizer at the right time, the right amount, the right place and the right price. This company distributes its fertilizer to farmers through distributor and retailers which scattered across districts and sub-districts. This paper aims to identify fertilizer quality factors from the perspective of distributors, retailers, and farmers.

2. Research Methods

A case study is used as a research method. To investigate the phenomenon in real-context, the case study is a good approach. This is because case study can provide a depth insight into the problem from a real case. Pupuk Iskandar Muda North Sumatera supply region is selected as the case study. This supply region distributes fertilizers for plantation areas in North Sumatera Province. In this research, product quality in perspective of distributors, retailers, and farmers is a phenomenon to be investigated.

2.1. Research Process

To achieve the aim of the research, the research process is divided into two stages: a qualitative stage and a quantitative stage. In the qualitative stage, the research focuses to investigate fertilizer quality factors from the perspective of distributors, retailers, and farmers. A depth investigation using interview was used to identify these factors. Then, it is followed by the quantitative stage that focuses to determine the significance of fertilizer quality factors. A survey using a questionnaire was used to define significant fertilizer quality factors. Figure 1 displays the research process used in this research.

| Qualitative Stage                              | Quantitative Stage                                      |
|------------------------------------------------|--------------------------------------------------------|
| • Interview distributors, retailers and farmers to identify fertilizer quality factors | • Survey distributors, retailers and farmers to identify significance of fertilizer quality factors |
| • Analysis of interview result                | • Analysis of result from survey using regression       |

Figure 1. Research Process

2.2. Analysis Methods

An interview result is analyzed using thematic analysis to define fertilizer quality factors stated by distributors, retailers, and farmers. Multiple linear regression analysis is used to determine whether there is an influence of independent variables on the dependent variable. In this case, fertilizer quality is the dependent variable. SPSS software is used to apply regression analysis to result from the survey. The regression equation can be formulated as follows [8].

\[ Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e \]  \hspace{1cm} (1)

Where:

- \( Y \) = Fertilizer quality (Distributor, Retailer or Farmer)
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\[ a = \text{Constant} \]
\[ b_1, b_2, b_3, b_4 = \text{coefficient of determination} \]
\[ X_1 = \text{Fertilizer quality factor 1} \]
\[ X_2 = \text{Fertilizer quality factor 2} \]
\[ X_3 = \text{Fertilizer quality factor 3} \]
\[ e = \text{Error} \]

3. Result and Discussion

3.1. Qualitative Result

From an interview with distributors, retailers and farmers, some fertilizer quality factors have been identified. Table 1 shows these factors.

| Fertilizer Quality Factors from the Perspective of Distributors | Fertilizer Quality Factors from the Perspective of Retailers | Fertilizer Quality Factors from the Perspective of Farmers |
|---------------------------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------|
| Quality of fertilizer granules (XA1).                        | Quality of fertilizer granules (XB1).                     | Quality of fertilizer granules (XC1).                    |
| The quality of fertilizer Packaging (XA2).                  | The quality of fertilizer Packaging (XB2).                | The quality of fertilizer Packaging (XC2).               |
| Accuracy of fertilizer weight (XA3).                         | Accuracy of fertilizer weight (XB3).                      | Accuracy of fertilizer weight (XC3).                     |
| Suitability of the amount of fertilizer received with the amount ordered (XA4). | Suitability of the amount of fertilizer received with the amount ordered (XB4). | Suitability of the amount of fertilizer received with the amount ordered (XC4). |
| Suitability of the type of fertilizer received with requested (XA5). | Suitability of the type of fertilizer received with requested (XB5). | Suitability of the type of fertilizer received with requested (XC5). |
| Conformity between subsidized prices and the company selling price (XA6). | Conformity between subsidized price and distributor selling price (XB6). | Conformity between subsidized price and retailer selling price (XC6). |
| Accessibility of the company warehouse (XA7).                | Accessibility of distributor warehouse (XA7).             | Comparison with competitor price (XC7).                  |
| Adequate company warehouse facilities (XA8).                 | Adequate distributor warehouse facilities (XB8).          | Accessibility of retailer store (XC8).                   |
| Availability of fertilizer in the manufacturer's warehouse at the time of purchase (XA9). | Availability of fertilizers at the distributor at the time of purchase (XB9). | Availability of fertilizers at the retailers’ store when needed (XC9). |
| Impact of fertilizer on land yields (XC10).                  | Ease of use (XC11).                                       |                                                           |

From the appearance of the product, three quality factors have been identified from distributors, retailers, and farmers as quality factors. The first factor is a fertilizer granule. According to them, fertilizer with good quality must have fine granules with similar size and shape. The second factor is fertilizer packaging. Fertilizer is distributed from the factory to farmers through long trips that need strong and good packaging. From distributors and retailers perspective, good packaging makes the product easier to distribute and sell while in farmers’ perspective good packing is
3.2. Quantitative Result

This stage has the purposes to determine significant quality factors and to develop fertilizer quality models. To achieve these objectives, quality factors identified from the interview with distributors, retailers, and farmers are used to develop a questionnaire. Significant quality factors and fertilizer quality models from the perspective of distributors, retailers, and farmers are defined through an analysis of questionnaire answer. This section is divided into three subsections: Significant quality factors from the perspective of distributors, significant quality factors from the perspective of retailers and significant quality factors from the perspective of farmers.

3.2.1. Significant Fertilizer Quality Factors from Distributors Perspective

Distributors play a role to distribute fertilizer from fertilizer factory to fertilizer retailers. Five distributors have been surveyed related to fertilizer quality factors. Figure 1 shows significant quality factors from the distributor’s perspective.
It can be seen from figure 2, Distributors emphasized the accuracy of weight and suitability of fertilizer’s type as significant quality factors. Both have positive b value that means the quality of fertilizer is likely to increase if the company could maintain the weight of fertilizer so it is same with the weight written on the packaging and could manage the type of fertilizer sent to distributor same with the type of fertilizer requested. Based on Figure 2, it can be obtained the regression equation as follows:

\[ Y = 6,250 + 1,458 XA3 + 5,708 XA5 + e \]  

(2)

### 3.2.2. Significant Fertilizer Quality Factors from Retailers Perspective

Retailers have a role to distribute fertilizers from distributors to farmers. Retailers sell fertilizers in their store. Ten retailers have been surveyed related to fertilizers quality factors. It can be observed from Figure 3, the accuracy of fertilizer weight and suitability of fertilizer’s type are statically significant quality factors from the perspective of retailers. Both factors have positive b value that means the quality of fertilizer is likely to increase if the distributor could maintain the weight of fertilizer and the type of fertilizer to be sent. Figure 3 displays significant quality factors from the retailer’s perspective.

Based on figure 3, the regression model for fertilizer quality is displayed by Equation 3

\[ Y = 6,725 + 3,627XB3 + 3,539XB5 + e \]  

(3)

### 3.2.3. Significant Quality Factors from Farmers Perspective

Farmers is the final customer that use fertilizer for their lands. Thirty farmers have been surveyed related to fertilizer quality factors. All ten quality factors identified in the qualitative stage are stated to be significant quality factors (see Table 2). Furthermore, all quality factors have positive b value that means the increase in these factors will be likely to increase the quality of fertilizer. Figure 4 shows significant quality factors from the farmers perspective.
Based on Figure 4, we can obtain the regression formula as follows:

\[ Y = 1.398 + 1.264XC1 + 0.588XC2 + 1.022XC3 + 1.266XC4 + 1.258XC5 + 1.376XC6 + 1.013XC7 + 1.058XC8 + 0.793XC10 + 1.037XC10 + 1.037XC11 + e \]  

(4)

4. Conclusion

Based on the results, some conclusions are obtained as follows.

- Fertilizer Quality Factors could be different between distributors, retailers, and farmers.
- From the distributor’s perspective, two fertilizer quality factors are found to be statistically significant: the accuracy of fertilizer weight and suitability of fertilizer types.
- From the retailer’s perspective, there are two statistically significant fertilizer quality factors: the accuracy of fertilizer weight and the suitability of fertilizer types.
- From the farmers perspective, there are ten statistically significant fertilizer quality factors including fertilizer granules, fertilizer packaging, Accuracy of fertilizer weight, suitability of fertilizer amount, suitability of fertilizer type, Different of fertilizer price with subsidize price, Different of fertilizer price with competitor price, Accessibility of retailers’ store, Effect of fertilizers on yields and ease of processing fertilizers.
- Fertilizer enterprises might consider these quality factors in maintaining customer satisfaction.

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