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Analysis of the quality local raw-material fish feed products through quality raw-materials, costs and production process

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ABSTRACT

The examination in Tegal, problem experienced by shrimp farmers is the high cost of fish and shrimp feed which has an impact on reducing the income of shrimp farmers. To solve this problem, namely using alternative fish food made from raw material, low cost and producing autonomous. This type of examination is qualitative and quantitative research, with sample of 30 respondents. An Observable variable model and an Inter-variable model were used in the model evaluation process for the primary data. Testing with PLS software was used to do hypothesis testing. The pathfactors output or image output serves as the foundation for directly evaluating the hypothesis. The PLS bootstrapping analysis of the Raw Material Quality element on Product Quality yielded t-calculations of 3.625>1.960 and a factor value of 0,486 <0,05. Thus, it can be concluded that the hypothesis "Raw Material Quality has Positive and Important Effect on Product Quality" is accepted. The factor value for costs on product Quality is 0,340, the p-value is 0,017<0,05, and the t-calculation is 2.396>1.960, The production process on product Quality has a factor value of 0,200, p-values of 0,031<0,05, and t-calculations of 2.164> 1.960, indicating that the hypothesis that "Costs" have Positive and Important Effect on Product Quality is accepted. The notion that "The Production Process Has a Positive and Important Influence on Product Quality" is thus believed to be true.

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INTRODUCTION

The Tegal area is located along the northern coast of Java which is used for economic activities of the community along the coast, namely fish and shrimp ponds. For years, losses experienced by pond farmers caused by nature are fish harvest failures caused by long droughts because high air temperatures have an impact on fish and shrimp death. Other natural factors are the rainy season and the sudden rise in sea water which has an impact on overflowing pond water so that many fish and shrimp are carried away by the water. Another problem that causes pond farmers to

experience losses is the increasingly high cost of fish and shrimp feed (Sittisom & Srimarut, 2020). The uncertain global situation and inflation that has occurred in raw materials for both imported and local feed (khandan Barani et al., 2019). The soaring price of fish feed has an impact on reducing the income of pond farmers. Production of fish feed made from local raw materials is cheaper because the ingredients are available in Indonesia, especially Tegal city. Pond farmers can produce independently even with traditional equipment to get cheaper alternative feed. Manufactured fish feed is more expensive due to the large amount of imported raw materials and high labor costs.

So that pond farmers must produce independent fish feed made from local raw materials. Making fish feed using raw materials has been widely done by fish farmers as an alternative feed from agri food (Prabakusuma et al., 2023). Local raw materials used to make fish feed product are raw materials that have good nutritional value so that they can meet the nutritional needs of fish (Supriadi, 2023). These raw materials are fish heads, shrimp heads, river crabs, bran and plants such as moringa leaves, papaya leaves, kale and others that contain good vegetable protein for fish (Dorothy et al., 2018). Another plant that can be used for fish feed/pellets is the kenaf plant. Pond farmers can use plant resources for fish farming (Tewari & Kaur, 2022). The use of plants for alternative fish feed must have high nutrition and be easily absorbed such as indigofera zollingeriana plants (Sy et al., 2023). The kenaf plant has great potential for the food and feed industry (Kujoana et al., 2023a).

The American Society states that "Quality is the entirety of a product or service's features and characteristics that bear on its ability to satisfy stated or omplied needs." A number of elements, including raw materials, costs, and the production process, affect the Quality of the product. Quality is the extent wich the performance of a product exceed expectations. To increase fish production by making feed designed using local raw materials, reducing costs and appropriate working capital. For example, fish meal as a source of animal protein can be replaced by vegetable protein which is widely available in the local environment (Sy et al., 2023). The expenses incurred to transform raw resources into completed goods that are prepared for sale are known as production costs (Elghamry, 2023). Production expenses can be broadly classified into three categories: direct labor costs, overhead charges, and raw material costs (Sari Wiyanti & Imam Santoso, 2023). The production method focuses on the product. Product foces means that this type of production operation is designed to process products that have high uniformity and onlly limited difference. (Murdifin Harming & Mahfud Nurnajamudin, 2017) The pelletizing efficiency was obtained using determine the effetiveness of the mechine in producing the pellets (Okolie et al., 2019).

The purpose of this study is (a) to analyze local raw materials on the Quality of fish feed products; (b) to analyze costs on the Quality of fish feed products; (c) to analyze the production process on the Quality of fish feed products. The benefits of this study for researchers are to apply operational management science in the agriculture and fisheries sectors, namely to examine the Quality of fish feed products with local raw materials.

RESEARCH METHOD

Both qualitative and quantitative research are used in this kind of analysis. The qualitative method is a method based on the philosophy of postpositivism, often referred to as the interpretation method because the research data is based on interpretations found in the field. Quantitative methods are called scientific/scientific methods because they fulfill scientific rules, namely concrete, objective, measurable, tational and systematic.

Pond farmers in Tegal were the study's target population. A sample represents a portion of the population's size and makeup. It is believed that a decent sample will be representative of the population or be able to do so. Non-probability sampling and the incidental sampling method,

were the methods used for sampling with sample consisted of thirty responders. (Sugiyono, 2019). After then, the data is processed and examined to generate information (Suliyanto, 2018). The data is then processed and analyzed to produce information. Determination of the sample using the slovin formula, obtained 60 respondents. However, of the 60 questionnaires only 30 questionnaires were distributed.

A evaluation model (Observable variable model) and a structural model (Inter-variable model) are used in the model evaluation process for primary data. The measurement model is used to test several indicators in the form of convergent validity, discriminant validity and reliability. To determine the relationship among components, the structural model, also known as the Inter-variable model, is used. For validity and reliability tests using 30 samples. According to Suliyanto (2018: 202) that if data on variation cannot be obtained, then the way out to determine the sample size is that the sample should not be less than 30. The number 30 in statistics is the limit number between large samples and small samples. Testing the hypothesis comes next, and it involves putting the structural model to the test using PLS software once the model has been evaluated. The path factors output values or the image output serve as the foundation for directly evaluating the hypothesis.

Next, the study's design was put together, as seen in the accompanying image:

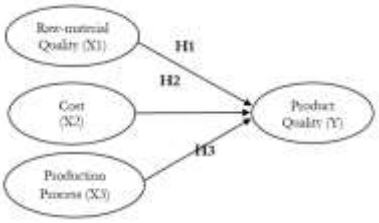

Figure 1. Research Design

Based on the picture above, hypothesis in this study is the quality of raw materials has a positive effect on the quality of local fish feed products, costs have a positive effect on the quality of local fish feed products and the production process has a positive effect on local fish feed.

RESULTS AND DISCUSSIONS

Result

Feed quality is the success of a fish farming business. This will have an impact on fish rearing. The use of local raw materials as alternative feed can increase the quantity of fish yield. The results of this research can be described as follows

Evaluation of Measurement Model (Observable variable model)

Testing for convergent Validity, discriminant validity, and reliability is done in order to evaluate the evaluation model that is used to measure indicators in the component of Raw Material Quality, Cost, and Production Process. additionally, to compute the evaluation model with the use of the PLS Algorithm, an analysis tool.

a. Convergent Validity

The Average Variance Extracted (AVE) value is used to verify convergent validity. An indicator is considered Validity if its loading factor is positive and more than 0,7 and if its AVE value is greater than 0,5 in each construct . From the loading factor value in the form of the weight of each indicator as a measure of each variable. Large loading factors, therefore, are indicative of powerful (dominant) elements. The Result loading factor from the convergent validity test is explanation for why every indicator's factor loading is greater than 0,7 and the AVE Raw Material Quality 0,748; Cost 0,755; Production Process 0,718; and Product Quality 0,790 is greater than 0,5.

So it can be concluded that these indicators are declared valid and can be used as a measure of their latent variables.

b. Discriminant Validity

Discriminant validity testing is used to test the validity of a model, which can be seen through cross loading and the fornell-lacker criteria which show the magnitude of the correlation between constructs and their indicators and indicators with other constructs. The values utilized for cross loading and the Fornell-Lacker criteria are greater than 0,7. Discriminant Validity value is deemed to be good if the AVE root value of each component is higher than the association among components and other components. The table 1 below displays the fornell-lacker:

Table 1. Fornell-Larcker Criterion Value

Variabel	Cost	Raw Material Quality	Product Quality	Production Process
Cost	**0,907**			
Raw Material Quality	0,846	**0,944**		
Product Quality	0,869	0,865	**0,889**	
Production Process	0,777	0,853	0,847	**0,879**

Source: SmartPLS Output Results (v.3.2.9)

Based on the table 1, he value obtained from Fornell-Larcker of each variables is Cost value is 0,907; Raw Material value is 0,944; Quality Product value is 0,889 and Production Process value is 0,879 are greater than 0,7.

And the value obtained from the cross loading of each variable is Cost Value is 0,878; 0,867; 0,900; 0,799; 0,929;0,722; 0,868 and 0,927 of greater than 0,70, Raw Material value is 0,797; 0,783; 0,889; 0,914; 0,901; 0.862; 0,707; 0,840; 0,870; 0,892; 0,915; and 0,900 of greater than 0,70, Product Quality value is 0,873; 0,932; 0,902; 0,861; 0,837; 0,935; 0,897; 0,918 and 0,838 of greater than 0,70, Production Process value is 0,847; 0,727; 0,847; 0,865; 0,911; 0,885; 0,794; 0,819 and 0,915 of greater than 0,70. The meaning that when an item is connected to its own latent element, its value is higher than when it is related to other latent variables. So each variable in this study has correctly explained its latent variable and proven that the discriminant validity of all items is declared valid

c. Reliability

The Cronbach Alpha and Composite Reliability values are used to calculate each element's PLS reliability. According to the test results, the component may be regarded as reliable and consistent because the Cronbach Alpha values and Composite Reliability of the elements related to raw material Quality, cost, production process, and product Quality are all above 0,7. The table below displays the Cronbach Alpha and Composite reliability levels:

Table 2. Reliability Test

Variabel	**Cronbach's Alpha**	**Composite Reliability**
Cost	0,953	0,961
Raw Material Quality	0,969	0,973
Product Quality	0,967	0,971
Production Process	0,950	0,958

Source: SmartPLS Output Results (v.3.2.9)

As can be seen from table 2 above, the elements cost, production process, product quality, and raw material quality all have composite reliability values of research> 0,7 and Cronbach Alpha> 0,7. It can be inferred from this data that all elements have a high degree of reliability because they all meet the composite reliability and Cronbach alpha requirements. in order for

additional analysis to be performed by assessing the Inter-variable model and verifying the goodness of fit model.

Structural Model (Inter-variable model)

The inner model test is carried out after conducting the outer model test. R square of the examination model, as shown in the following image, and important values are used for evaluating the Inter-variable model or structural model to ascertain the relationship among components :

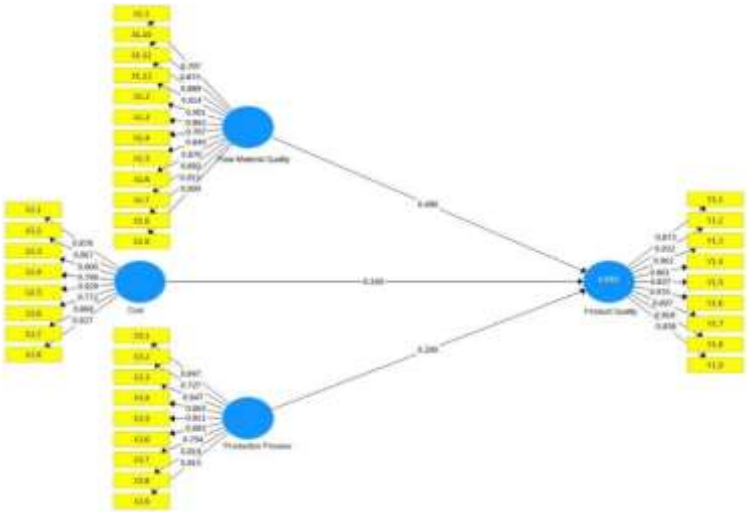

Figure 2. Structural Model
Source: SmartPLS Output Results (v.3.2.9)

The R-square for each reliant latent element in this study is used to evaluate the PLS structural model. Table 2 below shows the estimated R-square discoverys using PLS.

a. R Square

Table 3. R Square Test Results

Variabel	R-*Square*	R-*Square Adjusted*
Quality Product	0,943	0,936

Source: SmartPLS Output Results (v.3.2.9)

According to table 3 above, the Product Quality element's R-Square value is 0,943, which indicates that 94.3% of the variation can be described by the autonomous element, and the remaining 0,057% can be explained by factors not covered in this study.

b. Predictive Relevance (Q Square)

Using the Predictive relevance test, which involves blindfolding the participants to reveal the Q square value, it is possible to assess how well the observation value in this study is generated. It can be declared that the observation value is good if the Q square value is more than zero, and bad if the Q square value is less than zero (S. P. Pranata, 2024). For structural models, Q-Square predictive relevance evaluates how well the model generates the conservation value and forecasts its parameters.

The results of the Predictive Relevance test can be seen in the picture below:

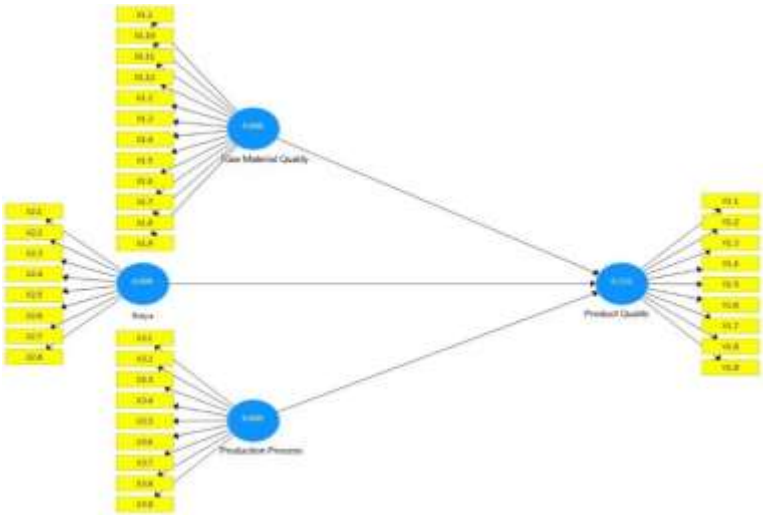

Figure 3. Predictive Relevance
Source: SmartPLS Output Results (v.3.2.9)

Based on the image above, it can be concluded in the table below:

Table 4. Predictive Relevance

Variabel	Q^2 (=1-SSE/SSO)	Keterangan
Product Quality	0,722	Memiliki nilai predictive relevance

Source: SmartPLS Output Results (v.3.2.9)

Table 4 the data above can be obtained the Q square value on the dependent variable> 0, which is 0.722> 0, which means it has a predictive relevance value. From this value, it can be concluded that this study has a good observation value because the Q square value> 0 (zero).

Hypothesis Testing

The process of testing structural models involves the use of PLS software. Examining the structural relationship model seeks to determine the relationships among the study's variables. The output or the values found in the path factors output serve as the foundation for directly evaluating the hypothesis. The direct testing of the hypothesis is based on the determination that there is a important influence of the exogenous element on the endogenous element if the T calculation value is greater than 1.960 and the p value is less than 0,05 (significance level = 5%).

The outcomes of this study's structural model testing can be fully explained in terms of the subsequent hypothesis testing:

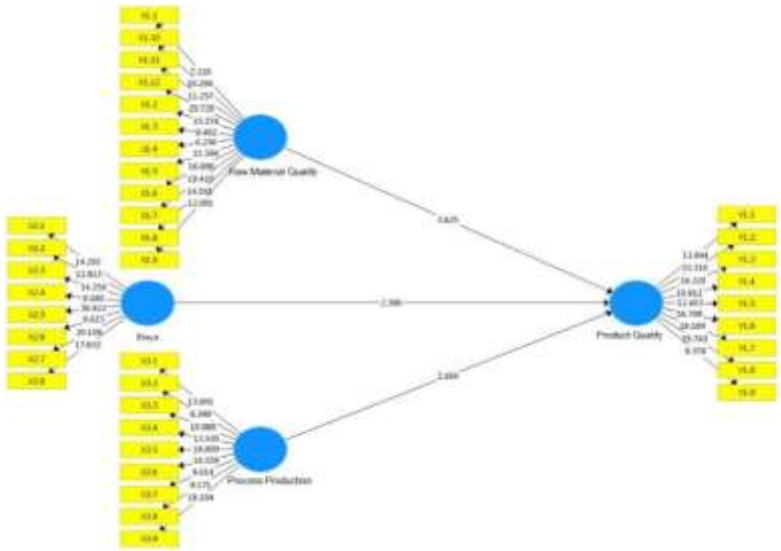

Figure 4. Hypothesis Testing
Source: SmartPLS Output Results (v.3.2.9)

Every proposed relationship in PLS is statistically tested through simulation. Table 7 below shows how the bootstrapping method is applied to the study's samples in this instance:

Table 5. Hypothesis Testing

Variabel	Sampel (O)	T Statistik (| O/STDEV |)	P Values
Cost -> Product Quality	0,340	2.396	0,017
Raw Material Quality -> Product Quality	0,486	3.625	0,000
Production Process -> Quality Product	0,200	2.164	0,031

Source: SmartPLS Output Results (v.3.2.9)

Table 5 above provides an explanation for the PL bootstrapping analysis's discoverys:

a. The Effect of Raw Material Quality on Product Quality.

The Effect of Raw Material Quality on Product Quality was the first hypothesis test. The results indicate a factor value of 0,486, p-values of 0,000 <0,05, and t-calculations of 3.625> 1.960, So the hypothesis that states that "Raw Material Quality Has a Positive and Significant Effect on Product Quality" is accepted.

b. The Effect of Costs on Product Quality.

The Effect of Raw Material Quality on Product Quality was the first hypothesis test. The results indicate a factor value of 0,486, p-values of 0,000 <0,05, and t-calculations of 3.625> 1.960, So the hypothesis that states that "Costs Have a Positive and Significant Influence on Product Quality" is accepted.

c. The Influence of the Production Process on Product Quality.

The third hypothesis—that is, the impact of the production process on product Quality—was tested, and the discoverys indicate a factor value of 0,200, p-values of 0,031 <0,05, and t-calculations of 2.164 > 1.960, . So the hypothesis that states that "The Production Process Has a Positive and Significant Influence on Product Quality" is accepted.

Discussion

a. The Influence of Raw Material Quality on Product Quality.

The first hypothesis—that is, the impact of raw material Quality on product Quality—was tested, and the discoverys indicate that the factor value was 0,486, the p-value was 0,000 < 0,05, and the t-calculation was 3.625 > 1.960, These results indicate that Raw Material Quality Affects Product Quality.

According to the study's discoverys, pond farmers frequently allow their fish to exist on their own without providing adequate nutrition. The reason for this state is that they do not have enough money to feed their fish. Pond farmers' revenue will be negatively impacted by the cost of synthetic fish feed (Suryani et al., 2022). Thus, they make use of the resources and raw materials that are close to the pond. Thus, they use components like fish heads and river crabs (Rasidi, 2022) and shrimp from factories that prepare fish and shrimp, together with other plants like papaya and moringa leaves.

Fish farmers still have challenges while producing feed, particularly in the beginning when it comes to creating feed formulas that would yield high-Quality feed at reasonable pricing. Local ingredients that can be processed into fish feed include shrimp, crabs, and crab waste, which is turned into feed for tiger shrimp feed additives. Chitin, which is proven to be effective in tiger shrimp feed additives, can be substituted for tawes and carp feed ingredients. The ability to provide fish feed with adequate nutrition is what matters most to them (Yi et al., 2023). The use of fish meal, soybean meal, flaxseed, peanut meal as alternative conventional fish feed(And Badia A. Ali, 2022).

b. The Effect of Costs on Product Quality.

The results of the second hypothesis test, namely the Effect of Costs on Product Quality, show a factor value of 0,340, p-values of 0,017 <0,05 and t-calculations of 2.396> 1.960, These results indicate that Costs Affect Product Quality.

The discoverys of this study show that the cost of fish feed is the biggest expense the fish farming business. Making autonomous fish feed using local raw materials is more efficient, but the price is cheaper. The results of the study, the use of local raw materials can save 30% - 50% feed costs depending on the ingredients used such as river crabs, remaining fish heads, remaining shrimp heads, snails, chicken intestines, rice bran, soybean meal, leaves and others. Cost emphasis is not only on the use of raw materials at low prices, but also on the use of labor.

Quality costs must be applied to control the Quality of products produced (Hutapea et al., 2021). Information on feed prices with local or natural raw materials so as to obtain a calculation of the price of feed ingredients to compare and decide whether to make their own feed/pellets or buy manufactured feed/pellets

c. The Effect of the Production Process on Product Quality.

The results of the third hypothesis test, namely the Effect of the Production P(Ziblim et al., 2015)rocess on Product Quality, show a factor value of 0,200, p-values of 0,031 < 0,05 and t-calculations of 2.164> 1.960, These results indicate that the Production Process Affects Product Quality.

The findings of this research are that farmers process raw materials with makeshift equipment, utilizing used goods into fish feed production machines (Salah et al., 2023). The creativity of farmers with simple equipment, producing fish feed with good nutrition and nutrition (Zlaugotne et al., 2022). The weakness of the farmer's production process is that it uses simple technology so that the amount of production is still low and in terms of product performance It still looks bad. new technology is needed for large production with good performance. (Ravishankar & Elavarasan, 2023). This is the constraint of the farmer, not only the performance of the product but also the limitations of the production process. The importance of implementing production management (Blanco-Encomienda et al., 2018), followed by the supply of raw materials in the

production of fish feed/pellets. A fast production process must be balanced with the availability of raw materials so that the machine will work continuously (Salah et al., 2023).

The farmer needs to use pellet machine to mold soft feed for fish and poultry (Baris, 2023). pellet machine technology has different diameters and the pellet machine is operated by an electric motor which can increase production (Rowan, 2023). The pelletizing machine will reduce the moisture of the molded material and is varied by constant temperature control and determines the moisture content of the feed/pellets produced (Okolie et al., 2019) The mechine is suitable for small and medium sca;e fish and poultry farming.

CONCLUSION

The conclusion of this study is that farmers can make good fish feed using local raw materials, so they can reduce feed costs. By using makeshift equipment, they are able to produce alternative fish feed. The benefits of this research are to provide new insights and knowledge about local raw material products used by pond farmers in the Tegal area. This research provides economic benefits for pond farmers in Indonesia, especially pond farmers in Tegal. Farmers can increase profits by reducing the cost of fish feed. Farmers are not worried about the rising price of fish feed because they can produce fish feed independently from local raw materials.

The weakness of this research is that the testing area is still at the local level in Tegal only. Another obstacle experienced by researchers is the delay in laboratory test results to accurately check the nutritional content of feed. In Tegal, there is no laboratory available to test the nutritional content of fish feed, so the laboratory test of fish feed must go to a state university. This obstacle is also felt by pond farmers, so they look for information about the nutrition of raw materials used to make fish feed from google/website or youtube. From the experience during fish farming, the farmers then make the right composition for fish feed with local raw materials.. Future research is expected to continue this research by adding product innovation variables with the use of local plant raw materials and floating fish feed molding technology available in Indonesia, and carried out in a wider area.

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