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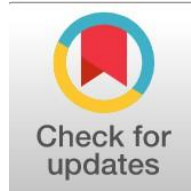
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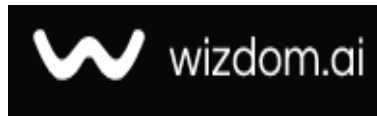
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The Effect Of Product Quality And Service Quality On Customer Satisfaction Of Smoked Tilapia In Penatarsewu Village

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Abstract

Product consistency remains an essential determinant in sustaining consumer trust within traditional food processing micro-enterprises. **General Background** Small and medium enterprises relying on traditional processing methods often encounter operational challenges regarding finished product uniformity. **Specific Background** Smoked tilapia production in Penatarsewu Village utilizes manual coconut-shell combustion, generating variations in product maturity, color, and hygiene that directly affect buyer perceptions. **Knowledge Gap** Empirical evaluations evaluating how product attributes and service delivery simultaneously direct customer satisfaction in localized smoked fish processing remain limited. **Aims** This investigation evaluates the direct effects of product quality and service quality on customer satisfaction among consumers of smoked tilapia in Penatarsewu Village. **Results** Multiple linear regression analysis of questionnaire data from 60 respondents established that product quality ($t = 3.835$, $p < 0.05$) and service quality ($t = 3.230$, $p < 0.05$) demonstrate positive, significant contributions to customer satisfaction, with a combined determination coefficient (R^2) of 0.794. **Novelty** This empirical framework provides quantified regression metrics specific to traditional smoked fisheries, identifying priceconformance, product durability, and responsiveness as dominant drivers. **Implications** Processing actors can utilize these findings to modernize smoking technology, stabilize product attributes, and structure responsive delivery protocols to strengthen long-term customer retention.

Key Findings Highlights

Product quality significantly increases customer satisfaction with a partial regression coefficient of 0.630 ($t = 3.835$).

Service quality demonstrates a positive significant effect on customer satisfaction with a coefficient of 0.330 ($t = 3.230$).

Combined product and service quality variables account for 79.4% of the variance in customer satisfaction levels.

Keywords : Product Quality, Service Quality, Linear Regression, Smoked Tilapia, Customer Satisfaction

Introduction

Sidoarjo is famous for its shrimp and milkfish. Both are often processed by smoking. But in addition to milkfish and shrimp, pond farmers in Sidoarjo, especially in Penatarsewu village, Tanggulangin sub-district, also produce an abundance of tilapia. Many of the mujair fish from these ponds are processed into smoked mujair. Most of the people in this village do smoked tilapia business. The processed fish is obtained from the ponds owned by the local community [1]. Smoking in smoked tilapia MSMEs usually starts at 06.00 WIB until 13.00 WIB. Before the mujar fish is processed into the smoking process, the fish is cleaned and then washed thoroughly with running water [2].

One of the smoked tilapia MSME entrepreneurs in Penatarsewu Village is Mrs Painah. In a day, Mrs Painah takes about 5 hours to process 80 kg - 1 quintal of fresh tilapia into smoked tilapia. However, during this time, the fish smoking carried out by Mrs Painah is still with manual smoking techniques, namely still using charcoal from coconut shells which results in the length of the production process. This traditional smoking technique is considered less hygienic in the process and the results that will be obtained are uneven, both in terms of size and level of maturity [2]. With this, the quality of smoked tilapia produced becomes inconsistent and can affect buyer satisfaction. Therefore, business actors must improve the quality of the products produced to maintain consumer trust and satisfaction. Establishing a good relationship with customers is also important for business actors to do so that they are better known and services can be considered good, so that they are in accordance with what consumers expect [3].

Research on the effect of product quality and service is Maramis used multiple linear regression analysis methods to identify the effects of product quality, price, and service on customer satisfaction of PT Air Manado [4]. Yonata used descriptive methods to analyse research on the effect of service quality and customer satisfaction on customer loyalty of PT Satria Antaran Prima [5]. Mentang used multiple linear regression analysis methods to see the effect of product quality and service on customer satisfaction at Marina Hash restaurant in Manado during the COVID-19 pandemic.

In the SMEs of Smoked Mujair in Penatarsewu Village, Tanggulangin itself, there has been no research that discusses the effect of quality and service on customer satisfaction. Therefore, this research can help MSMEs to improve product quality and consumer loyalty. So that the research objectives: (1) Knowing the indicators that affect the quality of products and service quality on the satisfaction of buyers of smoked tilapia MSME products. (2) Provide suggestions for improving quality in smoked tilapia MSMEs.

The multiple linear regression method is a method for analysing the relationship of two or more variables that have cause and effect between each other. This method is used to study statistical relationship patterns between two or more variables [6]. In conducting multiple regression analysis, there are several types of tests that need to be done, namely : (1). The classical assumption test which aims to determine the variables as well as the dependent variable is stated to have a normal distribution or not. The classical assumption test is a statistical requirement that must be carried out when performing multiple linear regression analysis on an Ordinary Leas Square (OLS) basis [7]. This classic assumption test is divided into normality test, multicollinearity test, heteroscedasticity test, and autocorrelation test [8]. (2). After that, hypothes testing is a method to draw a conclusion that will determine the acceptance or rejection of the hypothesis [9]. This hypothesis test consists of simultaneous (f-test) and significant tests (t-test). The F test is a test conducted to determine the effect of the relationship between the independent variable and the dependent variable. Meanwhile, the T test is a test conducted to determine whether there is an effect of independent variables in a significant regression model on the dependent variable [10].

Methods

The research method contains approaches and techniques used in the data collection process, and a description of the methods used in data processing and analysis to support problem solving. The research was conducted in Penatarsewu Village, Tanggulangin Subdistrict, Sidoarjo.

There are two types of data that will be used during the research, namely: (a). Secondary data, the secondary data used is a number of variable data obtained from the literature. The variables and indicators used in this study are shown in table 1 which can be obtained from literature sources.

Table 1. Research Variables

Variable	Indicator	Definition	Source
Product Quality (X1)	Conformance (X1.1)	Conformity between the price of the product and the quality of the product obtained	[9]
	Product Dimensions (X1.2)	-Product weight diversity -Product size diversity	
Service Quality (X2)	Durability (X1.3)	Product shelf life	[10]
	Delivery time (X2.1)	Timeliness of product delivery	[1]
	Service Quality (X2.2)	Speed in responding to consumers	
	Consistency (X2.3)	Consistency of product delivery to consumers	[9]
	Discount (X2.4)	Discounts given to regular customers	[2]
Customer Satisfaction (Y)	Responsiveness (X2.5)	Responsiveness in fulfilling consumer requests	[1]
	Expectation match (Y1)	Taste and quality in accordance with consumer expectations	[9]

Repurchase intention (Y2)	Repurchase the product	[10]
Willingness to recommend (Y3)	Willing to recommend products to others.	
Loyalty (Y4)	Willingness of consumers to buy products consistently	
		[13]

(b). Primary data, primary data obtained from distributing questionnaires to respondents who are smoked tilapia consumers in the Tanggulangin area. In determining the number of representative samples, it depends on the number of indicators multiplied by 5 to 10 [14]. The following is the formula for determining the sample used:

$$n = (5 - 10) \times \sum \text{Indicators}$$

Sumber: [15]

To reach the minimum limit of respondents, the variables studied were multiplied by 5. In this study, the total number of samples taken was :

$$n = 5 \times 12 \text{ indicator}$$

$$n = 60 \text{ sample}$$

The research steps taken are: (1). Literature study, carried out by examining various literatures that have relevance to the problems to be solved. Furthermore, direct observation to MSMEs. Primary data collection in the form of observation to observe the production process and identify factors that affect the quality of smoked tilapia produced. Data collection also requires interviews to gather information from resource persons. The resource persons consisted of business owners and workers. (2). The results of observations and interviews are used for consideration of problem formulation. (3). The preparation of a questionnaire is carried out with a 1-5 likert scale to get an assessment of customer satisfaction [16]. Respondents of this questionnaire are smoked tilapia consumers. (4). The validity test is carried out to test the validity, if the data is invalid, it is necessary to prepare the questionnaire again. A data can be said to be valid if r_{count} is positive and $r_{\text{count}} > r_{\text{table}}$ [4]. The following is the validity test formula [17] :

$$r_{XY} = \frac{\sum XY - \frac{(\sum X)(\sum Y)}{N}}{\sqrt{\left[\sum X^2 - \frac{(\sum X)^2}{N}\right] \left[\sum Y^2 - \frac{(\sum Y)^2}{N}\right]}}$$

(5). Reliability test is carried out to determine the size of the consistency of the data to be measured. This reliability test is carried out using the Cronbach's Alpha test with the help of IBM SPSS Statistic 22 software whose value will be compared with the minimum acceptable reliability coefficient value. If the Cronbach's Alpha value is > 0.60 , then the data is said to be reliable [4].

$$r_1 = \frac{\sum X_{1i}X_{1i} - \frac{(\sum X_{1i})^2}{N}}{\sqrt{\left[\sum X_{1i}^2 - \frac{(\sum X_{1i})^2}{N}\right] \left[\sum X_{1i}^2 - \frac{(\sum X_{1i})^2}{N}\right]}} \dots [17]$$

(6). Data processing uses multiple linear regression analysis methods which aim to determine the relationship between product quality and customer satisfaction. There are two stages of multiple linear regression test, namely classical assumption test and hypothesis testing. The following hypothesis is obtained:

H1: There is a significant influence between product quality on customer satisfaction.

H2 : There is a significant influence between service quality and customer satisfaction.

(7). Discussion and conclusions are drawn after solving the problem with the multiple linear regression analysis method. At this stage contains the final results of the research and suggestions that are expected as a consideration for further research.

Results

The first stage carried out is the validity test of the questionnaire data that has been obtained. Because the data can be said to be valid if the r_{count} value is positive and $r_{\text{count}} > r_{\text{table}}$ [4]. Factor analysis is used to correlate the number of factors with the measured value where 5% (0.05) and the degree of freedom is $df = n-2$ ($60-2 = 58$) so that the r_{table} value obtained is 0.2542 which has provisions like this: (a). The data is said to be invalid if the r_{count} value shows a value smaller or lower than 0.2542, it can be said that the data is invalid. (b). The data is said to be valid if the r_{count} value shows the minimum value of 0.2542, if more than that, the data is said to be valid.

Table 2. Validity Test		
Variable	Indicator	R _{Count}
Product Quality	Conformance (X1.1)	1,000
	Product Dimensions (X1.2)	0,480
	Durability (X1.3)	0,655
Service Quality	Delivery time (X2.1)	0,295
	Service Quality (X2.2)	0,469
	Consistency (X2.3)	0,599
	Discount (X2.4)	0,450
Customer Satisfaction	Responsiveness (X2.5)	0,537
	Expectation match (Y1)	0,523
	Repurchase intention (Y2)	0,444
	Willingness to recommend (Y3)	0,485
	Loyalty (Y4)	0,524

Based on table 2, it can be concluded that all items have a corrected item - total correlation value above 0.2542. It can be said that all statement items on each research variable are valid.

The second stage is Reliability Test. The reliability test is carried out with the Cronbach's Alpha test which will be compared to the minimum acceptable reliability coefficient value [4]. If the Cronbach's Alpha value is > 0.60 , then the variables in the study are said to be reliable [4].

Table 3. Reliability Test Results	
Reliability Statistics	
Cronbach's Alpha	N of Items
,771	13

Based on table 3, it can be seen that the Cronbach's alpha value obtained by the variable is $0.771 > 0.60$. Thus, all research variables are said to be reliable or consistent and can be used for further testing.

The third stage is the Normality Test. This normality test is used to see whether the data under study is normally distributed or not. If this is not done, then statistical tests on small samples are said to be invalid again. The stages of the normality test are as follows:

A. Classical Assumption Test

The Classical Assumption Test aims to perform a normality test with significance using the One Sample Kolmogorov Smirnov method, with the following conditions: (a). If the sig value shows a value < 0.05 , it is concluded that the data circulating is abnormal data [4]. (b). If the sig value shows a value > 0.05 then the circulating data or distributed data is normal data [4].

Table 4. Classical Assumption Test Results
One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual	
N			60
Normal Parameters ^a	Mean	.0000000	
	Std. Deviation		1.75825079
Most Extreme Differences	Absolute	.100	
	Positive	.100	
	Negative		-.088
Kolmogorov-Smirnov Z		.771	
Asymp. Sig. (2-tailed)		.591	

a. Test distribution is Normal.

Table 4 shows the significant value of the Kolmogorov Smirnov test is 0.591 with a value of more than 0.05, which indicates that the data is normally distributed.

B. Linearity test

Linearity is tested with linear regression or Pearson correlation analysis. The variable relationship is said to be significant or there is a linear relationship between the variables tested. If the significance level in the linearity test shows 0.05 or less than 0.05 [4].

Table 5. Linearity Test Results
ANOVA Table

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Customer_satisfaction * Service_quality	Between Groups	(Combined)	321.749	11	29.250	8.179	.000
		Linearity	263.943	1	263.943	73.808	.000
		Deviation from Linearity	57.806	10	5.781	1.616	.131
	Within Groups		171.651	48	3.576		
	Total		493.400	59			

Based on table 5, it can be seen that the significance of all variables is < 0.05 , which means that there is a linear relationship between the independent variable and the dependent variable.

C. Autocorrelation Test

This autocorrelation test is used to determine whether or not there is autocorrelation. A good regression model should not have autocorrelation. In this study, the autocorrelation test used is using the Durbin Watson Test method with the following conditions [4]: (a). If the DU value $< DW$, and $DW < 4-DU$, then H_0 is accepted, meaning that there is no autocorrelation in this study. (b). If $DW < DL$ or $DW > 4-DL$, then H_0 is rejected, meaning there is autocorrelation in this study. (c). $DL < DW$ and $DW > DU$, or $4-DU < DW$ and $DW < 4-DL$, then there is no definite conclusion from this study.

Table 6. Autocorrelation Test Results
Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.749 ^a	.561	.546	1.949	1.990

a. Predictors: (Constant), Service_quality, Product Quality

b. Dependent Variable: Customer_satisfaction

In this study, the respondents taken were 60 or $N = 60$ with the number of independent variables 2 or $K = 2$, so that $dL = 1.5144$ and $dU = 1.6518$ were obtained. Then $dU < d < 4-dU$. From the picture above, the DW (Durbin-Watson) value is 1.990. With the basis for decision making: ($dL < dW < 4-dU = 1.5144 < 1.990 < 2.3482$), then there is no autocorrelation in the multiple regression used.

D. Multicollinearity Test

The multicollinearity test is carried out with the aim of seeing whether there is a correlation between the independent variables in a regression model. A good regression model requires that there is no correlation between the independent variables. This test checks the level and tolerance of VIF (Variance Inflation Factor). Tolerance measures a selected independent variable that is not explained by other independent variables. If tolerance > 0.1 or VIF value < 10 then there is no multicollinearity between independent variables and vice versa [4].

Table 7. Multicollinearity Test

Coefficients ^a								
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
Model		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	,286	1,874		,153	,879		
	Product_Quality	,666	,190	,411	3,506	,001	,559	1,788
	Service_quality	,383	,109	,410	3,496	,001	,559	1,788

a. Dependent Variable: Customer_satisfaction

Table 7 explains that if the variance inflation factor (VIF) value for the product quality variable is 1.788 for < 10 , for the service quality variable it is $1.788 < 10$, we can conclude that the value of all independent variables is less than 10. The same also applies if all tolerance values are $>$ from 0.10. There is no multicollinearity in the regression model of this study.

E. Heteroscedasticity Test

The heteroscedasticity test is used to determine whether there is a difference in variance between the residuals from one observation and the

residuals from other observations in the regression model. A good and correct regression model is one that is free from heteroscedasticity. Heteroscedasticity occurs if there is no regular, unclear pattern, and the points are scattered above and below the number 0 on Y [4].

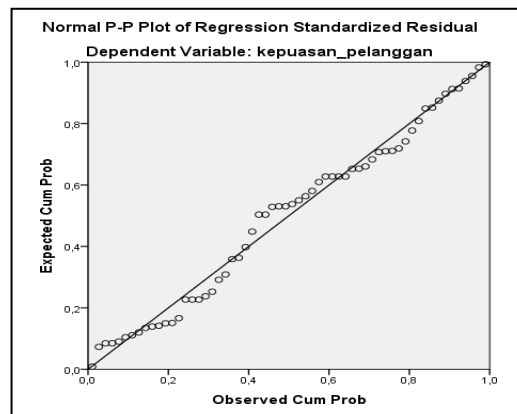


Fig. 1. Normal P-Plot of Standarized Residuals

Based on the results of the Normal P-Plot Of Standarized Residual Figure 1, it is known that the points spread around the diagonal line and the distribution is close or almost close to the diagonal line. This indicates that the data is normal distributed and fulfils the normality test. Figure 2 shows that the residual plots spread irregularly (randomly) and do not form a certain pattern. So there is no heteroscedasticity.

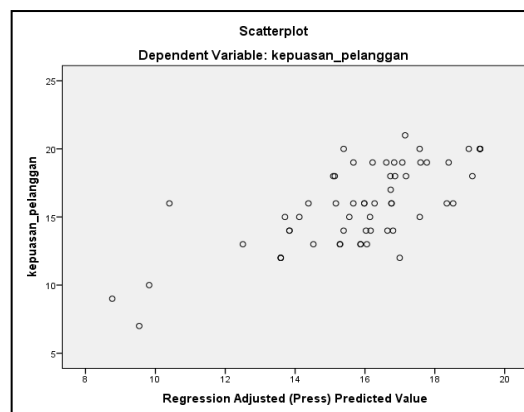


Fig. 2. Scatterplot

F. Multiple Linear Regression Analysis

Regression analysis is a test to measure the effect of the independent variable on the dependent variable. Data processing was carried out using the IBM SPSS Statistic 22 programme. Table 9 is the result of multiple linear regression analysis.

Table 8 Correlation Output

Correlations					
		Customer_satisfaction	Product_quality	Service_quality	
Pearson Correlation	Customer_satisfaction	1,000	,687	,673	
	Product_quality	,687	1,000	,660	
	Service_quality	,673	,660	1,000	
Sig. (1-tailed)	Customer_satisfaction	.	,000	,000	
	Product_quality	,000	.	,000	
	Service_quality	,000	,000	.	
N	Customer_satisfaction	60	60	60	
	Product_quality	60	60	60	
	Service_quality	60	60	60	

From Table 8, it is obtained that the analysis of the relationship or correlation between customer satisfaction and product quality has a value of 0.687, the relationship between the customer satisfaction variable and service quality has a value of 0.673, and the relationship between the product quality variable and service quality has a value of 0.660 with a correlation level of 1.000, which means that there is a strong correlation between the variables. While the significant value obtained is 0.000, which means it is smaller than the alpha value of 0.05 ($\text{sig} < \alpha$). So that the three variables do not have a relationship.

Table 9. Multiple Linear Regression Analysis Test Results

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,916	1,459		1,313	,195
	Product_quality	,630	,164	,461	3,835	,000
	Service_quality	,330	,102	,389	3,230	,002

a. Dependent Variable: Customer_satisfaction

The formula for multiple linear regression is [9]:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + e$$

The regression equation shows a constant value of 1.916. This shows that when the value of product quality and service is 0, the purchasing decision is 1.916. The regression coefficient of the product quality variable (X_1) is 0.630. This means that when product quality increases by 1 unit, customer satisfaction (Y) increases by 0.630. The coefficient value between product quality and customer satisfaction is positive, the higher the service quality, the higher the customer satisfaction. The regression coefficient of the service quality variable (X_2) is 0.330. So when service quality increases by 1 unit, customer satisfaction (Y) increases by 0.330. The coefficient value between service quality and customer satisfaction is positive, the higher the quality of service provided, the higher the customer satisfaction.

G. T-test

This test is conducted to determine how much influence the independent variable has on the dependent variable. To conduct a partial hypothesis test, you can compare the calculated t value with the t table. If the calculated t value is greater than the t table, then there is a strong reason to accept the first hypothesis (H_1) and reject the null hypothesis (H_0), and vice versa if the calculated t value is lower than the t table [4]. Significance tests can also be used. explain the t test criteria, which include: (a). If $\text{sig.} > 0.05$ or $t \text{ count} < t \text{ table}$ then the variable has a significant effect if tested partially. (b). If $\text{sig} < 0.05$ or $t \text{ count} > t \text{ table}$ then the variable does not have a significant effect if a partial test is carried out.

Table 10 T Test Results (Partial Test)
Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	1,916	1,459			1,313	,195
	Product_quality	,630	,164	,461		3,835	,000
	Service_quality	,330	,102	,389		3,230	,002

a. Dependent Variable: Customer_satisfaction

Table 10 is the result of the t -test where the alpha value is 5% (0.05) and the degree of freedom value is $k = 2$ and $df_2 = n - k - 1 = 60 - 2 - 1 = 57$, then the t_{table} is 1.672 and it can be concluded that: (a). The effect of product quality on customer satisfaction, based on the results of the t test, obtained a t_{count} of 3.835 and a sig value. $0.00 < 0.05$, which means that t_{count} is greater than t_{table} , so product quality has a positive and significant effect on customer satisfaction. (b). The effect of service quality on customer satisfaction, based on the results of the t test, obtained a t_{count} of 3.230 and a sig value. $0.002 < 0.05$, which means that the t_{count} is greater than the t_{table} , so service quality has a positive and significant effect on customer satisfaction.

H. Multiple Determination Coefficient Test (R^2)

The R square test aims to measure the ability of the regression model to explain the effect of the dependent variable due to the independent variable. Table 11 is a table of the R square test results.

Table 11. R Square Test Results

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,794 ^a	,630	,617	1,789

a. Predictors: (Constant), Product_quality, Service_quality

b. Dependent Variable: Customer_satisfaction

The R value is 0.794 or 79.4%. Which means that the ups and downs of customer satisfaction variables are affected by product quality and service quality by 79.4%, while the rest is affected by other variables outside the study.

Discussion

Product quality on customer satisfaction.

Based on the results of the analysis, it can be proven that product quality has an effect on customer satisfaction. This shows that the quality of smoked tilapia products sold by Mrs Painah's smoked tilapia MSMEs is of good quality at the right price so that customers feel satisfied. The quality of smoked tilapia products on customer satisfaction is caused by several things such as the price match with the product obtained, a long enough shelf life and the level of maturity and taste of smoked tilapia. It can be concluded that the better the quality of a product, the higher the level of customer satisfaction. To be able to maintain the level of customer satisfaction, umkm must innovate and develop product quality by maintaining and improving the quality of smoked tilapia.

Service quality on customer satisfaction.

Based on the results of the analysis conducted, it is proven that service quality affects customer satisfaction. This shows that umkm mujair asap Ibu Painah is always consistent in providing services to her customers. The readiness to respond to consumer requests and the consistency of product delivery provided make consumers feel comfortable and satisfied with the services provided.

Conclusion

It can be concluded that in the first hypothesis, product quality has a significant influence on customer satisfaction of umkm mujair asap Mrs Painah. This means that product quality can affect customer satisfaction. In the second hypothesis, service quality has a significant effect on customer satisfaction of umkm mujair asap ibu Painah, which means that the services provided can affect customer satisfaction. There are several limitations in the research conducted, namely that the number of respondents is not large and the survey population is only from one MSME, so that the data analysed cannot be generalised. Therefore, further research can increase the number of samples and expand the scope of research objects. The variety of variables used in the model in determining the factors that influence customer satisfaction is also still very limited. It is hoped that further research will add more factors or variables related to product and service quality.

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