



Mathematical Modeling of the Reinforcing the Profitability of Traditional Markets

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Abstract

This study aims to develop a mathematical model to analyze the impact of the revitalization program at Koga Market, Bandar Lampung, on traders' profits by examining the influence of sales volume, marketing costs, staple-goods prices, and infrastructure costs. Using a quantitative survey approach involving 50 randomly selected traders, data were collected through questionnaires, interviews, and documentation, and analyzed using descriptive statistics, classical assumption tests, and multiple linear regression. The results show that staple-goods prices and infrastructure costs have a strong and significant positive effect on traders' profits, marketing costs also contribute positively, while sales volume shows a negative but insignificant effect. All classical assumptions were met, indicating that the regression model is valid for explaining the profit determinants. The findings confirm that market revitalization has generated measurable economic benefits through improved infrastructure and stable commodity prices, suggesting the need for continued infrastructure enhancement and strengthened marketing strategies to further support traders' economic sustainability.

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INTRODUCTION

Koga Market is a traditional market located in the center of Bandar Lampung City (Nandavita et al., 2025). Situated in a strategic location, the market is managed by Korem 043/Garuda Hitam and offers a variety of daily necessities, ranging from staple foods and accessories to fresh fruits and vegetables. The income of sellers at Koga Market is relatively stable. The long-term impact of the coronavirus has not yet fully recovered due to low inflation and low income. However, due to preparations for Eid al-Fitr, the profits of all sellers

increase in certain months, namely April and June.

Markets play a strategic role because they are closely linked to Regional Own-Source Revenue (PAD) (Inggawati et al., 2013). They support the regional economy, so the existence of traditional markets must receive more attention from local governments (Pratiwi & Kartika, 2019). According to Basu Swastha in the book *Consumer Psychology*, markets consist of people who have desires to be satisfied, money to spend, and the willingness to spend it. A market is a place where supply and demand meet, where

sellers and buyers interact in the process of exchanging economic value (Effendi, 2016), either regularly or irregularly. Through these activities, the market serves as an important space that supports the dynamics of trade and the fulfillment of community needs.

One of the approaches frequently used to address economic challenges and enhance community activities is revitalization (Aziezy et al., 2024), which refers to the process or effort of restoring and reinvigorating something that had previously been neglected. In other words, revival means making something or an action important, but the word "vital" itself means "very important" or "very necessary" for life. According to Shri Eddy Swasono, regeneration is the process of revitalizing dilapidated urban areas, including their socio-cultural and economic life, through physical and non-physical interventions to overcome new challenges (Wicaksana, 2016). This concept emphasizes the importance of renewing the functions and vitality of an area so that it can become productive and competitive once again.

This market revitalization program was carried out in 2013 according to a source, namely Mr. Ryan Baladewa, head of the Korem 043/Garuda Hitam cooperative. On January 13, 2021, a request was submitted for approval to extend the use of BMN assets in the form of leases and state-owned property at Korem 043/Garuda Hitam, consisting of a portion of land and buildings located on Jl. Teuku Umar, Kel. Sidodadi, Kec. Kedaton, Bandar Lampung City, with a proportional acquisition value of IDR 10,850,615,202.00 (ten billion eight hundred fifty million six hundred fifteen thousand two hundred two rupiah), as stated in the attached letter.

Along with the growing needs of the community, the development of businesses selling essential goods has also continued to increase. This can be seen

from the rising number of entrepreneurs involved in the sale of basic necessities, indicating that high demand is driving expansion and diversification within this sector. The first step in marketing any basic goods in the market is to understand the business profile of the basic goods themselves. A profile can be understood as a framework that describes the condition of a person or an entity from various perspectives. Through the development of a profile, the characteristics or conditions being analyzed can be observed more clearly and comprehensively.

In the context of markets, one of the aspects frequently profiled is essential goods, which are primary necessities sold to consumers through direct sales systems. The direct sales system is a product and service promotion strategy that aims to influence consumer behavior. In direct sales, the emphasis is on decision-making based on rationality and the added value provided by the product. Invoices can be viewed after the sale is complete, which led researchers to investigate the income of market traders in Koga Market, Bandar Lampung.

Issues related to the process of maximizing profits from the sale of staple goods at Koga Market in Bandar Lampung are the best solution in sales. Therefore. This study aims to develop a mathematical model to measure the impact of revitalization on the profits of traders at Koga Market, Bandar Lampung.

RESEARCH METHODS

This study was conducted in February 2025 at Koga Market, Bandar Lampung. A quantitative approach with a survey method was used, in which data were collected through questionnaires, interviews, and documentation, and then analyzed using multiple linear regression. This quantitative approach is based on post-positivist philosophy (Clark, 1998), which emphasizes testing theories through empirical data. The study

involved four independent variables, namely sales volume (X1), marketing costs (X2), staple food prices (X3), and infrastructure costs (X4), while the dependent variable was the sellers' profit (Y).

The research population consisted of all 50 staple food sellers in Koga Market. The sample was selected using probability sampling with a simple random sampling technique. Based on the Slovin formula with a 5 percent error tolerance, the total sample obtained was 50 respondents. Data were collected through documentation such as archives and photographs, interviews with traders to gain deeper insights, and a structured questionnaire that used a four-point Likert scale developed from previous research instruments. The questionnaire was adapted from the work of Suciyawati (2021) and had been tested for validity using the Pearson Product Moment correlation and for reliability using the Cronbach Alpha method.

Before conducting the regression analysis, there are some prerequisite tests (Suri et al., 2024). These included a normality test using the Kolmogorov-Smirnov method, a linearity test, a heteroscedasticity test using Spearman correlation, a multicollinearity test using Tolerance and VIF values, and an autocorrelation test using the Durbin-Watson method. Data analysis consisted of simple linear regression to examine the effect of each independent variable on sellers' profit and multiple linear regression to determine the simultaneous effect of all independent variables.

RESULTS AND DISCUSSION

Descriptive Statistics Results

This study focuses on data on the revitalization of traditional markets (Koga Market). The data used is sourced directly from individual sellers at Koga Market.

Table 1. Descriptive Statistics Results

No.	Variable	N	Min	Max	Mean	Std. Dev
1.	Y	50	70	200	43.4	40.2
2.	X ₁	50	13	700	190.6	164.7
3.	X ₂	50	10	150	42.6	30.6
4.	X ₃	50	40	130	26.72	25.99
5.	X ₄	50	20	150	44.5	21.6

Based on Table 1, the minimum and maximum values for each variable show different data ranges. Variable X₁ has the widest range, from 13 to 700, indicating a much higher level of variation compared to the other variables. The mean values reflect the general tendency of each variable. X₁ has the highest mean of 190.6, while X₃ has the lowest mean of 26.72. Variable Y, as the dependent variable, has an average value of 43.4 with a range from 70 to 200. The standard deviation of each variable also provides information about the degree of data dispersion. X₁ has the largest standard deviation (164.7), indicating high variability, while X₄ has the

smallest standard deviation (21.6), suggesting the most stable data distribution.

Interview Results

Based on the interviews conducted with several vendors regarding sales profits in the market, the following insights were obtained:

Market Sales Profit (Y)

Based on interviews conducted with several traders regarding market sales profit, it was found that their earnings vary widely, with weather being a highly influential factor. When the weather is

sunny, traders tend to purchase more goods to sell, resulting in higher income compared to previous days. Conversely, unfavorable weather can be a threat to traders (Rahman et al., 2023).

Sales Volume (X_1)

In interviews related to sales volume, field data indicated that sales volume is a crucial factor in increasing market profits. This aligns with Hafizh et al. (2025) statement that sales volume is the most dominant factor in determining market profits. Factors such as good product quality and proper customer service also contribute to higher buying and selling activities.

Marketing Costs (X_2)

Regarding marketing costs, interviews with traders revealed that these expenses differ from one store to another. Some traders utilize social media (Kembang & Kalbuadi, 2024), others rely on word-of-mouth promotion (Al Machfudz & Indayani, 2025), and some use banners placed in front of their shops.

Prices of Staple Goods (X_3)

From interviews about the prices of staple goods, it was found that prices tend to be relatively stable and fall within a standard range, with pricing determined based on the desired profit margin.

Facilities and Infrastructure (X_4)

Based on interviews about market facilities and infrastructure, it is known that the facilities at Koga Market are adequate. Each trader has basic equipment such as scales, stalls, or shop units for selling. Supporting infrastructure, including access roads, public restrooms, parking areas, and a prayer room, is also available and functioning well.

Classical Assumption Test

In multiple linear regression analysis, the assumption must be met,

namely the classical assumptions. The following are the results of the classical assumption test for the multiple linear regression model.

Normality Tests

The normality test is an assumption that must be met when conducting research. The normality test is used to see whether the data is normally distributed or not. In this study, the normality test used is the Shapiro Wilk Test.

Table 2. Normality Test Results

<i>W</i>	<i>p – value</i>
0.827	0.161

Based on Table 2 the *p – value* is greater than α , namely $0.161 > \alpha$. This indicates that there is no basis to reject the null hypothesis (H_0), meaning the residuals are normally distributed. Therefore, it can be concluded that the assumption of normality has been satisfied.

Linearity Test

The linearity test in study used the Reset Test. The following are the results of the linearity test.

Table 3. Linearity Test Results

<i>Reset</i>	<i>p – value</i>
4.951	0.791

Based on Table 3, the results of the linearity test using the RESET Test show that the *p – value* is greater than α , namely $0.791 > 0.05$. This indicates that there is no evidence to reject the assumption of linearity. Therefore, the relationship between the independent variables and the dependent variable can be considered linear.

Homoscedasticity Test

The following are the results of the homoscedasticity test using the Breusch Pagan (BP) Test.

Table 4. Homoscedasticity Test Results

BP Value	df	p – value
7.600	4	1.900

Table 4 shows that the p-value is greater than α , namely $1.900 > \alpha$. Based on the decision rule of the Breusch–Pagan Test, this means there is no basis to reject the null hypothesis. Therefore, the regression model does not exhibit heteroscedasticity, indicating that the assumption of homoscedasticity is fulfilled.

Autocorrelation Test

The following are the results of the homoscedasticity test using the Breusch Pagan (BP) Test.

Table 5. Autocorrelation Test Results

DW	p – value
1.964	0.961

Based on Table 5, the Durbin–Watson value is 1.964. In addition, the p-value is greater than 0.05, indicating that there is no autocorrelation present in the model.

Multicollinearity Test

The multicollinearity test is used to determine whether there is a correlation among the independent variables in the study. The following table presents the results of the multicollinearity test for the independent variables:

Table 6. Multicollinearity Test Results

Variable	VIF Value
X ₁	1,019
X ₂	1,076
X ₃	1,214
X ₄	1,222

Based on Table 6, the results of the multicollinearity test indicate that there are no signs of multicollinearity among the variables. Therefore, it can be concluded that the regression model is free from multicollinearity and is appropriate for further multiple regression analysis.

Correlation Between Variables

Correlation analysis aims to determine the degree of linear relationship between two variables. The following are the coefficients between variables:

Table 7. Correlation Between Variables Results

	Y
X ₁	-0.058
X ₂	0,266
X ₃	0,965
X ₄	0,528

Based on Table 7, only variables X₃ and X₄ demonstrate a significant correlation with the dependent variable. From the independent variables, namely sales volume (X₁), marketing costs (X₂), staple food prices (X₃), and infrastructure costs (X₄), only staple food prices and infrastructure costs show a very strong relationship with sellers' profit (Y). This indicates that variations in sellers' profit are largely influenced by these two variables.

In contrast, sales volume (X₁) and marketing costs (X₂) do not exhibit a significant relationship with sellers' profit, as reflected by their weak correlation coefficients. Several factors may account for this outcome. First, the limited variability in sales volume and marketing costs across respondents may reduce their statistical association with profit. Second, profit in traditional markets is often shaped more strongly by external economic conditions such as fluctuations in staple food prices (Ardi, 2018) and infrastructure-related expenses. Third, higher sales volume does not always translate into higher profit when profit margins are small or operational costs remain high. Finally, marketing efforts in traditional market settings tend to be simple and may not generate substantial changes in sales performance. These conditions collectively explain why X₁ and X₂ show weak correlations with sellers' profit.

Multiple Linear Regression Analysis

The results of the multiple linear regression analysis of market profits at

Koga Market, Bandar Lampung, using the Statistical Package for the Social Sciences (SPSS) software are presented as follows:

Table 8. Multiple Linear Regression Results

Variable	Coefficient	Std. Error	t – value	p – value
Intercept	-8.168	3.180	-2.568	0.014
X ₁	-1.170	7.30	-1.607	0.115
X ₂	0.944	0.402	2.345	2.345
X ₃	1.370	0.050	27.180	<0.001
X ₄	2.950	0.609	4.845	<0.001

Based on the results of the multiple linear regression analysis, the mathematical model developed to measure the impact of market revitalization on traders' profits at Koga Market is expressed as follows:

$$\hat{Y} = -8.168 - 1.170X_1 + 0.944X_2 + 1.370X_3 + 2.950X_4$$

The regression analysis demonstrates that the developed mathematical model can effectively measure the impact of the revitalization program on traders' profits at Koga Market. The results indicate that variables X_1 , X_2 , X_3 and X_4 positively and significantly influence profit, with X_3 showing the strongest effect. In contrast, X_1 exhibits a negative but statistically insignificant relationship with profit. These findings confirm that specific aspects of the revitalization effort play a substantial role in increasing traders' income, thereby supporting the study's objective of constructing a model capable of capturing the economic effects of market revitalization.

The results of this study highlight that the revitalization program at Koga Market generates measurable economic benefits for traders, demonstrating the importance of well-planned market development initiatives. The model produced in this research provides practical evidence that improvements in market conditions can enhance traders' income, thereby reinforcing the relevance of revitalization as a strategy to

strengthen local economic activity. These findings imply that policymakers and market managers should continue to prioritize interventions that directly support trading activities, encourage a conducive business environment, and sustain infrastructure improvements. Moreover, the model developed in this study can serve as a useful tool for evaluating the effectiveness of future revitalization programs, ensuring that decisions are supported by empirical evidence rather than assumptions.

CONCLUSIONS AND SUGGESTIONS

This study demonstrates that the revitalization of Koga Market has generated a tangible economic impact on the vendors. The variables of staple-goods prices and facility costs are the most significant factors influencing the increase in vendor profits, followed by marketing costs, which also show a positive effect. Meanwhile, sales volume does not have a significant effect on profit, indicating that it is not a primary determinant of income. All classical assumption tests are satisfied, confirming that the regression model developed is valid for explaining the influence of revitalization on profit. Overall, the revitalization has been proven to improve vendors' economic conditions through enhanced market facilities and stable commodity prices.

Based on the findings of this study, market managers and the government need to maintain and further improve the

quality of market infrastructure, as it has been proven to contribute directly to vendors' profits. Vendors are advised to strengthen their marketing strategies, particularly through digital platforms, to achieve more stable income. Future research is recommended to expand the study area or include additional variables such as competition, service quality, or weather factors in order to produce a more comprehensive model.

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