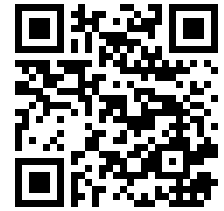# The Role of Infrastructure on Economic Growth in West Sumatra Province

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ABSTRACT: This study aims to determine the length of roads and the amount of electricity sold partially and simultaneously against economic growth in West Sumatra province for the 2012-2021 period. This type of research is quantitative research. The data consists of road length, the amount of electricity sold as infrastructure variables and economic growth. This study uses multiple regression to analyze the impact of infrastructure indicators (consisting of road length and amount of electricity sold) on economic growth. The findings revealed that, while the amount of electricity sold had a significant impact on economic growth, the length of the road had a partial insignificant impact with a regression coefficient value of 0.632 and a significant level of $0.333 > 0.05$ and the length of the road did not, with a regression coefficient value of 2.012 and a significant level of $0.020 > 0.05$. Simultaneously, the variable length of the road and the amount of electricity sold affect economic growth with *a significant* level of $0.011 < 0.05$. The contribution of variable road length and the amount of electricity sold is 77.60% to economic growth while the remaining 22.40% is influenced by other factors not examined in this study. This research is expected to contribute to the government, especially in the field of Urban and Regional Planning. The result of this study is that electricity infrastructure indicators have a significant effect on economic growth indicators.

KEYWORDS: Road Length, Amount of Electricity Sold and Economic Growth

I. INTRODUCTION

Indonesia's economic growth in 2021 reached 3.5-4.3 percent, far above the economic growth in 2020 due to Covid-19 which hit almost the entire world. This recovery in economic growth is due to much looser public mobility and activities compared to 2020 and good pandemic handling policies that are key to public and business confidence. And as a result of all this, it has an impact on all sectors to grow positively again with the highest growth in the transportation and warehousing sectors, as well as accommodation and food and drink. Economic growth

According to (Yolanda et al, 2023) and (Yolanda, Nagara, Sumarni, &; Efiani, 2021) explain Economic growth is often used as a gauge for measuring the health or progress of a nation's economy, and many academics have studied it. And according to (Yasnida et al, 2023), Indicators for measure economic growth with Gross Domestic Product (GDP) Growth mirrored by the amount of added value generated by all production activities. Another thing that affects economic growth is the existence of infrastructure. Infrastructure is one of the important aspects to accelerate the process of national and regional development. And according to (Srinivasu and Rao, 2013), Adequate infrastructure is essential for the modernization and productive commercialization of a nation and the achievement of surplus income and capital accumulation. Thus, infrastructure plays an important role as one of the driving wheels of economic growth. (Islamiah, 2015) Infrastructure has a positive influence on economic growth, meaning that if basic infrastructure needs decrease, economic growth will also decrease.

Infrastructure includes all physical and social structures and essential amenities, such as buildings, irrigation systems, roads, and bridges, that are required for the operation of businesses and community activities. Adequate infrastructure can facilitate economic activities. This can be seen from the Road infrastructure for example. In addition, the availability of other infrastructure such as electricity can also improve the economy and welfare of the people of a region. Electricity infrastructure can affect either directly or indirectly to increase household and industrial production in order to maximize the output produced.

Research on the role of infrastructure in economic growth includes: (Nugraha, Prayitno, Situmorang, &; Nasution, 2020) which states that infrastructure has a positive effect on economic growth. (Zhang & Cheng, 2023) states that transportation infrastructure has a positive effect on economic growth for the long term. (Fosu &; Twumasi, 2022) analyze the impact of infrastructure (transportation and water, rail networks, aviation, energy, and fixed telephone lines) on economic growth in the US.

The Role of Infrastructure on Economic Growth in West Sumatra Province

(Babatunde, 2018) In Nigeria, government expenditure on infrastructure for transportation and communications, education, and health has a substantial impact on economic growth, whereas spending on infrastructure for agriculture and natural resources has little impact. (Irshad, Mehr-un-Nisa, &; Ghafoor, 2023), his study found that investments in telecommunications, electric power consumption, and transportation contribute to economic growth in lower-middle-income countries.

A very vital aspect to achieve increased economic growth is the availability of infrastructure because it is one of the driving wheels to achieve increased economic growth. The following data on road length and the amount of electricity sold which is infrastructure that affects economic growth in West Sumatra Province in 2017-2021 can be seen from the table below:

Table 1. Data on Road Length, Number of Electricity Sold and Economic Growth in West Sumatra Province in 2017-2021

No.	Year	Road Length (Km)	Amount of Electricity Sold (Gwh)	Economic growth (%)
1	2017	1,083.04	3,667.68	9,07%
2	2018	1,098.67	3,748.21	7,70%
3	2019	1,113.64	3,709.92	6,78%
4	2020	1,127.40	3,903.91	-1,57%
5	2021	1,144.42	4,135.90	5,67%

Source: BPS and PLN West Sumatra Province 2022

Based on Table 1 above, in 2017 road construction was 1,083.04 Km, electricity distribution was 3,667.68 and West Sumatra economic growth was at 9.07%, in 2018 road construction increased by 1,098.67 Km, electricity distribution increased by 3,748.21 and there was a decrease in economic growth at 7.70%, in 2019 road construction increased by 1,113.64Km, electricity distribution was 3,709.92 and West Sumatra economic growth is at 6.78%, in 2020 road construction has increased by 1,127.40 Km, electricity distribution is 3,903.91 and West Sumatra's economic growth is at -1.57% this is due to the pandemic is hitting world regions as well as West Sumatra, in 2021 road construction has increased by 1,144.42 Km, electricity distribution is 4,135.90 and West Sumatra's economic growth is at 5.67%, This condition tends to fluctuate, and one of the factors that affect economic growth is capital accumulation, such as investment in infrastructure development in the form of equipment or other infrastructure facilities that support smooth productivity in a region or State, (http://sumbar.bps.go.id).

After giving a thorough analysis of the province of West Sumatra's roads and electricity usage, the author is curious to learn more about how the region's infrastructure and economic growth are related.

II. LITERATURE REVIEW

According to Robert Solow, economic growth is a series of activities that originate in four main factors, namely people, capital accumulation, modern technology and output. And also Rostow suggests that economic growth is divided into 5 stages, namely: Traditional society, Pre-take-off, Take-off, Push towards maturity and high consumption. Meanwhile, according to Simon Kuznets, economic growth is how a country is able to increase the output of economic production accompanied by ideological adjustments. In contrast, economic growth is defined as an increase in the gross domestic product (GDP) or gross national product (GNP), regardless of whether the increase is higher or smaller than the rate of population growth or if changes in the economic structure take place or not (Lincolin Arsyad, 1999). And Harrod-Domar views that there needs to be capital formation or investment in order to achieve stable economic growth. And according to (Sukirno, 2012), there is a method of improving a country's economic situation over time by gradually changing it. The four factors of production that affect economic growth are Natural Resources, Organization, Capital Accumulation, Technological Progress, Division of Labor and Scale of Production (Sukirno, 2012). Thus it is said that economic growth is the process of changing the economic condition of a country continuously towards a better state during a certain period. High and sustainable economic growth is a prerequisite for ongoing economic development.

Road Infrastructure, (Ferdy, 2015) asserts that is a locomotive for economic development both in urban and rural areas. The infrastructure sector can generate jobs for millions of employees in Indonesia through projects. According to (Syafrizal, 2012), To facilitate the expansion of an urban region, it is fundamental that there be good highways. The route also intends to facilitate the movement of people and goods between metropolitan centers that include offices, industrial and service regions, residential and residential districts, and outlying locations. The road also intends to promote equitable development in the city and its relationship to the surrounding environment, as well as enhance the city's role as a hub of growth. Researchers who examine the link between improved transportation and economic expansion include: (Irefan &; Adry, 2018), (Ng, Law, Jakarni, &; Kulanthayan, 2019), (Zepeda-Ortega, Ángeles-Castro, &; Carrillo-Murillo, 2019), (Ziberi, Miftari, &; Omaj, 2021), (Parulian &; Mahendra, 2022), (Baoligao, Kusadokoro, &; Chitose, 2022), (ETSIBA, 2023) and (Chen, 2023).

Electrical Infrastructure in the form of electrical energy which is indispensable as one of the supports of production and daily life. Electrical energy for industrial and residential needs is generated from power plants, for example: PLTA, PLTB, PLTD (diesel),

PLTM, PLTS (solar), PLTU, and others. The more developed a region, the need for electricity becomes a primary demand that must be met, not only for households but also for economic activities, especially industry. The electrical energy infrastructure consumed by the community shows how much the use of electrical energy can help in driving the regional economy to increase economic productivity. Researchers who discuss the relationship of electricity infrastructure with economic growth are: (Luo, 2014), (Adams, Atsu, Klobodu, &; Richmond, 2020), (Parulian &; Mahendra, 2022), and (Karay, Firmansyah, Sugiyanto, &; Widodo, 2022).

III.   METHODOLOGY

This study used a type of quantitative research. This method aims to provide a fairly clear picture of the problem under study. The data used in this study is time series data from 2017-2021.

Data Analysis techniques used in this study include:

1. Descriptive Statistical Analysis provides an overview or description of a data or pattern of data movement to make the data easily manageable so that the results can be interpreted. This analysis is the mean value, standard deviation, variance, maximum, minimum, sum, range, kurtosis and skewness (Ghozali, 2015).

2. Classical Assumption Test consisting of:

a. The normality test is a procedure carried out before performing data analysis. The Kolmogorov-Smirnov test is the normalcy test that is employed (Sugiyono, 2013). If the significant value is more than 0.05 at (P>0.05), the data is considered to be normal. In contrast, data is considered abnormal if the significant value at (P0.05) is less than 0.05.

b. The multicollinearity test is used to determine whether or not the regression model detects a correlation between the independent variables. It is referred to as a multicollinearity problem if there is a correlation. There should be no collation between independent variables in a good regression model. Multicollinearity arises if the Tolerance value is more than 0.10 and the VIF is 10. Multicollinearity does not exist if the Tolerance value is more than 0.10 and the VIF is lower than 10.

c. This study's autocorrelation test tries to determine whether confounding mistakes in period t and errors in period t-1 (prior) are correlated in a linear regression model. In the procedure for detecting autocorrelation problems can be used *Durbin-Waston* quantity.

d. Heterokedacity Test
    This test is run to see if there is a variance inequality from one observation's residual to another's in the regression model. The glacier test is one method for determining if there is or is not heterokedasticity. The glacier test suggests regressing the residual's absolute value to the independent variable. Heterokedacity is not present if the value of sig. > 0.05, and the opposite is also true. (Ghozali, 2013).

3.   Multiple Linear Regression Analysis

The data analysis technique used in this study is an econometric method, namely Multiple Linear Regression. Multiple linear regression analysis is performed to determine the influence or relationship of the independent variable to the dependent variable linearly. The formula used to calculate the multiple linear regression equation with two independent variables is as follows:

$$Y = \alpha + \beta_1 . X_1 + \beta_2 . X_2 + \varepsilon$$

Where

Y	:	Economic Growth
α	:	Constant
X1	:	Road Length
X2	:	Amount of Electricity Sold
ε	:	*Error term* (residual error)

4. **Test Hypothesis:**

a. **The t-test (Partial Test)** is used to test whether or not an independent variable has an effect on the dependent variable. This test is performed by comparing the calculated t value with the table t. If $t_{counts} > t_{table}$ with a significant level below 5% (0.05), then partially the independent variable is significantly related to the dependent variable and vice versa,

b. **The** F-test **(Simultaneous Test)** is used to examine the effect together of the variables economic growth (X1) and education level (X2) on poverty level (Y). To test the significance of the effect of several independent variables on the dependent variable, this test is appropriate for multiple regression analysis.

c. **The Determination Coefficient Test (R Square)** shows the extent of the relationship between the dependent variable (Y) and the independent variable (X) (Ghozali, 2016). To express the magnitude of the influence of variable X on Y can be determined through SPSS Version 23

The Role of Infrastructure on Economic Growth in West Sumatra Province

IV. RESULTS AND DISCUSSION

West Sumatra has considerable natural resource potential. These natural resources are sourced from agriculture, plantations, mining, fisheries, tourism, small and medium industries, services and trade. The economy of West Sumatra is generally dominated by agriculture which is the source of livelihood for most of the people of West Sumatra. Agriculture is the main source of raw materials for industry.

Good cooperation between industry and agriculture, creating balance with each other, because a strong agricultural field will support the creation of industry well. The industrial sector has shown an important role for the economy, both in increasing sources of state income and in providing welfare for the wider community. The industrial field of West Sumatra has the dominant characteristics of small industries, home industries and handicraft industries.

Padang is the capital of West Sumatra province and also a place in and out for tourists who come to visit various regions of West Sumatra. West Sumatra has a very good area and geographical conditions. The natural beauty of West Sumatra is one of the attractions for tourists to visit directly. As social creatures, humans have an instinct to relate to others. Travel from one region to another is a social symptom of humans who always want to interact with others.

The Central Statistics Agency (BPS) of West Sumatra released the population of West Sumatra in 2021 as many as 5,580,232 people. This number is included in the BPS data table in West Sumatra Province in the 2022 Figures. Of the 55,580,232 people in West Sumatra, the male population is 2,810,407, while the female population is 2,769,825 people.

Descriptive Statistical Test Results:

Table 2. Descriptive Statistical Test Results

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Road length	10	7.05	7.33	7.2376	.12059
Amount of electricity sold	10	14.86	15.24	15.0660	.11507
Economic Growth	10	-.016	.063	.04623	.023375
Valid N (listwise)	10				

Source : processed 2023

The road length variable has a minimum value of 7.05 and a maximum value of 7.33, with an average value of 7.23 and a defiation standard of 0.12, according to the findings of the statistical tests in table 2 above. The variable amount of electricity sold has a minimum value of 14.86 and a maximum value of 15.24 with an average value of 15.06 and a deficiation standard of 0.11. The economic growth variable has a minimum value of -0.016 and a maximum value of 0.063 with an average value of 0.046 and a standard definition of 0.023.

Classical Assumption Test Results

a. Normality Test

Table 3. Normality Test Results

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		10
Normal Parametersa,b	Mean	.0000000
	Std. Deviation	.09033518
Most Extreme Differences	Absolute	.248
	Positive	.162
	Negative	-.248
Test Statistics		.248
Asymp. Sig. (2-tailed)		.116c

The Asiymp Sig (2-tailed) significance value of 0.116 is more than 0.05, as shown by table 3 above. Therefore, it may be inferred from the Kolmogorov-Smirnov normality test results that the data are normally distributed. As a result, the requirements for the regression model's assumption of normality have been satisfied.

b. **Multicollinearity Test**

Table 4. Multicollinearity Test Results

Type		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Road extension (X1)	,249	4,013
	Amount of electricity sold (X2)	,249	4,013

Based on Table 4 above, it can be known the VIF value for each research variable as follows:

1. The VIF value for the road length model variable (X1) of 4.013 < 10 can be proven that there is no multicollinearity problem and the tolerance value of 0.249 > 0.10 can be proven for the road length variable (X1) it is stated that there are no symptoms of multicollinearity.

2. The VIF value for the variable model of the amount of electricity sold (X2) of 4.013 < 10 can be proven that there is no multicollinearity problem and the tolerance value of 0.249 > 0.10 can be proven for the variable amount of electricity sold (X2) it is stated that there are no symptoms of multicollinearity.

c. **Autocorrelation Test**

Table 5. Autocorrelation Test Results

Type	R	R Square	Durbin-Watson
1	.881a	,776	2,482

a. Predictors: (Constant), Road length, Amount of electricity sold
b. Dependent Variable: Economic Growth

Based on Table 5 above, it is evident that no positive autocorrelation exists and that the Durbin-Watson value for the autocorrelation test is 2.482. There is therefore no positive autocorrelation and no negative autocorrelation in regression analysis, leading to the conclusion that there is no autocorrelation at all.
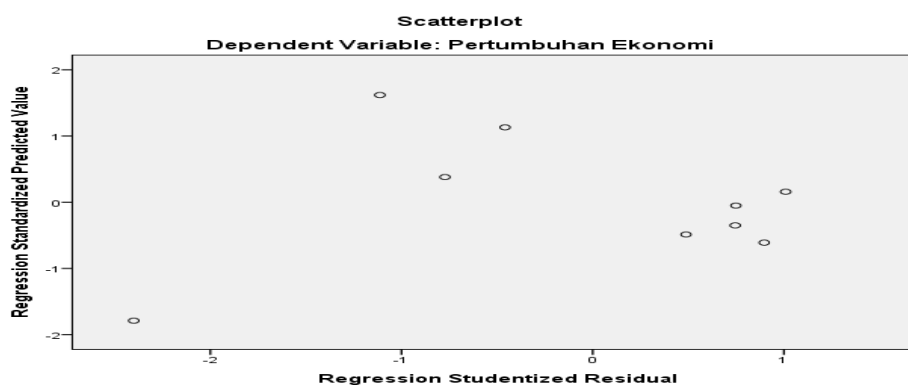
d. **Heteroscedasticity Test**

Figure 2. Heteroscedasticity Test Results

The scatterplot in Figure 2 above demonstrates how the points are dispersed randomly, lack a discernible pattern, and are dispersed both above and below the number 0 on the Y axis..

Multiple Linear Regression Test Results

Table 6. Results Recapitulation Multiple Linear Regression Test

Type		Unstandardized Coefficients		Standardized Coefficients
		B	Std. Error	Beta
1	(Constant)	22,779	6,317	
	Road length	,632	,600	,408
	Amount of electricity sold	-2,012	,644	-1,210

a. Dependent Variable: Economic Growth

The Role of Infrastructure on Economic Growth in West Sumatra Province

Based on Table 6 above, the results of the regression coefficient (β) above can be seen, the regression equation is obtained as follows:

Y = 22.779 + 0.632 X1 – 2.012 X2 + *e*

The coefficients of the multiple linear regression equation above can be interpreted as follows:

1. The constant value coefficient in the regression equation of 22.779 shows that if the infrastructure variable (Road and Electricity) does not change, then the economic growth variable increases by 22.779 units.
2. The regression coefficient of the road length variable (X1) is 0.632, this value shows that if the road length variable increases by one unit, the economic growth variable will increase by 0.632 units provided that other variables are constant.
3. The regression coefficient of the variable amount of electricity sold (X2) of -2.012 shows that if the variable amount of electricity sold increases by one unit, the economic growth variable will decrease by 2.012 units provided that other variables are constant.

Statistical Test Results

a.   Simultaneous Test (Statistical t-Test)

Table 7. t-Test Results

Type		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	22,779	6,317		3,606	,011
	Road length	,632	,600	,408	1,053	,333
	Amount of electricity sold	-2,012	,644	-1,210	-3,216	,020

A.Dependent Variable: Economic Growth

Based on the table above, it can be seen that:

1. The first hypothesis in this study is to determine the significance of the effect of road length (X1) on economic growth (Y). In table 4.7 above, it can be seen that the variable significance level of road length (X1) 0.33 is greater than the significance level of 0.05, while the calculated value of 1.053 < table 2.306, this proves that the length of the road (X 1) does not have a significant effect on economic growth (Y) in West Sumatra Province.

The results of this study are in line with the results of research conducted by (Siyan, Makwe, Peter, Rita, &; Edith, 2015) states that there is a positive relationship between road infrastructure and economic growth in Nigeria, (Ng et al., 2019) states that road infrastructure has a positive effect on economic growth in 60 countries, (Mahyoga &; Sri Budhi, 2022) Stating the positive relationship between road infrastructure and economic growth. Meanwhile, the results of the following study reinforce the form of relationship between the infrastructure of the net and economic growth, where the positive and significant forms among them are (Irefan &; Adry, 2018) In his research found that road infrastructure has a positive and significant effect on economic growth in Indonesia.(Baoligao et al., 2022) in China states that the length of the road has a positive and significant effect on economic growth. (ETSIBA, 2023) states that the length of the road has a positive and significant effect on economic growth in CEMAC Member Countries.

Road infrastructure has an effect but not significant on economic growth in West Sumatra Province statistically, allegedly because currently the length of the road is no longer the only main support for smooth economy. This is because these areas already have enough road access so that they do not require additional road lengths. It is the quality of the road that further plays an important role in the smooth flow of economy between economic regions. Conversely, narrow roads with many damaged surfaces will pose a higher risk of traffic jams and shipping delays. Thus, at present, although the growth of road length tends to be slow, if the quality of roads is improved, the smooth distribution of economic goods and services will be seen. The smooth distribution of economic goods and services will contribute greatly to supporting higher economic growth.

2. The second hypothesis of this study is to determine the significance of the effect of the amount of electricity sold (X2) on economic growth (Y). In table 4.7 above, it can be seen that the variable significance level of the amount of electricity sold is 0.020 less than the significance level of 0.05, while the calculated value of 3.216 > table 2.306, this proves that the amount of electricity sold has a significant effect on economic growth in West Sumatra Province.

Electricity infrastructure is one of the indispensable energies as one of the supports of production and daily life. The more developed a region, the need for electricity becomes a primary demand that must be met, not only for households but also for economic activities, especially industry. Electrical energy is essential to practically all aspects of human life, including home tasks, industrial processes, and almost all other industrial activities. Economic activities are of course also greatly assisted by the presence of electrical energy. The above research results are in line with research conducted by (Winanda, 2016), (Suriani &; Keusuma, 2015), (Haider, Amjad, Ullah, &; Naveed, 2012), and (Maqin, 2011) which found that electricity has a positive and significant effect on economic growth.

b. Simultaneous Test (F-Test)

Table 8.F-Test Results

ANOVAa

	Type	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	,226	2	,113	10,385	.011b
	Residuals	,065	8	,011		
	Total	,291	10			

a. Dependent Variable: Economic Growth

b. Predictors: (Constant), Road length, Amount of electricity sold

Based on table 8 above, the test results state Fcalculate 10.385 > F table 5.14 or with a significant value of 0.011 which is smaller than α = 0.05, this means that the regression model used is considered worthy of testing, so it can be said that the length of the road and the amount of electricity sold simultaneously affect economic growth in West Sumatra Province for the 2012-2021 period.

These results are in line with what is on the ground. Road Infrastructure in a few years describes the increase in road length according to surface type. Road infrastructure that has a supporting role in community economic activities because economic mobility currently relies heavily on the road network. The distribution of goods and services produced is currently dominated by the use of land transportation modes. The large influence of land routes in the smooth running of the economy, this makes the government must always pay serious attention to the condition and quality of roads, especially on the main routes of the economy. The decrease in the feasibility level and road capacity greatly affects the smooth movement of the economy.

Road Infrastructure, Electricity Infrastructure is also one of the important factors in increasing Economic Growth. Electricity infrastructure which is one of the indispensable energy as a support for production and daily life. The more developed a region, the need for electricity becomes a primary demand that must be met, not only for households but also for economic activities, especially industry. Lack of electrical energy will result in disruption of the production of economic goods and services which will result in reduced economic output so that it will reduce Economic Growth.

c. Coefficient of Determination Test Results

Table 9. Coefficient of Determination Test Results

Model Summary

Type	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.881a	,776	,701	,10431

a. Predictors: (Constant), Road length, Amount of electricity sold

Based on table 9 above, the Adjusted *R Square* is 0.701. This shows that the contribution of variable road length and the amount of electricity sold is 70.1% to economic growth in West Sumatra Province for the 2012-2021 period, as the remainder 29.9% is influenced by other factors that are not studied in this study.

V. CONCLUTION

Based on the results of the study, it can be concluded: (1) Road length has an insignificant effect on economic growth in West Sumatra Province for the 2012-2021 period. It is identified that the infrastructure of long sections of roads in West Sumatra Province as a whole has increased but not significantly. (2) The amount of electricity sold has a significant effect on economic growth in West Sumatra Province for the 2012-2021 period. This is identified as infrastructure, part of the amount of electricity sold in West Sumatra Province, very good, economic growth decreases because the cost of electricity loads rises, so the purchasing power of the community is less, so the impact of economic growth decreases. (3) The length of roads and the amount of electricity sold simultaneously affect economic growth in West Sumatra Province for the 2012-2021 period.

In order to achieve sustainable economic growth, advice to policymakers for infrastructure development (roads and power) should be adopted in conjunction with other socioeconomic and urban expansion policies.

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