



The impact of sustainable independent oil palm cultivation on regional development in Angkola Sangkunur Sub-District, South Tapanuli regency

Henry Marpaung^{1*}, Marlon Sihombing², Agus Purwoko³

¹ Students of Regional and Rural Development Planning, University of North Sumatra, Indonesia

^{2,3} Lecturer Master Program of Regional and Rural Development Planning, North Sumatra, Indonesia

* Corresponding Author: **Henry Marpaung**

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Abstract

This research aims to analyze the impact of the implementation of sustainable independent oil palm cultivation by smallholder farmers, consisting of legal aspects, technical cultivation aspects, environmental management aspects, labor aspects, and institutional aspects, on rural area development in Angkola Sangkunur sub-district, South Tapanuli regency. The data used in this research includes both primary and secondary data. The primary data were collected by distributing questionnaires to a probability sample of all respondents, while the secondary data were obtained from literature as supporting data. Multiple linear regression analysis was used to analyze the data, and the hypotheses were tested using simultaneous (F-test) and partial (t-test) tests. The results of the data analysis indicate that the technical cultivation aspect and institutional aspect have a significant positive impact. Meanwhile, the legal aspect and environmental management aspect have a positive impact but are not significant, and the labor aspect has a negative and insignificant impact on rural area development in Angkola Sangkunur sub-district, South Tapanuli regency.

Keywords: Implementation, Sustainability, Rural Development

Introduction

The Indonesian government recognizes that the palm oil industry is a highly potential economic sector to be developed, considering its efficient land use. Palm oil only requires 6% of agricultural land to produce over 40% of the world's vegetable oil (Darmawan, 2015). Rumondang (2017) claimed that the vegetable oil produced from 1 Ha of palm oil plantation is equivalent to the vegetable oil produced from 4-10 Ha of other crops.

On the other hand, based on Molenaar *et al.*'s (2013) ^[26] study, the productivity of smallholder palm oil plantations in Sumatra and Kalimantan owned by plasma farmers is only 6% below the Good Agricultural Practices (GAP) productivity, while those owned by independent farmers are 40% below GAP productivity. There are many factors that contribute to the low productivity of smallholder palm oil plantations, including suboptimal plantation management, poor quality of planting materials, low input production, mistakes in implementing Best Management Practices (BMP), incorrect water management, and pest and disease infestations (Jelsma *et al.*, 2017; Molenaar *et al.*, 2013; Woittiez *et al.*, 2017) ^[20, 26, 42].

The palm oil industry in Indonesia has made a positive contribution, but it also faces sustainability issues that challenge all actors in the supply chain. Sustainable aspects of Indonesian palm oil plantations have drawn global attention and changed the competitive landscape of the vegetable oil industry. Anti-palm oil NGOs have launched negative campaigns against the industry, according to the Palm Oil Agribusiness Strategic Policy Institute (PASPI).

Various stakeholders have established the RSPO in 2004, which is one of the voluntary standards for sustainable palm oil. The Indonesian government has also issued regulations on sustainable palm oil, including Presidential Regulation No. 44 of 2020 on the certification system for sustainable palm oil plantations in Indonesia and Minister of Agriculture Regulation No. 38 of 2020 on the implementation of certification for Indonesian palm oil plantations.

According to these regulations, ISPO certification is mandatory for palm oil companies and farmers operating in Indonesia. This sustainable certification model has been implemented by both plantation companies and smallholder farmers.

The implementation of sustainable palm oil production, whether it is RSPO or ISPO, is a standardized approach to managing palm oil that covers legal aspects, organizational management following the internal control system (SKI) indicators, technical cultivation aspects in line with Good Agricultural Practices (GAP) indicators, environmental and labor aspects in accordance with applicable regulations. This implementation is a step towards improving opportunities for palm oil farmers to increase their prosperity through increased production and access to the market.

The aspect of legality is a fundamental requirement for sustainable palm oil plantation management. Compliance with legal aspects is important to obtain business certainty based on evidence of land ownership and other permits, such as Land Ownership Certificates (LOC), Plantation Registration Certificates (PRC), and Environmental Management Statement Letters (EMSL). Legal completeness can also facilitate access to financing and prevent land disputes or conflicts.

Technical aspects of cultivation are based on best farming practices as a process of managing palm oil to improve the quality and productivity of fresh fruit bunches. Sustainable palm oil management is expected to contribute to the development of rural areas through increasing the welfare of palm oil farmers. In addition, the environmental aspect of sustainable palm oil management aims to conserve vulnerable areas near land such as swamps and rivers with high erosion potential, while avoiding the opening up of forested areas for new development.

The aspect of legality is a fundamental requirement for sustainable palm oil management. Fulfillment of legal aspects is important to obtain business certainty based on proof of land ownership and other licenses, such as land ownership certificates, plantation registration certificates, and environmental management declarations. Legal completeness can also be used to facilitate access to financing and to avoid land disputes or conflicts.

The technical aspect of cultivation is based on best agricultural practices as a process of managing palm oil to improve the quality and productivity of fresh fruit bunches. Sustainable palm oil management is expected to contribute to the development of rural areas through improving the welfare of palm oil farmers. In addition, the environmental aspect of sustainable palm oil management preserves vulnerable areas such as swamp and river areas with high erosion potential, and avoids opening up forest-covered areas for new development.

Management of employment is expected to reduce workplace accidents by following work procedures and providing complete personal protective equipment (PPE). The organizational management aspect that is in line with sustainable principles will strengthen the function and role of institutions through the Internal Control System (ICS). Strong organizational management is expected to access the necessary markets and production facilities. Additionally, the role of institutions will improve the effectiveness of member development.

Based on the data, the level of implementation of sustainable palm oil management among farmers is much lower compared to companies. According to Hutabarat's (2017) [19]

and Hidayat *et al.* (2016) [18], the main reason farmers implement sustainable palm oil principles are to increase their welfare through higher productivity and prices.

The implementation of sustainable palm oil has had significant impacts on various aspects including legality, organizational management, technical cultivation, environmental management, and labor management. Budi Fachrudin's (2021) [13] research found that the implementation of Good Agricultural Practices (GAP) in cultivation techniques, plantation management, and harvesting of fresh fruit bunches (FFB) has a significant impact on the income of oil palm smallholder farmers. This finding is supported by Idsert Jelsma's (2017) [20] research which suggests that the implementation of GAP positively affects productivity and contributes to rural development.

The RSPO certification, as one of the implementations of sustainable palm oil, has contributed to improving the welfare of farmers, especially in terms of timely availability of production inputs, increased productivity, processing of products, and access to markets (Dompok Napitupulu *et al.*, 2015). Furthermore, Sakti Hutabarat's (2017) [19] research shows that the adoption of ISPO certification has provided farmers with better knowledge and access to information about best agricultural practices and land legality. However, on the other hand, smallholder farmers have not yet seen significant improvements in their access to markets.

Based on the background presented above, the author conducted a research entitled: "The Impact of Sustainable Independent Oil Palm Cultivation on Regional Development in Angkola Sangkunur Sub-District, South Tapanuli Regency.

Research Method

This research is a descriptive quantitative study conducted in 2022 in the Angkola Sangkunur District of South Tapanuli Regency. The primary data was collected through a series of questions posed to respondents using both questionnaires and interviews, while secondary data was obtained from relevant supporting institutions.

The sampling technique used in this study is probability sampling, where every member of the population has an equal chance of being selected as a sample. The sample size was determined using the Slovin method, resulting in a total of 165 samples. Data collection was carried out using a questionnaire.

To ensure the validity and reliability of the research instrument, validity and reliability tests were conducted. Multiple regression analysis was used to analyze the data, and partial (t-test) and simultaneous (F-test) tests were conducted to test the hypotheses. To obtain unbiased and efficient regression coefficients, the data analysis in this study needs to satisfy several classical assumptions.

Result and Discussion

1. Validity Test

With a sample size of $(n) = 30$; $df = n - 2 = 28$, then at the value of $\alpha = 0.05$, the table value obtained is 0.361. Based on the test results, it can be known that the value of all calculated r values from the 37 statements in this questionnaire is greater than r_{table} (0.361), so it can be concluded that all statement items used in the research questionnaire are valid.

2. Reability Test

Based on the data processing results of all question items in

the questionnaire, the value of Cronbach's Alpha for all variables is above 0.6, indicating that the questionnaire used in this study has good reliability.

3. Classical Assumption Test

A. Results of Multicollinearity Test

Table 1: Results of Multicollinearity Test

Model	Collinearity Statistics
	Tolerance / VIF
1 (Constant)	
Legal Aspect (X1)	,793 / 1,261
Technical cultivation aspect (X2)	,645 / 1,551
Environmental management aspect (X3)	,601 / 1,664
Labor aspect (X4)	,646 / 1,548
Institutional Aspect (X5)	,597 / 1,674

a. Dependent Variable: Pengembangan Wilayah Pedesaan

The results of the multicollinearity test in Table 1 indicate that all of the independent variable tolerance values have a value greater than 0.10, and the Variance Inflation Factor (VIF) values are less than 10. Therefore, it can be concluded that there are no issues of multicollinearity between the independent variables in the regression model used.

B. Normality Test

Based on the output of the normality test using the Kolmogorov-Smirnov Test, it can be observed that the value of Asymp. Sig. (2-tailed) is 0.065, which is greater than the significance level of 0.05. This indicates that the standardized residuals are normally distributed, and the normality assumption in this study is met.

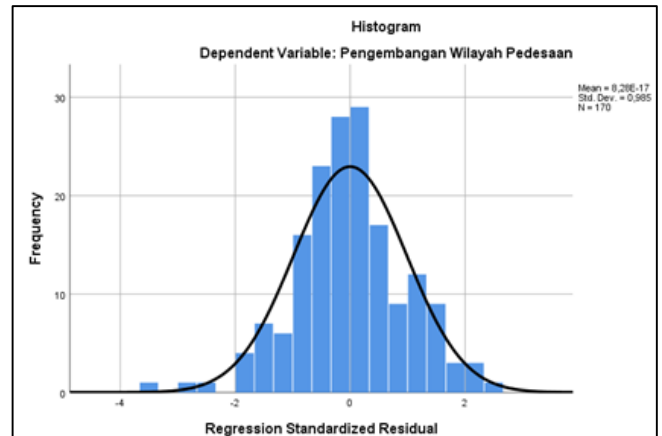


Fig 1

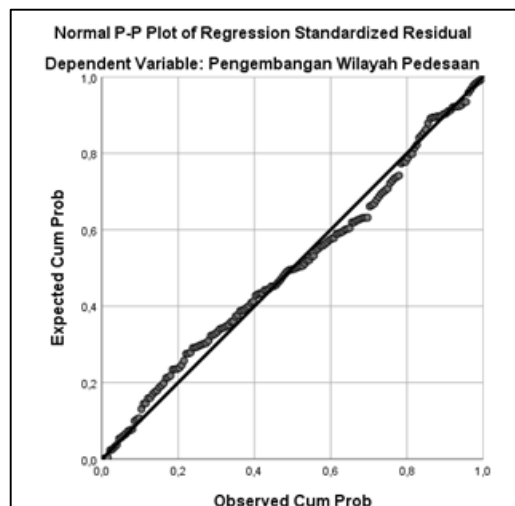


Fig 2

Furthermore, the normal probability plot shows that the data points are scattered along the diagonal line, indicating that the

data in this study are normally distributed.

C. Heteroscedasticity Test Result

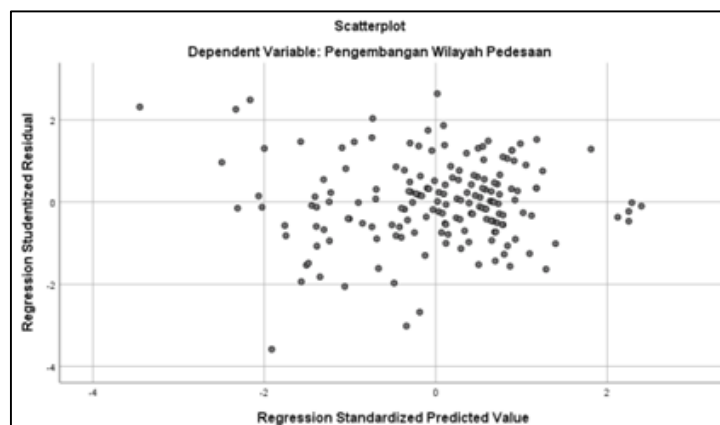


Fig 3

In addition, the histogram graph above shows that the shape of the data is not skewed to the left or right.

The scatter plot obtained for heteroscedasticity testing shows that the data points are randomly scattered and evenly distributed above and below the zero line on the Y-axis.

4. Multiple Regression Analysis

Based on the table 2 below, the multiple linear regression equation is obtained as follows:

$$Y = 0,767 + 0,253X_1 + 0,572X_2 + 0,266X_3 - 0,116X_4 + 0,437X_5 + e$$

This equation can be interpreted as follows

1. The constant value (β_0) of 0.767 means that if all independent variables, namely Legal Aspect (X1), Technical Cultivation Aspect (X2), Environmental Management Aspect (X3), Labor Aspect (X4), and Institutional Aspect (X5) are 0, then Rural Area Development (Y) has a value of 0.767.
2. The coefficient of Legal Aspect (β_1) of 0.253 indicates that the Legal Aspect variable (X1) has a positive effect on Rural Area Development in Angkola Sangkunur sub-district, South Tapanuli district. If the value of Legal Aspect increases by one unit, Rural Area Development increases by 0.253 assuming other variables are constant.
3. The coefficient of Technical Cultivation Aspect (β_2) of 0.572 indicates that the Technical Cultivation Aspect variable (X2) has a positive effect on Rural Area Development in Angkola Sangkunur sub-district, South Tapanuli district. If the value of Technical Cultivation Aspect increases by one unit, Rural Area Development increases by 0.572 assuming other variables are constant.
4. The value of the Environmental Management Aspect (X3) variable is positively related to the development of rural areas in Angkola Sangkunur sub-district, South Tapanuli Regency, as shown by its coefficient (β_3) of 0.266. An increase in the value of Environmental Management Aspect by one unit results in a 0.266 increase in the development of rural areas, holding all other variables constant.
5. The coefficient of Labor Aspect (β_4) of -0.116 indicates that the variable Labor Aspect (X4) has a negative effect (in the opposite direction) on the development of rural areas in Angkola Sangkunur sub-district, South Tapanuli Regency. If the value of Labor Aspect increases by one unit, the development of rural areas will decrease by 0.116, assuming that other variables remain constant.
6. The coefficient of Institutional Aspect (β_5) of 0.437 indicates that the variable Institutional Aspect (X5) has a positive effect on the development of rural areas in Angkola Sangkunur sub-district, South Tapanuli Regency. If the value of Aspek Kelembagaan increases by one unit, the development of rural areas will increase by 0.437, assuming that other variables remain constant.

Table 2: Multiple Linear Regression Analysis Results

Model	Coefficients ^a				
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
1 (Constant)	,767	3,576		,215	,830
Legal Aspect (X1)	,253	,141	,126	1,798	,074
Technical cultivation aspect (X2)	,572	,123	,362	4,641	,000
Environmental Manage Aspect (X3)	,266	,156	,138	1,708	,090
Labor aspect (X4)	-,116	,115	-,078	-1,007	,315
Institutional Aspect (X5)	,437	,178	,198	2,448	,015 a.

a. Dependent Variable: Rural Area Development

Testing of Partial Significance (t-test)

1. The variable of Legal Aspect (X1) has a calculated t-value of 1.798 and a significance value of 0.074 which is greater than 0.05. This means that the variable of Legal Aspect (X1) has no significant partial effect on the development of rural areas in Angkola Sangkunur sub-district, South Tapanuli Regency.
2. The variable of Technical Cultivation Aspect (X2) has a t-value of 4.641 and a significance value of 0.000, which is smaller than 0.05. This means that the variable has a significant partial effect on the development of rural areas in Angkola Sangkunur sub-district, South Tapanuli Regency.
3. Environmental management Aspect (X3) has a calculated t-value of 1.708 and a significance value of 0.090, which is greater than 0.05, meaning that environmental management has no significant partial effect on the development of rural areas in the Angkola Sangkunur sub-district, South Tapanuli Regency.
4. Labor Aspect (X4) has a calculated t-value of -1.007 and a significance value of 0.315, which is greater than 0.05. This means that Labor Aspect has no significant partial effect on the Rural Area Development in the Angkola Sangkunur district of South Tapanuli regency.
5. Institutional Aspect (X5) has a t-value of 2.448 and a significance value of 0.015, which is less than 0.05. This means that Institutional Aspect has a significant partial effect on the Development of Rural Areas in Angkola Sangkunur Subdistrict, South Tapanuli Regency.

Table 3: Partial Significance Test Result (T-test)

Coefficients ^a					
	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
1 (Constant)	,767	3,576		,215	,830
Legal Aspect (X1)	,253	,141	,126	1,798	,074
Technical cultivation aspect (X2)	,572	,123	,362	4,641	,000
Environmental Manage Aspect (X3)	,266	,156	,138	1,708	,090
Labor aspect (X4)	-,116	,115	-,078	-1,007	,315
Institutional Aspect (X5)	,437	,178	,198	2,448	,015 a.

Dependent Variable: Rural Area Development

Simultaneous Testing (*F-test*)

Based on Table 4 below, it can be seen that the significance value of all independent variables is equal to $0.000 < 0.05$, which means that it can be concluded that the variables of Legal Aspect, Technical Cultivation, Aspect, Environmental Management Aspect, Labor Aspect and Institutional simultaneously have a significant effect on the development of the rural area in Angkola Sangkunur Sub-district, South Tapanuli Regency.

Table 4: F Test

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	1664,703	5	332,941	18,219	,000b
Residual	2996,944	164	18,274		
Total	4661,647	169			

a. Dependent Variable: Rural Area Development

b. Predictors: (Constant), Legal Aspect, Technical Cultivation Aspect, Environmental Management Aspect, Labor Aspect and Institutional Aspect

7. Determination Coefficient test

The results of the statistical data processing in Table 5 below show that the R Square (R^2) coefficient test obtained is $0.357 = 35.70\%$. This means that all the independent variables used, namely Legal Aspects, Technical Aspects of Cultivation, Environmental Aspects, Labor Aspects, and Institutional Aspects, are able to explain the dependent variable by 35.70% , while the remaining 64.30% is explained by other variables not included in this research model.

Table 5: R Square

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,598a	,357	,338	4,27482

a. Predictors: (Constant), Institutional Aspect (X5), Legal Aspect (X1), Technical cultivation Aspect (X2), Labor Aspect (X4), Environmental Management Aspect (X3)

b. Dependent Variable: Rural Area Development

Discussion

1. The Impact of Legal Aspect on Rural Area Development

The variable of legal aspect has a regression coefficient (β) of 0.253 with a Sig. value of 0.074 and a obtained t-value of 1.798. Therefore, it can be concluded that the legal aspect variable has a positive but not significant effect on rural area development in Angkola Sangkunur District, Tapanuli Selatan Regency.

This research is in line with the opinion of Jelsma *et al.* (2017) [20] that there are not many independent oil palm plantations in Indonesia that have legal ownership certificates such as Land Certificate (SHM), where most of them only

have SKT or Girik.

The implementation of sustainable oil palm cultivation in the legal aspect, such as increasing proof of ownership to become SHM and the importance of having SHM training, provides confidence to farmers in managing their oil palm plantations, which are also declared to be in non-forest areas (APL) and not in forest areas.

Fulfillment of the legal aspect can have a positive impact on access to capital, assets, and income of the community, which will increase farmers' income. The same opinion was also found in a study conducted by Chalil (2020) [10] that with certification, oil palm farmers have the perception of getting higher productivity and selling prices.

2. The Impact of Technical Cultivation Aspect on Rural Area Development

The variable of technical aspects in cultivation has a regression coefficient (β) of 0.572 with a Sig. value of 0.000 and a t-value of 4.641. Thus, it can be concluded that the technical aspects of cultivation have a significant positive effect on farmers' income, which is one of the factors in rural development. This research is consistent with the study conducted by Budi Fachrudin *et al.* (2018) which states that the implementation of good agricultural practices in plantation management activities, TBS harvest, participation, and planting year have a significant effect on oil palm farmers' income.

The technical cultivation training covers various topics such as superior seeds, weed control, fertilization, and harvesting techniques. The technical knowledge enhancement program in sustainable palm oil production has encouraged farmers to carry out maintenance and fertilization, thus promoting an increase in TBS production and quality. The same results were found in Bariot Hafif's study (2014) which states that the implementation of technology to overcome agroecological factors that limit the growth and production of oil palm, such as water availability, nutrient retention, and erosion risk.

3. The Impact of Environmental Management Aspect on Rural Area Development

Based on the regression analysis, the variable of environmental management aspect has a regression coefficient (β) of 0.266 with a Sig. value of 0.090 and a calculated t-value of 1.708. The result shows that the variable of environmental management has a positive but insignificant effect on rural area development. The implementation of this variable includes the management of riverbanks, attention to extreme sloping lands, and agricultural waste management. This finding is consistent with Chalil's (2020) [10] research, which showed a significant difference in waste management between certified and non-certified farmers, but not in the

management of paraquat pesticides. According to Imam Arifandy *et al.* (2020), in their study on the effect of adopting ISPO on improving environmental management performance and socio-economic changes in the community, the implementation of ISPO can improve and enhance the company's environmental conditions, increase revenue, and reduce expenditure. At the farmer level, the adoption of ISPO requires farmers to issue a Statement of Environmental Management (SPPL), which raises awareness among farmers for environmental management, such as forest conservation, high conservation value, and riverbank management.

4. The Impact of Labor Aspect on Rural Area Development

The Labor aspect has a regression coefficient (β) of -0.116 with a significance value of 0.315 and a t-value of -1.007. This suggests that the Labor aspect has a non-significant negative impact on rural development. The Sustainable Palm Oil certification requires certain conditions for the Labor aspect, such as identifying work risk management, providing personal protective equipment (PPE), and paying workers according to the regional minimum wage standard (UMR). Proper labor management in sustainable management practices can eliminate discrimination against workers and accommodate their rights according to regulations.

However, the implementation of Sustainable Palm Oil has an opposite effect on the Labor aspect, as there is an increase in costs for farmers to fulfill the related requirements in the short term. These costs include mandatory provision of PPE, insurance, health examinations, first aid equipment, and wages in accordance with applicable regulations. This increase in costs can potentially burden small-scale farmers who may not have the financial capacity to comply with the standards. It is important to balance the benefits of sustainable management practices with the economic viability of small-scale farmers to ensure a sustainable and equitable palm oil industry.

5. The Impact of institutional Aspect on Rural Area Development

The variable of institutional aspect) has a regression coefficient (β) of 0.437 with a Sig value of 0.015 and a t-value of 2.448. From these results, it can be concluded that the institutional aspect has a significant positive impact on rural development. The implementation of sustainable palm oil requires strengthening institutions through the establishment of internal control systems, meetings, and other activities.

This research aligns with Jelsma *et al.*'s (2017) ^[20] study, which showed that with strong institutional arrangements, small-scale oil palm farmers can participate in supply chains under favorable conditions and substantially increase productivity, contributing to rural development and land conservation. Napitupulu *et al.* (2015) found that palm oil plantation companies tend to facilitate transactions with farmer groups that have RSPO certification.

Meanwhile, Hidayat *et al.* (2016) ^[18] stated that sustainable certification benefits self-help farmers in accessing premium prices through institutional/group mechanisms. In the implementation of sustainable palm oil, to encourage institutional strengthening, the Samin farmer group has transformed from an individual to a joint institution, with the highest decision-making body being the members' meeting. The Samin group also has mechanisms that accommodate members' aspirations in sub-groups and groups by forming a management organizational structure. With this institution,

the Samin farmer group has increased bargaining power through joint selling of fresh fruit bunches, joint purchase.

Conclusion

This research found that Technical Cultivation Aspects (X2) and Institutional Aspects (X5) have a significant positive impact on rural development in the Angkola Sangkunur district of South Tapanuli regency. Legality Aspects (X1) and Environmental Management Aspects (X3) were also found to have a positive impact, but their effect was not significant. Labor Aspects (X4) had a non-significant negative impact on rural development. These findings suggest that improving Technical and Institutional Aspects can help promote rural development in the area, while improving Legal and Environmental Management Aspects may also be important, but may not have as much impact.

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