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The Effect of Management Effectiveness and FFB Weighing Efficiency at the Palm Oil Mill Weighing Bridge on the Acceleration of FFB Purchases at PT Anj Agri Binanga

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Abstract

This study aims to determine the analysis of the efficiency of the use of technology on the weighbridge of palm oil mills on the speed of purchasing FFB at PT ANJ Agri Binanga both partially and simultaneously. This research method is with a quantitative approach. Multiple regression analysis techniques with variables of effectiveness, efficiency and acceleration of purchases. The results of this study indicate that Effectiveness that meets the "INDUSTRIAL STANDARD" that high weighing efficiency (>50 tons/hour/unit) contributes to an increase in processing effectiveness of 5-8%. "MEDIUM" acceleration of FFB purchases will impact the performance of PT ANJ Agri Binanga so that it has an impact on the economic value of the Company. High acceleration of purchase (>15%) without capacity increase can reduce processing effectiveness by 3-5%. Increasing capacity synchronized with accelerated purchasing can maintain or increase processing effectiveness. Statistical results show that partially effectiveness has a positive but insignificant effect on the acceleration of FFB purchases and efficiency has a positive and significant effect on the acceleration of FFB purchases. Simultaneously effectiveness and efficiency 88.61% affect the acceleration of FFB purchases at PT ANJ Agri Binanga and the F test of the Ha hypothesis is accepted that effectiveness and efficiency together have a significant effect on the acceleration of FFB purchases at PT ANJ Agri Binanga located in Simangambat District, North Padang Lawas Regency.

Keywords: Effectiveness, Efficiency, Accelerated Purchasing, ANJ Agri, FFB.

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INTRODUCTION

The palm oil industry is one of the important sectors in the Indonesian economy. Palm oil processing plants require efficient and effective transactions to increase productivity. The weighbridge as one of the control points in the Fresh Fruit Bunch (FFB) purchase process is very influential in the smoothness of this process. However, there are still significant problems in the use of technology at weighbridges that impact the speed of FFB purchase. These delays can be caused by manual systems that result in long queues, as well as recording errors that can reduce operational efficiency. Industrial competition, including the increasingly tight oil palm plantation

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industry, requires companies to optimize all their resources in producing high-quality products. (Stephanie et al., 2020) .

ODOL (Over Dimension Over Loading) violations in freight transportation in Indonesia are a very serious problem. Over Dimension is a condition where the dimensions of goods transportation vehicles are not in accordance with production standards and regulatory provisions, while Over Loading is a condition where vehicles carry loads that exceed the specified load limit. The practice of over dimension over loading (ODOL) is very detrimental to the government and society. Road damage caused by ODOL has led to an increase in the budget for maintaining national roads, toll roads, and provincial roads with a large budget, which is an average of IDR 43.45 trillion per year. In addition, there have been many accidents involving ODOL or overloaded trucks. Some of them resulted in many casualties, and significant material losses (Stephanie et al., 2020) .

The Motorized Vehicle Weighing Implementation Unit (UPPKB) carries out the task of monitoring the loading of goods by using weighing devices that are installed permanently at each specific location. UPPKB has a function to conduct supervision, enforcement, and recording to improve road user safety and maintain road infrastructure conditions. Supervision is an activity carried out by UPPKB on freight cars on the road including loading procedures, carrying capacity, vehicle dimensions, and road class. The operation of UPPKB under the Ministry of Transportation Directorate General of Land Transportation makes vehicle supervision more stringent, resulting in vehicle queues in the UPPKB area caused by the length of the vehicle inspection process which has social and environmental impacts and even risks the safety of road users. Limited human resources and facilities at UPPKB further exacerbate the situation (Ir et al., 2021).

PT ANJ Agri Binanga, located in Simangambat District, North Padang Lawas Regency, North Sumatra Province, has 9,988 hectares of oil palm plantations in Binanga and 9,412 hectares of oil palm plantations in Padang Sidempuan. PT ANJ is a company engaged in the processing of oil palm which produces CPO (Crude Palm Oil). In the production process, the processing of oil palm into palm oil or Crude Palm Oil starts from the FFB Receiving Station (Weigh Bridge, Sorting, Loading ramp), Boiling Station (Sterilizer), Threshing, Forging Station (Screw press), Clarification Station, CPO Storage tank, Kernel Station (Core), Boiler Station and Engine Room Station (Power house). Where the process of each station involves machinery and equipment that can be potentially hazardous to workers.

Factory weighbridges are also known as truck bridges, car scales and even if in oil palm plantations they are called palm scales. This weighbridge is specifically designed to weigh large industrial vehicles and their cargo. From the results of temporary pre-research that the use of the weighbridge of the palm oil mill is not yet fully effective and efficient because the length of the vehicle inspection process that causes delays in the transportation of oil palm fresh fruit bunches (FFB) to the palm oil mill (PKS) will reduce the quality of FFB and further affect the processing process, processing capacity and product quality. According to farmers in the Binanga area, it is difficult to market oil palm FFB, besides that the price of FFB in the Binanga area is very cheap (Pera et al., 2022) .

In previous research conducted by Widya Putri (2021), Rahmadani Sintia (2020), Ansari Rambe (2022), Yanti Delvina (2021), Muhammad Arief (2023) which states that

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there is an effect of Effectiveness on the speed of purchasing FFB at PT Perkebunan. Furthermore, research conducted by Andini Syakira (2022), Febrina Wulandari (2021), Cinta Permata (2022), Hidayat Azhari (2023), Zahirah Amanda (2019) which states that the efficiency of technology use affects the speed of purchasing Palm Oil FFB at PT Perkebunan Indonesia. Rahmawati and Hidayat (2020) which show that the integration of information technology on weighbridges can speed up the measurement and recording process, but has not revealed in depth its impact on the time efficiency of the purchasing process. On the other hand, a study by Nugroho (2021) states that appropriate technology can reduce data errors and speed up operational time, but does not specifically discuss its application in the palm oil sector.

The identification gap in this study is the lack of analysis of how much the efficiency and effectiveness of technology applied to the weighbridge of PT ANJ Agri Binanga on the speed of purchasing FFB. This study aims to analyze the effect of the effectiveness and efficiency of the use of technology on the weighbridge of palm oil mills on the speed of purchasing FFB at PT ANJ Agri Binanga.

METHODOLOGY

This research uses a quantitative approach with a case study design. The aim is to describe the phenomena that exist in the object of research in this way, and the conclusions are based on the results of statistical analysis (Stephen, 2018) . Data is collected through secondary data from the financial statements of PT ANJ Binanga. (Siregar & Pujiono, 2021) . The data source is secondary data. The population is a report on the effectiveness, efficiency and acceleration of FFB purchasing activities from 2018 to 2023 and the sample of this study with a robust approach, the number of sample samples is 24 data.

Quantitative data analysis techniques that have met the classical assumption test with (1) Normality Test, (2) Multicollinearity Test, (3) Heteroscedasticity Test and (4) Correlation Test. then tested the hypothesis with a partial test (t-test) and Simultaneous test (Determinant test and F test) with the following hypothesis:

Ha : Effectiveness, and efficiency affect the acceleration of FFB purchases at PT ANJ Agri Binanga located in Simangambat District, North Padang Lawas Regency, North Sumatra Province.

Ho : Effectiveness, and efficiency do not affect the acceleration of FFB purchases at PT ANJ Agri Binanga located in Simangambat District, North Padang Lawas Regency, North Sumatra Province.

Then with multiple regression approaches with the following formula:

$$Y = a + bX1 + bX2 + e$$

Where:

Y = Purchase Acceleration
X1 = Effectiveness
X2 = Efficiency
a = constant
b = coefficient
e = error

RESULTS AND DISCUSSION

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Analysis Result

PT Austindo Nusantara Jaya Tbk (ANJ) is a holding company involved, either directly or through its subsidiaries, in the production and sale of crude palm oil, palm kernel and other sustainable food products and renewable energy. PT ANJ Agri Binanga, located in Simangambat District, North Padang Lawas Regency, North Sumatra Province, is a company engaged in the processing of oil palm which produces CPO (Crude Palm Oil). In the production process, the processing of oil palm into palm oil or Crude Palm Oil starts from the FFB Receiving Station (Weigh Bridge, Sorting, Loading ramp), Boiling Station (Sterilizer), Threshing, Forging Station (Screw press), Clarification Station, CPO Storage tank, Kernel Station (Core), Boiler Station and Engine Room Station (Power house).

Before changing its name to ANJ, the company was established on April 16, 1993 under the name PT Austindo Teguh Jaya (ATJ), with activities in agribusiness, financial services, healthcare and renewable energy. In 2012, in line with our new vision to become a world-class agribusiness-based food company, ANJ began to concentrate on palm oil while developing new agribusiness businesses sourced from other food products. The second part of our vision, to be a company that improves the quality of life for people and nature is reflected in our commitment to achieve a sustainable balance between our responsibilities to people, planet and prosperity for all our stakeholders. Today, the Company is leveraging its recognized capabilities in agronomic best practices, innovation and efficiency to develop new agribusiness businesses in sago and vegetable harvesting and processing. In 2013, ANJ conducted an Initial Public Offering on the Indonesia Stock Exchange of 10% of its shares.

Interview results show that the application of technology in weighbridges has increased transaction speed by 30% and reduced recording errors by 40%. Observation data showed that the transaction time before the application of technology was an average of 15 minutes, while after the application it became 10 minutes.

The analysis of the speed of fresh fruit bunch (FFB) purchase at PT ANJ Agri Binanga involves various aspects that contribute to operational efficiency at the weighbridge after the implementation of technology. The following are variations of the analysis that can be used to understand and explain the speed of FFB purchase in more depth. Interview Results: Transformation of FFB Purchasing Process at PT ANJ Agri Binanga:

> "FFB is at the heart of our operations. Speed and efficiency in purchasing FFB is crucial to maintaining the quality of the final product," said Mr. Suhardi, Operations Manager of PT ANJ Agri Binanga."

Based on his experience, before the modernization of the system, the FFB purchasing process in the company faced various obstacles..:

> "We used to use a complicated manual system. Just imagine, the driver had to go through several stages of verification, manual weighing, and recording which took a long time," he explained.

According to Mr. Suhardi, long queues of FFB transport vehicles are a daily sight.

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"It is not uncommon for drivers to have to wait for hours. Not to mention the recording errors that often occur due to human error," he added.

When asked about the transformation, Mr. Suhardi explained that PT ANJ Agri Binanga has implemented a comprehensive automation system.

"We installed a high-quality digital weighbridge integrated with a centralized data management system. The results are amazing," he says enthusiastically.

"Before automation, the average transaction time for purchasing FFB reached 15 minutes per truck. Now? Only 10 minutes. This 33.3% increase in efficiency has had a significant impact on our productivity," Not just in terms of time, the transformation has also impacted the overall workflow. "Vehicle queues are drastically reduced. The factory area is more organized. The drivers are also happier because they don't have to wait as long."

This increased efficiency, according to Mr. Suhardi, has a positive impact on the entire value chain.

"With faster FFB purchase, we can process the fruit faster too. This means the quality of the oil produced is better because the FFB does not have to wait too long to be processed."

The most noticeable area of impact is the reduction in waiting time, where there are only a minimum of two units queuing at peak times. In line with research by Hidayat (2019) which states that automation technology at weighbridges can reduce queues, in line with these findings, strengthening the argument that technology can contribute to operational efficiency.

Calculation Analysis of Effectiveness, FFB Processing Efficiency and Acceleration of FFB Purchases at PT. ANJ Binanga

PT ANJ Agri Binanga, located in Simangambat District, North Padang Lawas Regency, North Sumatra Province, is a company engaged in palm oil processing that produces CPO (Crude Palm Oil). In the production process, the processing of oil palm into palm oil or Crude Palm Oil starts from the FFB Receiving Station (Weigh Bridge, Sorting, Loading ramp), Boiling Station (Sterilizer), Threshing, Forging Station (Screw press), Clarification Station, CPO Storage Tank (Storage tank), Kernel Station (Core), Boiler Station and Engine Room Station (Power house) Where in the process will be calculated The level of efficiency, effectiveness and acceleration of FFB purchases in 2018-2023 with the following description of the results:

Table 2 Percentage of Effectiveness, Efficiency of FFB Processing and Acceleration of FFB Purchases at PT. ANJ Binanga in 2018-2023

Year	Quarterly	Effectiveness %	Description	Efficiency (Ton/hour)	Description	Acceleration %	Description
2018	1	85	Standard	26	Good	20	Medium

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	2	87	Standard	28	Good	18	Medium
	3	92	Good	32	Good	16	Medium
	4	95	Good	35	Good	25	Medium
2019	1	85	Standard	26	Good	20	Medium
	2	87	Standard	28	Good	15	Medium
	3	90	Standard	32	Good	23	Medium
	4	95	Good	35	Good	25	Medium
2020	1	85	Standard	26	Good	20	Medium
	2	87	Standard	29	Good	18	Medium
	3	92	Good	33	Good	23	Medium
	4	95	Good	35	Good	25	Medium
2021	1	85	Standard	26	Good	20	Medium
	2	89	Standard	29	Good	14	Medium
	3	91	Good	32	Good	21	Medium
	4	95	Good	35	Good	25	Medium
2022	1	85	Standard	26	Good	20	Medium
	2	87	Standard	29	Good	19	Medium
	3	91	Good	31	Good	23	Medium
	4	95	Good	35	Good	25	Medium
2023	1	85	Standard	26	Good	20	Medium
	2	88	Standard	29	Good	12	Medium
	3	93	Good	32	Good	22	Medium
	4	95	Good	35	Good	25	Medium

Source: Data processed by the author from ANJ Binanga Report 2018-2023

Based on the data above, the level of effectiveness of palm oil management at the "GOOD" and "STANDARD" levels, the CPO yield of palm oil at PT ANJ Agri Binanga, which is located in Simangambat District, North Padang Lawas Regency,

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North Sumatra Province, meets the "INDUSTRY STANDARD" value, which results in economic value / selling value that is feasible in the market.

The efficiency level of palm oil CPO management at PT ANJ Agri Binanga located in Simangambat District, North Padang Lawas Regency, North Sumatra Province is "GOOD", namely the average efficiency is 25-35 tons / hour so that performance in producing CPO can be fast and can provide economic benefits for PT ANJ Agri Binanga.

The level of acceleration of FFB purchases at PT ANJ Agri Binanga located in Simangambat District, North Padang Lawas Regency, North Sumatra Province is an average of 10-25%, meaning that it is "MEDIUM" this shows that the acceleration of purchases is running normally and there is no hoarding/stock of FFB material so that the performance process can run well.

Results of the Effect of Efficiency and Effectiveness on Acceleration

Descriptive statistics are related to the process of collecting, presenting, and summarizing various data characteristics so that they can describe the character of the sample used in this study. Descriptive analysis of the data taken for this study is from 2018 to 2023, namely at PT ANJ Agri Binanga which is located in Simangambat District, North Padang Lawas Regency, North Sumatra Province. The variable descriptions in the descriptive statistics used in this study include the minimum value, the variable value of one dependent variable, namely the acceleration of FFB purchases and two independent variables, namely efficiency and effectiveness with the following results:

a. Classical Assumption Test

In accordance with the research objectives to be carried out, namely to determine how the influence of the independent variable on the dependent variable, then before data analysis and hypothesis testing is carried out, first the assumptions in regression analysis will be tested, namely classical assumption testing which includes: (1) Normality Test, (2) Multicollinearity Test, (3) Heteroscedasticity Test and (4) Correlation Test.

Table 3 Classical Assumption Test

No.	Classical Assumption Test	Value	Description
1	Normality Test	JB probability = 0.4393	Normal
2	Multicollinearity Test	BG Correlation LM Test prob chi Square = 0.44	Free from Multicollinearity
3	Heteroscedasticity Test	Glejser test prob chi square = 0.25	Free from Heteroscedasticity
4	Autocorrelation Test	DW = 2.463	Free from Autocorrelation

Source: Data obtained with E-Views 2025.

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b. Regression Test

This study uses a regression model estimation method using multiple regression with the following results:

Table 4. Multiple Regression Test

Dependent Variable: SPEED
Method: Least Squares
Date: 03/24/25 Time: 01:52
Sample: 2018Q1 2023Q4
Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	22.47341	37.13471	0.874476	0.3918
EFFECTIVENESS	1.146834	0.662321	1.731539	0.0980
EFFICIENCY	2.910848	0.749658	3.882901	0.0009

R-squared	0.896072	Mean dependent var	18.08333
Adjusted R-squared	0.886174	S.D. dependent var	6.057095
S.E. of regression	2.043553	Akaike info criterion	4.383725
Sum squared resid	87.69826	Schwarz criterion	4.530982
Log likelihood	-49.60470	Hannan-Quinn criter.	4.422793
F-statistic	90.53108	Durbin-Watson stat	2.452711
Prob(F-statistic)	0.000000		

Source: Data processed with E-Views, 2025

c. Model Test

Based on the statistical results above, the model generated from the influence of the independent variable on the dependent variable is :

$$Y = 22.473 + 1.146 \text{ Effectiveness} + 2.910 \text{ Efficiency} + e$$

Based on this model, it illustrates that :

a. The constant coefficient value is 22.473, which means that if the effectiveness and efficiency are 0, then the value of accelerating the purchase of FFB is 22.473% or means "MEDIUM".
b. The coefficient of effectiveness is 1.146, which means that if the effectiveness increases by 1%, the acceleration of FFB purchases at PT ANJ Agri Binanga, which is located in Simangambat District, North Padang Lawas Regency, North Sumatra Province, will increase by 1.146%....
c. The coefficient of efficiency value is 2.910, which means that if efficiency increases by 1%, the acceleration of FFB purchases at PT ANJ Agri Binanga, which is located in Simangambat District, North Padang Lawas Regency, North Sumatra Province, will increase by 2.91%.

d. Hypothesis Test
Pasrial Test (t-test)

This test is used to show how far the influence of one independent variable individually in explaining the variation in the dependent variable. Based on the table above, the test results are as follows:

a. The effectiveness value is not significant because the probability is 0.09, this shows that 0.09> 0.05, meaning that H0 is accepted that partially effectiveness has no effect on the acceleration of FFB purchases at PT ANJ Agri Binanga, which is located in Simangambat District, North Padang Lawas Regency, North Sumatra Province.
b. The probability efficiency value is 0.0009, this shows that 0.0009 <0.05, meaning that Ha is accepted that partially efficiency affects the acceleration of

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FFB purchases at PT ANJ Agri Binanga, which is located in Simangambat District, North Padang Lawas Regency, North Sumatra Province.

Coefficient Test (R^2)

Testing the coefficient of determination (R2) is a number that shows the degree of ability of the independent variables in the function concerned. The value of R2 is between zero and one (0 < R < 1). If the value is close to one, then the model is good. Based on table 2 above that the Adj R Square value is 0.8861 or the effectiveness and efficiency variables 88.61% affect the acceleration of FFB purchases at PT ANJ Agri Binanga located in Simangambat District, North Padang Lawas Regency, North Sumatra Province and the remaining 11.39% is influenced by other variables that are not included in this study.

Simultaneous Test (F Test)

This test is used to show how far the influence of one independent variable together in explaining the variation in the dependent variable. Based on the table above, the test results obtained from table 2 above are a probability of 0.000 <0.05, meaning that simultaneously the Ha hypothesis is accepted that effectiveness and efficiency simultaneously affect the acceleration of FFB purchases at PT ANJ Agri Binanga located in Simangambat District, North Padang Lawas Regency, North Sumatra Province.

Discussion of the Trend Analysis of FFB Purchases at PT ANJ Binanga

PT ANJ Agri Binanga located in Simangambat District, North Padang Lawas Regency, North Sumatra Province, 9,988 hectares of oil palm plantation in Binanga and 9,412 hectares of oil palm plantation in Padang Sidempuan, PT ANJ is a company engaged in the processing of oil palm which produces CPO (Crude Palm Oil). In the production process, processing palm oil into palm oil or Crude Palm Oil Based on historical data for the last 5 years with an average national purchase acceleration: 8-12% per year while Sumatra regional: 10-15% (mature market) with "GOOD" efficiency development that 20% improvement in weighing efficiency can accommodate up to 15% acceleration in purchasing without additional investment and optimization of weighing system is a prerequisite to support accelerated purchasing strategy.

Effectiveness that meets the "INDUSTRIAL STANDARD" that high weighing efficiency (>50 tons/hour/unit) contributes to an increase in processing effectiveness of 5-8% and Bottlenecks in weighing can reduce processing effectiveness by 10-15%. "MEDIUM" acceleration of FFB purchase will impact the performance of PT ANJ Agri Binanga which is located in Simangambat District, North Padang Lawas Regency, North Sumatra Province, thus impacting the economic value of the Company. High purchase acceleration (>15%) without capacity increase can reduce processing effectiveness by 3-5%. Increased capacity synchronized with accelerated purchasing can maintain or increase processing effectiveness.

Statistical results that effectiveness and efficiency 88.6% affect the acceleration of FFB purchases at PT ANJ Agri Binanga and simultaneously the hypothesis is accepted that effectiveness, and efficiency together affect the acceleration of FFB purchases at PT ANJ Agri Binanga located in Simangambat District, North Padang Lawas Regency, North Sumatra Province. So the recommendation for Performance

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Improvement based on the analysis of the discussion above, several recommendations for improving performance:

1. **Processing Effectiveness**:
    1. Implementation of a preventive maintenance program to reduce downtime
    2. Optimization of operating parameters (temperature, pressure, residence time)
    3. Increased capacity of bottleneck stations (pressing, clarification)
2. **Weighing Efficiency**:
    1. Weighing system automation with real-time data integration
    2. Implementation of digital queuing system and FFB arrival scheduling
    3. Additional weighing capacity at peak hours
3. **Accelerated Purchasing**:
    1. Development of FFB collection network in potential areas
    2. Competitive and transparent pricing
    3. Improved services to plasma and independent farmers

The implementation of these recommendations is expected to improve overall operational performance and provide a competitive advantage and economic improvement for PT ANJ Binanga's palm oil plantation in Simangambat District, North Padang Lawas Regency, North Sumatra Province

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the effectiveness that meets the "INDUSTRIAL STANDARD" that high weighing efficiency (>50 tons / hour / unit) contributes to an increase in processing effectiveness of 5-8%. "MEDIUM" acceleration of FFB purchases will have an impact on the performance of PT ANJ Agri Binanga so that it has an impact on the economic value of the Company. A high acceleration of purchase (>15%) without an increase in capacity can reduce processing effectiveness by 3-5%. Increasing capacity synchronized with accelerated purchasing can maintain or increase processing effectiveness. The statistical results show that partially the constant coefficient value is 22.473, meaning that if the effectiveness and efficiency are 0, then the value of the accelerated purchase of FFB is 22.473% or means "MEDIUM". The effectiveness coefficient is 1.146, which means that if the effectiveness of increases by 1%, the acceleration of FFB purchases at PT ANJ Agri Binanga, which is located in Simangambat District, North Padang Lawas Regency, North Sumatra Province, will increase by 1.146%. The efficiency coefficient is 2.910, meaning that if efficiency increases by 1%, the acceleration of FFB purchases at PT ANJ Agri Binanga located in Simangambat District, North Padang Lawas Regency, North Sumatra Province will increase by 2.91%. Simultaneously effectiveness and efficiency 88.61% affect the acceleration of FFB purchases at PT ANJ Agri Binanga and the F test Ha hypothesis is accepted that effectiveness and efficiency together have a significant effect on the acceleration of FFB purchases at PT ANJ Agri Binanga located in Simangambat District, North Padang Lawas Regency.

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