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Assessing the Impact of RED II and EUDR on Indonesia's Palm Oil Export Market Share and Market Concentration in the European Union

Dita Rosyita*, Intan Mega Maharani, Putra Astaman, Aulia Nurul Hikmah, Aditya Arief Rachman
Faculty of Agriculture, Universitas Pembangunan Nasional Veteran Jawa Timur, Surabaya, Indonesia
dita_rosyita.agribis@upnjatim.ac.id

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Corresponding Author: Dita Rosyita, Universitas Pembangunan Nasional Veteran Jawa Timur, Email: dita_rosyita.agribis@upnjatim.ac.id

ABSTRACT

The Renewable Energy Directive II (RED II) and the European Union Deforestation Regulation (EUDR) are the European Union's primary policy instruments for achieving energy transition targets, sustainability standards, and emission reductions. These regulations restrict the use of palm oil as a feedstock for biodiesel and tighten traceability requirements for deforestation-free products, thereby potentially affecting Indonesia's export performance. This study aims to analyze changes in share and market concentration of Indonesia's palm oil exports (HS 151100) in four major EU destination countries, Netherlands, Italy, Spain, and Germany following the implementation of RED II and the early phase of EUDR implementation. This research employed time series data from 2011 to 2024, divided into two periods: seven years before the policy implementation (2011-2018) and seven years representing the early phase of RED II (2019-2024). However, the data remain limited for comprehensively assessing the impact of the EUDR, as they only cover the 2023-2024 period. The methods used include the Market Share Index (MSI), the Herfindahl-Hirschman Index (HHI), and a two-mean difference test using a paired sample t-test. The results show a significant decline in Indonesia's market share in three main countries, Netherlands, Italy, and Spain following the implementation of the policies, while Germany remains relatively stable. The HHI value decreased from 0.016 to 0.06, indicating a shift in market structure from a moderately concentrated market to a more differentiated oligopoly market. This change indicates that Indonesia has undertaken market diversification in response to increasing non-tariff barriers and policy risks imposed by the European Union.

Keywords: *EUDR, Market Share, Market Concentration, Palm Oil, RED II*

INTRODUCTION

Historically, the European Union has been one of the major contributors to global greenhouse gas emissions and thus holds significant responsibility for emission reduction efforts (Oliver et al., 2022). This commitment is demonstrated through the EU's active participation in various international forums concerning in climate change issues, including the Kyoto Protocol, the Intergovernmental Panel on Climate Change (IPCC), the United Nations Framework Convention on Climate Change (UNFCCC), and others (PAPSI, 2019). These efforts are reinforced by the European Green Deal, which outlines a target of reducing greenhouse gas (GHG) emissions by 55% by 2030 and achieving net-zero emissions by 2050 (European Commission, 2020). Within this framework, two key policy instruments have been implemented, the Renewable Energy Directive II (RED II) enacted in 2018 and European Union Deforestation Regulation (EUDR) enforced in 2023.

RED II sets a target of achieving a 32% share of renewable energy consumption by 2030, primarily by promoting the use of biodiesel as an alternative energy source (European Parliament, 2018). Biodiesel is prioritized because it produces 48% lower emissions compared to fossil fuels (Pradhana, 2020). In 2019, the composition of biodiesel in the European Union was dominated by rapeseed oil (37%), palm oil (30%), and used

cooking oil (UCO) (18.5%) (Van Grinsven, 2020). To meet its palm oil demand, the EU imports the commodity from several countries, including Indonesia. However, in 2018, the EU announced its plan to pashed out palm oil use at the 2019 biodiesel composition level by 2021-2024 and to completely phase it out (0%) by 2030 (Directive (EU) 2018/2001, 2018). This policy emerged because palm oil is classified as a commodity with a high risk of deforestation or High Indirect Land Use Change (ILUC) (Rum et al., 2022). In addition to RED II, the European Union also introduced the EU Deforestation Regulation (EUDR) in late 2023. This regulation requires all agricultural products entering the EU market to be free from deforestation practices and to be traceable through geolocation information (European Commission, 2023).

The combination of RED II and EUDR has tightened market access for Indonesian palm oil. The heightened sustainability standards potentially increase non-tariff barriers and reduce Indonesia's competitiveness in the European Union market (Nepal et al., 2022). This situation may lower the EU's demand for palm oil, which would consequently decrease the value and volume of Indonesia's palm oil exports. The impact extends beyond declining demand, as it also risks depressing the price of fresh fruit bunches (FFB) and reducing the income of smallholder farmers, for more than 40% of the national palm oil industry (Susila & Setiawan, 2020). Although the findings of Rifin et al. (2020) indicate that EU restrictions generate relatively minor short-term effects reflected in a slight decrease in GDP by 0.00274%, a 0.128% decline in total exports, increases in skilled and unskilled unemployment by 4.86% and 4.82% respectively, and a 2.33% reduction in land use, these policies still pose potential long-term risks. Over the long run, the policies may contribute to more substantial structural losses for the Indonesian economy.

The potential loss of the European Union as a major export destination for palm oil may weaken Indonesia's competitive position in international trade. Therefore, analysing the dynamics of market share and market concentration becomes essential for understanding Indonesia's repositioning in the global palm oil market following the implementation of RED II and EUDR. Recently, research on palm oil exports has primarily focused in sustainability impacts, market share, and export performance, while largely overlooking non-tariff barriers and their effects on changes in export market share and market concentration (Jamilah, et al., 2022; Pratama & Widodo, 2020). Therefore, this study seeks to fill this gap by analysing shifts in market share and concentration of Indonesia's palm oil exports following the introduction of non-tariff barriers (RED II and EUDR), using the most recent data. These two analyses are crucial for informing export policy direction, strengthening trade diplomacy, enhancing competitiveness, and developing long-term sustainable export strategies.

RESEARCH METHODS

This study aims to analyze the market share and market concentration of Indonesia's palm oil exports (HS 151100) in the European Union market following the implementation of RED II and EUDR. The analysis focuses on four major destination countries: the Netherlands, Italy, Spain, and Germany. The study employs time series data covering the period of 2011–2024. Secondary data were obtained from the Trade Map and UN Comtrade databases. The analysis period is divided into two sub-periods: the before policy period (2011–2017) and after policy period represent the early phase of RED II (2018–2024). However, the data are limited in fully assessing the impact of the EUDR, as they are limited to the 2023-2024 period. Three analytical methods are used in this study: market share analysis, market concentration analysis, and a two-sample mean difference test for market share and market concentration. The following sections describe each method in detail.

Market Share Analysis

Market share analysis, or the Market Share Index, is used to assess a country's level of export market penetration. A higher market share indicates stronger export performance. Market share is calculated using the following formula (Krugman, 1986):

$$S_i = \frac{X_i}{\sum_{j=1}^{n} M_j} \quad \text{..... (1)}$$

Explanation:
S_i = Market share of Indonesia's palm oil exports to Netherlands, Italy, Spain, and Germany
X_i = Value of Indonesia's palm oil exports to Netherlands, Italy, Spain, and Germany
$\sum_{j=1}^{n} X_j$ = Total palm oil import value of Netherlands, Italy, Spain, and Germany

Market Concentration Analysis

Market concentration analysis is used to measure the distribution of market share among trading partners. This analysis is essential for understanding the market structure and the degree of export dependence on specific destination countries (Adelman, 1969; Widyasari & Asfi, 2013). A high level of market concentration indicates greater risk, particularly when new policies or trade barriers arise in destination markets (Kusumaningtias et al., 2020).

To measure market concentration, the Herfindahl–Hirschman Index (HHI) is employed by summing the squares of the market shares of each export destination. The HHI ranges from 0 to 1, where a value of 1 reflects a highly concentrated market. According to the guidelines of the U.S. Department of Justice (2010), an HHI value between 0.15 and 0.25 indicates a moderately concentrated market. An HHI above 0.25 is classified as a highly concentrated market, while markets with an HHI below 0.15 are considered unconcentrated. The HHI calculation formula is as follows (Pindyck & Rubinfeld, 2018):

$$HHI = \sum_{i=1}^{n}(S_i)^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Explanation:
S_i = Market share of Indonesia's palm oil exports to Netherlands, Italy, Spain, and Germany
n = Number of export destination countries

Two-Sample Mean Difference Test for Market Share and Market Concentration

The two-sample mean difference test is employed to statistically measure the difference between the means of two data groups. This test serves to support and strengthen the descriptive analysis (Gavin, 2008). Prior to conducting the mean difference test, a normality test is performed using the Shapiro–Wilk test (Shapiro & Wilk, 1965). A normality test is required to ensure that the differences between paired observations are normally distributed. If the p-value > 0.05, the data are considered normally distributed; conversely, if the p-value < 0.05, the data are not normally distributed. If the data are normally distributed, the paired sample t-test is used. Conversely, if the data are not normally distributed, the Wilcoxon test is applied (Wilcoxon, 1945). For the paired sample t-test, the hypothesis states that if the significance value (2-tailed) ≤ 0.05, there is a significant difference between the mean market share and market concentration before and after the policy implementation. If the significance value (2-tailed) > 0.05, there is no significant difference between the two periods (Field, 2013). For the Wilcoxon test, the hypothesis states that if the p-value ≤ 0.05, a significant difference exists between the market share and HHI before and after the policy implementation. If the p-value > 0.05, there is no significant difference in market share and market concentration between the two periods (Wilcoxon, 1945; Gibbons & Chakraborti, 2011). The normality test and the two-sample mean difference test are conducted using SPSS software.

RESULTS AND DISCUSSION

Market Share of Indonesia's Palm Oil Export in the European Union

The analysis period in this study is divided into two phases: before and after the implementation of the Renewable Energy Directive (RED II) and the EU Deforestation Regulation (EUDR). RED II began to take effect in late 2018, while EUDR was implemented in 2023. Although introduced at different times, both policies share the same objective, restricting palm oil imports from countries that do not comply with the European Union's sustainability standards. Based on the calculated market share prior to policy implementation, Indonesia's palm oil exports recorded the highest market penetration in Italy, with an average share of 60.08% per year, followed by Spain (44.46%), Netherlands (35.17%), and Germany (18.01%). Overall, Indonesia's market share across the four countries exhibits fluctuations with a declining trend, particularly in Italy and Netherlands (Figure 1). The sharpest decline occurred in Italy, with an average decrease of 12% per year. This condition coincided with Italy's weakening economic performance, increased propaganda and negative perceptions toward palm oil, and growing pressure to substitute palm oil with other vegetable oils (Ulfah, 2019; Jamilah et al., 2022).

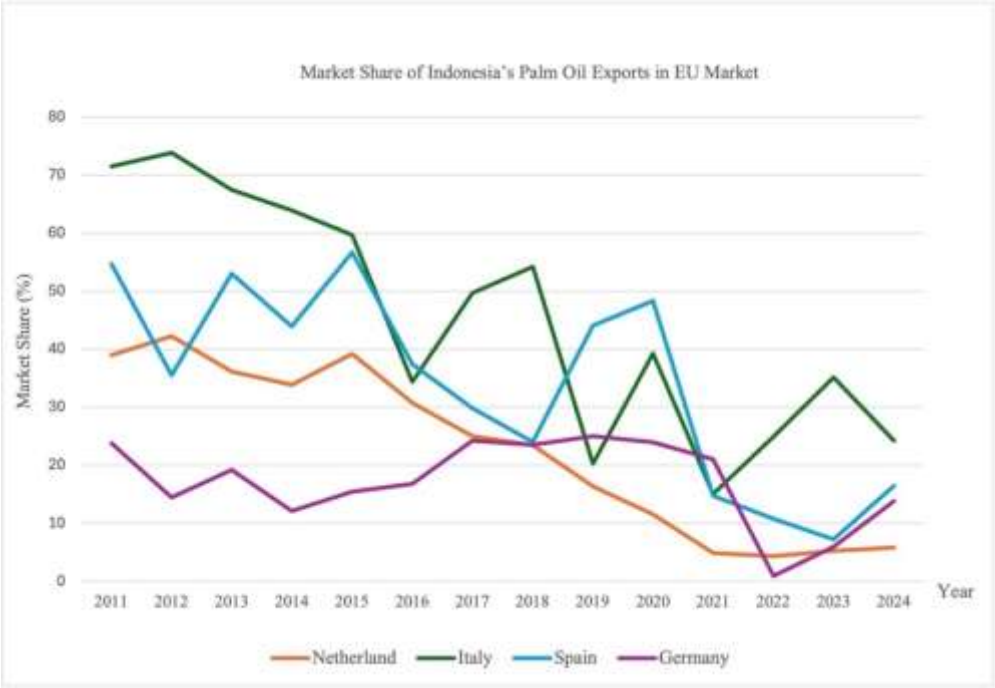

Figure 1. Market Share of Indonesia's Palm Oil Exports in Major European Union Destination Countries (TradeMap, processed by the author, 2025)

Period after RED II was officially implemented in 2018, Indonesia's palm oil export market share declined across all destination countries in the European Union (Figure 1). The most substantial decrease occurred in Italy, with a reduction of 29.64%. Nevertheless, Italy remained the primary export destination, recording the highest market share at 30.44%, followed by Spain (23.66%), Germany (16.30%), and the Netherlands (10.24%). RED II restricts the use of palm oil as a feedstock for biodiesel by introducing a phase-out policy for palm-oil-based biodiesel in the European Union. To support this regulation, EU provided subsidies for alternative vegetable oils—such as rapeseed, sunflower, and soybean oil—as replacement feedstocks (Wu & Pfenninger, 2022). Previous research by Rifin et al. (2020) found that a complete cessation of Indonesia's palm oil export to the European Union would have a relatively small short-term impact on GDP (-0,000247%). In contrast, this study finds that Indonesia's average market share decline by 2,5% per year, with estimated economic losses reaching USD 22.914 per year.

Table 1. Market Share of Indonesia's Palm Oil Exports in Major European Union Destination Countries Before and After Implementation RED II and EUDR

Period	Netherland (%)	Italy (%)	Spain (%)	Germany (%)
Before Implemented RED II dan EUDR	35,17	60,08	44,46	18,01
After Implemented RED II dan EUDR	10,24	30,44	23,66	16,30

Source: TradeMap, processed by the authors, 2025.

The implementation of RED II marked a shift in the European Union's energy paradigm toward a low-carbon economy. The policy supports the achievement of a 32% renewable energy share by 2030. Meanwhile, palm oil is perceived as a high-carbon-emission commodity that is incompatible with this objective, leading to restrictions on its use (European Parliament, 2018). Consequently, Indonesia's palm oil market share began to decline, particularly in Italy. This decline reflects a significant policy effect. Moreover, the phenomenon aligns with the theory of non-tariff barriers to trade, wherein environmental policies function as an indirect form of protectionism against imported products (Niu et al., 2018). The implementation of the EUDR in 2023 further intensified non-tariff barriers by requiring due diligence across the palm oil supply chain. The regulation mandates exporters to adopt traceability systems to ensure that palm oil products entering the EU market are free from deforestation practices. Overall, the competitiveness of Indonesia's palm oil exports in the European Union has

weakened due to increasing regulatory pressure and heightened environmental scrutiny (Jamilah et al., 2022).

Dynamics of Market Concentration of Indonesia's Palm Oil Exports in the European Union Market

The market concentration level of Indonesia's palm oil exports is analysis using the Herfindahl–Hirschman Index (HHI), which is calculated by squaring the market share of each destination country. This index provides important insights into the structure, dependence, and risk profile of commodity export markets (Adelman, 1969). A high HHI value indicates strong dependence on specific markets, implying that policy changes in those regions may exert significant impacts on export performance. Throughout the analysis period, Indonesia's average HHI value across the four EU countries fluctuated yet exhibited a downward trend (Figure 2).

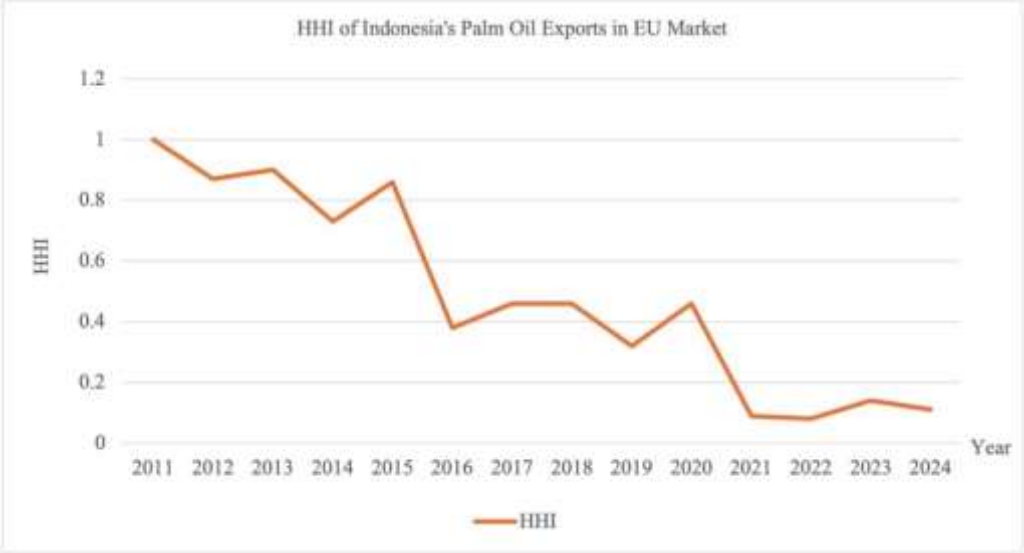

Figure 2. Average HHI Value of Indonesia's Palm Oil Exports in Major European Union Destination Countries (TradeMap, processed by the author, 2025)

Based on the HHI calculations presented in Table 2, prior to the implementation of RED II and following with EUDR, the HHI value was 0.19. According to the U.S. Department of Justice Horizontal Merger Guidelines, this value is classified as a moderately concentrated market (U.S. Department of Justice, 2010). Thus, Indonesia's market share in the European Union is relatively concentrated, with a high level of dependence on four major countries: the Netherlands, Italy, Spain, and Germany. The implication is that any regulatory changes in the EU, particularly in these four countries, could directly affect the volume and stability of Indonesia's palm oil exports. Therefore, as and exporting country, Indonesia's position is relatively vulnerable to change in international trade policies in these four countries.

Table 2. Market Concentration Values of Indonesia's Palm Oil Exports in the European Union Market

Country	Average HHI Before RED II and EUDR	Average HHI After RED II and EUDR
Netherland	0.13	0.02
Italy	0.38	0.11
Spain	0.21	0.08
Germany	0.03	0.03
average	0.19	0.06
Market Concentration	Moderately concentrated	Low concentration
Market Structure	Loose oligopoly	Differentiated oligopoly

Source: TradeMap, processed by the authors, 2025

Following the implementation of RED II and EUDR, the average HHI value decrease to 0.06. This decrease indicates a shift in the market structure from a moderately concentrated market to a low-concentration market. This condition suggests that, as an exporting country, Indonesia has begun to diversify its palm oil export destinations to mitigate the risks, associated with EU policies. Indonesia has begun to adjust its palm oil export destinations by diversifying into other markets as a response to mitigate policy-related risks in the European Union.

This diversification represents an appropriate strategy for directly responding to the European Union's non-tariff policies. In addition, this measure aims to maintain export stability and reduce dependence on countries with stringent regulations. These findings are consistent with the Trade Concentration and Dependency Theory, which posits that highly concentrated export market structures increase policy exposure risk in primary destination countries, prompting exporting countries to adjust their market targets accordingly (Sahat et al., 2016).

Before the policy implementation period, the market structure of Indonesia's palm oil exports in the European Union was moderately oligopolistic, with an HHI value of 0.19. This indicates that the market was dominated by several major exporting countries, characterized by relatively low competition but high risk. An oligopolistic market structure offers short-term advantages in the form of more competitive prices, however in the long run it is highly vulnerable to changes in trade regulations and environmental conditions in destination countries (Mulyaningsih, 2015). In contrast, following policy implementation, Indonesia's market structure shifted toward a weak oligopoly of differentiated of RED II and the EUDR, Indonesia's market share was no longer concentrated in the four main European Union countries, as exports were redirected toward alternative markets. In addition, an increasing number of exporting countries have entered the European Union Market, leading to more intense competition. Consequently, Indonesia's position has weakened and is no longer dominant in these four countries.

Two-Sample Mean Difference Test for Market Share and Market Concentration of Indonesia's Palm Oil Exports in the European Union

1. Results of Shapiro–Wilk Normality Test for Market Share and Market Concentration

Based on the Shapiro–Wilk normality test for the market share of the four main EU countries, the significance values (p value) obtained were 0.070 (Netherlands), 0.319 (Italy), 0.321 (Spain), and 0.086 (Germany) (Table 3). These values are greater than the chosen significance level of p=0.05, indicating that the market share data are normally distributed. For market concentration data, the significance values were 0.052 (Netherlands), 0.133 (Italy), 0.205 (Spain), and 0.189 (Germany). These values also exceed the p=0.05 significance threshold, indicating that the market concentration data for the four export destination countries are normally distributed. Since both market share and market concentration data are normally distributed, the two-sample mean difference test was conducted using the paired sample t-test.

Table 3. Shapiro–Wilk Normality Test Results for Market Share and Market Concentration Data

Country	Market Share	Market Concentration
Netherland	0.070	0.052
Italy	0.319	0.133
Spain	0.321	0.205
Germany	0.086	0.189

Source: SPSS, processed by the authors, 2025

2. Results of the Two-Sample Mean Difference Test for Market Share and Market Concentration Using the Paired Sample T-Test

Based on the results of the two-sample mean difference test for the market share of the four main destination countries, the significance values obtained were 0.001 (Netherlands), 0.005 (Italy), 0.023 (Spain), and 0.725 (Germany). The significance values for the Netherlands, Italy, and Spain are less than the 0.05 threshold, indicating a significant difference in market share before and after the implementation of RED II and EUDR. Conversely, Germany's significance value of 0.725 exceed p=0.05, suggesting no significant difference before and after the policies, indicating that Indonesia's palm oil export market share in Germany remained relatively stable.

The results of the two-sample mean difference test for market concentration exhibited a similar pattern, with significance values of 0.001 (Netherlands), 0.004 (Italy), 0.037 (Spain), and 0.98 (Germany). The significance values for the Netherlands, Italy, and Spain are below the p=0.05 threshold, indicating a significant change in market concentration following the implementation of RED II and EUDR. In contrast, Germany's significance value of 0.98 exceeds p=0.05, suggesting no significant difference in market concentration before and after the policies.

Table 4. Results of the Paired Sample T-Test for Market Share and Market Concentration

Country	t-Test for Market Share	t-Test for Market Concentration
Netherland	0.001	0.001
Italy	0.005	0.004
Spain	0.023	0.037
Germany	0.725	0.98

Source: SPSS, processed by the authors (2025)

The statistically significant decline and shift in market share indicate that non-tariff policies have a considerable impact on Indonesia's palm oil exports. This, in turn, affects the Indonesian economy, including reductions in GDP and employment in the oilseed sector (Rum et al., 2022). According to Pratama and Widodo (2020), a simulation of the European Union's non-tariff trade policy assuming a complete halt of exports to the EU would result in a trade balance reduction of up to USD 4.144,98 million, a real GDP decline of 7,66%, and a decrease in national welfare amounting to USD 30.083,1 million. The shift in market structure from a differentiated oligopoly also indicates the entry of more competitors into the EU market. Therefore, Indonesia must enhance product quality and align with EU environmental standards to maintain competitiveness. Moreover, the traceability requirements under EUDR pose a risk of marginalizing smallholder farmers within the Indonesian palm oil supply chain.

CONCLUSION

The results show a significant decline in both market share and market concentration during the implementation period of the RED II and EUDR policies. The largest decrease in market share occurred in Italy, reaching 29,64%. Indonesia's market concentration also declines from an average HHI of 0.19 to 0.06, indicating a structural shift from a moderately oligopolistic market to a differentiated oligopolistic market. The paired sample t-test supports these findings, demonstrating significant differences in market share and market concentration before and after the implementation of the RED II and EUDR policies in the Netherland, Italy, and Spain. Furthermore, the analysis indicates that the four main European Union countries currently contribute a substantially smaller share to Indonesia's total palm oil exports. This finding suggests that Indonesia has undertaken strategic export market diversification during the implementation period of the RED II and EUDR policies. To maintain export competitiveness, Indonesia needs to develop affordable traceability mechanisms and comply with environmental standards through ISPO and RSPO certification. In addition, mapping alternative third-country export destinations may serve as a policy option to sustain palm oil export volumes.

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