Environmental, Social and Economic Factors Affecting the Performance of the Malaysian Biofuels Market

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

On March 21, 2006, Malaysia launched the National Biofuel Policy to support the production and use of biofuel as a fuel source and reduce the country's dependence on fossil fuels (Yusoff et al., 2013). However, the biodiesel industry in Malaysia has been slow to expand, and major milestones of the National Biofuel Policy have been postponed or cancelled (McBride, 2024). Current research on the Malaysian biodiesel market focuses on isolated analyses of technical, economic, social, environmental, and organizational factors affecting the progress of the industry. These studies note the unavailability of technical experts, high capital expenditure, competition with traditional fossil fuels, hesitation from investors, community acceptance, land use conversion, biodiversity loss, and food security as reasons for the lack of adoption of biofuel technology at a large scale (Rashidi et al., 2022).

While these studies provide valuable insights into the reasons for the delayed advancement and adoption of biofuel technologies, the focus on individual effects fails to demonstrate the full complexity of the system and the influence that these actors have on one another. In addition, the focus on economic outcomes and institutions can overlook the importance of non-human actors such as cultural traditions and land characteristics on biodiesel market expansion.

In this study, I will use actor-network theory (ANT) to analyze the connections between private companies, palm oil plantation development practices, international trade relations, and government ministries in Malaysia. Specifically, I will demonstrate how the relationship between biodiesel companies and foreign trade bodies has caused the underperformance of the Malaysian biodiesel market by hindering global biodiesel trade after exposing environmental and land conflict concerns. To support my argument, I will use both Malaysian and United States

government reports, interviews with the Plantation and Commodities Minister Johari Abdul Ghani, and publications from the World Trade Organization (WTO) and European Commission to provide evidence.

Background

Due to its humid, tropical climate, Malaysia has a large palm oil industry. This generates a large quantity of available biomass with a high potential for use in commercial biodiesel production. Palm biodiesel has a similar chemical structure, energy content, low sulfur content, and combustion efficiency to conventional diesel, making it an ideal alternative fuel source (Rashidi et al., 2022).

As a part of the country's National Biofuel Policy, Malaysia initiated a B5 (5% palm methyl ester and 95% petrodiesel blend) mandate which reached full national implementation in Peninsular and East Malaysia in 2014 (Mahayuddin et al., 2022). A B7 mandate was achieved in 2016 with plans to increase the blend mandate to 20% in 2020. However, due to complications from the Covid-19 pandemic, a lack of blending infrastructure and funding, and other factors, the B20 mandate is still yet to reach full implementation. Only the State of Sarawak and the islands of Labuan and Langkawi have implemented the B20 mandate in the transportation sector (McBride, 2024). Although 22 biodiesel plants currently exist in Malaysia with a total annual production capacity of 2,762,00 tonnes, only 906,153 tonnes were produced in 2022 (Mahayuddin et al., 2022). This severe under capacity biodiesel production demonstrates the weak advancement in the industry.

Literature Review

Previous research has investigated what factors are contributing to the challenges in the Malaysian biodiesel industry and key government policies affecting its progress. Johari et al.

(2015) analyzed the current state of biofuels in Malaysia under the National Biofuels Policy and the Biofuel Industry Act. The study examined the environmental, socioeconomic, and technological challenges in the industry and found that high feedstock prices, competition with food, sustainability of production, engine compatibility, fuel subsidies, and crude oil prices are the major factors slowing development. While this work is valuable in identifying areas of improvement, the separation of environmental, socioeconomic, and technical challenges fails to demonstrate the relationship and influence that these factors have on one another.

Other research has addressed this issue by using a relationship focused lens to understand how the connections between different groups affect biodiesel market development. Mintz-Habib (2013) used the Institutional Feasibility Study (IFS) framework to analyze the cultivation and commercialization of *Jatropha Curcas* as a biofuel feedstock in Malaysia. IFS considers the interactions between various regulatory and cultural actors and contends that institutions provide a connection between global priorities and local effects. Overall, the use of IFS provided insight into the extent to which a fast growth rate in global biodiesel demand can support a sustainable market. The study also demonstrated how a rise in global biodiesel demand can conflict with native land rights and cause land degradation. However, by representing the biodiesel market as a vertical global value chain, actors at the top (global and national level) are given more influence than actors at the bottom of the chain (local level). In addition, the focus on economic outcomes can overlook the importance of social and environmental effects of the biodiesel market. In this study, I will use actor-network theory (ANT) which will allow me to understand how the relationships between a complex network of actors contribute to the social, economic, and environmental viability of the biodiesel industry in Malaysia.

Actor Network Theory Framework

In my analysis, I will use actor-network theory (ANT), which was developed by science, technology, and society (STS) scholars including Michel Callon, Bruno Latour, and John Law. ANT proposes that a technology's development is shaped by the complex relationships between heterogeneous actors (Cressman, 2009). These actors can be technical, social, natural, economic, and conceptual. A key component of ANT is the equal power given to all actors, both human and non-human. This idea is semiotic in nature since the power and meaning of the various actors depends on the context and interactions with others (Cressman, 2009).

Translation, developed by Callon and French philosopher Michel Serres, is a subconcept of ANT that describes how technological development and actor networks are formed, changed, and maintained over time (Callon, 1981). The process of translation includes the overlapping stages of problematization, interessement, enrollment, mobilization, and black-box. During problematization, the major network builders define a problem and the roles of other actors in the network needed to solve the problem. These key actors shape the interests of other actors to serve the network's goal. In the interessement stage, the primary actors recruit other actors to engage in their network and adopt similar interests. The major actors assign roles to others during the enrollment stage and begin to represent and speak for other actors during mobilization. When the actor network has been established and functions stably, the black box stage has been reached (Callon, 1981).

A network's power is determined by the strength of the relationships and bonds that connect actors working towards the shared goal. This power can be questioned by rogue actors who act against the network's goal and alter the current balance of power and thus the stage of translation achieved. A key criticism of ANT is that the equal treatment of all actors in a network

neglects power imbalances and structural inequities. However, Callon (1986b) defended that by not focusing solely on human actors, ANT provides a more thorough analysis of how networks are constructed. The subconcept of translation, and the analysis of how and why networks change over time, can reveal these power imbalances and other political dynamics while still considering a wider variety of actors.

Analysis

Palm Oil Environmental Concerns and Its Impact on Biodiesel Exports

I will show that through palm and jatropha oil production, Malaysian biodiesel companies contribute to deforestation and land use changes that garnered negative international attention, causing a reduction in biodiesel exports. By not prioritizing sustainable production, biodiesel companies created struggles during the enrollment stage of translation because they were not performing their role with a focus on the shared problem of GHG emissions. This ultimately weakened the network and resulted in a broken bond with the European Union (EU), the biggest importer of Malaysian biodiesel, preventing mobilization.

In order to produce an economically viable product, biodiesel companies often try to build partnerships with farmers to obtain access to cheaper land. The intention is to increase farmers' incomes and encourage efficient land use (Mintz-Habib, 2013). However, this can also create pressure to degrade the land. For example, some biodiesel companies in Sarawak including Bionas Berhad and Alam Waiduri Sdn Bhd (AWSB) have been partnering with local communities to clear unused peat lands for jatropha oil production. Specifically, AWSB cleared 200,000 ha of land, one third of which was peat land (Mintz-Habib, 2013). This is environmentally concerning because peatland stores large amounts of carbon, and clearing this land releases the stored carbon dioxide back into the atmosphere.

One study found that it will take 169 years to repay the initial carbon debt created by land use change caused by palm oil production for biodiesel in northern Borneo, Malaysia (Achten & Verchot, 2011). The extended time period required to pay off this carbon debt and begin reducing GHG emissions is not sufficient when dealing with an urgent matter like climate change. Since the ultimate goal of biodiesel use is to reduce GHG emissions and dependency on fossil fuels, these biodiesel companies act against the shared goal of the network by changing land-use patterns. Therefore, the biodiesel companies have not fully enrolled in the network. This caused strain with the Malaysian government, trading partners, and other actors in the network who want to ensure a positive environmental impact with regards to biodiesel use.

To address this concern, the Malaysian government is encouraging replanting palm oil trees instead of expanding palm oil plantation land area. However, little progress has been made towards implementing this change. At the 36th Palm & Lauric Oils Price Outlook Conference & Exhibition, Plantation and Commodities Minister Datuk Seri Johari Abdul Ghani said

> In 2024, Malaysia managed to replant 114,000 hectares, or 2.0 per cent of its total planted area, a decline from 2023, when replanting covered 132,000 hectares (2.3 per cent). This is below the recommended annual target of four to five per cent, which is approximately 285,000 hectares per year (*Oil Palm Replanting Without Expanding Land Use Critical to Long-Term Sustainability*, n.d.)

The acknowledgement of environmental concerns and push towards replanting efforts demonstrates the government's desire to create a reputation of Malaysia being a sustainable palm oil producer. However, without widespread, fast action among biodiesel companies, the opposite has occurred.

As climate change and GHG emissions became top global priorities, media outlets began to dramatically publicize the environmental concerns surrounding palm oil production. In 2018, an article titled “Palm Oil Was Supposed to Help Save the Planet. Instead It Unleashed a Catastrophe” appeared in The New York Times (Lustgarten, 2018). The article received widespread engagement, with hundreds of comments and references in palm oil forums and environmental blogs. Many similar articles appeared in news outlets across the globe, creating hesitation about investment in biodiesel. The rapid, digital spread of news brought attention to the issue of biodiesel sustainability and started a launch of investigations into palm oil plantation practices.

The results of these investigations confirmed that biofuel feedstock cultivation has resulted in the clearing of peatlands and called into question the benefits of biodiesel use. A study commissioned by the European Commission found that during 2005-2010, the share of plantations expanding on peat land reached 46% in Malaysia (Valin et al., 2015). The study demonstrated similar results in neighboring countries, with a 25.4% expansion rate for the same time period in Indonesia. These findings generated concern among EU nations that their energy and climate targets were not being met, leading to changes in legislation surrounding biodiesel use.

The EU Renewable Energy Directive II (RED II) was implemented in 2019 and introduced new policies directed at preventing indirect land use change (ILUC) by setting limits on biofuels that have a large expansion in high carbon stock land. The directive states that “Member states will still be able to use (and import) fuels covered by these limits, but they will not be able to include these volumes when calculating the extent to which they have fulfilled their renewable targets” (*Promotion of the Use of Energy from Renewable Sources*, 2018). This

exclusion of palm oil based biodiesel from counting towards renewable energy goals significantly reduced the demand for Malaysian biodiesel. According to a report published by the United States Department of Agriculture (USDA), the EU accounts for 48 percent of Malaysia's biodiesel exports, making it the largest consumer (Wahab, 2023). Therefore, the enactment of this legislation had a significant impact on the relationship between the EU and the government of Malaysia. Due to the large changes in foreign trade demand, the Malaysian government implemented a higher biodiesel blend mandate (B10) in 2019 to make up for reduced exports (Wahab, 2023). Therefore, there was a major shift towards domestic consumption causing instability in the market. By effectively removing the benefits associated with palm oil based biodiesel, the EU became a rogue actor in the Malaysian biodiesel market, threatening the network's power. By speaking out against the use of palm oil based biofuels, the EU did not represent the interests of the network therefore preventing mobilization.

Recent Improvements in Sustainable Palm Oil Production

Others may argue that the Malaysian government's commitment to addressing sustainability concerns has restrengthened the power of the network. The pressure put on the industry by media outlets and environmental advocacy groups caused Malaysian biodiesel producers to reduce deforestation and make significant progress towards sustainable palm oil production. In a video posted on Instagram by the Malaysian Palm Oil Council (2025), Malaysian Palm Oil Council Chariman Dato' Carl Bek-Nielson speaks about Malaysia's progress in sustainable palm oil production. The caption states,

> Malaysia remains committed to sustainability, maintaining 50% forest cover since 1992 and reducing primary forest loss. With deforestation rates declining and oil palm mature

areas shrinking by 200,000 hectares, Malaysia is strengthening its position as a trusted supplier of sustainable, deforestation-free palm oil (Malaysian Palm Oil Council, 2025) This demonstrates the effort of the industry to change the narrative on the environmental impact of palm oil production. However, the negative reputation created by mass media and the persisting legislation limiting biodiesel trade is difficult to overcome.

In fact, due to the industry's progress in sustainability, the continued limits placed on palm oil trade by the EU has increased tensions between the EU and Malaysia. Malaysia challenged the RED II measures claiming that it unfairly discriminates against palm oil based biofuels by classifying them as a high risk of ILUC (World Trade Organization, 2024). On March 5, 2024, the WTO ruled that the legal framework of RED II is valid and that biofuels causing deforestation cannot be counted as renewable. The panel did note that aspects of the implementation and design of the directive are inconsistent with WTO rules and must be adjusted (World Trade Organization, 2024). By upholding the EU's ability to place trade constraints on biofuels, the relationship between Malaysia and the EU will continue to face challenges and threaten the stability of the Malaysian biodiesel network.

Biodiesel Trading Relationships and Its Impact on Market Success

The switch from primarily exporting biodiesel to domestic consumption created economic challenges for the Malaysian government, causing a failure to reach their goals of increasing the biodiesel blend mandate. Thus, the removal of the EU as a primary actor in the network and the connection between trade partners and the Malaysian economy ultimately led to the underperformance of the Malaysian biofuels market.

The current biodiesel market relies heavily on investment from the government to make biofuels economically competitive with petrodiesel. The National Biofuel Policy enacted in 2006

established a financial support mechanism to generate funding. According to a report by the USDA, the funding for the current B10 biodiesel is approximately 9.7 million USD for 2023. This funding comes from tariffs placed on crude palm oil production and is managed by the Malaysian Palm Oil Board (Wahab, 2023). In addition to biofuel subsidies, infrastructure development is necessary to support production and blending. The 2023 USDA report stated that the Malaysian government allocated 79 million USD towards biofuel blending facilities and other infrastructure (Wahab, 2023). In 2020, Malaysia had nine blending facilities that served 4,000 petrol stations (Wahab, 2023). The significant investment from the government since the policy's enactment in 2006 shows the continued commitment to the biofuels industry.

Although the government provides financial support, the push to higher blend mandates to make up for reduced exports and meet climate agreements requires even more funding. After the B10 mandate reached full national implementation in 2019, the B20 mandate was announced in 2020. However, the COVID-19 pandemic, in conjunction with high palm oil prices and insufficient blending facilities, caused a delay in its rollout. The B20 mandate still has yet to reach implementation, and the B30 mandate which was scheduled to be implemented in 2025 is now pushed back as a goal for 2030 (McBride, 2024). When asked about the delay, Plantation and Commodities Minister Datuk Seri Johari Abdul Ghani said, "Our industry currently does not have the necessary blending infrastructure to accommodate B20. An estimated RM643 million investment is required from industry players to build blending capacity" (The Edge Malaysia, 2025). Due to the high capital cost, uncertainty in the market due to EU environmental regulations, and unstable crude palm oil prices, biodiesel companies are not willing to make the investment.

Since the government's biodiesel blend mandate is the main driver of domestic consumption of palm oil, the lack of blending infrastructure will limit the potential of the biodiesel market. With the inability of the country to make up for declining exports by increasing demand in the domestic market, the biodiesel market cannot continue to expand. Thus, the tense relationship between the EU and Malaysia has prevented the Malaysian government from having the funding necessary to achieve their biodiesel blend mandate goals and caused the underperformance of the market.

Conclusion

The Malaysian biodiesel market has made slow progress towards the goals set forth in the National Biofuel Policy. Using ANT, I have shown how biodiesel companies failed to perform their role of reducing GHG emissions through biofuel production by clearing environmentally significant peatlands. This prevented their full enrollment in the network and generated international concern among biodiesel importers. The RED II directive passed by the EU caused the decline of Malaysian biodiesel imports, which created tensions between Malaysia and the EU. The weakened bonds between trading bodies and lack of funding to expand domestic use of biofuels continues to threaten the stability of the Malaysian biodiesel market. In order to reach the market's full potential, the palm oil producers, government of Malaysia, and its trading partners need to realign on their shared goal of reducing GHG emissions while creating economic opportunities through biodiesel trade.

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