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The Impact of The European Union (EU) Renewable Energy Directive (RED II) on Palm Oil to the Malaysian Economy

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ABSTRACT

The oil palm industry has contributed significantly to the Malaysian economy and forms its agricultural industry pillar. Malaysia's total export earnings from palm oil and other palm-based products increased significantly from only RM11.70 billion in 1996 to RM73.25 billion in 2020. The oil palm industry generates income for Malaysia and has also played a key role in improving its citizens' quality of life. However, over the past decades, the oil palm industry has been the subject of conflicting claims, especially from the European Union (EU), which has criticised the oil palm industry's reputation and affected the marketability of Malaysian palm oil globally. In May 2019, the EU adopted the Delegated Regulation (EU) 2019/807 of 13 March 2019 supplementing Directive (EU) 2018/2001 (EU Red II) in which defines palm oil as a high indirect land-use change (ILUC) risk, therefore unsustainable feedstock for biofuel production for the EU Member States market. Consequently, the palm-based biofuel feedstock could not be counted towards the EU renewable energy targets. This study has determined the implication of EU RED II on the Malaysian economy via the input-output (I-O) analysis. The findings illustrate that the reduced palm oil export to the EU due to its plan to phase out palm oil from 2021 gradually affects the Malaysian economy and its other sub-sectors. These findings will be helpful to policymakers and industry players as reference resources to assess the influence of the anti-palm oil campaign and the EU policy measures on the Malaysian economy.

Keywords: EU RED II, impact to Malaysia, input-output (I-O) analysis, palm oil.

INTRODUCTION

The Malaysian oil palm industry generates revenue for the country and has also played a key role in uplifting people's quality of life by alleviating rural poverty, improving socioeconomic and the infrastructure (education and health facilities) as well as the living standards of the farmers concerned. The oil palm industry alone employs more than three million people and spurs the growth of other spin-off economic activities. However, over the past decades, the oil palm industry has been hit with various contrary allegations,

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particularly from the European Union (EU) countries, which have tarnished the reputation of palm oil, affecting the marketability of Malaysian palm oil globally. These allegations associate palm oil with deforestation, forest burning and wildlife habitat degradation.

In 2018 and 2019, the EU adopted legislative, in simple terms, consider palm oil as an unsustainable feedstock for biofuel production. The Directive (EU) 2018/2001 of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast) (RED II) was published in the Official Journal on 21 December 2018 and entered into force three days later. On 13 March 2019, the Delegated Regulation (EU) 2019/807 supplementing Directive (EU) 2018/2001 as regards the determination of high indirect land-use change-risk feedstock for which a substantial extension of the production area into land with high carbon stock is observed and the certification of low indirect land use change (ILUC) risk biofuels, bioliquids and biomass fuels was adopted. The Delegated Regulation laying down parameters of which fuels will be considered as having 'high risk' or 'low risk' of ILUC.

The legislative argued that palm oil production presents a high risk of ILUC. As a result, oil palm crop-based biofuels cannot be counted towards EU renewable energy targets. Thereafter, the EU Member States must transpose the revised regulation into national law by 30 June 2021 (European Commission, 2019). The revised regulation entered into force on 1 July 2021.

The EU restriction will lead to a longstanding effect unfavourable to the Malaysian oil palm industry because Europe is a 'trendsetter' that could have a spill over effect to other countries to follow suit with its decision of restricting palm oil. France was the first EU Member State to restrict its biofuel industry from using palm oil. The French National Assembly adopted an amendment for its 2019 budget on 19 December 2018 to exclude the use of palm oil as a biodiesel feedstock and removed the tax incentives for palm-oil-based biofuels by 2020.

Similarly, the Federal Cabinet of Germany in February 2021 adopted new provisions for the use of renewable energy in transport sector which transposed the RED II and its delegated regulation. The provisions included among others, increasing the greenhouse gas (GHG) reduction quota for fuels from the current 6% to 22% by 2030 (BMU, 2021).

Although the Netherlands is a major importer of the Malaysian palm oil, the country amended its Environmental Management Act-the law in which RED II is anchored (Gratton, 2021). The Dutch Emissions Authority implemented the new legislation on 1 January 2022.

While Belgium has taken a sterner step. The country had notified the European Commission on 22 March 2021 of the draft Royal Decree on product standards for transport fuels from renewable sources (Notification Number: 2021/0175/B) which transposes the RED II into Belgian national law. The draft Royal Decree includes the ban on biofuels and biogases produced from palm oil and soya oil in the Belgian market starting from 1 January 2022 (Baumol and Wolff, 1994).

The oil palm sector was the major contributor (37.1%) from the agricultural sector to the Malaysian Gross Domestic Products (GDP) in 2020. The entire agricultural sector's contribution to the GDP in 2020 was RM118.6 billion (DOSM, 2020). The oil palm industry contributed around 5% to 7% of the country's GDP (Nambiappan *et al.*, 2018). Palm oil has been a significant influence in reducing poverty in Malaysia as the oil palm industry is one of Malaysia's largest employers. Based on the Annual Census of Oil Palm Estates conducted by the Department of Statistics, Malaysia, there were 437 696 workers in the Malaysian oil palm plantation sector in 2019.

Additionally, Ni *et al.* (2016) reports that there were about 650 000 smallholders who owned and cultivated almost 40% of overall palm oil plantations in Malaysia. These smallholders have benefited from oil palm farming as a way out of poverty in the rural communities. Approximately three million people in Malaysia rely on the Malaysian oil palm industry for their livelihood. Thus, any factors that have adverse impacts on the exportation of palm oil and palm products could negatively impact the livelihood of many people who were reliant on the industry and eventually the nation's economy. Therefore, it is important to determine the implication of the EU RED II to the whole Malaysian economy and to the oil palm industry itself. One of the suitable economic tools in measuring these impacts is the input-output (I-O) analysis.

I-O analysis developed by Wassily Leontief is a mathematical model to describe the interconnected economic structure between sectors or economic activities. Leontief (1986) states that input output analysis is a method that systematically measures reciprocal relationships between sectors in an economic system. I-O analysis can be utilised in projecting and forecasting production or supply of sectoral needs to meet sectoral demands, forecasting the need for skilled labour to increase sectoral capacity and investment and identifying the key sectors in the economy. Also, I-O table can predict the impact of shocks such as trade changes, export and imports and determine profit-ratio in a national economy.

Indonesia as the largest producer and exporter of palm oil has done numerous studies to observe and analyse the impact of its palm oil sector on the Indonesian economy using I-O analysis as well as social accounting matrices (SAM) and computable general equilibrium (CGE) models. Although Malaysia is the second-largest producer and exporter, studies focusing on the impact of Malaysian palm oil export on the Malaysian economy using I-O analysis are minimal and underexplored compared to Indonesia.

Europe Economics (2014) reports the correlation between palm oil importation with the EU-27's downstream economic activity by reversing the I-O analysis method. The key finding from the study was that palm oil is associated with the contribution to the EU's GDP of €2.7 billion in the downstream sector of EU27 countries, thus confirming that importation of palm oil is important for EU27 countries.

Sipayung (2016) reveals that the Indonesian palm oil industry is an inclusive economic activity. Any development of oil palm plantations in terms of consumption, investment and exports will create more significant benefits in output, income, value-added and job creation in the Indonesian economy. It is estimated that the acceleration of the Indonesia oil palm downstream industry will make the growth of added value faster and more widespread. CNBC Indonesia Research Team (Raditya Hanung, 2018) has used the I-O analysis to compute the impact of the decline in palm oil exports to European countries on the Indonesian economy. Based on the analysis, a decrease in the final demand for the palm oil sector of IDR1.0 million will result in a decrease in the total output of all sectors in the economy in Indonesia by IDR2.12 million, reduce the community's income in the form of wages by IDR320 000 and reduce the number of jobs by 17 people in the economy.

One of the earliest studies was on the economic impact of palm oil production on the Malaysian economy using the I-O technique (Puasa, 2008). At the average price of RM1500 per tonne, the Malaysian oil palm industry could create employment for 775 861 people, bring a total income of RM2.5 billion and generate total revenue of RM20.1 billion. A study to reinvestigate the structural changes in the Malaysian economy for production using the sector's ranking method and I-O model conducted by Bekhet (2009) reveals a high reliance on prime sectors such as oil palm, primary rubber products, and wood sectors as well as the crude oil, gas, mining and quarrying sectors. Another I-O analysis reported by Ahmad Fuad and Puasa (2011) the estimation of the ultimate total impact of a change in the NKEA requires the measurement of the changes that occur elsewhere in the economy. The technique available to obtain these measurements is called input-output (I-O on the impact multiplier for 12 National Key Economic Areas (NKEAs) that palm oil is an important sector with great potential for further development and has a strong influence on the Malaysian economy. Even though the agricultural sector generally has a lower degree of economic integration with the rest of the economy, the output of this sector has a high demand for other sectors, particularly manufacturing. The authors recommended that the oil palm estates and smallholdings be emphasised for growth policies for their robust pull effects on the rest of the economic sector.

Saari (2014) documents that the agricultural sector has an enormous relative impact on poverty obliteration than its actual share in the economy. Meanwhile, Jaafar *et al.* (2015) prove that both oil palm cultivation sectors in Malaysia and Indonesia are economically more linked to their manufacturing sector than the agriculture or service sectors. An analysis on price, quantity and exchange rate has shown that the total economic impact is expected to increase total output by RM36.4 billion, household income by RM2.5 billion and gross value added by RM11.1 billion and to create 108 838 jobs (Puasa, 2017).

A paper by Norshaheeda *et al.* (2018) measures the strengths of the inter-industry linkages and the contribution of the agriculture sub-sector in Malaysia. In the meantime, the downstream sector of the Malaysian oil palm industry is recognised as one of the key sectors with superior influence on Malaysia's economic development. The Khazanah Institute reports that palm oil-related activities extend to various sectors that encompass the 124 commodity activities listed in Malaysia's I-O table 2015 (Khazanah Research Institute, 2018). First, the oil palm commodity's activity is very much relevant to the harvesting of oil palm fresh fruit bunches (FFB), categorised in the agriculture sector. Meanwhile, crude palm oil (CPO) production from FFB is categorised under the manufacturing sector (particularly the manufacturing of animal, vegetable oils and fats). Despite CPO and animal fats, the oils and fats commodity also involve the manufacturing of refined palm oil, palm kernel oil, crude and refined vegetable oil, coconut oil and compound cooking fats and animal oils and fats, which are also exported globally. Lastly, the retailing of palm oil, either domestically or through exports, is classified under the wholesale and retail trade under the services sector, which means that the wholesaling of edible oils and fats (palm oil) is considered as part of the services sector.

I-O analysis is very appropriate for this study, which focuses on reducing export on the gross value added, total output and total employment compensation for each sector and the economy. In the input-output table, exports are one of the final demand components that act as an injection variable to a sector while imports are under the primary input category a leakage variable.

It is also worrying that not many studies have been done in Malaysia to evaluate the economic impact of Malaysian palm oil export disruptions in Europe regarding its influence on the other sectors in the Malaysian economy. Yet, several studies have examined the inter-industrial linkages of the agricultural sector in Malaysia, which can be a reference for the Malaysian palm oil industry. Therefore, I-O analysis is the most appropriate method for conducting this study because I-O analysis can significantly contribute to designing policies. The results and findings from this study will guide the relevant authorities and policymakers in formulating new or alternative policies to counter Europe's regulations on palm oil as for any cases, inputs or by-products are the primary focus of policy concern (Baumol and Wolff, 1994).

METHODOLOGY

Material

The primary focus of this study was to examine the economic impact and implication of the decline in the export of Malaysian palm oil to Europe due to the EU Resolution and Delegated Act (RED II) adopted by the European countries to the Malaysian economy. Thus, the study made use of the secondary data source of the export of palm oil and its derivatives (other palm products) to European countries from the Malaysian Palm Oil Board (MPOB) and Malaysia I-O tables 2015 for 124 sectors from the (DOSM, 2018).

The I-O table is a compilation of dataset from an I-O analysis. The table known as the I-O table provides a complete overview of the flow of goods and services on demand and supply for a given calendar year. DOSM constructed the I-O table for Malaysia. The I-O tables are produced once every five years. The Malaysian I-O table 2015 is used for this I-O analysis study (DOSM, 2018). For publication, the size of the table is aggregated to 124 commodities by 124 activities. The supply table shows the supply of domestic and imported goods and services and the use table shows the usage of domestic and imported goods and services in the economy. This study utilised Khazanah Research Institute (2018) reports on palm oil related activities from the 124 commodities activities listed in Malaysia's I-O table 2015 as per *Table 1*.

Method

This study employed the I-O analysis approach based on the Leontief's input-output framework (Miller and Blair, 2009) to compute the total output, gross value added and income impacts to the Malaysian economy and project the decrease in Malaysian palm oil export to European countries in 2021.

i) Calculation of the Monetary Value of Affected Malaysian Palm Oil and Its Derivatives Exported to Europe

Before examining the impact via the I-O approach, it is crucial to calculate the monetary value of affected Malaysian palm oil and its derivatives exported to Europe. Approximately around 50% of imported palm oil to Europe is used for biofuel (Oil World, 2021). Palm oil is imported in crude form, refined form, palm fatty acid distillate, oleochemicals (methyl esters) and biodiesel for its usage in the EU's biofuel industry (Flach *et al.*, 2017). According to Flach *et al.* (2020) palm oil was third in terms of feedstock use in 2020 for biofuel generation. Presently, palm oil is primarily used as feedstock for biofuel generation in Spain, Italy, France and the Netherlands with minimal usage in Germany, Finland, Belgium and Portugal (Flach *et al.*, 2018). Generally, the EU uses palm oil for industrial purposes, including power and heat generation. Biofuel production is estimated at 3.7 million tonnes in 2017, 3.5 million tonnes in 2018 and 3.6 million tonnes in 2019.

It was also estimated that 50% of Malaysian palm oil and products exported to the EU are utilised for biofuel generation in the EU. Based on 2018 data for Malaysian palm oil export to the EU, approximately 1 841 988 tonnes of palm oil and its derivative were exported to Europe for its usage in the biofuel and renewable energy industry in Europe. Based on *Table 2*, it is likely that the volume exported is equivalent to RM6.85 billion (corresponding value in 2015) worth of Malaysian palm oil and its products. This corresponding value of RM6.85 billion was used in this study to suit the Malaysian I-O Table, 2015.

The estimated monetary value was used as the input (variable) to adjust the final demand in the Malaysian I-O table 2015. The entire 124 commodities were evaluated in this study using the Malaysia's I-O table 2015.

Based on the export value in monetary (2015) calculated in *Table 2*, RM6 090 104 (sum of CPO, RPO, PFAD and ME) was deducted from export value under the 'Manufacturing of Vegetable and Animal Oils and Fats'

TABLE 1. CLASSIFICATIONS BY ECONOMIC ACTIVITY FOR PALM OIL RELATED SECTOR IN MALAYSIAN INPUT-OUTPUT (I-O) TABLE 2015

Sector as in I-O Table 2015	Commodity	Industry/ Commodity Code (MSIC code)	Description
Agricultural	Oil palm	1261	Growing of oil palm (estate)
		1262	Growing of oil palm (smallholdings)
Manufacturing	Manufacture of vegetable and animal oils and fats	10401	Manufacture of crude palm oil
		10402	Manufacture of refined palm oil
		10403	Manufacture of palm kernel oil
		10404	Manufacture of crude and refined vegetable oil
		10405	Manufacture of coconut oil
		10406	(a) Manufacture of compound cooking fats
		10407	Manufacture of animal oils and fats
	Coke and refined petroleum products	19202	Manufacture of biodiesel products
Wholesale and retail trade	Wholesale and retail trade, repair of motor vehicles and motorcycles	46202	Wholesale of palm oil

Source: The Malaysia Standard Industrial Classification (MSIC) 2008; Malaysia I-O Table 2015.

TABLE 2. THE ESTIMATED USAGE OF EXPORTED MALAYSIA PALM OIL PRODUCTS TO EUROPE FOR BIOFUEL AND RENEWABLE ENERGY FEEDSTOCK

Product	Category (Malaysia I-O Table 2015)	qVolume (tonnes) 2018	Value (RM million) in 2018	Export price 2015 (USD)	Exchange rate	Export value estimated for year 2015 (Export tonnage in 2018 x Average price in 2015) (RM 000')
Crude Palm Oil (CPO)	Palm Oil (21)	1 088 757	2 541.76	558	3.8741	2 353 617.53
Refined Palm Oil (RPO)	Palm Oil (21)	228 414	650.14	586	3.8741	518 550.22
Palm Fatty Acid Distillate (PFAD)	Palm Oil (21)	146 893	311.48	5 000.5	3.8741	2 845 684.31
Biodiesel (BD)	Biodiesel (43)	253 940	736.03	775	3.8741	762 437.43
Methyl Ester (ME)	Oleochemicals (21)	123 984	584.45	775	3.8741	372 251.98
Total		**1 841 988**				**6 852 541.46**

Source: MPOB (2016; 2018).

commodity (No. 21 in Malaysian I-O table 2015). However, based on the Malaysian I-O table 2015, the export value for biodiesel in the I-O table 2015 is much less than the computed monetary value of biodiesel exported to Europe (*Table 2*), possibly because European countries had significantly increased their import of biodiesel to the region since 2016. Therefore, for this study, the total export for biodiesel production was deducted by 51% from the export value for under the 'Coke

and Refined Petroleum Products' (No. 44 in Malaysian I-O table 2015) commodity to adjust the final demand for the sector. This is based on average market share of palm biodiesel to Europe from total Malaysian biodiesel exported in 2015.

ii) The Technical Coefficient (A)

The technical coefficient (A or a_{ij}) can be represented as the quantity of input required to produce a unit of output. It is often called as I-O coefficient and direct coefficient. The formula to calculate the A matrix element is below:

$$A=a_{ij}=\frac{x_{ij}}{X_j}$$

Where $A=a_{ij}$ input coefficient for use matrix, activity by activity or commodity by commodity and also known as direct coefficients x_{ij}= usage of sector i input by sector j; and X_j= sector output to j.

The input technical coefficients were available in Malaysia's I-O Table 2015.

iii) Leontief Inverse (L)

$$Leontief\ Inverse\ Matrix\ (L) = (I\text{-}A)^{-1}$$

I is identity matrix

Leontief Inverse Matrix is known as the total requirement coefficients matrix which measures the dependency of sector j on the output of sector i when final demand for its goods or services unit increased.

iv) Simulation and Impact Assessment

The matrix equation giving the net output of goods and service required to satisfy the consumer demand is:

$$X = (I\text{-}A)^{-1} D$$

where
X = Total Sectoral Output
D = Total Sectoral Final Demand

$(I\text{-}A)^{-1}$ is the L matrix or Leontief Inverse Matrix,

The formula gave the model to calculate the total economic impact resulting from the estimated palm oil decrease in export to Europe:

$$X^{new} = (I\text{-}A)^{-1}D^{new}$$

whereas D^{new} is total sectoral final demand after taking account of the decrement of palm oil export to Europe.

v) Hypothetical Extraction Method (HEM)

The HEM was applied to quantify how an economy's total output would vary if one sector is removed by examining the backward linkage (BL) and the forward linkage (FL) of an industry to another industry. It is an analysis tool to measure the importance of sector that produces goods and services for the economy by examining the interdependence of supply and demand within the sector.

a. HEM backward linkage method.

The backward linkage (BL) method measures the level of integration and interdependency of a specific sector in consuming output from other sectors. Since the backward linkage involves input from various sectors, thus it shows the interrelationships among the suppliers in sectors. An industry or sector has noteworthy BL when its production of output requires extensive intermediate inputs from many other industries.

For BL, the HEM eliminates the i-th column of the input coefficient matrix, indicated by A^{-i}, and eliminates the i-th element of the final demand vector, indicated by D^{-i}. Following the elimination method, the total output after extracting for sector i is as follow:

$$X_1^{-I} = (I\text{-}A^{-i})^{-1}D^{-i}$$

Hence, the normalised BL after the complete extraction is derived as:

$$BL_i = \frac{i'x - i'x_1^{-i}}{x_i}$$

Where $i'x - x_1^{-i}$ represent the total output after the extraction of sector i.

b. HEM forward linkage method.

The forward linkage (FL) measures the level of integration and interdependency of other sector in consuming output from a specific sector. Hence, it defines the relationship among the producers of output in the sectors. An industry has noteworthy forward linkages when a substantial amount of its output is used by other industries as intermediate inputs to their production.

The FL was calculated based on the extraction of the Ghosh model (supply driven model) where input-output model is operated by transposing the vertical (column) to a horizontal view. Hence, the total input after extracting sector i was computed by replacing the i-th row with zero entries (indicated by B^{-i}) and by eliminating the primary input vector for the i-th element, denoted by d^{-1}, which give:

$$X_1^{-i} = v^{-i}\,(I\text{-}B^{-i})^{-1}$$

$B = X^{-1}A$ represents the Ghosh coefficient matrix.

Hence, the normalised BL after the complete extraction is derived as:

$$FL_i = \frac{x'i - (x_b^{-1})'i}{x_i}$$

where $i'x - (x_b^{-1})'i$ represent the total input after the extraction of sector i.

RESULTS AND DISCUSSION

Total Output Impact

A decrease occurs in the total output change when the export to Europe is reduced, as illustrated in *Figure 1* and summarised in *Table 3*.

The reduction of palm oil export to Europe could decrease the Malaysian total output of RM15.27 billion. *Figure 1* also shows that the vegetable and animal oils and fats manufacture sector (Sector No. 21 in I-O table) had the highest impact on the total output reduction which is RM8.11 billion (53% of the total output decrement), followed by the oil palm sector (15%), wholesale and retail industry (9%) and coke and refined petroleum product (3%) of the total output decrement. These four primary impacted industries were also the four palm-oil-related industries, as stated in *Table 1*.

Total Income (Employment Compensation) Impact

The distribution of each industry's employment compensation is also summarised in *Table 3*. In this scenario, the reduction of palm oil exports to Europe could decrease the Malaysian total employment compensation by RM1.44 billion. *Figure 3* showed that the oil palm sector's (sector No. 6 in I-O table) employment income was impacted the most with a total income reduction of RM0.64 billion (44%), followed by the wholesale and retail industry (16%) and vegetable and animal oils and fats manufacture (12%).

RM15.27 billion, while changes in total gross value added were RM4.54 billion and total income was RM1.44 billion. *Figures 5, 6* and *7* show that the manufacturing sector, wholesale and retail trade and government services were obstructed the most by reducing palm oil exports to European countries. The vegetable and animal oils and fats industry was not the primary industry experiencing the highest total value-added impact. Instead, the oil palm sector, classified under the agricultural sector was affected the most. It contributes around 39% of the total value added reduced. Moreover, the impact on professional services

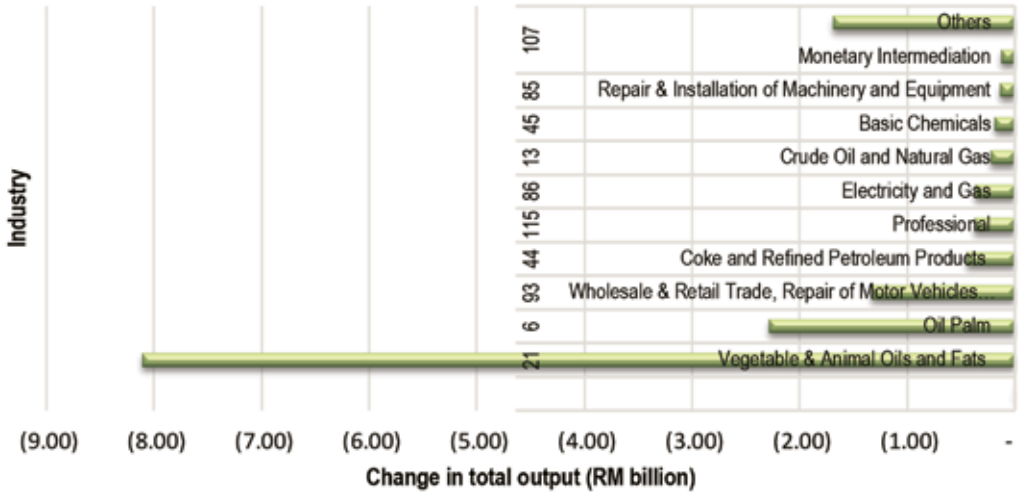

Figure 1. Changes in top ten industries ranked based on total output economic impact.

Total Value-added Impact

The distribution of each industry's value-added impact is summarised in *Table 3*. In this scenario, the reduction of palm oil exports to Europe could reduce RM4.54 billion of the total value-added. *Figure 2* shows that the oil palm industry (sector No. 6 in I-O table) would receive the most impact, losing RM1.77 billion (39%) followed by the wholesale and retail industry (17%) and vegetable and animal oils and fats manufacture (11%).

Impact Evaluation according to the Sectors

Figure 4 summarises the total economic impact on the Malaysian economy by comparing the total output, total gross value added and total income (employment compensation). The change seen in the total output is the highest (0.55%), followed by gross value added (0.40%) and total income (0.35%). Although the changes look minimal in percentage value, the total output reduction is considered significant, about

is also quite significant, affected around 5% of the total value-added and 6% of the total employment compensation possibly because of the contributions of scientific research and development and market research professionals, who are continually involved in enhancing the competitiveness of the Malaysian oil palm industry's performance globally.

Based on the backward and forwarded linkages computed using HEM *(Table 3)*, it is noted that the vegetables, animal oils, and fats industry has an index value of

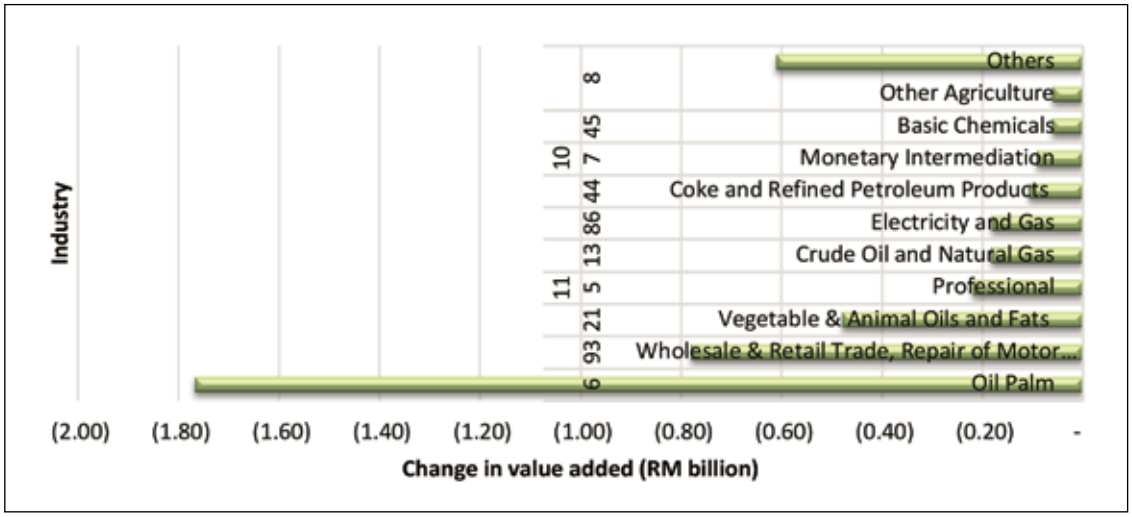

Figure 2. Changes in top ten industries ranked based on total value-added economic impact.

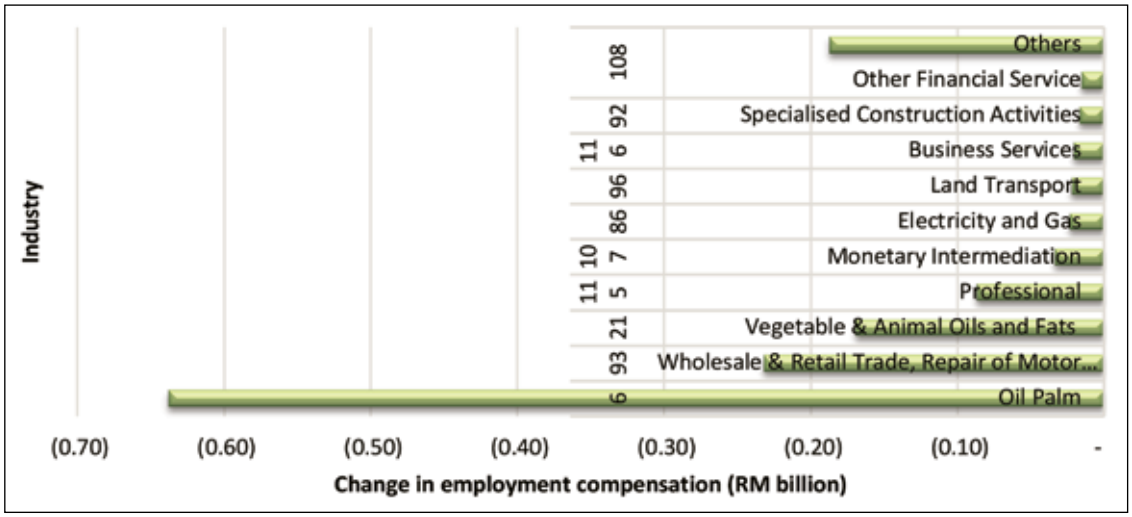

Figure 3. Changes in top ten industry ranked based on total employment compensation economic impact.

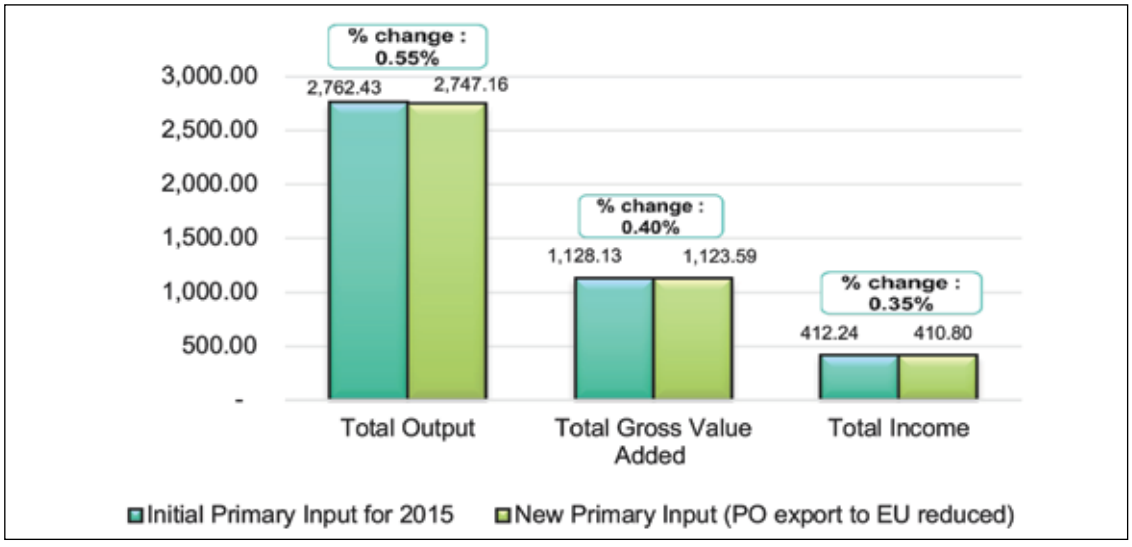

Figure 4. Total economic impact and reduction in value.

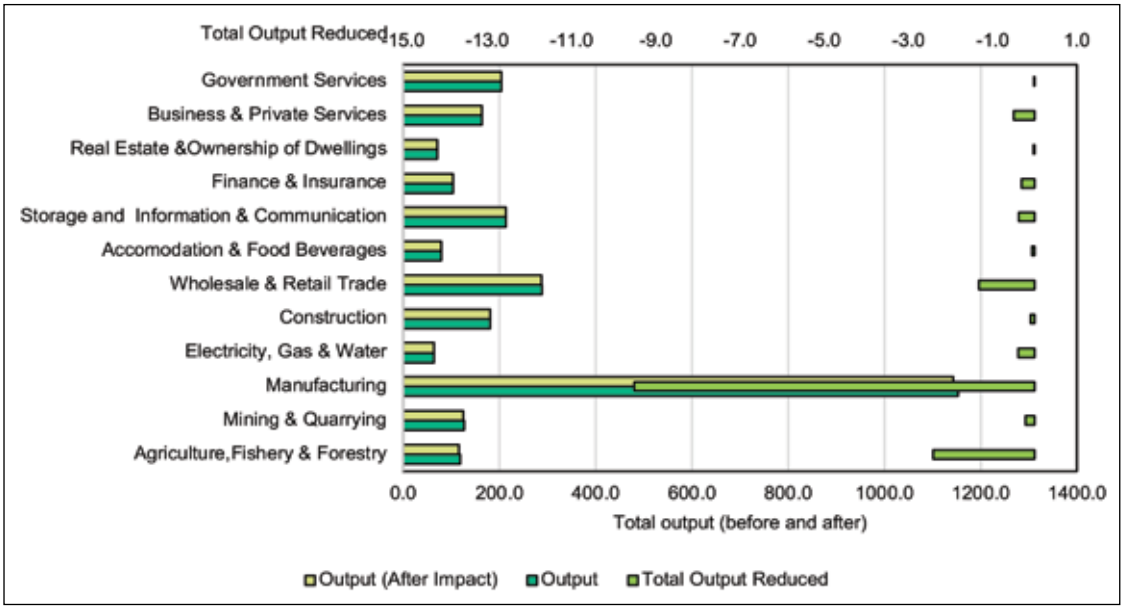

Figure 5. Impact on total output according to the sectors.

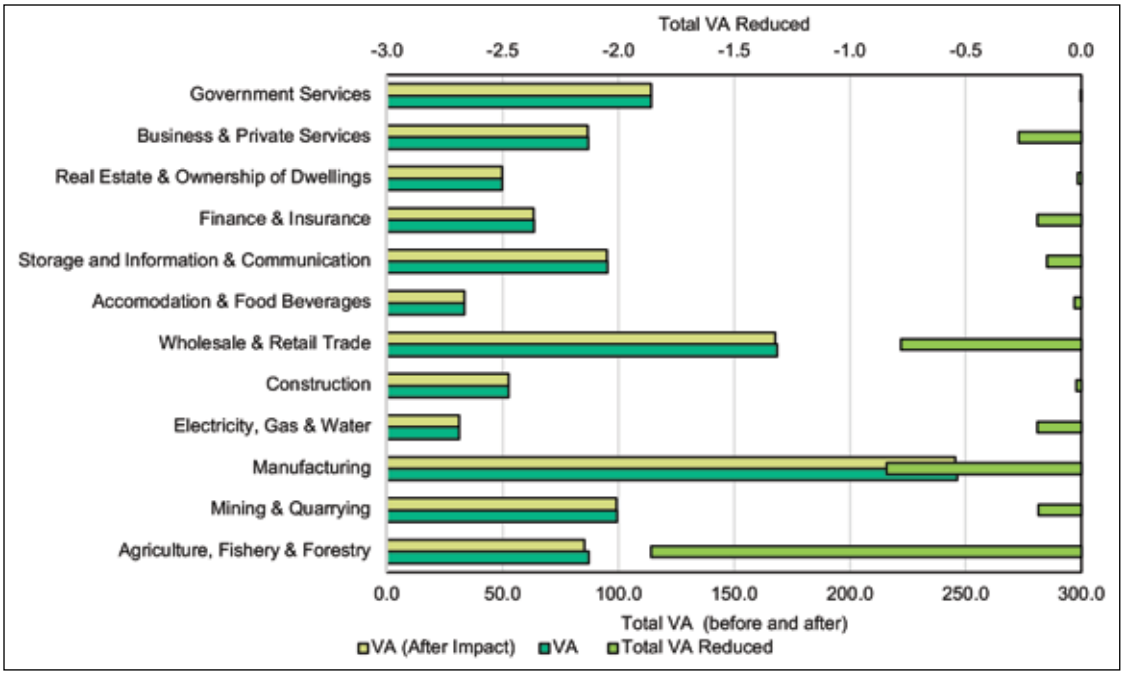

Figure 6. Impact on total gross value according to the sectors.

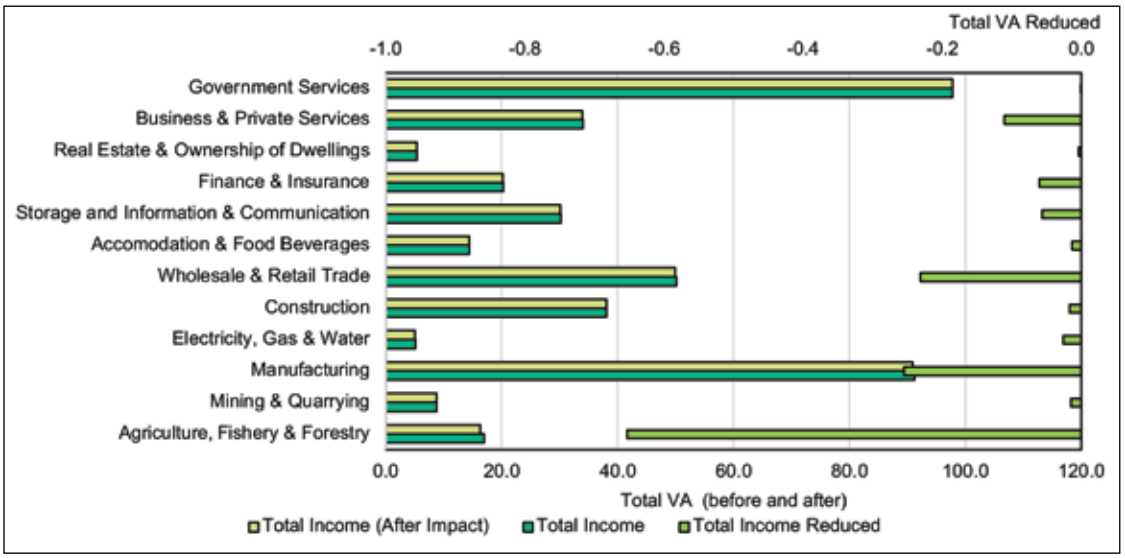

Figure 7. Impact on employee compensation according to the sectors.

TABLE 3. TOP 15 IMPACTED INDUSTRIES AND BACKWARD AND FORWARD LINKAGES

Absorption matrix of domestic production at basic prices, 2015 (124 x 124) commodities		Linkage		Reduction in value (RM '000) ranked by value added		
		BL	FL	Total output economic impact	Total gross value-added economic impact	Total income economic impact
6	Oil palm	0.08	1.88	(2 284 087)	(1 767 200)	(637 663)
93	Wholesale and retail trade, repair of motor vehicles and motorcycles	0.88	2.09	(1 332 068)	(779 816)	(231 861)
21	Vegetable and animal oils and fats	1.37	2.27	(8 107 312)	(479 006)	(169 124)
115	Professional	0.65	2.75	(376 735)	(219 363)	(86 680)
13	Crude oil and natural gas	0.53	1.60	(222 048)	(181 870)	(14 524)
86	Electricity and gas	0.55	2.26	(369 946)	(181 521)	(23 319)
44	Coke and refined petroleum products	0.45	2.61	(445 078)	(107 372)	(5 305)
107	Monetary intermediation	0.65	1.88	(124 783)	(91 441)	(33 450)
45	Basic chemicals	0.85	2.15	(182 948)	(60 948)	(8 610)
8	Other agriculture	0.31	2.10	(80 148)	(59 864)	(12 849)
109	Insurance/ Takaful and pension funding	0.95	1.73	(74 179)	(47 770)	(9 670)
96	Land transport	1.13	2.53	(122 890)	(47 494)	(22 035)
108	Other financial service	0.40	3.16	(108 978)	(45 475)	(15 207)
85	Repair and installation of machinery and equipment	0.48	3.10	(134 573)	(40 802)	(14 912)
116	Business services	1.18	2.93	(99 916)	(39 654)	(20 460)
	Others (includes 109 commodities)	-	-	(1.20)	(0.39)	(0.14)
	Total	**-**	**-**	**(15.27)**	**(4.54)**	**(1.44)**

Note: BL: backward linkage, FL: forward linkage

more than one for both backward and forward which means that the vegetable and animal oils and fats industry provides the output to a wide range of industries and that its influence in the economy is more significant than the total average of industries in Malaysia. The finding from the study illustrated in *Table 3* justifies reduction in palm oil export to Europe based on the EU decision to ban palm oil by 2021 influences the Malaysian economy and its other sub-sectors.

CONCLUSION AND RECOMMENDATION

The study shows that if the European countries completely ban palm oil usage for biofuel and renewable energy production by 2021, Malaysian palm oil exports are expected to decrease by RM6.85 billion and thus reduce the total output value for the nation economy by RM15.27 billion, the total value-added (VA) by RM4.54 billion and employee compensation by RM1.44 billion (based on the

2015 monetary value of palm oil products).

The decrease in the total output would undoubtedly affect Malaysia's economic growth and eventually affect other economic variables, thus gradually leading to unemployment and lower household income. Ultimately, it would reduce domestic consumption and disrupt the overall economy and sectors related to forward and backward linkages for all related sectors. Reducing the total household income (employment compensation) would also indirectly create social problems because of higher unemployment rate.

Because the oil palm industry is essential to Malaysia's economy, the EU RED II implications are significant. It was estimated that 50% of the total Malaysian palm oil and its products exported to Europe are used for biofuel and renewable energy production and feedstock. Indeed, the impact will be even more enormous if European countries entirely ban palm oil use in Europe in both the food and non-food sectors, as the Malaysian palm oil market share to Europe was about 14% of the total palm oil export revenue generated for 2018.

The Malaysian Government is recommended to establish an effective contingency plan before losing its grip on the EU market to reduce the detrimental outcome for the Malaysian economy. In term of sustainability assurance, Malaysia has backed up its conservative policies with a commitment to the Malaysian Sustainable Palm Oil (MSPO) certification system, which has resulted in widespread adaption of sustainable standards throughout the country. In addition, Malaysia on 15 January 2021 has initiated legal action against the EU by filing for consultation through the Dispute Settlement Mechanism (DSM) under the World Trade Organisation (WTO).

It is the right time for Malaysia to explore new markets for its palm oil as risks of declining European demand increase. The UN Population Division has calculated that the countries likely to experience the most significant increase in population between 2019 and 2050 are India, Nigeria, Pakistan, the Democratic Republic of Congo, Ethiopia, the United Republic of Tanzania, Indonesia, Egypt and the United States of America. Moreover, India is expected to exceed China as the world's most populated country and enlarge by nearly 259 million people between 2020 and 2050 (United Nations, 2019). The Asian countries and the West African Continent are among potential new markets and sustain China and India as the existing main traditional markets for Malaysia's palm oil.

Another possibility is to increase palm oil uptake domestically through domestic biofuel consumption. The current mandate for biodiesel in the transport sector is B10 (10% of biodiesel and 90% of regular diesel). Meanwhile, the industrial sector's current mandate is B7 (7% of biodiesel and 93% of regular diesel). The B20 programme for the transportation sector was implemented in Langkawi and Labuan in January 2020. However, the original rollout plan of the B20 programme has been readjusted because of COVID-19 (Wahab, 2020). Higher B20 mandates are expected to use 1.3 million tonnes of crude palm oil each year (Gustam and Hassan, 2020). Apart from the advantage of stabilising the CPO price because of higher demand, this move will increase the uptake of palm oil in the country which will compensate for the losses of Malaysian palm oil export to the European market and thus benefit smallholders by increasing the price of fresh fruit bunches (FFB).

It would be useful to further study the impact of increasing biodiesel usage domestically in Malaysia using the I-O approach to divert or regain the possible future decrease in palm oil export to European countries. The I-O approach should be used to study the employment consequences of policies aimed at supporting biofuels consumption domestically in Malaysia and whether it can capture the losses from reducing palm oil export to Europe in the future. A new study should also be carried out to determine the optimal level of palm oil consumption domestically in the food and non-food sectors, reducing dependence on palm oil export to ensure a balanced policy to develop the wealth of both producers and consumers of palm oil within the country.

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