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Determinants of Treasury Bill Rates in the Philippines

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ABSTRACT

Purpose – A treasury bill (T-bill) is the safest money market instrument issued by the Philippine government and matures in a year or less than a year. This paper identified and analyzed the factors that affect the movement of the T-bill rate in the Philippines.

Design/Methodology/Approach – An Ordinary Least Squares (OLS) technique was applied in this study using time-series data from 1971 to 2015. The process of forward splicing was used to complete the data of Consumer Price Index (CPI). Splicing is defined as the process of combining two or more index numbers of different bases into a continuous series of index numbers of a common base. There are two types of splicing: backward and forward splicing. In this study, only forward splicing was used because of missing data in recent years. To see if there was a structural break in the model caused by external shock (financial crisis), the model was tested for a structural stability test: specifically, the Chow Test.

Findings - Based on the result, having low economic growth, low expected foreign returns, and high inflation would result in a high T-bill rate. Any major financial crisis can also influence the T-bill rate positively due to the influx of investors who would want to secure a safe investment. Furthermore, investors would be risk averse by investing in T-bills if the performance of the economy is sluggish and the expected foreign return is low. Thus, the T-bill rate serves as an investors' guide on when they would take a riskier investment or a safer investment.

Research Implications – Most studies related to this topic focused only on the use of real gross domestic product, real money supply, and expected foreign returns as factors affecting the Treasury Bill Rate. Adding two other variables in the model, inflation as well as financial crisis, and testing it for structural break, multicollinearity, and autocorrelation were the added value of this paper. Such tests are crucial for unbiased regression results that will affect the policy implications if not addressed properly.

Keywords: expected foreign return, financial crisis, GDP, inflation, treasury bill rate
JEL Classifications: C22, E43, E44, G01

Ⅰ. Introduction

A Treasury bill (T-bill) is perceived as "the core of the Philippine money market" (Singson, 1971). It is a money market instrument issued by the Philippine government, and it matures in a year or less than a year. It is the safest investment since it is the government is

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indebted to the person who purchased the T-bill. This provides an incentive for risk-averse investors to use Treasury bills instead of other instruments such as corporate bonds, stocks, and Treasury Bonds, which provide higher return but higher risk.

In early 1949, T-bills already appeared in the trading operations of the Central Bank of the Philippines, but were not given much attention until after May 9, 1966. The Treasury bill program was introduced with an initial offering of 91-day T-bills (Singson, 1971). In the succeeding years, Treasury bills were given more emphasis, and became an essential part of trading activities, and which were considered one of the most marketable securities in the money market.

Treasury bills in the Philippines in the early years were influenced only by monetary policies through money supply indicators such as monetary stock, monetary base, and free reserves (Singson, 1971). As the country continues to relax its limitations and become more and more open, world interest and exchange rate, as well as inflation, were added to the factors affecting Treasury bill interest rates.

Knowing the factors that affect the T-bill would be significant as it also serves as the benchmark for financial investors to invest or not in other financial instruments. When the T-bill rate rises, other interest rates rise as well, and vice versa. Analyzing the factors that affect the T-bill rate would be helpful as it serves as an indicator for investors to make a riskier investment when the T-bill rate is lower than expected. Other than that, the T-bill rate also helps in verifying the assumption of if other macroeconomic variables such as economic growth and inflation are in a good condition.

Ⅱ. Literature Review

One of the first studies in the Philippines concerned with the role of Treasury Bills as a factor of the money market examined the impact of monetary policy on the Treasury bill rate. In a study by Singson (1971), three factors were used as an indicator of monetary policy since, at that time, the ideal money indicator had not been specifically determined. The three indicators were monetary stock, monetary base, and free reserves. The results showed that there was a very weak relationship between monetary policy and Treasury bill rates. Thus, the impact of the monetary policy is insignificant in influencing Treasury bills (Singson, 1971). He explained that this was due to its early stage, and it needed more development plus the absence of a broad market prevented possible open-market operation engagement by the Central Bank of the Philippines and limited entry of likely investors.

In a more recent study done by Dakila and Claveria (2006), relevant factors such as deviation of nominal GDP, month-on-month changes in the exchange rate, and the 90-day London Interbank Offered Rate (LIBOR) positively influenced the 91-day T-bill rate while real money supply had an opposite effect. They also added that about 96 percent of Treasury bill rate changes could be explained by these factors.

1. Interest Rate Determination Model

Edwards and Khan (1985) presented three models for interest rate determination: an open-economy model, a closed economy model, and a general-case model. Two of the possible extensions by which the general case model can be improved are (1) the analysis of the determinants of real interest rates in developing countries, and (2) the analysis of interest rate behavior during the process of liberalization of the capital account of the balance of payments. They concluded that interest rate determination for developing countries is very important as it will dictate the issue where policymakers are most concerned about, which is how interest rates will behave when faced with changing foreign and domestic factors. This will serve as a starting point in analyzing the volatility of interest rates in a developing country.

The framework developed by Edwards and Khan (1985) was used in other studies in different countries. It was adapted in interest rate determination in India, Nigeria, Malaysia, and the Philippines. However, studies conducted in East Asia did use Edwards and Khan

(1985) with a twist, while in Boston, a different measure on interest rate determination has been adopted.

In India, Patnaik and Vasudevan (1998) used 91-day Treasury bill rates for the secondary market that represented the interest rate in India, while Index of Industrial Production was used as output instead of Gross Domestic Product. They found that a co-integrating relationship existed between interest rates, real money supply, output, and expected foreign returns. They also found that by using the error-correction model, foreign asset returns were significant in the short and long run, and therefore domestic factors were not the only elements affecting Treasury bill rates. They concluded that the strong link between domestic and foreign interest rates were explained by a rise in foreign portfolio inflows, more exposure of international institutions and funds to Indian markets, and a continuous rise in foreign direct investments.

Onanuga and Shittu (2010) analyzed the influence of both domestic and foreign factors on the interest rate in Nigeria, and adapted not just the model developed by Edwards and Khan (1985) but also the methods and procedures used by Patnaik and Vasudevan (1998). They found that a rise in real money supply, expected foreign returns, and domestic outputs will cause a decline in Treasury bill rates.

In Malaysia, Hussin et al. (1993) and Goh and Alias (2002), as cited by Ahmad and AbdKarim (2010), employed the model of Edwards and Khan (1985), and both studies found that there is a strong relationship among the domestic interest rate, foreign interest rate, and the expected change in the exchange rate. The results suggest that with little reliance on domestic factors, the domestic interest rate would not be easily influenced by changes in monetary policy.

A study in the Philippines regarding interest rate determination by Gochoco (1989) used the interest rate model of Edwards and Khan (1985). For the years 1991-1995, where the financial sector was in the liberalization period, the degree to which both domestic conditions and external factors influenced the interest rate was analyzed. Capital accounts in the Philippines are neither fully open nor fully closed. The authors used a dummy variable to represent the periods in which there is a tightening and/or loosening of financial capital controls. The study showed that domestic monetary controls directly affected the interest rate by only a little amount, and the rate by which domestic interest rate rise is reflected in the rate of changes in foreign interest rate.

However, a study conducted by Cavoli (2007) on interest rate determination for East Asia, took a different approach using the model developed by Edwards and Khan (1985). They only employed part of the simple open economy case to observe the how pre-crisis monetary and exchange rate policy affected the interest rates of East Asia. They incorporated the effects of the sterilization of capital inflows by changing the conditions for money market equilibrium. The countries involved in the study were Korea, Thailand, Indonesia, Malaysia, and the Philippines. They concluded that sterilization was effective in influencing the interest rate. This shows that the model was not limited to only the variables initially introduced.

In Boston, Hendershott and Peek (1992) examined the Treasury bill rates of 1970s and 1980s. They developed a new measure of monetary policy to explain the impact on the subsequent rise and decline in interest rates. Income elasticity of money demand, growth rate of money supply, default risk on bonds, inflation rate, full employment federal purchase, marginal tax rate, investment tax incentives, and private saving supply shocks were used as independent variables to explain the volatility of real six-month Treasury bill rates. The authors found that monetary policy, fiscal policy, private saving supply shocks, and default risk on bonds had a significant influence on the major movement of real six-month Treasury bill rates. Full employment federal purchase, marginal tax rates, and investment incentives account for the impact of fiscal policy. Overall, they found that higher real rates were explained by tight money, expansionary fiscal policy, high inflation, and low private saving supply shocks.

2. Effect of Financial Crisis and Inflation on Interest Rate

During the 1997 financial crisis, East Asian currencies collapsed, leading to a rise in interest rates. Cho and West (2003) said that empirical studies provided a varying relationship between interest rates and exchange rates. Cho and West (2003) established that an escalating increase in interest rates was linked to the appreciation of currencies for countries that experienced the banking and currency crisis. Studies focusing on the 1997 East Asian financial crisis by Cho and West (2003) provided opposing results. Two of the studies concluded that an interest rate increase led to exchange rate appreciation, while the other two concluded that no strong relationship existed between interest rates and the exchange rate in the five East Asian countries, namely Indonesia, Korea, Malaysia, the Philippines, and Thailand.

According to Dohner and Intal (1989), one of the tenacious attributes of Philippine monetary policy are the restrictions on interest rates. Results showed that short term lending became safer than long-term loans due to some changes in the rate ceiling structure. In addition, loans with a maturity of one year and less fell between 95 to 96 percent (Dohner & Intal, 1989).

According to Alburo (1999), the Philippines had just started to escalate in growth rates in terms of real Gross Domestic Product when the Asian financial crisis happened. The growth rates had a short period of steadiness before falling dramatically for all the affected countries, not only in the Philippines (Alburo, 1999).

In a more recent financial crisis, the same thing occurred with real Gross Domestic Product. The 2008 global, economic, and financial crisis resulted in a recession among the developing countries (Yap et al., 2009). The growth rate of GDP in the Philippines slowed down from the fourth quarter of 2008 to the first quarter of 2009 (Yap et al., 2009). The deceleration in the Philippine economy during the period of financial crisis was not the result of the existing crisis, but rather because of the recession in major countries which affected the prices of food and fuel, leading to inflation (Yap et al., 2009).

Yap (1996) said that the presence of high inflation was a threat to the economic performance and condition of the Philippines. Sill (1996) explained that a rise in expected inflation would result in an increase in interest rate. Contrary to that, in a study by Dohner and Intal (1989), domestic inflation and interest rates were negatively proportional to each other.

Ⅲ. Methodology

The Ordinary Least Squares (OLS) technique was applied in this study using time-series data from 1971 to 2015. The process of forward splicing was used to complete the Consumer Price Index (CPI) data. Splicing is defined as the process of combining two or more index numbers of different bases into a continuous series of index numbers of a common base. There are two types of splicing: backward and forward splicing. In this study, only forward splicing was used because of missing data in the recent years.

The expected foreign returns were computed by adding the U.S. 91-Day Treasury bill rate and the annual change in the Philippine Peso to U.S. Dollar exchange rate (₱/U.S.$). Other variables such as the inflation rate and a dummy variable for financial crisis (Fin) were included to measure the effect of major and minor crises on the behavior of the Treasury bill rate in the Philippines. The functional form used in this study is:

$$TBR_t = \beta_0 + \beta_1 RGDP_t + \beta_2 RMS_t + \beta_3 EFR_t + \beta_4 In_t + \beta_5 Fin + \varepsilon_t \quad (1)$$

Where:

TBR_t : the average market interest rates in the Philippines in time t, measured by the Treasury Bill Rate

$RGDP_t$: Real Gross Domestic Product in the Philippines

RMS_t : Real Money Supply in the Philippines, measured as the M_1 deflated by the Consumer Price Index (CPI)

EFR_t : Expected Foreign Return estimated by adding the U.S. 91-day Treasury Bill Rate and rate of depreciation of the Philippine Peso to U.S. Dollar exchange rate (₱/U.S.$) in the corresponding years

In_t: Inflation rate in time t

Fin: Financial Crisis as the dummy variable, 1 if the year is under the period of financial crisis, and 0 if otherwise

β_i i=0,1,2,3,4: the parameters of the model

ε_t: stochastic residual term

To see if there is a structural break in the model caused by external shock, the model was tested for a structural stability test: specifically, the Chow Test. This test, developed by Gregory Chow, tests whether a particular date causes a break between the regression coefficients. If the p-value is < 0.05, then the null hypothesis will be rejected, and thus, there is a break in the regression coefficients. If this is the case, then there are two options. First, it is still acceptable to keep all variables in the regression. Second, if there is a need for more degrees of freedom, then throw out the insignificant variables. This study tested the year 1998, when the Global Financial Crisis happened, and such an event caused a break in the regression coefficients. A dummy variable was used to divide the data into two, having a value of zero (0) for years 1998 and above, and one (1) for years 1999 and below. If there is a break in the data, then it will not have any long term policy implication.

Ⅳ. Results and Discussion

The study used real gross domestic product, real money supply, and expected foreign returns as factors affecting the Treasury Bill Rate in the Philippines, all of which are factors present in the past studies in other countries. Two other variables were added in the model: inflation, as well as financial crisis, a dummy variable.

Before applying OLS, two tests were conducted for this time-series data. The first one was the test for multicollinearity to see if correlation exists between the independent variables (dummy variable is included). The result of the test shows that a correlation exists between all of the variables (see Table 1).

Table 1. Correlation Matrix

	TBR	**lnRGDP**	**lnRMS**	**EFR**	**In**	**Fin**
TBR	1.0000					
lnRGDP	-0.3542	1.0000				
	0.0170					
lnRMS	0.4744	-0.3895	1.0000			
	0.0010	0.0082				
EFR	-0.3435	-0.0676	0.1374	1.0000		
	0.0209	0.6589	0.3682			
In	0.6747	-0.4774	0.2794	0.2546	1.0000	
	0.0000	0.0009	0.0631	0.0915		
Fin	0.4634	-0.1566	0.2384	-0.3497	0.2675	1.0000
	0.0013	0.3044	0.1148	0.0185	0.0756	

The variance inflation factor (VIF) was computed to see how much the variance increased because of the presence of multicollinearity. The tolerance of the model (TOL) was also computed to see if the multicollinearity was tolerable or not. A VIF equal to or greater than 10 and a TOL equal to or less than 0.4 would be problematic. The results for both VIF and TOL showed that multicollinearity would not be a problem because of the low VIF and high tolerance (refer to Table 2).

The second test conducted was the test for Autocorrelation. The Durbin-Watson statistics was derived. The Durbin-Watson of the model is very low, amounting to 0.670 (see Table 3). It does not fall within the critical values of the model where the upper and lower limits are 2.224 and 1.776, respectively. Thus, there is autocorrelation present in the model. To solve this problem, the model was transformed using Prais-Winsten Transformation, also known as the "Difference Method." After the transformation, the new Durbin-Watson was 2.060, which falls between the critical values. Thus, the autocorrelation problem was corrected and the transformation is effective. However, due to the lagging of variables in the transformation, the number of observations was reduced to 44.

Table 2. VIF and TOL Test Result

Variable	VIF	TOL (1/VIF)
lnRGDP	1.50	0.666545
lnRMS	1.47	0.680336
EFR	1.33	0.752754
In	1.31	0.764428
Fin	1.28	0.783722
Mean VIF	1.38	

Table 3 shows the regression result of the transformed and corrected model. The OLS regression reveals that 63.17 percent of the variation in the Treasury bill rate is explained by real GDP, real money supply, expected foreign returns, inflation rate, and financial crisis. Taken together, all these factors affect the behavior of T-bill rates in the Philippines.

Table 3. Regression Results of the Transformed Model

Variable	Coef.	t	P > |t|
Real Gross Domestic Product (GDP)	-8.93234***	-3.32	0.002
Real Money Supply	-0.37035	0.64	0.529
Expected Foreign Returns	-0.07667*	-1.82	0.077
Inflation Rate	0.24919***	6.53	0.000
Financial Crisis (Dummy Variable)	2.13639**	2.46	0.018
Constant	35.64854***	3.75	0.001
Number of Obs = 44	Adjusted R^2 =		0.6317
F(5, 38)*** = 15.75	Root MSE =		2.252
Prob > F = 0.0000			
Durbin-Watson Statistics (Original)	0.670286		
Durbin-Watson Statistics (Transformed)	2.060403		

Note: ***significant at 1% level, **significant at 5% level, and *significant at 10% level.

Four factors were found to significantly affect the T-bill rate individually, and these are real gross domestic product, expected foreign returns, inflation, and financial crisis.

Real GDP showed a highly negative significant relationship with the Treasury bill rate. Based on the results, a one percent increase in real gross domestic product will decrease the T-bill rate by 8.93 percentage points. The negative relationship between the two variables conformed to the results obtained in a study by Onanuga and Shittu (2010). This can also be explained by the IS-LM Framework (Dornbusch & Fischer, 2005), which suggests that there is a negative relationship between the interest rate and domestic output. As the real output becomes sluggish, more investors would be more risk averse by engaging in less risky assets, such as T-bills (safest investment, especially during economic uncertainty).

The expected foreign returns showed a significant negative relationship with the Treasury bill rate. An increase of one percent on the expected foreign return would decrease the T-bill rate by 0.08 percentage point. The negative result conforms to the results of Onanuga and Shittu (2010). This implies that the continuous depreciation of the Philippine Peso to the U.S. Dollar exchange rate (₱/U.S.$) would tend to be lower the domestic interest rate. This is because more investors tend to invest in higher returns promised by higher foreign returns when an appreciation in the dollar happens, thus making the peso weaken.

Inflation showed a significant positive relationship with the Treasury bill rate. This means that a one percent increase in inflation will increase the T-bill rate by 0.25 percentage points, conforming to a study by De la Cruz and Dickinson (2011). In order to keep positive real interest, nominal interest rates (T-bill rate) will cope with rising inflation.

A financial crisis is also a significant factor in affecting the Treasury bill rate in the Philippines. The presence of a financial crisis increases the T-bill rate by 2.13 percentage points. As a crisis occurs, inflation strikes, causing an immediate increase in the interest rate. To see if there is a structural break in the model caused by external shock, the model was tested with a structural stability test: specifically, the Chow test. Only the year 1998 was tested using the Chow test because it is the year when the most known crisis occurred: the Asian Financial crisis. The p-value is 0.0008, revealing that there is a break, which means that the crisis significantly influenced the T-bill market. However, as discussed in the methodology, it would not be applicable in terms of long-term policy. Remedial measures for a significant structural break could be subject to further study.

V. Conclusion

Based on the result, when the T-bill rate is high, this can be explained by low economic growth, low expected foreign returns, and high inflation. Any major financial crisis can also influence the T-bill rate positively due to the influx of investors who may want to secure a safe investment. As a whole, investors track the performance of the economy through GDP growth and inflation, as well as expected foreign returns, and determine when they should take a riskier or safer investment. T-bills are also known as risk-free assets.

Although this study was based on the model developed by Edwards and Khan (1985), there are limitations to this study, such as the non-inclusion of the degree of openness of the country. Moreover, the data used were on an annual basis, not considering seasonal adjustments which can only be corrected if the data is quarterly, which was not permitted due to the unavailability of data for all variables on a quarterly basis. Furthermore, this study does not have a long-term policy implication since the results of the Chow test suggest that there is a break in regression coefficients.

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Good Aquaculture Practices Adoption and Certification of Shrimp Aquaculture Farms in Bulacan, Philippines: Status, Issues and Prospects

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ABSTRACT

Purpose – This research assessed shrimp farmers' awareness, perception, adoption, and certification as well as discussed the challenges relative to the Philippine National Standards Code of Good Aquaculture Practices (GAqP) in the three municipalities of Bulacan, the Philippines, Hagonoy, Paombong, and Calumpit, to gauge their readiness toward exploring trade opportunities.
Design/Methodology/Approach – The exploratory and pioneering assessment was based on the farm production practices and challenges encountered by fifty (50) shrimp farms in the study area, which were obtained through in-depth interviews using a semi-structured questionnaire and observations on the respondents' shrimp farming practices. The adoption of GAqP practices was measured by frequency count of the number of farmers who practiced or complied with the standards.
Findings – Results showed that only two of the respondents were aware of the term GAqP, as the majority were not familiar with GAqP, nor with the certification process. However, it was observed that the current practices of the farmers were already compliant with almost half of the standards specified in GAqP. Furthermore, it was noted that the respondents adopted certain standards that were related to the production aspects of shrimp rearing, but other aspects, such as environmental, socio-economic, and animal welfare, were rarely followed.
Research Implications – The current production of shrimp in the study area will not be sustainable unless full adoption with GAqP is achieved. Certain issues regarding adoption and certification of GAqP were identified, which included a lack of information dissemination, an absence of demand for certified products in the local market, and misaligned goals of national and local government for the implementation of standards. To address these issues, intensification of GAqP implementation, information dissemination, and development of an incentive program for GAqP compliance are recommended if shrimp industry players are to take advantage of burgeoning trade possibilities, particularly in the export market.

Keywords: adoption, aquaculture, certification, GAqP, Philippines
JEL Classifications: Q22, Q12

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Ⅰ. Introduction

Shrimps are a high value commodity that are traded around the world. In 2017, the global production of farmed shrimp was around 2.9-3.5 million tons (FAO, 2018). Asia Pacific contributed nearly around 75%-80% of the total production of shrimp. It was reported in Aqua Culture Asia Pacific Magazine that the production trend in Asia could be considered industry expansion, and in the cases of India, Vietnam, Indonesia, and to a smaller extent, in the Philippines, a conversion trend. On the other hand, recovery in Thailand was disrupted, while production in Malaysia and China declined (FAO, 2019).

Shrimp, one of the major aquaculture products in the Philippines, ranked fourth in terms of volume of export fishery commodities of the country with a volume of 46,068 metric tons valued at 21.46 billion pesos, accounting for 20% of the total value of aquaculture production in the Philippines (PSA, 2017). There are two commonly farmed species of shrimp in the country: the Black Tiger Prawn (*P. monodon*), or *sugpo* as it is locally called, and the Pacific White Shrimp (*P. vannamei*), or locally known as *hipong puti*. Black Tiger Prawn is produced mostly for export, while the Pacific White Shrimp is for the local market. The former registered a 4.6% production growth in the second quarter of 2019 (12,373.82 metric tons) compared with the same quarter of 2018, at 11,824.81 metric tons (PSA, 2019a). The province of Bulacan in the Philippines is known as one of the major shrimp producers in the country. It ranked third among other provinces in terms of volume of production of Black Tiger Prawn. The shrimp produced in Bulacan mostly come from aquaculture farms. About 1,053 metric tons of *sugpo* were produced in the province in 2018 (PSA, 2019b). Though shrimp production in the country has been stable, the Philippines is still lagging behind in terms of quantity and quality compared to neighboring countries.

Table 1. shows the volume and value of different aquatic commodities exported by the Philippines from 2014 to 2016. In general, the average growth rate of volume and value decreased at 6.27% and 6.49%, respectively. For shrimp exports, the average growth rate of volume increased by 0.19% only, and the value decreased at a rate of 18.04%. This shows that the county's export volume has remained relatively the same, but the value of the commodity has been decreasing alarmingly (PSA, 2017).

In recent years, the market has been more particular in the quality of food products available. At first, quality is concerned mainly with food safety. However, with the growing concern for food security in the future, there is a need to include environmental and socio-economic sustainability (NRC, 2010). This can be observed in the food sector, including fisheries and aquaculture products. In the light of this, certain standards have been set up by Non-Government Organizations (NGOs) around the world, along with certification as proof of truly adhering to these standards. Corsin, Funge-Smith, and Clausen (2007) defined certification as "a procedure through which written or equivalent assurance states that a product, process or service conforms to specified requirements."

Several certification systems have been introduced by international NGOs, such as Best Aquaculture Practices (BAP), GLOBAL G.A.P., and Good Aquaculture Practices in Vietnam (VietGAP), to name a few. Several countries have adopted these standards, and even developed their own standards tailored to their countries. Thailand, Vietnam, and China have developed their own certifying bodies, aside from acquiring international third party certification for some shrimp farms (Tsantiris, Zheng, & Chromo, 2018).

Table 1. Volume of Fishery Exports in the Philippines from 2014-2016

Volume (MT)	2014	2015	2016	Average Growth Rate %
Total Fishery Export	316,863	226,821	257,219	-6.27
Total Major Fishery Export	197,272	181,588	198,977	0.29
% Contribution to Total Fishery Exports	62.26	80.06	77.36	8.08
1. Tuna	117,909	97,815	103,543	-4.06
2. Shrimps and Prawns	8,917	5,475	8,968	0.19
3. Seaweeds	42,469	38,968	39,874	-2.04
4. Octopus	4,132	2,041	3,442	-5.57
5. Crab, Crab Fat and Crab Meat	12,581	11,464	14,160	4.18
6. Grouper, Live		16,178	17,345	3.61
7. Squid and Cuttlefish	5,069	3,357	4,231	-5.51
8. Ornamental fish, Live	5,988	5,900	6,876	4.94
9. Roundscad	191	226	129	-10.82
10. Sea Cucumber, Dried	16	164	408	816.67
Value ('000 Php)				
Total Fishery Export	56,349,274	41,701,161	45,373,785	-6.49
Total Major Fishery Export	45,075,639	33,033,319	35,372,911	-7.18
% Contribution to Total Fishery Exports	79.99	79.21	77.96	-0.85
1. Tuna	19,597,882	13,521,026	13,556,374	-10.28
2. Shrimps and Prawns	5,313,847	1,606,011	2,437,564	-18.04
3. Seaweeds	11,687,900	9,245,231	9,444,811	-6.40
4. Octopus	1,124,110	410,654	638,300	-14.41
5. Crab, Crab Fat and Crab Meat	6,226,377	5,070,842	4,991,822	-6.61
6. Grouper, Live		2,094,256	2,723,334	15.02
7. Squid and Cuttlefish	842,811	614,726	954,541	4.42
8. Ornamental fish, Live	266,928	260,568	284,089	2.14
9. Roundscad	13,205	30,966	15,464	5.70
10. Sea Cucumber, Dried	2,579	179,039	326,613	4188.11

Source: PSA (2017).

As Southeast Asia's aquaculture industry heads toward a greater volume of production and extra-regional exports, it is beset with an issue of critical importance. The U.S. Soybean Export Council and USSEC's Southeast Asia Aquaculture Program has noted that there are still many players in the aquaculture industry that are either unaware of, or not paying attention to, the international movement by buyers to purchase only certified products. Buyer pressure has paved the way to put standards and certifications into place to ensure seafood safety after several international issues involving potentially unsafe aquaculture products, such as antibiotic residues in seafood. Moreover, these standards are also fostering

an environment wherein responsible production and sustainability issues are becoming more important, which will move Southeast Asia's aquaculture industry in general from short-term production approaches to those long-term. This is aligned with the USSEC ideal for the promotion of a profitable and sustainable feed-based aquaculture industry that plans for the long term (del Carmen, 2018).

Standardization of production practices has become a trend in the global market. The application of certification in business operations is also important to improve the quality of shrimp and allow the shrimp products of a country to become more competitive in the global market. Given that shrimp is an export product of the Philippines, a study on the status of certification, including awareness and perception of shrimp farmers, is essential to give an idea of the global competitiveness of the country in this commodity. The study could help give a glimpse of the current situation of shrimp production practices in Bulacan, Philippines, and the adoption to current standards set in the Philippines. It also identifies the awareness and perception of aquaculture farmers on certification. It may also help to show how adoption of these standards could serve as a guide for farmers to improve the production practices of shrimp. In addition, the results of the study will be instrumental to the exploration of the potential direction of the shrimp industry for the country, and could lead to environmental awareness and the sustainable production of shrimp in the Philippines.

The general objective of this study was to assess the status of adoption and certification of shrimp aquaculture farms in Bulacan, Philippines. Specifically, the study aimed to a) present a profile of the shrimp aquaculture farmers and their farms in Hagonoy, Paombong, and Calumpit, Bulacan; b) compare the practices of the shrimp farmers with the standards in the Philippine Code of Good Aquaculture Practices and determine if farmers adopt the practices; c) identify the issues and challenges in adopting and obtaining GAqP certification, and assess the adoption of the farmers to the standards relative to these issues; and d) recommend solutions to the issues and challenges identified.

Ⅱ. Overview of the Fisheries Industry in the Philippines

The Philippine fisheries industry is composed of marine fisheries, inland fisheries, and aquaculture. Included in these broad categories are a vast array of aquatic creatures, such as different species of fish, mollusks, crustaceans, and sea plants, among others. Marine and inland fishing and production are dependent on the volume of fish caught. The two operate very similarly to each other; the only difference is in the area of production since inland fishing operates in lakes, rivers, and reservoirs instead of seas and oceans. Aquaculture is another form of fish production present in the country, and contributes a large chunk of the overall volume of the production of the fisheries sector. This is shown in Table 2, with aquaculture accounting for a volume of 2.2 million metric tons in 2016.

Aquaculture is defined as the "aquatic equivalent of agriculture or farming on land" (Edwards & Demane, 1997). Farming suggests an intervention in the life cycle of an organism. This differentiates aquaculture from fish capture. Aquaculture covers both aquatic plants and animals like seaweeds and fish over different types of water mediums, namely freshwater, brackish, and seawater. Freshwater farms are located in inland areas like lakes and rivers, while brackish and seawater aquaculture is located in coastal regions in areas like deltas and estuaries, among others. Brackish water is a mixture of freshwater and seawater, and can naturally be found in deltas of rivers (Baluyut & Balnyme, 1995).

Being an archipelago, the Philippines is an abundant source of fish and seafood products. In 2014, the country ranked 8th among the highest fish producing countries in the world, with almost 4.7 million metric tons of fish together with other marine resources (BFAR, 2015). The overall production

increased by 1,082.35 metric tons from 2016 to 2018, as shown in Table 2. Aquaculture constitutes the majority of the volume of fishery production in the country, which was about 2.3 million metric tons (52.89%) out of the total 4.35 million metric tons in 2018. In general, the fisheries sector had an average growth rate of 0.007%. The aquaculture sector, on the other hand, posted an average growth rate of 2.27 %. There was a 3.72% decrease for commercial fisheries, and a 1.43% decrease for the municipal sector in terms of fishery production volume.

Table 2. Fishery Volume of Production by Sector, 2016-2018 (in Metric Tons)

Sector	2016	2017	2018	Average Growth Rate%
All Sectors	4,355,792.42	4,312,089.51	4,356,874.77	0. 01
Commercial	1,016,948.05	948,281.45	946,437.62	-3.72
Municipal	1,137,931.03	1,126,017.30	1,106,071.84	-1.43
Aquaculture	2,200,913.34	2,237,790.76	2,304,365.31	2.27

Source: PSA (2019a).

The country exports several commodities like tuna, seaweed, mud crab, and shrimp/prawn. The main markets for these products are from developed countries like the United States and Japan. Around 1.5% of the Philippines' total gross domestic product for 2015 was contributed by the fisheries industry, which translates to 194 billion pesos (estimated at USD 3.8 billion) in value (BFAR, 2015). Total shrimp exports were valued at 2.43 billion pesos (estimated at USD 47.6 million) in 2016, and contributed approximately 7% of the total fishery exports of the Philippines (PSA, 2017).

In many parts of the country, aquaculture has long been established. The Philippines reached its peak in the industry in the year 1998 when it ranked as the fourth leading aquaculture producer in the world in terms of production weight, next to its Asian neighbors of China, India, and Japan, according to the Food and Agriculture Organization of the United Nations (FAO, n.d.). Shrimp has been one of the main aquaculture industries in the Philippines. It has been one of the contributors to socio-economic development of the country because of its performance in the export market. Most of the shrimp production in the country is done through aquaculture. Table 3 presents the volume of production of shrimp by species from 2011-2017. The Black Tiger Shrimp (*P.monodon)* is the most farmed in the country, contributing to 95.06% of total production of shrimp in 2016, followed by Pacific White Shrimp (*P. vannamei*) with 3.6% in the same year.

The Black Tiger Shrimp (*P. monodon*), or locally known as *sugpo,* earned its name from the black stripes across their backs. This species is believed to have originated from the coasts of the Indian Ocean, and was distributed around the world. It is considered a high value export commodity in the Philippines. Figure 2 shows a sample of a market-ready black tiger shrimp.

On the other hand, the other species farmed in the Philippines, the Pacific White Shrimp (*P. vannamei*), locally known as *hipong puti*, is native to Central South America. It was introduced to Asia during the late 1970s, and was eventually produced in the Philippines in the 1990s due to the unstable production of the black tiger prawn. It served as an alternative source since the black tiger prawn was afflicted with the White Spot Syndrome Virus and Yellow Head Virus diseases during that time.

One of the largest producers of shrimp is the province of Bulacan on Central Luzon island in the northern Philippines. Municipalities such as Hagonoy, Paombong, Malolos, Calumpit, Bocaue, and Meycauayan City have shrimp production systems. The volume of

tiger prawn production of Bulacan in 2018 was estimated at 1,053 MT, and ranked sixth in the country (PSA, 2019b). Most of the culture practice in the province is a polyculture system where shrimp is grown alongside other aquaculture animals such as milkfish, tilapia, and mudcrab.

Table 3. Philippine Aquaculture Shrimp Production by Species (in metric tons), 2011- 2017

Year	Farmed Production (MT)				
	Tiger Prawn	White Shrimp	Endeavor Prawn	Freshwater Prawn	Total Production
2011	47494.68	1974.05	689.82	2.86	50161.41
2012	48196.64	1878.6	778.45	4.53	50858.22
2013	49466.92	1870.99	757.2	5.75	52100.86
2014	47843.44	1826.66	1150.63	3.44	50824.17
2015	49527.33	1646.04	950.34	2.51	52126.22
2016	49139.25	1673.69	635.76	1.63	51450.33
2017	46067.64	1744.29	644.03	1.36	48457.32

Source: PSA (2018).

Table 4. Tiger Shrimp, Major Destination, Form and Value, 2014-2016

Type/Major Destination	Value of Production			Average Growth Rate%
	2014	2015	2016	
1. Frozen				
Japan	1,132,631	523,729	1,233,120	2.96
USA	821,981	345,326	567,229	-10.33
Korea	511,600	114,733	69,874	-28.78
Taiwan	56,852	37,186	46,577	-6.02
France	51,222	185,331	35,047	-10.53
2. Fresh/Chilled				
United Arab Emirates	122,597	68,406	88,866	-9.17
Taiwan	35,977	31,649	44,622	8.01
Hong Kong	11,854	42,456	15,623	10.60
3. Prepared/Preserved				
USA	54,532	51,472	44,479	-6.15
Canada	2,253	6,724	36,561	507.59
Australia	3,498	9,591	21,327	169.90
Netherlands	2,384	198	14,279	166.32
4. Other than Fresh/Chilled or Frozen				
Japan	4,350	12,241	37,027	250.40

Source: PSA (2017).

Polyculture is predominantly used in the area because the other species reared are used to cover losses in case one fails. The shrimp stocks on the farms were obtained from neighboring provinces such as Aurora and Zambales.

There was a drop in production volume in 2017 at 48,457 MT compared to the previous year, which was 51,450.33 MT, as presented in Table 3. The past three years show a decreasing trend in shrimp production. The sudden drop in production in 2017 was caused by a decline in tiger shrimp production in Central Luzon and Northern Mindanao. According to the Fisheries Situation Report of the PSA (2018), Bulacan had problems realted to water pollution and weather changes, and Zamboanga del Sur, a province in southern Philippines, was still recovering from damage caused by flashfloods.

Most of the shrimps are exported in frozen or fresh/chilled form to countries like Japan, the United States of America, and France, which are the major destinations of shrimps produced in the Philippines. Table 4 shows the export value of these shrimp products to the major export markets of the Philippines. Japan is the number one destination for Philippine shrimp exports, and this continues to grow, as seen in the average growth rate presented in Table 4.

Ⅲ. Review of Literature

1. Certification in Aquaculture

Quality has been one of the aspects of food production with which the market has been very particular. The unlimited demand of people for truly high quality food products has pushed producers to exploit resources to the point of complete exhaustion. Several organizations like the United Nations (UN) have realized this and the possible implications for the future. Zero hunger and malnutrition have been one of the main long term goals of the UN. In order to attain sustainability in the food supply, producers must consider other factors aside from being able to supply the needs of consumers. A number of studies (Costello et al, 2010; Hilborn et al., 2015; Jabareen, 2008; Konig et al., 2016; Ng et al., 2013) identified three components to consider in terms of sustainability: social, economic, and environmental sustainability. There is a need to balance these three aspects to ensure long-term sustainable food production. Aquaculture is no exception to sustainable practices due to the diminishing fish supply stemming from overfishing and destructive fishing methods. Further, aquaculture presents the potential for sustainability as certain factors can be controlled and regulated, compared to traditional fishing.

In response to the demand for sustainability in food production, some countries have developed standards from which one can base the sustainability of the production system. Standards are the requirements that a specific product or process should conform to in order to be deemed as sustainable (Corsin et al., 2007). Compliance to standards could either be mandatory or voluntary, depending on government institutes that regulate the production and trade of aquaculture products. Voluntary schemes are usually set by independent NGOs whose goal is to ensure the sustainability of aquaculture. While compliance to these standards is not required, one cannot disregard the fact that these standards could be beneficial for continuous production in the future. Best Management Practices (BMP), GLOBAL Good Agriculture Practices, and Best Aquaculture Practices (BAP) are some examples of standards that are voluntary and set by independent and international organizations.

Certification is defined as a process of assuring the conformity of product or process to set standards (Corsin, Funge-Smith, & Clausen, 2007) in which a certificate is issued by a certifying body to declare compliance. The word ecolabelling is synonymous with a certification only in that it is more particular to environmental sustainability (Wessells et al., 2001). A study by Corsin et al. (2007) identified four key elements commonly observed in certification schemes, and these are a standard-setting orgnization, which is responsible for the development of a certain set of

standards or coordination of standards; a clearly defined set of objectives that the scheme aims to achieve; a set of certification standards that characterize the process or product to obtain certification; and a certification process, or the set of activities that verify compliance with the standards.

The GLOBAL Good Agriculture Practices (GLOBAL GAP) Aquaculture Standard is a certification scheme that is derived from the earlier GLOBAL GAP for agricultural crops. It has been adopted in many agricultural and developed countries around the world like the EU and the USA, and was one of the earliest and one of the most recognized certification schemes, previously known as EurepGAP (Banzon et al., 2013). GLOBAL GAP Aquaculture Standard's system covers hatcheries and the grow-out of fish, crustaceans, and mollusks. Several aquaculture farms from top shrimp-producing countries, such as China and Thailand, have acquired certification from these third party certification bodies.

For developing countries in South East Asia, aquaculture has become important for the production of food for local consumption and international trade (ASEAN, 2015). The integration of the South East Asian market and production base in the ASEAN Economic Community Blueprint prompted quality management systems to reach food security and strengthen the competitiveness of ASEAN member state (AMS) fish products in world markets. A workshop, consisting of representatives from member countries, was conducted and designed specifically for the development of te ASEAN GAqP for food fish (ASEAN, 2015). The establishment of the ASEAN GAqP introduced uniform standards for fish production among AMS. It gave attention to the four areas of production, namely food safety, animal health and welfare, environmental integrity, and socio-economic aspects associated with the aquaculture of food fish (ASEAN, 2015). The content of the ASEAN GAqP guidelines are aligned with FAO's technical guidelines on aquaculture certification. It provides guidance for the development, organization, and implementation of credible aquaculture certification schemes (FAO, 2011).

2. Aquaculture Certification in Thailand

Thailand has been very particular in the production and trading of aquaculture products, which resulted in the existence of three national certification standards, namely the Code of Conduct (CoC) for Responsible Fisheries, Good Aquaculture Practices (GAP), and the latest GAP-7401 (Samerwong, Bush, & Oosterveer, 2018). The rationale for having three standards is to maintain the competitiveness of shrimp in the global market. In the same study by Samerwong et al. (2018), it was discussed that each certification scheme addressed a particular issue. For instance, the CoC was mainly for compliance with EU requirements; GAP has broader coverage to truly improve production; and GAP-7401 allows Thai producers to maintain the top shrimp exporter's position by enhancing GAP and increasing the credibility of production.

Farmers shoulder expenses in complying with the standards to get certification. However, the government has been very supportive in advocating these certification schemes, providing financial support, training, and assistance to farmers. It could be said that the producers are pressured to get certification. The process for certifying for CoC starts when a farmer gives an application form to the provincial fisheries office, then formally applies through the regional certification registration office. The office assigns auditors to the farm, and the assessment of the farm is carried out. If the farm passes, the certification committee signs the papers to certify the farm (Thai Department of Fisheries, 2008). The costs associated in certification, however, were not discussed in those studies. The drive of the government to improve the production of shrimp sets Thai aquaculture certification apart from neighboring shrimp producers.

3. Aquaculture Certification in Vietnam

Vietnam has also been aware of the value and importance of certification. Learning from the

experience of Thai production and having initial support from the US Department of Agriculture (USDA), VietGAP and CoC were born (Corsin, Funge-Smith, & Clausen, 2007). GAP and CoC of Vietnam also addressed certain components of production in that GAP was for food safety and environmental protection, while CoC was for quality inputs. Like other certification schemes, the farmers/ producers are the ones who invest to comply with the standards and earn certification. However, in the results of a study conducted by Marschke and Wilkings (2014), certification was found to be less suitable for small scale producers because they were unable to comply with the minimum requirements. This shows that there are changes to be done relative to the standard to accommodate small scale farmers in Vietnam. The cost was estimated by government officials to add 20-25% to the production cost (Vietfish International, 2012).

4. Aquaculture Certification in the Philippines

As a part of the Philippines' responsibility in the ASEAN roadmap, the Philippine National Standards (PNS) developed the Code of Good Aquaculture Practices, which was published in 2014 and covered four areas of aquaculture production: a) food safety, b) animal health and welfare, c) environmental integrity, and d) socio-economic aspects (BAFS, 2017). The formulation of this code aids in improving overall aquaculture farming in the country by aligning Philippine practices with the international standards of aquaculture. The Bureau of Fisheries and Aquatic Resources (BFAR) is responsible for the issuance of registration and accreditation of aquaculture farms, among others.

The process of accreditation for BFAR is simple and straightforward. The starting point is to give a letter to BFAR stating the intent to earn accreditation, along with the submission of all documents required. An initial inspection by the BFAR regional farm certification panel is conducted. If the farm complies, the farm is given certification. If not, then there is a period given for compliance, along with recommendations to improve the farm. Another inspection is conducted, and if the farm passes, then it will have accreditation. A disapproval of the application will be issued if requirements are still not met.

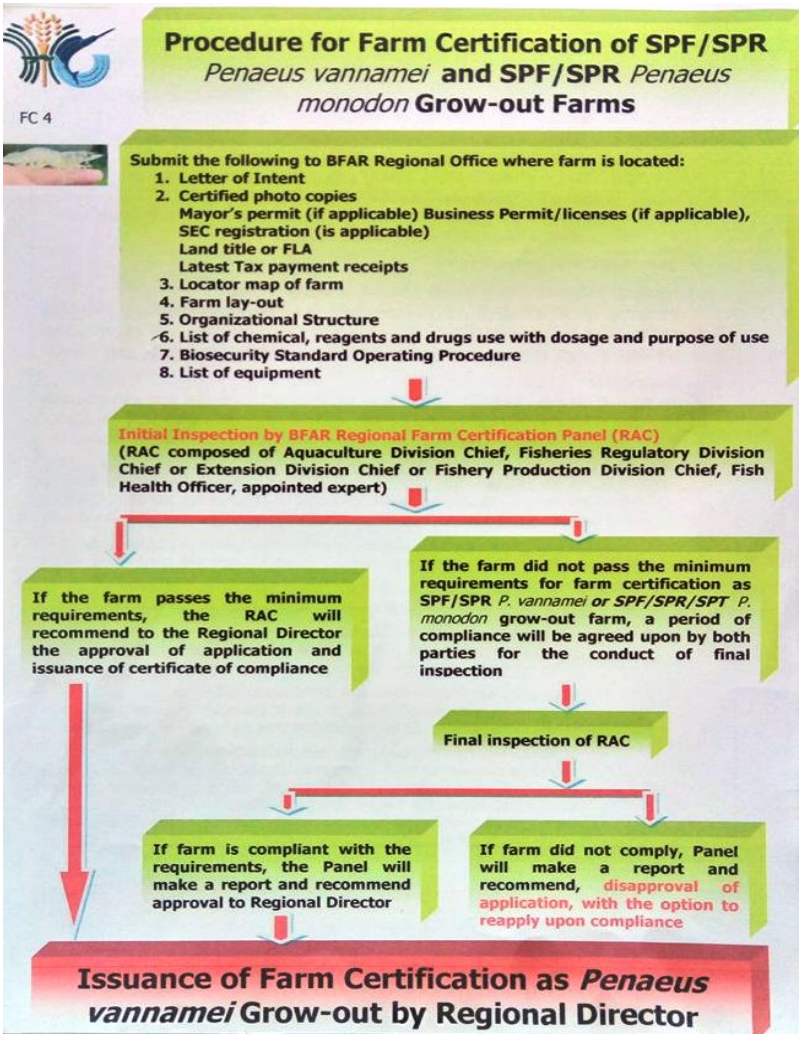
The process is illustrated in Figure 1, which also includes several documents needed for certification, while Figure 2 shows the minimum requirements set by BFAR for accreditation, and is the basis for approval or rejection of the certification. According to Mrs. Maria Abegail A. Albaladejo, the focal person for shrimp, and also the national coordinator of the shrimp production program (brackishwater section) of BFAR, the same requirements apply to both grow-out and hatchery certification. Mrs. Albaladejo explained that the for-mulation of standards for shrimp farms was primarily to contain and prevent the spread of diseases that were present in neighboring countries like Thailand. It was soon developed into a set of standards that covers production, harvest, post-harvest, animal health, socio-economic welfare, and environmental integrity. BFAR provides Specific Pathogen Free (SPF)/Specific Path-ogen Resistant (SPR) accreditation for shrimp farms. Certification/accreditation is highly recommended by BFAR to ensure the quality of the shrimp produced in the country.

In terms of the cost of certification, BFAR emphasized that the certification process is free, and that the farmer should only submit the required documents. However, there may be certain underlying costs in getting permits. Among the documents required for certification, the business permit and the mayor's permit have certain associated costs. Also, the cost for compliance with the standards should also be considered. However, BFAR did not have records for the investment costs for the certification process.

If the documents required are complete and all of the signatories are present, it only takes a day to process the certification, according to Ms. Albaladejo. However, some take three to seven days due to incomplete documents. A farm is considered certified

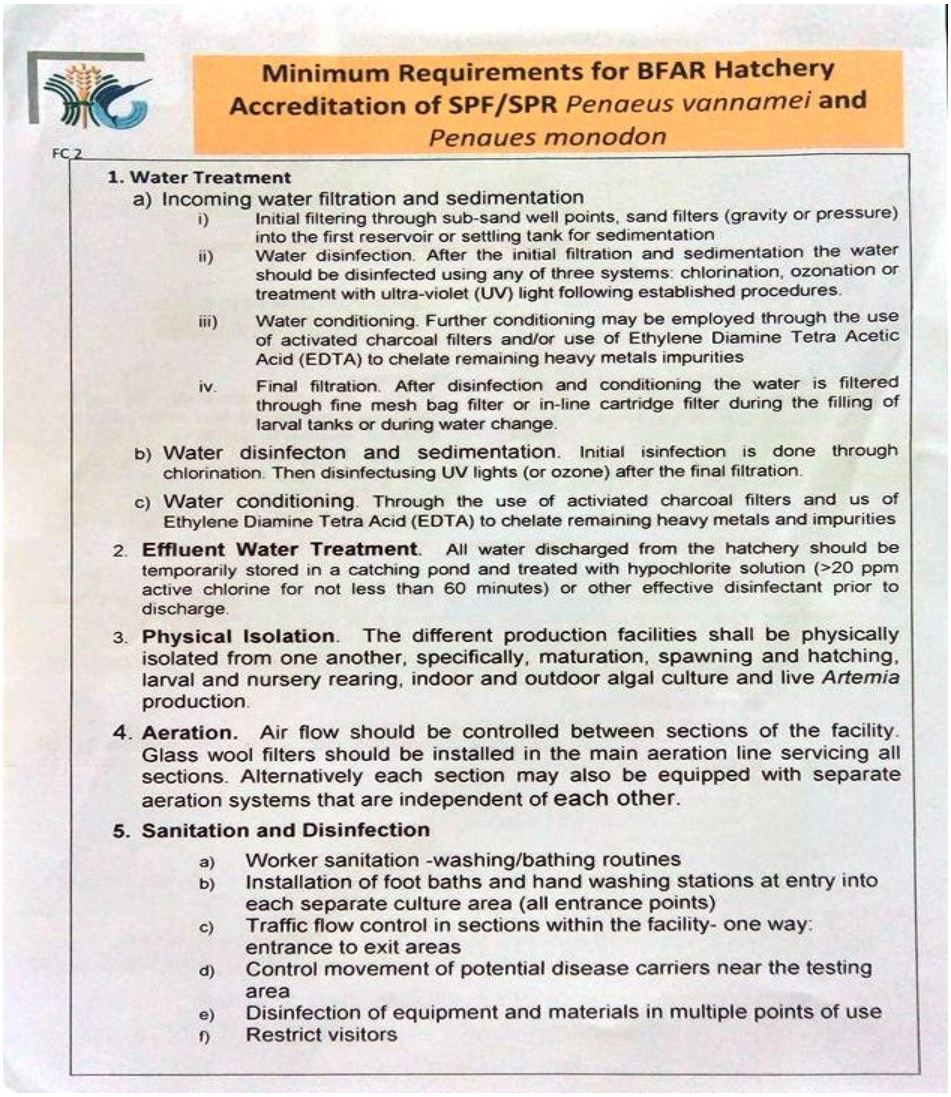
for 12 months upon issuance of the certificate. The renewal process requires all of the previous documents in order to update the records. Further, the certification scheme has no required farm size, type of culture, or method of culture. The farm only needs to provide the proper documents and pass the assessment of the BFAR regional farm certification panel. Furthermore, Ms. Albaladejo mentioned that certain seminars were conducted by the regional offices of BFAR in order to encourage farmers into becoming accredited. Moreover, documents and printed materials of rules and procedures were also distributed to the regional offices of BFAR. These were programs to disseminate information about GAqP, and these seminars were conducted by the regional officers of BFAR, who underwent initial training from seminars conducted regarding the standards. According to BFAR, there is only one internationally certified shrimp aquaculture farm in the Philippines, and that is Dataj Aquafarms Inc., a monoculture farm located in Sta. Teresita, Cagayan Province, with Pacific White Shrimp as their shrimp product.

Fig. 1. Flowchart for Aquaculture Farm Certification



Source: BFAR (2018).

Fig. 2. Minimum Requirements for BFAR Hatchery Accreditation



Minimum Requirements for BFAR Hatchery Accreditation of SPF/SPR *Penaeus vannamei* and *Penaues monodon*

FC 2

1. Water Treatment

a) Incoming water filtration and sedimentation

i) Initial filtering through sub-sand well points, sand filters (gravity or pressure) into the first reservoir or settling tank for sedimentation

ii) Water disinfection. After the initial filtration and sedimentation the water should be disinfected using any of three systems: chlorination, ozonation or treatment with ultra-violet (UV) light following established procedures.

iii) Water conditioning. Further conditioning may be employed through the use of activated charcoal filters and/or use of Ethylene Diamine Tetra Acetic Acid (EDTA) to chelate remaining heavy metals impurities

iv. Final filtration. After disinfection and conditioning the water is filtered through fine mesh bag filter or in-line cartridge filter during the filling of larval tanks or during water change.

b) Water disinfecton and sedimentation. Initial isinfection is done through chlorination. Then disinfectusing UV lights (or ozone) after the final filtration.

c) Water conditioning. Through the use of activiated charcoal filters and us of Ethylene Diamine Tetra Acid (EDTA) to chelate remaining heavy metals and impurities

2. **Effluent Water Treatment**. All water discharged from the hatchery should be temporarily stored in a catching pond and treated with hypochlorite solution (>20 ppm active chlorine for not less than 60 minutes) or other effective disinfectant prior to discharge.

3. **Physical Isolation**. The different production facilities shall be physically isolated from one another, specifically, maturation, spawning and hatching, larval and nursery rearing, indoor and outdoor algal culture and live *Artemia* production.

4. **Aeration.** Air flow should be controlled between sections of the facility. Glass wool filters should be installed in the main aeration line servicing all sections. Alternatively each section may also be equipped with separate aeration systems that are independent of each other.

5. **Sanitation and Disinfection**

a) Worker sanitation -washing/bathing routines

b) Installation of foot baths and hand washing stations at entry into each separate culture area (all entrance points)

c) Traffic flow control in sections within the facility- one way: entrance to exit areas

d) Control movement of potential disease carriers near the testing area

e) Disinfection of equipment and materials in multiple points of use

f) Restrict visitors

Source: BFAR (2018).

Ⅳ. Methodology

This research covered shrimp farms located in the three riverside municipalities of Bulacan, Philippines, namely Hagonoy, Paombong, and Calumpit, due to the fact that shrimp are mainly cultured in these places and most large *consignacions* (fish port markets) are located in Hagonoy, where exporters buy shrimp. Some of these *consignacions* were also interviewed for information about the price of shrimp and the markets for shrimp. A descriptive research design was used to characterize shrimp aquaculture in Bulacan. The research method was composed of descriptive statistics, including the use of a mean and frequency count. Semi-structured questionnaires were utilized to allow for the detailed descriptions of the respondents. In evaluating the awareness and compliance of the shrimp farm enterprises to certification standards,

primary data was obtained to ascertain the personal profile of the respondents, business profile, aquaculture practices, awareness, and perception of farmers on certification. To obtain additional information on certification, a key informant interview was conducted March 25, 2018. The informant was Mrs. Maria Abegail Albaladejo, the focal person for shrimp designated by BFAR. Some of the staff members under Mrs. Albaladejo also participated by answering some of the researchers' questions. Secondary data on the production level of the shrimp industry and total population of shrimp farm producers in the province of Bulacan, Philippines were obtained through the internet and records from BFAR, BAS, and PSA.

As of December 2017, there were 464 shrimp farms in the area based on the data provided by BFAR. A total of 50 respondents were interviewed. Furthermore, descriptive analysis was used in this study. The adoption of GAqP practices was measured by frequency count relative to the number of farmers who practiced or complied with the standards, wherein conclusions and recommendations were drawn.

V. Results and Discussion

1. Profile of Shrimp Farm Producers

The respondents' ages ranged from 28 to 72 years old, with a majority at 55 years old (8%). About three-fourths (76%) of the sample were male, which showed that males were more involved in shrimp farming than females. Moreover, 88% were married. In terms of household size, 36% of the respondents had a household size of four people. Most of the respondents (66%) reported that their sons helped in farm activities, but primarily in harvesting.

A majority of respondents (52%) finished high school. The most frequent (18%) number of years reported to be engaged in shrimp farming was five years. Further, 76% of the respondents had five or more years of farming experience. The respondents were active in joining different organizations. Sixty-two percent of the sample were members of an organization, of which 51.6% joined cooperatives. On the other hand, 48.39% of those in organizations were members of farmer associations within their area. The cooperatives provided certain equipment like pumps to drain the ponds, or aerators. The farmers could also obtain a loan from these cooperatives for capital. The other 19 (38%) respondents were not members of any organization. Most of their reasons were that the extra work was too much for them, and that they were fine doing business on their own. Micro-scale farmers had an average monthly income of Php 6,927 (USD 135.82). Small and medium scale operators had an average monthly income of Php 36,621 (USD 718.05) and Php 95,307 (USD 1,868.76), respectively.

2. Business Profile of Shrimp Farms

Farm size was categorized based on the classification given by the Municipal Agriculture Officer of Hagonoy, Bulacan, Philippines. Farms operating on less than one hectare were considered micro-scale, farms with one to five hectares were considered small-scale, farms operating six to 20 hectares were medium-scale, and farms with at least 21 hectares and above were considered large scale. Almost all (82%) of the farms in the sample were classified as small-scale. None in the sample had large scale operations. The largest farm size in the sample was 16 hectares.

Twenty-seven (54%) respondents actually owned and operated the farm. The rest were classified as farm tenants. A tenant does not own the land or property, but pays a fee to be able to farm on the land or property. The lease rate was not fixed and depended on the size of the land as well as the agreement with the owner. The payment was usually done annually, and may go for at least Php 20,000 to Php 50,000 per hectare (USD 392.15 to USD 980.39), based on the interviews.

Thirty-eight (76%) respondents cultured black tiger shrimp, eight (16%) cultured white shrimp, and only four (8%) of the farmers cultured both black tiger shrimp and Pacific White shrimp. However, for those who cultured both, the two shrimp species were not

cultured at the same time. The choice of species depended on the season, water conditions, and the availability of inputs. When asked why they chosen the species they farmed, almost all (84.4%) of the respondents who cultured black tiger shrimp reported that they earned more from tiger shrimp compared to Pacific White shrimp because black tiger shrimp can be sold at a higher price at the *consignacion*. Further, some respondents found it harder to culture Pacific White shrimp because it required different farm conditions compared to black tiger shrimp. For the eight (16%) respondents who reared Pacific White shrimp, they mentioned that their choice was because of favorable environment conditions (lower salinity) in their area. Aside from this, more can be stocked per hectare compared to black tiger shrimp, which balanced out the lower price compared to black tiger prawn.

All respondents practiced the polyculture system that cultivated different types of species in a given area. Milkfish, *tilapia,* and mud crabs were the most common aquatic animals cultured by the respondents who practiced polyculture. Polyculture was used by some farmers in order to increase the production per unit area as compared to a monoculture system. Aside from increasing their income by raising other species, this system of culture also contributed in terms of improving the pond environment. Further, some used tilapia and milkfish to provide aeration for the pond. According to one farmer, algal blooming is common in most ponds; milkfish, *tilapia,* and mud crabs were stocked to further utilize algal growth in ponds. Polyculture entails operating a different combination of species cultured in the pond. The most commonly reported by the respondents was the tiger shrimp-milkfish-mud crab combination for polyculture (34%).

In terms of number of fry per hectare, more than half (54%) of the shrimp producers employed the extensive method of culture. This is because of the fact that a majority of farms operated on a small-scale basis. Extensive farming employed very low stocking densities, usually 10,000 - 50,000 fry per hectare, and supplementary feed was not given. This required low financial requirements unlike semi-intensive and intensive culture methods. Furthermore, the rest of the farmers (46%) practiced the semi-intensive method, which required 60,000- 150,000 fry per hectare and used supplementary feeds such as shellfish, or sometimes cracked corn, to maintain the shrimps and keep them healthy and growing. None of the respondents practiced the intensive method of culture. One possible reason for this is because the intensive method of culture requires a great amount of capital, from facilities made from concrete tanks to the use of formulated seeds throughout production (FAO, n.d.).

Harvesting was usually done three to four months after the fingerlings were placed in the pond. Farmers measured whether shrimps had reached marketable size (≥ 7 inches) before sale in the markets. For every 50,000 tiger shrimp fingerlings cultured in a pond, there were approximately 4,000- 5,000 heads of shrimps for one hectare, depending on the quality of water. This translated to about 100kg worth of catch according to one farmer.

Most farms only employed a few workers working full-time, mainly due to the small farm sizes. Of the total respondents, 22 (44%) had one caretaker for the farm. Those farms which employed four workers operated fifteen or sixteen hectares of pond. Some owners, who worked alone on their farm, employed other workers if necessary. For instance, some owners tended to hire people to help them in pond preparation before the flood, and/or pond restoration after the flood. Other farmers also hired outside help during the harvest season.

The municipality of Hagonoy had *consignacions* which served as trading posts for buyers and sellers. The *consignacions* were open during Monday to Saturday from 8 a.m. to 3 p.m. The *'tindig',* or point person, had connections with all the exporters, and so he or she is the one who manages and contacts potential buyers, and determines which shrimps are to be exported and which shrimps are to be sold in the local market. Farmers also contacted the *tindig* if they will be late in bringing their produce in the

consignacion so that buyers can wait for them. In the *consignacion*, shrimps were purchased through bidding. A bid is an offer made by a trader or dealer to buy a commodity. It specifies the price the potential buyer is willing to pay and the quantity to be purchased. All respondents mentioned that they directly dropped their fresh produce at the *consignacion.* However, two of the Pacific White shrimp growers dropped one-fourth of their harvest at the port of Panasahan, Malolos, also in Bulacan province, where the produce was sold to the local markets of Malolos.

The initial investment for a shrimp farm per hectare was Php 50,000 (USD 980.39). For tenants, the land lease cost would range from Php 35,000 to Php 50,000 (USD 686.27 to USD 980.39) annually, based on the interviews. The sources of capital for most respondents were mainly from personal resources (42%), loans from organizations of which they were members (16%), and loans from family and friends (30%).

Micro-scale farms had a monthly income range of Php 4,707/month to Php 8,425/month (USD 92.29 to USD 165.19 monthly), or an average of Php 6,927.24/month (USD 135.82 per month). The range of monthly income for small-scale farms was from Php 9,201/month to Php 46,008/month (USD 180.41 to USD 902.11 monthly), or an average monthly income of Php 36,621/month (USD 718.05 per month). Large scale operators had a monthly income ranging from Php 50,416/month to Php 158,525.00/month (USD 988.54 to USD 3,108.33 monthly), or an average of Php 95,307/month (USD 1,868.76 per month).

3. Compliance with the Code of Good Aquaculture Practices

The status of adoption of GAqP practices are categorized into the four main aspects of aquaculture production considered in the Code of GAqP, namely food safety, animal health and welfare, environmental integrity, and socio-economic factors. The assessment of "adopted" or "not adopted" was based on the number of respondents who were observed to practice the specific standards. If at least 50% of the respondents were observed to comply with a certain standard, then the assessment would be that the standard was being adopted, otherwise the assessment was not being adopted.

3.1. Food Safety

Several requirements should be observed in this part of food safety and sanitation. The first is having the required environmental and business permits, locator map, and a farm lay-out map and design present within the premises of the farm. As presented in Table 5, all of the respondents did not have a locator map posted or stored within their farm's facilities. Only two farms (both were of medium scale), one with a 15-hectare and another with a 16-hectare area, had a rough lay-out plan available at the farm. The local government only collected real property taxes from the owners of the land. According to one of the key informants, these lands were once rice farms that were forced to convert to fishponds because of a change in the salinity of the water, since salty water is not ideal for rice production. The policies that applied to rice farms continued on the aquaculture farms, thus explaining the lack of required permits. Facilities for the storage of chemicals, fertilizers, reagents, fuel, and other expenses were only present on farms that had areas of 10, 15, and 16 hectares. This was because the rest of the respondents did not store these chemicals. Instead, the other respondents only bought the right amount of chemicals as needed on the farm. The absence of storage facilities could lead to placing more inputs during preparation since the farmers did not have a proper places to store them. The results of this showed that respondents did not have the required documents and permits for the farms. As earlier mentioned, most of the farmers did not have chemical storage facilities. Even though most respondents technically did not store the chemicals, proper storage facilities are still essential in case there are excess inputs such as chemicals, feeds, and fuel.

Table 5. Assessment of Adoption of GAqP Standards for Facilities

GAqP Standard for Facilities	Actual Practice	No. of Compliant Farmers	% of Adopters n=50	Assessment
Presence of Locator Map	None	0	0	Not Adopting
Presence of Farm Layout	Rough sketch of layout	2	4	Not Adopting
Presence of Permits (mayor, business, etc.)	Payment of real property tax instead of permit	0	0	Not Adopting
Presence of Chemical, Feed, and Fuel Storage Facilities	Farmers buy only what they need	3	6	Not Adopting

3.2. Sanitation

The recommended standards for sanitation and waste management are 1) the presence of disposal facilities, 2) proper farm cleaning practices, 3) proper container and equipment sanitation, 4) segregation practices, 5) personnel hygiene, and 6) foot baths and washing facilities. Waste disposal facilities are required to be placed where contamination should be avoided. Placement of these facilities near the household allows for a defined separation of waste and farm ponds. Further, daily cleaning of the surroundings helps to avoid contamination in the pond. The routine cleaning of the containers before and after harvest is ideal to maintain the quality of the shrimp. Results of the assessment for sanitation are shown in Table 6. The respondents followed waste disposal, facilities sanitation, and equipment sanitation standards, except for the standard for segregation. None of the respondents practiced segregating waste present in the facilities, which resulted in the assessment of non-adoption for that standard. In addition, foot baths, hand washing facilities, and standard protocols for worker hygiene were not present on any of the farms interviewed, which lead to the assessment that these practices were not being adopted by the farmers.

Table 6. Assessment of Adoption of GAqP Standards for Sanitation

GAqP Standard for Sanitation	Actual Practice	No. of Complying Farmers	% of Adopters n=50	Assessment
Presence of waste disposal facilities	Presence of trash cans on the farm	50	100	Adopting
Proper farm facilities cleaning practices	Sweeping and fishing out trash beside and within the pond	50	100	Adopting
Proper procedures for cleaning and sanitizing farm equipment and containers	Cleaning of containers before and after harvest of shrimp	50	100	Adopting
Segregation and removal of waste once a day	No segregation of wastes	0	0	Not Adopting
Personnel hygiene	Absence of uniform and standard procedures for worker's hygiene	0	0	Not Adopting
Foot baths and hand washing protocol	No foot baths and hand washing protocol	0	0	Not Adopting

3.3. Feeds and Feeding

For feeds and feeding standards, the standard requires farmers to 1) source feeds from monitored manufacturers, 2) use labelled feeds, and 3) feed shrimp using the right schedule. The source of the feed determines the quality of the shrimp; therefore, recognized feed manufacturers should be the primary feed source. In addition, a proper label for feeds indicating the composition, storage condition, expiry and feeding rate should be evident. The results of the assessment of adoption of GAqP standards for feeds and feeding are presented in Table 7. None of the respondents checked if the feeds bought were sourced and labelled properly. This became the reason for the assessment of non-adoption by the farmers. The proper administration of fish food focused on minimizing the number of leftover feeds since leftover feeds affect water quality. All respondents used natural feed for the shrimp farms. The practice of placing food 1-2 times a day was conservative, according to one respondent, which means that the shrimp typically completely consumed the food and the farmer provided more feed only when needed. This practice was assessed as adopted by the farmers.

Table 7. Assessment of Adoption of GAqP Standards for Feeds and Feeding

GAqP Standard for Feeds and Feeding:	Actual Practice	No. of Complying Farmers	% of Adopters n=50	Assessment
Sourcing feeds from company monitored by proper authority	Buying feed from local suppliers	0	0	Not Adopting
Use of properly labelled feeds	Buying feed from local suppliers	0	0	Not Adopting
Proper administration of fresh feed	Fresh feed is given 1-2 times a day after 1 month of production	50	100	Adopting

3.4. Record Keeping

Traceability is one of the standards included in GAqP, specifically, records on farm activities, source of fry, feeds and feed ingredients, harvesting record, record of the final buyer, and record keeping for at least 24 months. None of the respondents had records of the details on input sources and final output destinations. Although some farmers knew where the fry was sourced, there was no tangible record of the source. This lead to the assessment that all record keeping standards set in GAqP were not adopted by the farmers. Three respondents (6%) had records of the sales in which volume and quality were noted. The farms operating in hectarages of 6.3, 15, and 16 had these records and were able to store them in a filing cabinet. Table 8 shows the summary of the traceability standards vis-a-vis their practices, along with the researchers' assessments.

Table 8. Assessment of Adoption of GAqP Standards for Traceability

GAqP Standard for Traceability	Actual Practice	No. of Complying Respondents	% of Adopters n=50	Assessment
Adequate records on farm activities	None	0	0	Not Adopting
Record of source of fry	Records cost of fry	0	0	Not Adopting
Records of feed and feed ingredients (source, type, etc.)	Recoding production costs	0	0	Not Adopting
Harvesting record	Recording sales	3	6	Not Adopting
Record on buyer of final product	None	0	0	Not Adopting
Recordkeeping for at least 24 months after harvesting	Filing in cabinet, given that the farmer records	3	6	Not Adopting

3.5. Harvest and Post-Harvest

Harvest and post-harvest standards include harvesting equipment that ensures shrimp quality, planned harvesting, storing shrimp in cold and sturdy containers, quick and hygienic handling of shrimp, expedient post-harvest, proper use of food additives (if used), and transport of shrimp in a clean, cool, and careful manner. The farms used hard plastic coolers that could insulate the shrimp from the heat. Shrimp equipment should maintain the quality and prevent the shrimp from having any physical loss or damage. Eighty-six percent of the respondents practiced planning the production cycle for the year, which allowed for prevention of losses during heavy rains that cause floods. The respondents that did not schedule harvesting often had only less than four years of experience in shrimp farming. Post-harvest and handling of shrimp should be done immediately in a hygienic and careful manner to prevent losses in quality and quantity. All of the respondents followed the standards on harvest and post-harvest as seen in Table 9. The standard on the proper use of food additives was not considered since the farmers did not have practices regarding the use of food additives.

Table 9. Assessment of Adoption of GAqP Standards for Harvest and Post-Harvest

GAqP Standard for Harvest and Post-harvest	**Actual Practice**	**No. of Complying Farmers**	**% of Adopters n=50**	**Assessment**
Harvesting equipment ensures quality	Use of net to capture fish as water is drained	50	100	Adopting
Planned harvesting	Harvesting schedule that avoids some months of the rainy season	43	86	Adopting
Harvest chilled and stored in containers to prevent damage to shrimp	Placement of shrimp in a plastic cooler with ice	50	100	Adopting
Quick and hygienic handling of harvest	Bringing catch to *consignacion* right after harvest	50	100	Adopting
Post-harvest operations done quickly	Washing is done right before storing in cooler	50	100	Adopting
Food additives(if used) must comply with standards	No food additives used	Not applicable	Not applicable	Not Applicable
Careful, clean and cold (0-4C) transportation	Placement of shrimp in a plastic cooler with ice	50	100	Adopting

4. Animal Health and Welfare

Animal health and welfare has the standards of a surveillance and detection program, designated quarantine facilities, and appropriate use of veterinary drugs. The standard requires that the shrimp farm must have practices that ensure that virus outbreaks are prevented. Proper monitoring of shrimp health is needed for quick responses to any virus. The most immediate and common way to detect this is by determining if there were many deceased shrimp on a farm, according to one farmer. However, this was only good for the initial detection of viruses. There are new technologies used by BFAR to detect and identify diseases. All of the respondents carefully monitored the number of deceased shrimp on the farm. However, quarantine facilities were not observed on any of the farms. Table 10 shows that none of the farms adopted GAqP Standards on Animal Health and Welfare.

Table 10. Assessment of Adoption of GAqP Standards for Animal Health and Welfare

GAqP Standard for Animal Welfare	Actual Practice	No. of Compliant Farmers	% of Adopters n=50	Assessment
Surveillance and detection program for disease- infected or deceased shrimp	Actually feeling if there are deceased shrimp	0	0	Not Adopting
Designated quarantine facilities	Harvest when there are deceased shrimp	0	0	Not Adopting
Appropriate use of veterinary drug for shrimps	None use veterinary drugs	0	0	Not Adopting

5. Environmental Integrity

5.1. Water Management and Biosecurity

The water quality of a farm is crucial in shrimp aquaculture. The standard requires reservoir and settling ponds, water treatment ponds, nets to prevent escape, and predator control methods. No respondents t had water treatment, reservoirs, and settling ponds, which implies that there was no adoption of these practices. All farmers used nets to control escapes, while 70% used organic pesticide to prevent predator spawning. The respondents who did not use organic pesticide relied on complete the drying of the pond to prevent the spawning of predators. Table 11 shows the summary of adoption for water management.

Table 11. Assessment of Adoption of GAqP Standards for Water Management

GAqP Standard for Water Management	Actual Practice	No. of Compliant Farmers	% of Adopters n=50	Assessment
Presence of reservoir and settling ponds	Using net to filter draining water	0	0	Not Adopting
Presence of water treatment facilities	None	0	0	Not Adopting
Presence of nets to prevent escape	Use of net covering the perimeter of the pond	50	100	Adopting
Predator control	Use pesticide for predators	35	70	Adopting

5.2. Farm Management

Farm management practices a standards focus on maintaining the quality of the soil and water before stocking. This ensures the proper environment for culturing. Table 12 shows the summary of the standard vs. the current practice, and the assessment of the adoption of GAqP standards for farm management. The farmers adopted three out of the seven standards in farm management, namely the prohibition of chemicals, screening, and aerating the pond. Cross contamination was very evident in farm preparation since there were no treatments done to inflowing and effluent water. These harmful substances could contaminate other ponds, or the water source if left untreated. Only 16% of the respondents monitored water and soil quality, which is needed to determine the proper dosage of inputs such as fertilizers, liming substances, and organic pesticides.

Table 12. Assessment of Adoption of GAqP Standards for Farm Management

GAqP Standard for Farm Management	Actual Practice	No. of Compliant Farmers	% of Adopters n=50	Assessment
Preparation minimizes risk of cross-contamination	Use of nets in draining	0	0	Not Adopting
Prohibition of certain chemicals not used in aquaculture	Use of traditionally practiced inputs (lime, fertilizer,)	50	100	Adopting
Proper use of fertilizers, pesticides, and other inputs	Use of Lime, Organic Pesticide, Chicken manure	8	16	Not Adopting
Screening, settling, aerating pond water	A. Screening of water gates	50	100	Adopting
	B. Aerating the pond using milkfish or having an aerator	42	84	Adopting
	C. no settling ponds	0	0	Not Adopting
Regular monitoring of water quality	Based on color of and taste of water Sending BFAR samples On-site test kit	8	16	Not Adopting

6. Socio-Economic Aspects

For the socio-economic aspects, the standards indicate that the farm should consider the welfare of the farmers and workers. The standard includes aspects in anti-discrimination, anti-child labor, safety and training, appropriate wage rates, provision of living quarters, and minimizing the impact on the community, as presented in Table 13. Based on the practices of the respondents, anti-discrimination, anti-child labor, proper wage rates, and the provision of living quarters were assessed to be adopted. However, they did not adopt safety and first aid training, nor did they undertake efforts to minimize the impact of effects of farming activities on the community. This was because none of the farmers had programs for compensating employees against the harmful effects of aquaculture.

Table 13. Assessment of Adoption of GAqP Standards for Socio-Economic Aspects

GAqP Standard for Socio-Economic Aspect	Actual Practice	No. of Compliant Farmers	% of Adopters n=50	Assessment
Anti-discrimination and Anti-child labor policy	Hire men to help with farm activities	50	100	Adopting
Safety and first aid training	None	0	0	Not Adopting
Appropriate wage and working hours	Php 250-500 per person per day salary (USD 4.90-9.80/person/day)	50	50	Adopting
Provision of appropriate living quarters	Living quarters for caretakers if applicable	27*	100*	Adopting
Minimize the impact of farming activities on the community	None	0	0	Not Adopting

Note : *number of farmers with *caretakers* (n=27).

6.1. GAqP Adoption

There were 45 identified standards from the PNS Code of GAqP. The adoption of a certain standard was assessed earlier in Tables 5-13, and was based on the number of respondents who followed each standard practice of GAqP. Twenty four (53%) out of the 45 standards were assessed and were not adopted by the respondents. The results of this study showed, however, that the respondents were already adopting almost half of the standards of GAqP, even though most of them were unaware of GAqP. This indicates that the current practices of farmers were already half compliant. This could be explained by looking at standards which could be based on the traditional method of shrimp farming, but additional aspects were added to attain sustainability in shrimp aquaculture. Further, BFAR has been holding seminars at the Fish Farmers School in Hagonoy, Bulacan. These seminars focus on green water technology, initially a method of monitoring water quality for tilapia ponds, but further developed by BFAR to also cater to the shrimp industry. Such seminars covered several aspects of GAqP in terms of the production, preparation, and harvest of shrimp.

The results revealed that the food safety aspect, which was given emphasis in production, had more adopted standards. This indicates that the current practices were focused more on production and food safety, and failed to comply with environmental and animal health aspects. In terms of certification, the result implies that although half of the total standards still need to be met, there is a potential for farmers to fully adopt GAqP. However, farmers seem to be unaware of GAqP, which hindered the adoption of all standards.

Furthermore, the respondents who were most likely to adopt the standards were medium-scale operators. Based on the data, those with farm sizes of 6.3, 15, and 16 hectares complied with 26 standards, which was more than the average of the 21 standards adopted by respondents, as indicated in Table 14. Being affiliated with an organization resulted in more compliance with these standards. Farmers with membership in an organization adopted 23 standards. This could be because of the seminars on farming practices that the organizations provided to the members, as well as capital and machines.

Table 14. Summary Table of Adopted and Non-Adopted GAqP Standards

GAqP Aspect	Non-Adopted Standards	Percentage (%)	Adopted Standards	Percentage (%)	Total No. of Standards
Food Safety	12	46.15	14	53.85	26
Animal Welfare	3	100	0	0	3
Environmental Integrity	6	54.54	5	45.46	11
Socio-Cultural Aspect	2	40	3	60	5
Total	24	53.33	21	46.67	45

7. Certification Awareness and Perception

7.1. GAqP Awareness

There were only two respondents who demonstrated awareness of GAqP and were able to define it as follows: better techniques in farming and production for the export market. The two learned these concepts from a series of seminars conducted by BFAR at the Fish Farmers School in Hagonoy, Bulacan. However, these seminars taught farmers about ‘green water technology’, initially a method of monitoring water quality for tilapia ponds further developed by BFAR to cater to the shrimp industry. It covered several aspects of GAqP in terms of production, preparation, and harvest of shrimp. The green water technology seminar lacked other parts or aspects of GAqP, such as environmental, social, and animal welfare concerns.

The rest of the respondents (96%) had no idea of what GAqP was all about. This represents the government's performance in terms of implementation of GAqP in the area of study. This could also reflect the performance of BFAR in disseminating information and encouraging compliance with the national standards. Even though the agency has training programs and distributes materials on GAqP, the farmers in this study did not seem to know current and sustainable practices for shrimp farming. One might argue that the program is still in its early stages. However, after four years of implementation, one could assume that, given that BFAR regularly updates the regional offices, at least one of the farmers should have known fully the standards of GAqP, but the results of this research showed otherwise. This means that the regulatory body needs to further improve the implementation of the program.

When asked how certification for GAqP could be obtained, none of the respondents had an idea of the process undertaken to obtain certification. This was expected to happen since almost none of the respondents knew about GAqP. The two respondents familiar with GAqP reported that the certification process was not detailed in the seminars they attended.

When asked if the respondents knew of any certifying body, the majority answered BFAR. This could be misleading since the respondents automatically associated the agency with all of the policy-making and implementation. Technically, the respondents were not wrong, but the awareness of BFAR being a certifying body was because of the respondent's assumptions, and not because of true knowledge. None of the international certification bodies were identified by the respondents. The respondents were not aware of the other benefits of GAqP in the aspects of animal health, social relevance, and environmental sustainability, among others. Most of the respondents associated the benefits with production improvement only. This indicates the level of understanding of the certification process of the respondents, which could affect how the respondents view GAqP.

7.2. GAqP Perception

After awareness was determined, the basic idea about GAqP, its purpose, and overview of the certification process were provided to the farmer-respondents. Then, the farmers were asked to give their opinions on the benefits and drawbacks of GAqP. Out of the 50 respondents, half of them thought that GAqP was or could be important in improving shrimp production output. Some of the respondents deduced this from hearing the word 'good' in the term, "Good Aquaculture Practices". The other half did not think that GAqP was useful for shrimp farmers. The most common reason was that it was perceived to increase cost on the part of the farmer, therefore, decreasing income. The reason for this was the farmers mentioned that the requirements and renewal of this certification would add to the costs. In addition, the respondents perceived it to be difficult to implement, given that the respondents did not understand scientific terms like the amount of chemicals of biological organisms present in the farm, although salinity was a common term used by the farmers.

Eleven (22%) of the respondents answered export performance as their perceived benefit from GAqP. Four respondents (8%) cited an increase in production volume as their perceived benefit from the program. The rest of the respondents (70%) did not have any idea on the benefits of GAqP. On the other hand, when asked about the disadvantages of GAqP, most (56%) perceived it as an unnecessary cost since current production and sales were stable, even without certification. In addition, the farmers thought that their technical skill would not be enough to implement the practices. Thirty-two respondents (64%) thought that GAqP would be viable for farmers in the study area, given that the government would provide assistance. The rest thought that it would be hard to implement due to the insufficient income of small-scale farmers. However, 44 respondents (88%) would be willing to try, provided that all of the costs would be covered by the government. Further, all of the respondents thought that the local and national government would be the one to provide the assistance they need to adopt GAqP.

8. Issues in GAqP Adoption and Certification

There are several challenges related to GAqP adoption and certification. The main challenges identified by the respondents, and observed by the researchers, were mainly concerned with the lack of information dissemination, lack of awareness, demand for certified products, and lack of government regulations. These are detailed below.

8.1. Lack of Information Dissemination

The results showed that the respondents were already adopting almost half of the GAqP standards, given that the respondents were unaware, and the perception of the standards discussed earlier. The lack of information on the standards was identified to be one of the limiting factors for farmers to fully adopt GAqP. Further, the farmers were unaware of the benefits of compliance with the standards in terms of the environmental, socio-cultural, and animal health and welfare aspects. These factors affect how the farmers perceive the certification program. The provision of information on the standards, the benefits, and the process of certification could lead to farmers changing the previous negative perception of GAqP. In addition, the current BFAR seminars on green water technology have not incorporated GAqP. This is due to the fact that the municipal aquaculturist who managed these seminars realized after the study interviews were conducted that the seminars should now incorporate GAqP to increase awareness. This suggests that there is a need to actively implement the program to the regional office in the study area.

8.2. Lack of Demand for Certified Products

Awareness of GAqP in the study area was low, as only two respondents were able to define GAqP. Most of the farmers heard of it for the first time during the interview. In an interview with the operators of *consignacions*, the customers did not have concerns with the source and production practices employed to come up with the final product. The actual, physical inspection on the quality of the product was the primary concern of the shrimp buyer . Moreover, when asked about the exporter demands, the same results were noted. This implies that there is a lack of demand for certified products as a major issue of GAqP adoption and certification. Unlike in some foreign countries, local consumers were not primarily concerned with the methods of production and processing for food purchased (Roheim, Sudhakaran, & Durham, 2012). This indicates a lack of a driver for certification on shrimp farms. In addition, farmers did not have an incentive to adopt GAqP since there was no demand. Subsequently, the farms could not demand premium pricing for the certified products since the market could not see the value of buying certified products.

8.3. Lack of Stringent Government Regulation

With the participation of the Philippines in ASEAN economic integration, the government formulated GAqP standards aligned with ASEAN GAqP. However, implementation of the program was seen to have several problems. First, the shrimp farmers did not have any incentive to earn GAqP certification. Since the program is voluntary, the farmers in the study perceived it to be unnecessary for their farm as their market does not value such certification. Most of the respondents reported also that they have not fully adopted this because there were no government regulations. The absence of mandatory laws and regulations of the government gives a reason for the farmers not to adopt GAqP. Given this, mandatory regulations may possibly be the only way to initiate adoption and certification.

Another problem is the lack of political will in the implementation of the standards. This was observed when the interview with the BFAR informant was conducted. The staff and other officials in the agency were quite lax in explaining and giving information on the certification program. One employee said that the standards were voluntary, and that the farms would only have a certificate for it, nothing more. This is an

indication of the lack of political will for the implementation of the GAqP standards.

Ⅵ. Conclusion and Recommendations

It can be said that the respondents of the study, namely, the shrimp farmers in Hagonoy, Paombong, and Calumpit, Bulacan, Philippines, were generally not aware of the Good Aquaculture Practices (GAqP). Given that a small percentage of the respondents were able to give a rough definition of GAqP, and given the awareness, the implementation of GAqP has a long way to go. The respondents still followed traditional practices, which were inefficient and had certain effects on the environment and shrimp health. Nevertheless, it was noted in this study that the current practices complied with almost half of the standards of GAqP. Given this, the current production of shrimp in the study area will still not be sustainable unless full adoption is achieved.

Certain issues were noted which hindered respondents in the adoption of GAqP. The absence of information on GAqP hindered the farmers' full adoption of the GAqP standards in their current practices. The respondents could have fully adopted GAqP, given the right information on its benefits, both to farmers and to the environment. Another issue is that there was no incentive for the farmers to adopt the certification. This was because there was no requirement from the government to adopt these practices. Another factor was that there was no demand from the local market for certified food products. Therefore, the added cost of certification was not worthwhile for the farmer-respondents as sales would not increase. The attitude of the farmers also affects the decision to adopt GAqP. This varies depending on the characteristics of the farmers. Some of the older farmers interviewed were hesitant in adopting since they perceived it as a complex procedure.

Shrimp farming has a substantial contribution to the socio-economic development of the farmers. The current condition of shrimp farm enterprises in Bulacan, Philippines, underlines the importance of the assessment of the aquaculture practices of the farmers in order to sustain long- term economic activities in the study area.

The current practices observed during the study showed how much the shrimp farms are adopting the current technology. The development of shrimp production is stagnant compared to neighboring countries that have adhered to sustainable production. The continuation of the current practices could potentially damage the environment for shrimp grow-out, weaken production, and eventually reduce the competitiveness of shrimp in the export market. With this in mind, several recommendations are presented in the next section with regards to the adoption and certification of GAqP.

1. For Shrimp Aquaculture Enterprises

1.1. Attendance and Participation in Seminars

The lack of information is a huge barrier in knowing what production practices are better and sustainable. BFAR holds seminars in the regional offices on the proper way to farm shrimp. Participation in these seminars would allow for a more comprehensive explanation of GAqP and its benefits. Attendance in these seminars could also lead to other farmers gaining interest in GAqP. This could also end up informing the *consignacions* and those further down the line, the customers, which may create demand for certified products. Further, the farmers should stay in contact with the officials to have an update on the seminars available.

1.2. Participation in Collective Farming

It was observed in the study that larger scale operators are likely more able to adopt the standards. The formation and engagement in cooperatives would help farmers in achieving larger scale operations. This would help farmers in adopting certain aspects of the standards and spreading the underlying investment cost on the compliance with the standards.

2. For Support Sectors

2.1. Local Government Units of the Study Area

2.1.1. Policy Formulation and Implementation

The local government greatly impacts the businesses in their locality. Being in charge of policy formulation, regulation, and implementation, the local government can influence the production practices of farmers in the area. This recommendation is directed to the municipal and provincial agriculture officers in Bulacan, Philippines. First, they need to create local policies on the implementation of the standards. A mandatory law would initiate the full adoption of the standards. In effect, farmers in the area would have to comply.

2.1.2. Provision of Technical, Financial and Marketing Support

Policy formulation and implementation is achieved through proper government assistance in terms of financial and technical aspects. Provision of an aquaculturist for consultation, and the provision of loans for the farmers are recommended. Lastly, local government officials must also endorse the local market for buying products from certified farms. Flyers and publicity posts on social media could be done to endorse the products of certified farms.

2.2. The Certification Body, BFAR

2.2.1. Intensive Campaign for Endorsing GAqP

The lack of information dissemination is one of the factors that affects awareness on GAqP. A more intensive strategy in terms of conducting seminars for GAqP is highly recommended. This should include more frequent seminars on GAqP for farmers. Also, seminars for *consignacions* should be conducted to inform them about the importance of certified products. These seminars could also be in partnership with private enterprises and international certifying bodies to inform them about the programs available. Also, BFAR could host a Shrimp Producers' Expo to inform the public on the certification of shimp.

2.2.2. Incentive Program for Adoption of GAqP

It is evident that GAqP adoption is unattractive to the farmers right now. The recommendation would be to adopt an incentive program for the producers and marketers of shrimp. The program would implement premium pricing for the shrimp and shrimp products produced by a farm.

This would entice farmers because of the higher price for their products.

2.2.3. Focus on Larger Farms and Cooperative Farms

The last recommendation for BFAR is to focus on the GAqP certification of collective and corporate farms rather than small, individual farms. This would be a driver for farmers to create cooperatives and to reap benefits so that all of the members adopt GAqP standards and provide them with trade possibilities with the export market.

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Trade Performance via Infrastructure Investment: Evidence from Synergies among the Belt Road Initiative (BRI) and UN Sustainable Development Goals (SDGs)

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ABSTRACT

Purpose – The paper aims to identify synergies between the Belt Road Initiative (BRI) and UN Sustainable Development Goals (SDGs) from the perspective of sustainable infrastructure development.
Design/Methodology/Approach – The paper analyzes the long-run empirical relationship between infrastructure investment and trade performance. The study also deals with assessment on the basis of panel OLS, Random Effect, and GMM techniques toward the achievement of the SDGs in the period 2008- 2017.
Findings – The paper concluded that infrastructure investment in BRI countries has a positive impact on trade performance, and it promotes trade in Asian countries. It also draws attention to the fact that the joint work of these two global initiatives (BRI and Agenda 2030) could achieve aims in the future.
Research Implications – The outcome of this research can be observed as tentative, and further work is more desirable.

Keywords: BRI, GMM, infrastructure investment, SDGs 9
JEL Classifications: Q01, F14, F18, C01, H54

Ⅰ. Introduction

Since the world became a global village, international trade and investment systems has perpetually faced systemic pressures. Meanwhile, trade, in a global economy today, is about trade regions raising tariffs, thereby making them more protectionist. The US-China trade war not only impacted both but also shook the global and regional trade scenarios. As a top exporter, China is now struggling to shift its US-dependency into other unexplored and potential markets in Asia, the Middle East, and Africa.

In addition, the US also has a similar plan with a different cluster of regions. This is also due to the fact that both sides (China and the US) have so far failed to strike a deal, and the increased tariffs are affecting the respective domestic markets. President Xi initiated the China BRI (Belt and Road Initiative) during his visit to Kazakhstan in 2013, where he announced a project that would connect Asia, the Middle East, Europe, and Africa. The BRI has since been accepted and received global recognition with the agreement of more than a

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hundred countries with China. Meanwhile, critics called it a debt trap strategy, as China intended to spend more than $1 trillion in this project for building roads, railways, airports, and other infrastructure. Most of this Chinese investment is in the form of loans, foreign direct investment, and some hidden contracts with different countries. Some researchers opined that China is more concerned about neutrality by forming individual diplomatic ties that may prevent other countries from moving against them. An empirical study expressed views that the BRI is promoting cooperation among regions that helps in boosting relationships along the trade routes (Dong et al., 2018).

According to an estimation by the Asian Development Bank (ADB, 2017), the investment needs are about USD 26 billion in Asian infrastructure, about USD 170.7 billion in sub-Saharan African infrastructure, and about USD 63.4 billion in the United States (Tekdal, 2017). According to China's National Poverty Line, almost more than 700 million people were alleviated from poverty by the end of 2017, and rural poverty population was reduced to 30.46 million, with the poverty relative incidence dropping to 3.1% (Weiping, 2018). According to a survey, China lifted 850 million people out of poverty, and contributed to over more than 70% of global poverty alleviation (Weiping, 2018). Perhaps China's BRI is an inspiration for human development. Whether it is a "debt-trap" or a "welfare initiative", numerous researchers marked it an imperative development initiative, as the BRI contributes to human, economic and environmental sustainability. China's Belt and Road Initiative (BRI), its most significant infrastructure scheme, claims that the environmental impacts of the scheme are legitimate. By preventing threats to China's BRI ambitions, an analysis of the ecological effects of considerable infrastructure development at the scale of BRI was done (Farwa, 2018). Also, the Belt Road Initiative influences the future of global trade, and it also deals with permanent environmental degradation (Ascensão et al., 2018).

The UN started its Millennium Development Goals (MDGs) in 2000, with an aim to achieve all objectives by 2015, including eradicating poverty and hunger, creating employment, providing education, and others. According to the 2015 MDG report, poverty numbers have dropped from 1.9 billion in the 90s to 836 million in 2015. The assistance provided by developed countries rose from $81 billion to $135 billion between 2000 and 2014. In 2015, the United Nations presented blueprints for (SDGs) "Sustainable Development Goals" to continue the program for a better and more sustainable future called "Agenda 2030". The SDGs consist of 3 pillars: Economic Development, Human Development, and Environmental Protection. There are still 800 million people living with less than $1.25 of earnings per day (UN, 2018). The World Bank (2017) states that BRI-investment in infrastructure development also tendered favorable outcomes in the reduction of shipping time, trade cost, unemployment, poverty, and transfer technology.

A recent study qualitatively combined the BRI and the UN's SDGs with possible outcomes. Hong (2017) matched the two parallel programs as a "Capacity Development Project", and analyzed the close link between the BRI and Agenda 2030, and shared some common points in economic progress, along with social and environmental dimensions in large-scale regional development cooperation that could have significant contributions to the implementation of Agenda 2030. According to Renwick et al. (2018), the BRI contributes to the global infrastructure gap and helps to acheive Agenda 2030 and the SDGs. As stated, the BRI has put significant effort into policy coordination and connectivity facilities providing unimpeded trade and financial integration among the agreed countries. The ambition of the BRI is to initiate the efficient economic allocation of resources and ensure the free flow of economic factors that help create regional economic cooperation. According to CSIS (Center for Strategic and International Studies) (2013), the BRI has 6 economic corridors: the China-Mongolia-Russia Economic Corridor (CMREC), China-Central Asia-West Asia Economic Corridor

(CCWAEC), China-Indochina Peninsula Economic Corridor (CICPEC), Bangladesh-China-India-Myanmar Economic Corridor (BCIMEC), China-Pakistan Economic Corridors (CPEC), and the New Eurasia Land Bridge Corridor, also known as the Second Land Bridge (NELB). According to ADB (2017) the accumulated total is USD 480.3 billion for BRI participating economies, some 59% of the global total of USD 814.3 billion. The next most popular destination for Chinese construction is Asia (USD 170.7 billion), followed by Latin America (USD 63.4 billion), and Australia as the most important at around USD 17.1 billion, which is six times that of the United States and Canada combined (Hillman, 2018). Asia's yearly infrastructure financial investment gap will widen to USD 459 billion by 2020 (Hillman, 2018).

As infrastructure investment plays a vital role in promoting trade opportunities, productivity, and sustainable economic growth, (Xinhua, 2018), the BRI is the source from which to enhance infrastructure connectivity and devise comprehensive approaches to sustainable development. However, due to the lack of regional resources in infrastructure, countries are facing high labor costs and times in foreign trade. Developing countries need to develop soon, and hence the critical steps are building infrastructure and connecting with neighboring countries. In that context, China is a player for developing nations that keep investing in energy, transportation, telecommunication, and many more sectors.

There is an excellent opportunity for China to invest in the region to cope with future trade tensions (Hub, 2017). According to Song (2018), two-way investments between China and the BRI economies have exceeded $130 billion. China's direct investment in BRI countries has grown by 5.2% annually from 2013 to 2018 (Xiaojin & Zhong, 2019). Recently, China has established the New China Bank to finance the BRI project (Hideo & Ohashi, 2018). The BRI helps to achieve the 2030 Agenda to eradicate poverty, provide better access to health care, ensure food security, environmental protection, and create profitable corporations among nations through trade liberalization (Jin, 2018). The main concern of research is to find how the UN and BRI can work together to build a better economy. This report has attempted to find areas where the two global initiatives need to contribute in order to accomplish Agenda 2030. In regards, this study has explored the impact of infrastructure investment flow, manufacturing, CO_2 emissions, gross fixed capital formation, and medium and high tech industry sector trade performance.

Ⅱ. Literature Review

China is a global phenomenon, and since 1978, the Chinese have been working hard to open the economy to the world. China was able to achieve double-digit economic growth for a sustainable period of time. China intends to pour investment of around US$1.5 trillion into BRI countries until 2025, a record amount if completed. Meanwhile, the BRI has emerged with a wide economic policy (Shahriar et al., 2018). The paper also defines the importance of the Belt and Road Initiative (BRI) in facilitating the enforcement of Agenda 2030 for (SD) Sustainable Development. The study has chosen to assess how and where the BRI could best achieve Agenda 2030.

Sustainable Development Growth has 17 Goals, 169 targets, and 243 indicators, and all are theoretically, methodologically, and reliably well designed and tested to function (Janoušková et al., 2018). A growing body of empirical research is on the Belt and Road initiative and China's long term vision in the Middle East (Mukwaya & Molde, 2018), but very little research has been conducted on the empirical results of the BRI on infrastructure and trade performance. Generally, different authors have reported on new research directions and abruptly stated problems (Lin, 2017). So far, much theoretical research has been published on the infrastructure, regions, and districts of the Belt and Road. Empirical studies have indicated various characteristics of infrastructure development, like the Silk Road Economy Belt (South Africa, Middle East) (Mukwaya & Mold,2018). Environmental

issues are receiving ample attention from different fronts in recent decades. The relationship between environmental problems and international trade has been a considerable part of the discussion (Islam & Rajib, 2012). Meanwhile, good understanding and agreement have developed on the nature of interactions between international trade, environmental quality, and infrastructure. Experimental research also explained the positivity of exports on real income, and proposed a a transparent and green environment (Koo, 1979). In 2000, total exports to the OECD from China were around 61% while, on the other hand, BRI-participating economic system stood at 19% (Wavy, 2018). Afterward, the share trend of BRI-participating economic systems has moved continually upwards, and reached 34% in 2016 (Wavy, 2018). The links between trade, pollution, and national income have been analyzed in past studies. This showed that income (Gross Capital) gains from exports can affect pollution in different ways than economic growth (Copeland et al, 1994). Free trade bumps up the growth level and raises real income (Gross fixed capital formation), but it alters the national output's composition, and it therefore changes the relative frequency and CO_2 emission levels. (Islam & Rajib, 2012). Developed countries are more concerned with reducing the threat of CO_2 emissions, not only domestially but also internationally by giving tariffs to certain industries in developing countries which pollute. The explanatory variable "CO_2 emission" has been chosen as a concern under global environmental policy. Recent reports share that China has banned the importing of 24 various types of waste, which shocked multibillion recycling industries all over the globe (Baxter & Hua, 2017).

Gross Fixed Capital Formation (GFCF) as a percentage of Gross Domestic Product, which includes land improvements and infrastructure construction by both sectors (private and public), is indicative of infrastructure spending (Lu et al., 2018). China needs to invest in different regions to help grow economic infrastructure. The highest investment needs in the growth of GDP within the BRI Asian regions are seen in the Pacific (9.1%), as well as in South (8.8%) and Central Asia (7.8%) (ADB, 2017 This compares to around 5.7% in Southeast Asia and 5.2% of GDP in East Asian economies. Empirical study on infrastructure and African development has primarily focused on the impact of infrastructure flow on bulk growth and organizational output in exports (Mukway & Mold, 2018). A required contribution in infrastructure will be needed in a broad perspective with sustainable industrialization and advanced innovation in manufacturing. Many empirical research studies attested to the importance of infrastructure: trade gross fixed capital formation and investment (Hong, 2016). Some studies also noted that firm manufacturing and productivity also depends on infrastructure. A researcher found that, regarding labor productivity, enterprises in Asian countries performed poorly in contrast to the average for middle-income states (Tidiane et al., 2011). Average low performance countries are linked to investment climate deficiencies that cripple manufacturing competitiveness. The researchers performed siginificant work in the field of manufacturing efficiency and deficiencies that rely on the quality of various country's infrastructures, labor force experiences, education levels, cost and access to financing, trade barriers, and business-government relations that explain organizational and trade performance discrepancies (Anoušková et al., 2018). China's investment in the established foreign medium and high-tech industry, which helps achieve goals such as upgrading commercial enterprises through technology transfers. This empirical paper showed that China is about to invest USD 278.5 billion in the medium and high tech industry, or around 26% of the total of 1,090.3 billion, with the United States and Europe at USD 522.0 billion (Asian Development Bank, 2017). Work with the high tech industry and foreign direct investment has found that investment in knowledge building, high-tech production , exports, labor skills, innovation, and R&D bolster the technological infrastructure, which brings growth and development to the infrastructure and economy (Ekananda & Parlinggoman, 2017).

Ⅲ. Empirical Review

Research related to the practical review of infrastructure investment and trade performance is varied; however, it found different results on account of the direction and intensity of effects that are substantial. Hong (2017) concluded that BRI accelerated the achievement of SDGs and implementation of Agenda 2030. Similarly, (Dong et al., 2018) indicated that China needs to promote green construction under the BRI and look at more association with 2030 SDGs. Wang et al. (2007) empirically concluded with a Granger Causality model that found that inward FDI promoted exports in China and left an impact on labor-intensive industries domestically. Weishi et al. (2008) examined a Fixed Effect Model in which a 1% increase in FDI resulted in an increase of 8.8% in China's exports.

Frey (2017) explained SDG 8, "Promote economic growth, full employment, and decent work for all", and consummated the uncertainty in SDG 8 not only gives liberty for the accountability of human rights and monitoring but also promotes legitimacy for the business approach. Likewise, Rai et al. (2018) theoretically quantified that gender and labor rights highlight SDG 8 as it sustained growth economically. Horn and Grugel (2018) concluded that SDGs in middle-income economies could not offer sufficient conditions for development as that also needs to be embraced politically.

Mukwaya & Mold (2018) analyzed the results of the "Global Trade Analysis Project" (GTAP) and concluded that the import and export margin fell 10% due to an increase in the growth rate of East Africa from 0.4 to 1.2%. Gong et al. (2019) analytically measured the ICT sector in China, which produced investments in both the public and private sectors, but also holds significant interest for BRI member countries. Holden et al. (2017) analyzed economic belt and maritime multilateral trade treaties and welfare relations among China and linked BRI members. Qain (2017) analytically explained that more than 40 countries have ratified the agreement with China, and over 100 countries are part of the BRI. The BRI can have a cogent impact to execute sustainable development goals.

Ⅳ. Source of Data and Estimation

The main aim of the study was to check the impact of infrastructure investment on the trade performance of BRI countries, which draws attention to the potential gap of sustainable infrastructure by collaborating with both global initiatives. For data, panel OLS, random effect, and GMM tools have been adopted to evaluate the integration of variables as very few quantitative works have done before. A previous empirical study used the GTAP and GGE models and a GTAP 10 database to check the BRI trade in Eastern Africa (Mukwaya & Mold, 2018). In that model, trade performance was measured by the exports of goods and services (Liu, 2013). Infrastructure investment was measured by the medium and high-tech industry (Melitz, 2003), manufacturing value-added (Johnson & Noguera, 2012), total official flows for infrastructure (Piermartini, 2004), carbon dioxide emissions per unit of manufacturing value-added (Shahbaz, 2013), and gross fixed capital formation (Belloumi, 2014) and other proxy variables needed for consideration in this study. The data from 2008-2017 was obtained from the World Development Indicator (WDI), the global economy database, and the United Nation statistics division. The research has collected six Asian Belt Road Initiative (BRI) country's data (Bangladesh, China, India, Indonesia, Pakistan, and Turkey) to be investigated due to the limitations of the explanatory variable for a selected economy and timeline.

1. Econometric Estimation

Step-wise econometric estimations are detailed below:

1.1. Unit Root Analyses

The model has checked, through various panel unit root tests, for the detection of the integration of

variables. The proof of the ADF equation as follows, by Levin, Lin, and Chu (LLC, 2002),

$$\Delta y_{it} = \alpha_0 y_{it-1} + \sum_{p=1}^{ni} \alpha_{1ip} \Delta y_{it-p} + \lambda_{it} + \varepsilon_{it}$$

$\alpha_0 = n-1$, which involves the standard procedure of the existence of a unit root with the allowance of a differing lag order of integration in cross-sections of the panel. A Null Hypothesis (H_0) indicates non-stationery, whereas the Alternate Hypothesis (H_1) demonstrates a stationary series.

Im, Pesaran and Shin (IPS, 2003) used separate ADFs in individual cross-section panels that explained specific stats by quantifying the average t-statistic in ADF statistics $\bar{t}_{NT}$. A lag zero order in the above ADF equation canvasses the critical values mentioned in the cross-section (n) and length of a series. It also indicates to the equation that the implant is constant with the trend. For non-zero lags, IPS (2003) was followed by a standard normal distribution $\bar{t}_{NT}$, given below.

$$X_{\bar{t}_{NT}} = \frac{\sqrt{P}\left[\bar{t}_{NT} - N^{-1} \sum_{i=1}^{N} F(\bar{t}_{it}(N_i)) \right]}{N^{-1} \sum_{i=1}^{N} Var(\bar{t}_{it}(N_i))}$$

Where, $F(\bar{t}_{it}(N_i))$ and $Var(\bar{t}_{it}(N_i))$ are the mean and the variances of the ADF regression of the t-statistic rendered by IPS (2003), with respect to various lags, series lengths, and assumptions based on multiple test equations.

1.2. Panel Econometric Estimation Techniques

1.2.1. Fixed Effect Model

In the panel analysis, a Fixed Effect Model explains the specific effect of an individual correlated with explanatory variables. The Fixed Effect Model presumes one actual effect size, which underlies all research studies in data analysis; divergence due to a random error (Bell & Jones, 2015). The model highlights non-arbitrary quantities and groups of a mean as a sample of the population. A group of various observed indicators could generate data. In panel data, the fixed effect model testifies to the subject-specific means, as given below.

$$Y_{it} = \alpha_{yxt} X_{it} + \alpha_{yzt} Z_i + \delta_{\varpi} \eta_t + \varepsilon_{it}$$

1.2.2. Random Effect Model

The Random Effect Model presents that particular individual results are not associated with the independent variables (Bell & Jones, 2015). When the sample size is small (compared with the population) random effect model can be useful. The model explains the random quantities as well as the group means of a sample population. The data can be arranged as groups by several observed factors, and it shows object-specific means.

$$Y_{it} = \alpha_{yxt} X_{it} + \alpha_{yzt} Z_i + \delta_{\varpi} \eta_t + \varepsilon_{it}$$

1.2.3. Generalized Method of Moments (GMM)

In econometrics, this is a generic method for estimating parameters in statistical models that explain model parameters, and the expectation is zero as long as the the parameters are valid values. “GMM is one of the most versatile probability density models, which has been checked commonly in machine learning and pattern recognition and also capable of approximating any multimedia distribution” (Kwedlo, 2014). Panel OLS shows that the number of moment restrictions is equal to the number of unknown parameters, like ∑ [Xe] = 0 and 2SLS, which shows that the number of endogenous variables equals the number of instruments, is another example of an exactly identified GMM estimator which uses the moment of restriction ∑ [Ze]=0, and thus is also called MM.

The first difference is that GMM is applied when the time period is small (Blundell & Bond, 1998). The main advantage of this estimator is it does not require any external instrument to deal with endogeneity in some cases. GMM has applied two hypotheses; first, the instrumental variables are uncorrelated with the error terms, and second, the absence of second-order auto-correlation (AR2) has verified the first-order auto-correlation (AR1) which is detected and checked by Arellano-Bond tests.

$$\ln y_{i,t} - \ln y_{i,t-1} = \beta_0 + \lambda(\ln y_{i,t} - \ln y_{i,t-2}) + \beta'(\ln X_{i,t} - \ln X_{i,t-1}) + (\delta_t - \delta_{t-1}) + (\mu_{i,t} - \mu_{i,t-1})$$

3. Model Specification

This study examines the infrastructure investment and trade performance of BRI countries. The model was developed following the models of Weishi GU et al. (2008) and Ismail & Mahyideen (2015).

$$Y_{i,t} = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \mu_t$$

Wherein the subscripts i and t denote the cross-sectional unit and time-series data, respectively. μ is the disturbance term. α are parameters. Our estimated model is

$$EXPORT_{i,t} = \beta_0 + \beta_1 INFRAL_1 + \beta_2 GFCF_2 + \beta_3 MANF_3 + \beta_4 TECH_4 + \beta_5 CO2MVA_5 + \varepsilon_t$$

Table 1. Description and Measurement of Variables

Variables	Label	Description	Hypotheses
Exports of goods and services	(EXPORT)	Export of goods and services as a % of GDP	Negative
Carbon dioxide emissions	(CO2MVA)	Carbon dioxide emissions per unit of manufacturing value-added	Positive
Gross Fixed Capital Formation	(GFCF)	Gross Fixed Capital Formation as a % of GDP	Negative
Total official flows for infrastructure	(INFRAL)	Total official flows for infrastructure, by recipient countries	Positive
Manufacturing value-added	(MANF)	Manufacturing value added as a proportion of GDP (%)	Positive
Medium and high-tech industry	(TECH)	The proportion of medium and high-tech industry value added in total value added (%)	Negative

V. Estimation Results

1. Statistical Analysis

One of the objectives of this study is the measure of the explanatory variable within BRI nations. The table shows the descriptive statistical analysis of the variables chosen.

Table 2. Descriptive Statistics

Descriptive	EXPORT	CO2MVA	FGCF	INFRAL	MANF	TECH
Mean	47.82	0.90	29.51	2068.75	0.19	0.30
Median	19.33	0.77	29.48	1838.01	0.16	0.34
Maximum	24.62	1.76	45.51	5682.92	0.32	0.41
Minimum	17.04	0.29	12.52	263.14	0.12	0.09
Std. Dev.	73.37	0.52	8.96	1374.03	0.06	0.10
Skewness	1.84	0.16	-0.12	0.84	1.11	-0.92
Kurtosis	4.84	1.26	2.75	2.87	2.94	2.60
Jarque Bera	42.52	7.79	0.29	7.13	12.42	8.99
Probability	5.82	0.02	0.86	0.02	0.00	0.01

Table 2 shows descriptive statistics, and the mean values of the variables EXPORT, INFRAL, and GFCF indicate the wider dispersion and the mean values of the variables; CO2MVA, MANF, and TECH exhibit lower dispersion since standard deviations divert from the mean value. According to Blumer (1979), the table indicates that all variables show a positive skewed except GFCF; thus, the model shows satisfactory Skewness statistics. Kurtosis highlights a broader peak and thicker tail, i.e. Leptokurtic. This is why many of the values are concentrated around the mean.

Table 3. Correlation Matrix

	EXPORT	CO2MVA	GFCF	INFRAL	MANF	TECH
EXPORT	1					
CO2MVA	0.24	1				
GFCF	0.766	-0.12	1			
INFRAL	0.10	0.019	0.21	1		
MANF	0.87	-0.03	0.86	-0.05	1	
TECH	0.54	0.29	0.52	0.46	0.48	1

The correlation among the variables is shown in the above table, which represents the strength of the relationship between the variables. It shows no issue of multicollinearity. The variables epitomize weak correlation as well as the strong bond among most, which refers to adequate conjunctions.

2. Unit Root Analysis

Before applying different econometric estimation techniques like panel OLS, random effect, and GMM techniques, initial stationarity of the variables have been scrutinized through various panel unit root tests. The panel unit root tests of IPS (2003) and Levin, Lin, and Chu (2002) were used to check the stationarity of the variables. The results represent variables that are stationary at level, except for INFRAL, which is integrated at the of order 1. The results are given below in Table 4.

Table 4. Unit Root Analysis

Unit Root Test (Based on Levin, Lin, and Chu (LLC, (2002))					
Variables	Level		1st Difference		Conclusion
	Constant	Constant with Trend	Constant	Constant with Trend	
EXPORT	-1.32*	-1.29*	-	-	I(0)
CO2MVA	-1.46**	1.71**	-	-	I(0)
GFCF	-3.02*	-2.86*	-	-	I(0)
INFRAL	3.64	4.68	-0.61**	-0.18**	I(1)
MANF	-1.54**	-2.10**	-	-	I(0)
TECH	-0.13***	-0.71**	-	-	I(0)
Unit Root Test (Based on IPS (2003))					
Variables	Level		1st Difference		Conclusion
	Constant	Constant with Trend	Constant	Constant with Trend	
EXPORT	-1.74*	-1.57*	-	-	I(0)
CO2MVA	-0.86***	-1.16	-	-	I(0)
GFCF	-2.43*	-1.93*	-	-	I(0)
INFRAL	4.11	4.08	-2.32**	-3.11**	I(1)
MANF	-0.89*	-1.05*	-	-	I(0)
TECH	-3.54**	-3.87*	-	-	I(0)

Note: *, **, & *** show significant at 1, 5, & 10 percent, respectively.

3. Results and Discussion

This work has taken into consideration some important indicators to determine the impact of infrastructure investment on the export of goods and services to measure relationship with various gauges. The previous work only focused on trade performance, and did not show the linkages among the various other elements (Lu et al., 2018). This research estimation was based on various techniques like panel OLS, Random Effect, and GMM due to the reliability impact (Merale Fatahi-Vehapi et al., 2015). We used panel OLS as it has become quite reliable in the comparative economy. However, to evaluate meaningful inferences from the data given, it addresses description and estimation issues cautiously (Kittle & Winner, 2015).

Moreover, various routine tests have been scrutinized empirically, like the random and fixed effect models. In the process, random effect has been examined and found to have flexibility, generalizability, and highlight more precise and decisive outcomes. The research stated that random effect was more authentic in our study, which drew attention to individual-specific results uncorrelated with IV (Bell & Jones, 2015). GMM is a new dispensable method for self-adaptive differential results. We also tried to avoid difficulty with infeasible solutions that used a cognitive content, in which Cholesky factorization is used to encode the co-variance (Kwedlo, 2014). Below, Table 5 shows the results of panel OLS, Random Effect, and GMM technique results. The computed Wald statistic F value is 27.11, confirming long-run co-integration. The residual Cross-Section Dependence Test (Breach-Pagan LM Test) F statistics value is 42.10, which shows the existence of cross-section dependence in residuals, thus it is suggested to test the GMM technique. The results are given below:

Table 5. Regression Analysis of Different Estimation Techniques

Dependent Variable:	Export of Goods and Services		
Variables	**PLS**	**Random Effect**	**GMM**
CO2MVA	-7.95* (0.00)	-8.84* (0.00)	-8.68* (0.00)
GFCF	1.83* (0.00)	1.16* (0.00)	1.49* (0.01)
INFRAL	-0.001*** (0.30)	-0.001*** (0.13)	-17.45** (0.04)
MANF	13.9** (0.00)	63.96** (0.05)	8.45** (0.02)
TECH	24.46* (0.00)	15.47*** (0.23)	1.63** (0.05)
R^2	0.85	0.61	0.67
Adjusted R^2	0.81	0.57	0.65
D.W	2.44	2.02	1.70
J statistics	-	-	3.79*
	Wald Test F statistics	27.11* (0.000)	

Note: *, **, & *** show significant at 1, 5, & 10 percent, respectively.

The essential purpose is to check the impact of infrastructure investment on the trade performance of BRI countries. The results indicate that infrastructure investment has a significant positive impact on the trade performance of BRI countries. CO2MVA has a substantial and negative impact on exports of goods and services, which shows a negative relationship. Additionally, an increase in carbon dioxide emissions from manufacturing processes, from value-adding processes to finished goods, caused a decrease in the exports of goods and services, similar to results shown by (Mpho Bosupeng, 2016). The Chinese BRI has a substantial CO_2 emission, and increases in CO_2 affect the environmental negatively. The p-value of GFCF shows a significant and positive relation with exports of goods and services, much the same as Rajni (2013). Increasing capital formation in BRI countries leads to a boost in the exports of goods and services, according to the results. Flow of capital formation also depicts the attraction of foreign investors to be a part of the economy, and to provide more production, jobs, and importantly, technology spillover. INFRAL has an insignificant impact on exports of goods and services through OLS, random effect estimation, and GMM. It is also negatively related to exports of goods and services (Bensassi et al., 2015). It shows that an increase in INFRAL leads to a decrease in the exports of goods and services. MANF has a significant and positive impact on exports of goods and services (Hanson & Robertson, 2008). An increase in manufacturing products enhances the exports of goods and services. TECH has a significant and positive impact on exports of goods and services (Sandu & Ciocanel, 2014). The increase in the medium and high-tech industry will contribute to a rise in exports.

Ⅵ. Conclusion

Since China is pouring loans and investment into infrastructure development, it has driven powerful growth at home and framed itself as a contributor. This paper explores reasons of possible future collaboration for two global initiatives and shows a significant positive impact with the BRI as a tool to achieve SDGs. According to the result, an increment in capital

formation in BRI countries boosts exports of goods and services. Flow of capital formation also attracts foreign. Moreover, it is already understood that manufacturing value-added is an essential key to enhance the export of goods and services, as our results also match. Total official flows of infrastructure by recipient countries have increased from last decade, whereas our results conclude that aid, loans, and investment have a negative relation with exports. When developing countries are fighting to strengthen the economy, aid or loan money for development purposes usually goes into pockets of the corrupt. In this situation, only foreign direct investment can be beneficial as it needs to be managed an already designed multinational hierarchy system. Within the same perspective, another indicator, medium-high tech industries, which include domestic and transnational corporations (TNCs), have a strong and positive impact with trade. This indicator also gives an answer to why aid and loan for infrastructure is not appropriate for certain stages of development, such as when they can achieve economic success with investment for infrastructure and industrialization. As to CO_2 emission concerns, the results show a significant but negative relation with exports because we already seen that most developed nations have been banning imports from non-eco-friendly industries in developing countries. China itself has closed imports of various types of waste that pollute the environment. This study contributes better to the research field because of the reliability of GMM and OLS (Renwick et al., 2018). Previous theoretical studies have examined the BRI toward SDGs, but this study focused on more empirical analysis on trade performance of BRI countries. China is expanding its investment in the BRI, and it has a significant role to contribute to achieving SDG Goal 9 (Balazs & Horvath, 2016). Though China is spreading a positive image of the BRI to the world by investing in infrastructure, it does not mean all roads need to be connected with China. So far, the BRI has successfully portrayed a positive image and obtained ratification from over 100 countries. China is placing higher investments in BRI country infrastructure and helping to make possible some aspects of Agenda 2030. BRI countries should adopt policy for a more sustainable environment to decrease carbon dioxide emissions and promote sustainable industrialization. Many countries are also required to develop infrastructure for connectivity to decrease trade cost and save time. Future research is required to be focused on policies with different goals for Agenda 2030, and shall be conducted with a different cluster of regions.

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Comparative Palm Oil Trade Performance in Indonesia, Malaysia, and the Philippines

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ABSTRACT

Purpose – As one of the most traded commodities in the world with tremendous economic significance, palm oil is an inexpensive source of oil. This paper examined and compared the palm oil trade performance of the Philippines relative to its top palm oil producing neighbors, Indonesia and Malaysia, by analyzing import-export volume trends of the said food commodity, consumption and production trends, self-sufficiency, import dependence, and shifting patterns of comparative advantage.

Design/Methodology/Approach – Secondary data covering the period from 1964 through 2018 were collected from various sources, and descriptive analysis coupled with trend analysis were employed with respect to import and export, production, and consumption performance. Other trade indicators were computed, to wit: balance of trade, self-sufficiency ratio, import dependency ratio, and normalized trade balance. Implications were drawn after the comparative analysis among the three countries was done.

Findings – An increase in the volume of the palm oil supply in the Philippines is evident, and this is attributed to increasing importation. Relative to Malaysia and Indonesia, the Philippines lags behind in international trade. While Philippine palm oil industry growth has been stagnant in terms of international trade by virtue of its net importer status, Malaysia and Indonesia have overtaken the country significantly, having attained self-sufficiency in the commodity with trade surpluses, and the gap is expected to widen in the coming years. It is interesting to note that the Philippines, Malaysia, and Indonesia had identical production volumes and growth rates until the last decade of the 21st century. A steadily growing industry, palm oil is foreseen to continue being a vital industry, not only to top producing countries such as Malaysia and Indonesia but also in the Philippines, which is trying to improve its palm oil trade performance by expanding production.

Research Implications – The study findings imply expansion and income opportunities not only for local oil palm producers, processors, and traders in the Philippines but also for foreign market entrants.

Keywords: competitiveness, comparative advantage, Indonesia, Malaysia, palm oil, trade, Philippines
JEL Classifications: L66, P45, Q17

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Ⅰ. Introduction

One of the most traded food commodities in the ASEAN region is palm oil due to its economic importance as an inexpensive source of oil. In Asia, Malaysia pioneered the domestic production and exporting of oil palm and its byproducts. This was followed by Indonesia, making the two countries the major oil palm producers.

Oil palm was first introduced to the Philippines in the 1960s from Malaysia. Currently, about 85,000 hectares of land area is planted for oil palm, with Mindanao Island in the southern Philippines as the major producer. However, this is far below the projected one million hectares by 2023 (Batugal, 2013). The crop is cultivated primarily for oil production, with a total projected volume of 73.5Mmt for 2019 (Shahbandeh, 2018). At present, Malaysia and Indonesia remain the world's largest palm oil exporters. Aside from palm oil, other byproducts of oil palm are oleochemicals and biofuels.

In 2013, it was recorded that palm oil was the world's fourth largest traded food commodity, with an estimated trade value of $39B priced at $857/ton (IISD, 2014). In the Philippines, the importation of palm oil is increasing since it is tariff free. In 2018, the Philippines' import volume of palm oil reached an all-time high of 278,384.039 MT (valued at $176.234M), or an 176.33% increase relative to the imported volume in 2017 of 100,743.864 MT (valued at $75.274).

As for Malaysia, it accounted for about 55% of total imports, while the rest was from Indonesia. Whereas, in 2018, the Philippines exports of palm oil only had an estimated value of $1M (Index Mundi, 2019). In addition, the surge in palm oil importation of the Philippines from Malaysia and Indonesia resulted in negative effects on coconut oil favoring palm oil due to the relatively cheaper price of the latter (Arcalas, 2019). This scenario led the then Philippines' Department of Agriculture (DA) Secretary, Manny Piñol, in proposing a tariff on palm oil within 200 days (Chan, 2019).

With the economic importance and, at the same time, threat being experienced by the Philippines related to importing palm oil, this paper analyzed the trends in the import-export volumes of the said food commodity. Most of the imported palm oil comes from Malaysia and Indonesia. Specifically, this paper aimed to present consumption and production trends in terms of the volume palm oil in the country, determine the country's self-sufficiency, import dependence, reveal shifting patterns of comparative advantage, and compare the country's palm oil commodity indicators to relevant countries in the international trade, namely Indonesia and Malaysia.

Ⅱ. An Overview of the Global and Philippine Palm Oil Industry

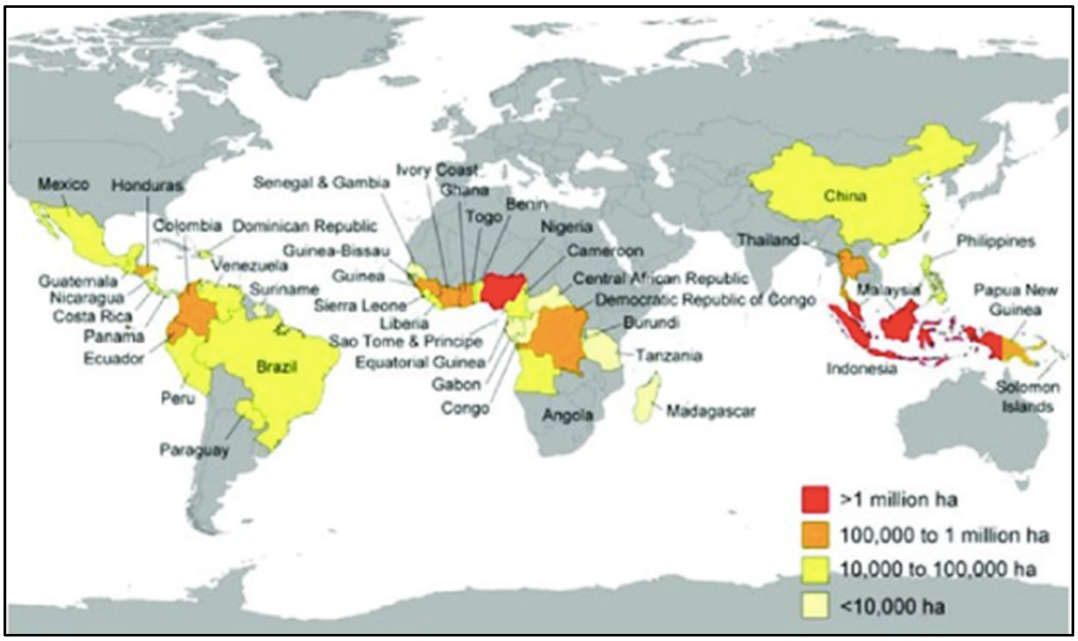
The palm oil is a high-yielding and largely-profitable vegetable oil used in food, soap, and oleochemical manufacturing (Afoakwa, 2013). Palm oil is an important byproduct of the oil palm tree. Oil palms (*Elaeis guineensis* Jacq.) originated from West Africa in a belt from Angola to Senegal. The variety of oil palm tree planted is mainly the *tenera* variety (a hybrid between the *dura* and *pisifera).* The *tenera* variety grows to almost 9 months for the oil palm to grow and it takes another 4 years before the fruitlets can be harvested. This yields an average of 4 to 5 tons of crude palm oil (CPO) per hectare annually, and about one ton of palm kernels. Oil palm can grow for 25 years and is most productive during the 10th through the 15th year.

1. Oil Palm Production

Oil palm plantations are found across Asia, Africa, and Latin America. Globally, an estimated 9.1M hectares of land are intended for oil palm production. Fig. 1 shows the concentration of oil palm plantations worldwide. Malaysia and Indonesia in Southeast Asia dominate the crop's global production. In 2016, Malaysia accounted for 39% of world palm oil production and 44% of world exports (Wahab,

Shaharuddin, & Abdul Rahman, 2016). In 2012, the estimated total global production of palm oil was almost 65 million tons, of which 58 million consisted of mesocarp oil, and 6.8 million tons were in the form of kernel oil (Corpuz, 2013).

Fig. 1. Location of Oil Palm Plantations Worldwide in 2009



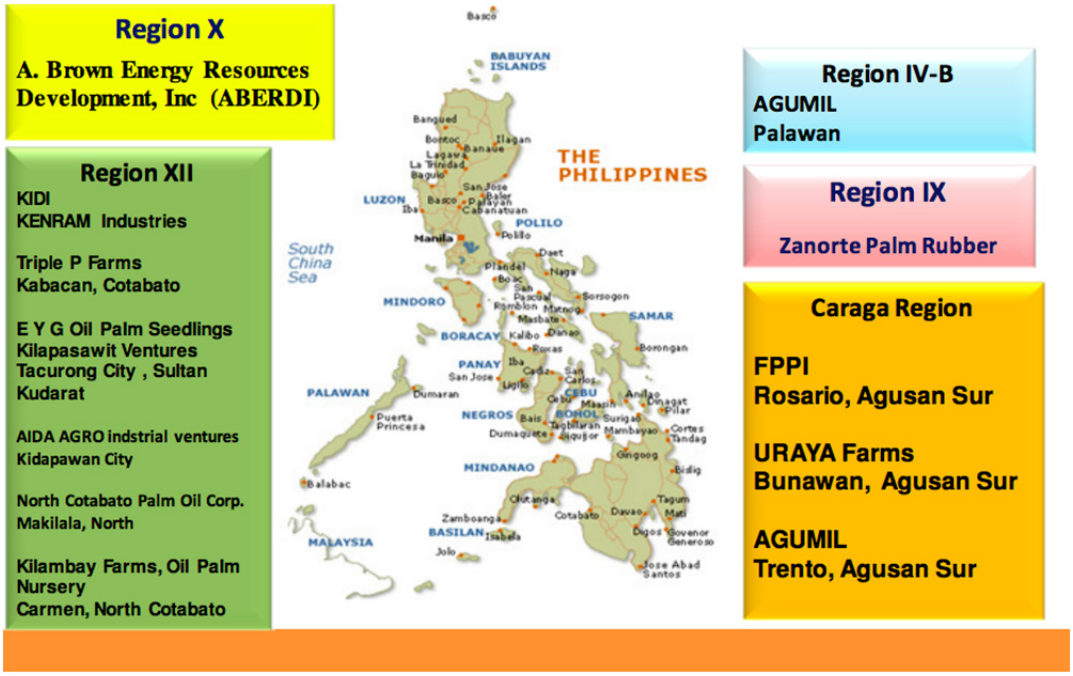
Source: Kongsager and Reenberg (2012).

The current rapid expansion of oil palm plantations in Indonesia and Malaysia is largely driven by (a) growing demand for oil for food and industrial processes in Asia, particularly in India and China, and (b) to a lesser extent, demand and speculation for biofuel. There is a general consensus that the trend of increasing palm oil yields will continue and accelerate. This trend may allow companies to improve production and profitability without the need for additional land, but it may also provide an incentive to establish new plantations and clear forests. Species diversity in oil palm plantations is much less than in natural forests, even degraded forests. Forest clearing for oil palm leads to species loss. However, the industry provides employment to more than half a million people and livelihoods to an estimated one million people.

In the Philippines, the underdeveloped oil palm plantation is associated with the failure of the government to invest in research and development (R&D) and seedling germination since conception. Thus, all seedlings are imported from Malaysia, Papua New Guinea, Costa Rica, and recently, Thailand. However, great potential is seen for nursery establishment as it can become a profitable business venture with the increased demand for oil palm planting materials.

Currently, there are five government-accredited oil palm nurseries in Mindanao. These are owned by palm oil mill operators such as AGUMIL, FPPI, ABERDI/Nakeen, and KIDI. The Kenram Agrarian Reform Beneficiaries Multi-Purpose Cooperative (KARBEMPCO) also owns a nursery, which is located inside their plantation in Sultan Kudarat province. Another nursery is run by a private company known as B.H. & Associates in M'lang, Cotabato province. Fig. 2 shows the map of oil palm nurseries in the Philippines.

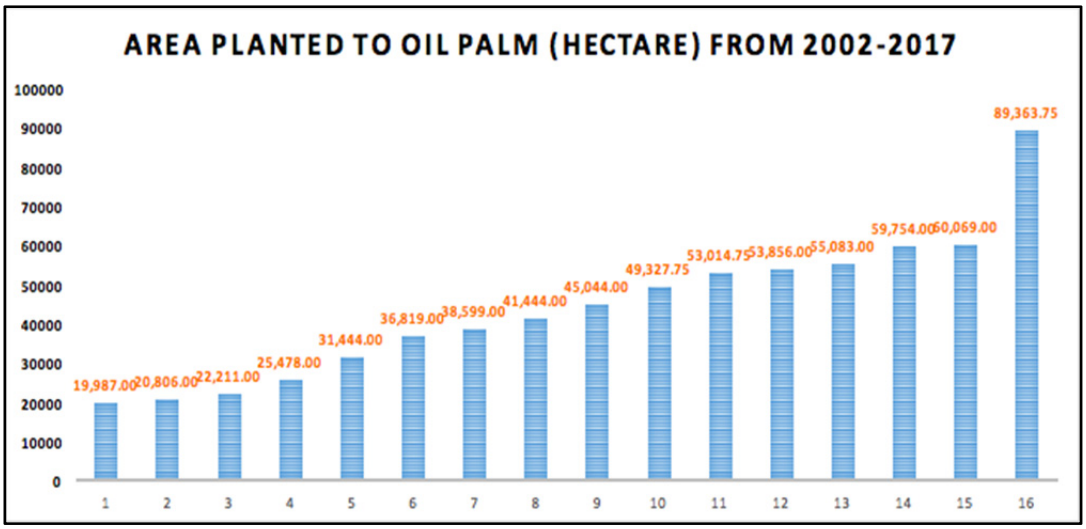
Fig. 2. Philippine Map of Nurseries as of 2012



Source: Paragan (2014).

Fig. 3 shows an increasing amount of land (in terms of hectares) in the country from 2002-2017 planted for palm oil. In 2002, the area planted to oil palm was only 19,987 hectares. Currently, the total land area is more than 85,000 hectares with the SOCCSKSARGEN and CARAGA regions contributing 38% of the total land area. Production increases at 7.62% annually (PCA, 2018).

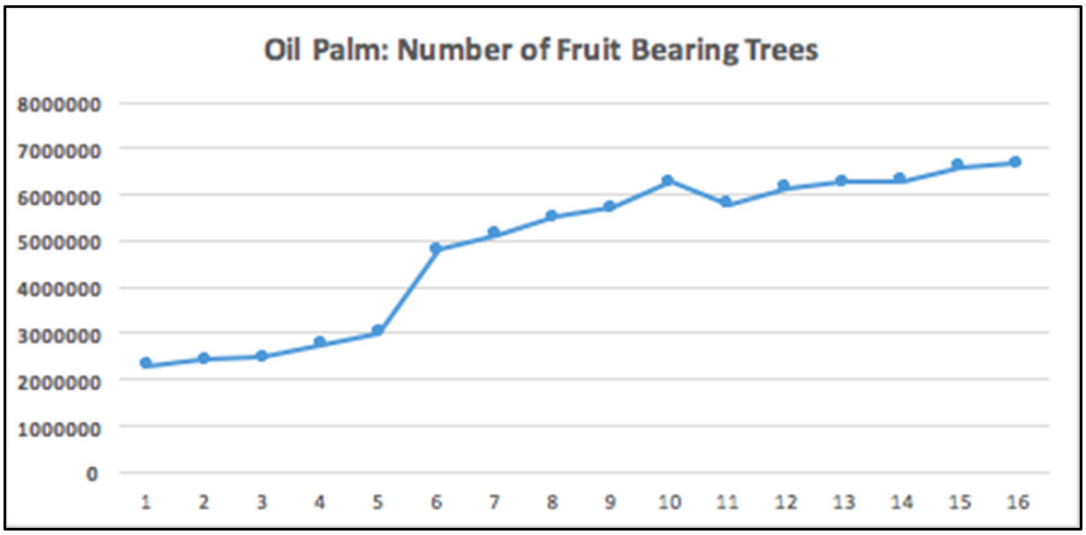
Fig. 3. Area Planted to Oil Palm in Hectares (2002-2017)



Source: PCA (2018).

In addition, there was a fluctuating trend in the number of fruit bearing trees (Fig. 4) from 2002 to 2017, but the number of fruit bearing trees steadily increased from 2012 to 2017, with 6.1M in 2012 to about 6.6M in 2017 (PCA, 2018).

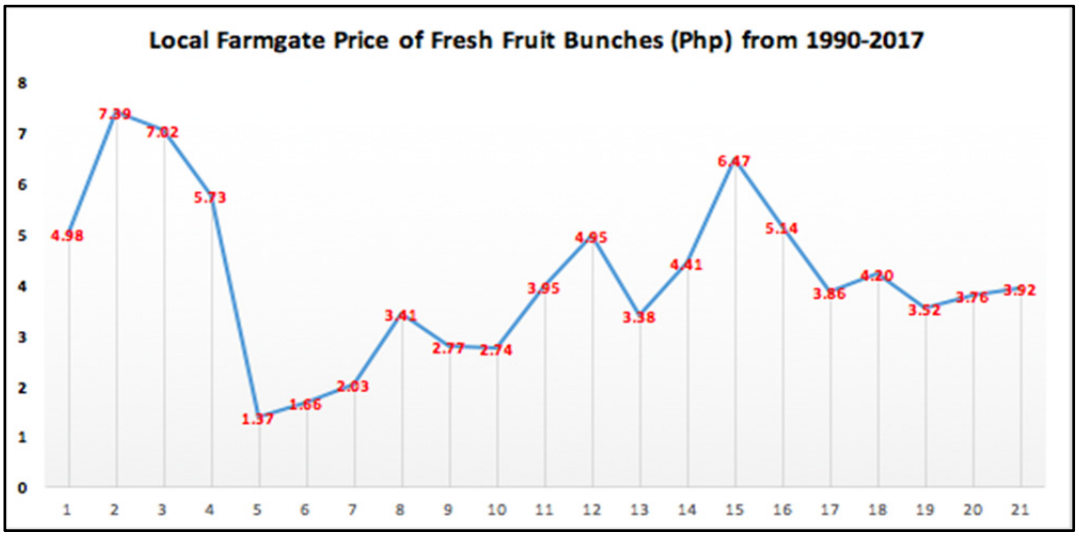
Fig. 4. Number of Oil Palm Fruit Bearing Trees, 2002-2017



Source: PCA (2018).

The price (in Php) of the fresh fruit bunches (FFBs) for the past 2 decades (or from 1990-2017) highly fluctuated (Fig. 5). The price of oil palm FFBs (Fresh Fruit Bunches) in 1991 peaked at more than USD 0.14 (Php 7), while in 2017 its price was merely USD 0.08 (Php 3.92) for FFBs. This was primarily due to the large volume of supply on the world market.

Fig. 5. Local Farmgate Price (FFB) of Fresh Fruit Bunches (FFBs), 1990-2017



Source: PCA (2018).

The Philippines does not have competitive advantage in terms of land area for production compared to Indonesia and Malaysia. However, the country has plans to expand to more than 1M ha of land in order to develop oil palm plantations. Table 1 shows potential areas for production, of which 98% are located in Mindanao, particularly Caraga (32.1%) and SOCCSKSARGEN (33.2%), followed by Central Visayas (11.9%) and Palawan (8.4%), according to the PCA (2018).

Table 1. Philippine Oil Palm Potential Area for Expansion

Regions	2012	2025/2030
I-IVB Luzon - Palawan	4,600 (8.4%)	100,000
VII-Central Vis.	6,506 (11.9%)	7,000
IX-Western Min.	320 (0.6%)	102,000
X-Northern Min.	1,820 (3.3%)	154,000
XI-Southern Min.	1,960 (3.6%)	104,000
XII-SOCSARGEN	18,200 (33.2%)	112,000
XIII-CARAGA	18,102 (33.1%)	384,000
ARMM	3,240 (5.9%)	103,000
Total	54,748 (100.0%)	1,066,000

Source: PCA (2018).

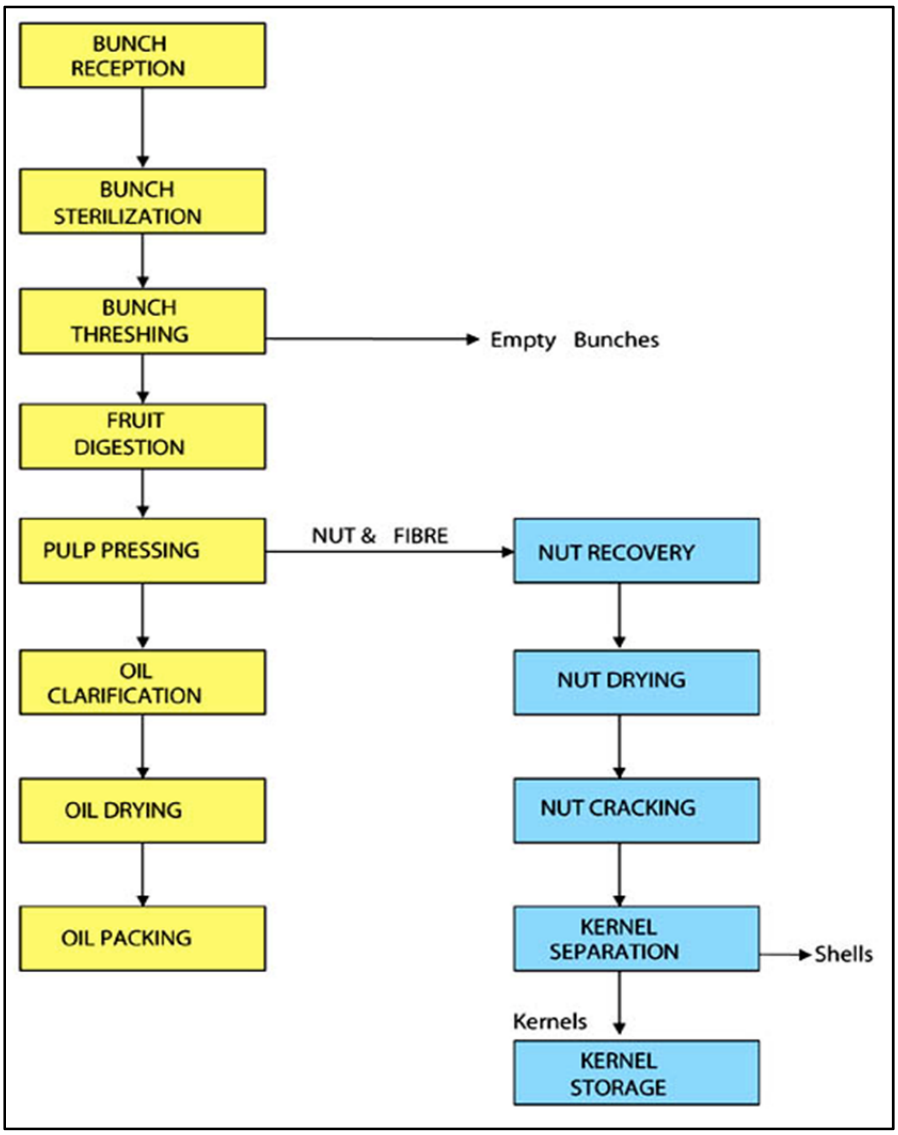
2. Processing of Palm Oil

Global palm oil production is estimated at more than 45 million tons, with Indonesia and Malaysia as the major players. Thailand also follows, but the Philippines is a minor player. Major importers of palm oil are China, India, and the European Union (Shahbandeh, 2018). Below is an illustration (Fig. 6) of a typical palm oil milling process. The general process flow of palm oil processing is: reception (weighing/ load ramping), sterilization, threshing, digestion/crushing, pressing, separation of nut and fiber, shelling and cracking, oil clarification, drying, packaging, transport, and waste water treatment.

Fig. 7 shows the Philippine map of mill processing plants as of 2012, concentrated in Mindanao. The produced palm oil is consumed by the Mindanao institutional markets and Manila institutional buyers.

There are eight existing palm oil mills in the Philippines with a total rated capacity of 265 MT FFB per hour. These companies are Filipinas Palm Oil Plantation, Inc. (FPPI), Agumil Philippines Inc. (AGPI), Palm Inc., Kenram Industrial and Development, Inc. (KIDI), ABERDI and Univanich Carmen Palm Oil Mill, with a total capacity of 265MT per hour. Hence, the country is capable of producing 1.22M MT of palm oil every year. About 86,660 hectares of oil palm plantation is necessary to operate at this capacity. While the Philippines is currently a minor producer of palm oil in the Southeast Asian region, thisis set to change with the intention of industry players in the country to transform at least one million hectares of idle lands within the country into oil palm plantations.

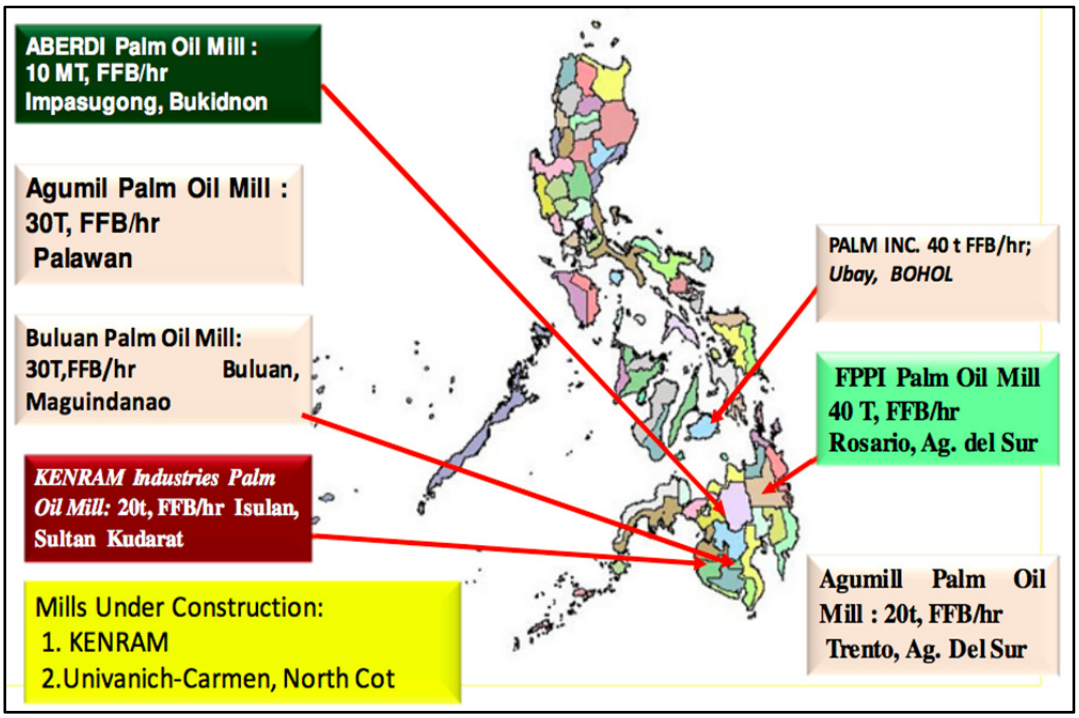
Fig. 6. Palm Oil Milling Process



Source: FAO (1995).

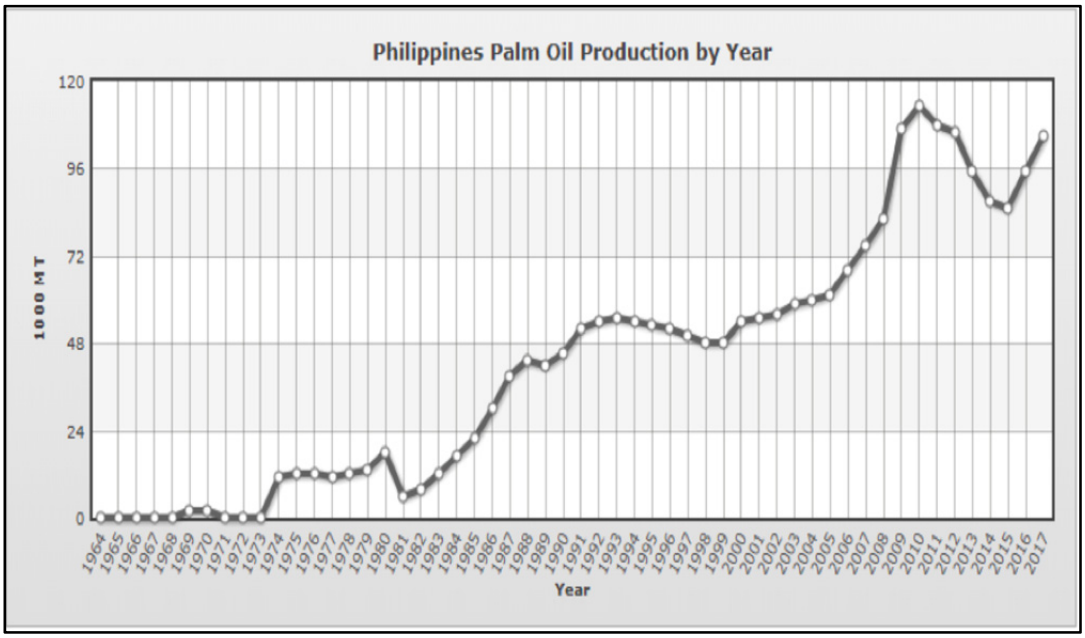
Fig. 8 illustrates palm oil production by year in the Philippines. This data was prepared by Index Mundi (2019) for the United States Department of Agriculture (USDA). Palm oil production peaked in 2010 at 565,549 MT due to a push from the government to develop the oil palm industry through the leadership of the Philippine Palm Oil Development Council. The Philippine Oil Palm Development Plan for 2004-2010 was crafted in 2003 with the mission of developing the palm oil processing industry through gainful production, processing, marketing oil palm production and byproducts, ensuring food security, increasing income, promoting rural employment, and sustainable development whilst taking into consideration the total preservation of the ecosystem.

Fig. 7. Philippine Map of Palm Oil Mills as of 2012



Source: Paragan (2014).

Fig. 8. Philippine Palm Oil Production, 1964-2017

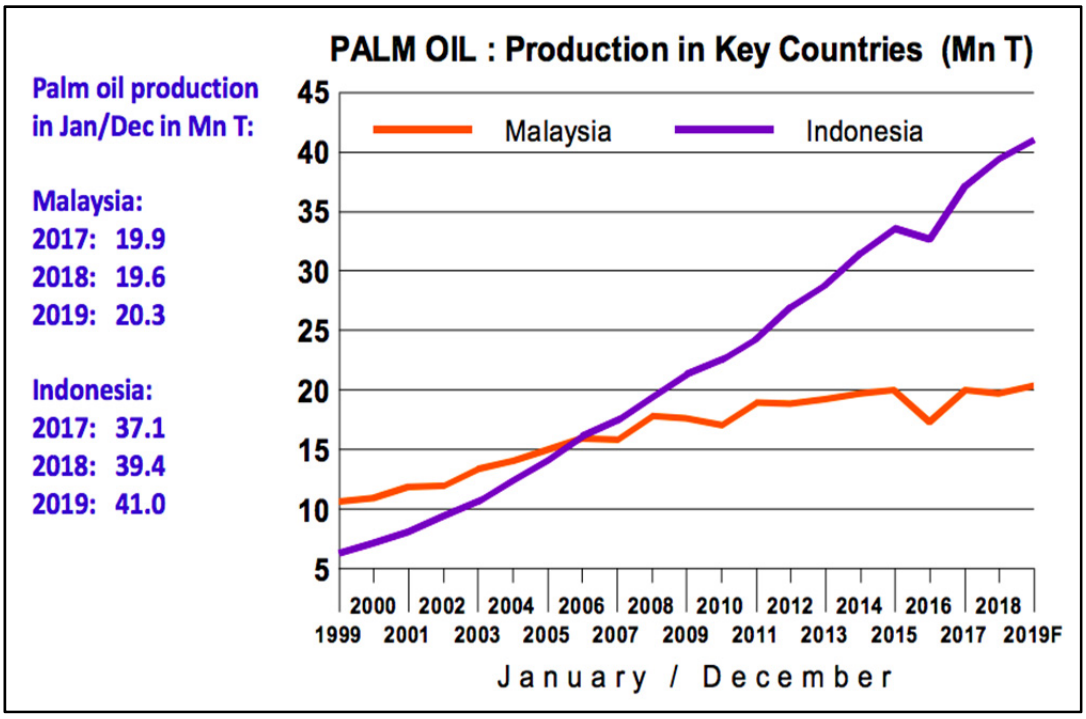


Source: Index Mundi (2019).

The derived products from oil palm are palm oil and palm kernel oil, which are cheaper compared to coconut oil. Palm oil comes from the palm fruit, while palm kernel oil comes from the fruit's seeds. Oil palm fruits need to be processed immediately, within approxi-mately 48 hours of harvest. Hence, a processing plant should be near a farm. A nucleus farm set-up will work well for the processing of the fruit. A contiguous oil palm plantation of 5,000 and 7,000 hectares is needed to supply raw materials for 20 tons of fresh fruit bunches (FFBs) and 30-ton FFBs capacity mills, respectively. Small patches of oil palm scattered around the country will not work (NAST, 2015). The Philippine oil palm is characterized by upstream and downstream activities.

Though Malaysia first planted oil palm, palm oil production volume has been exceeded by Indonesia, which tops other countries in terms of world production. Fig. 9 shows production in key oil palm countries, Indonesia and Malaysia. In 2017, Indonesia produced 37.1 million tons of palm oil, while 19.9 million tons were produced in Malaysia. Palm oil production volume for the two countries was seen to rise with only a minimal increase in Malaysia for 2018 and 2019.

Fig. 9. Palm Oil Production in Key Countries, Indonesia and Malaysia, in 2018



Source: Mielke (2018).

3. Import-Export of Palm Oil in the Philippines

Tables 2 and 3 show the import-export volume, value, and unit price ($) of palm oil from 2011 to 2017. Import value is steadily increasing from 62,444MT in 2011 to 332,293MT in 2017. However, the palm oil

export value was erratic during the same period and peaked in 2014 at a value of 57,068.31MT, while exports only registered 14,244MT in 2017. The low export value can be attributed to high local demand and consumption.

Table 2. Import Value, Volume, and Unit Price ($) of Palm Oil (2011-2017)

Year	Volume (MT)	Value (*FOB)	Unit Price (US$)
2011	62,444.27	67,195,519.00	1,076.09
2012	56,526.31	54,298,856.00	960.59
2013	33,556.19	29,601,495.00	882.15
2014	64,297.89	58,719,342.00	913.24
2015	166,668.61	109,417,971.00	656.50
2016	97,804.47	73,222,559.00	748.66
2017	332,293.62	226,039,766.00	680.24
Average	116,227.34	88,356,501.14	845.35

Note: *FOB: Free on Board.
Source: PSA (2017).

Table 3. Export Value, Volume, and Unit Price ($) of Palm Oil (2011-2017)

Year	Volume (MT)	Value (*FOB)	Unit Price (US$)
2011	1,704.16	1,649,598.00	967.98
2012	38,334.12	31,035,127.00	809.60
2013	66,336.23	50,558,757.00	762.16
2014	57,068.31	38,269,328.00	670.59
2015	25,643.04	13,235,234.00	516.13
2016	33,904.80	20,318,690.00	599.29
2017	14,244.09	13,239,400.00	929.47
Average	33,890.68	24,043,733.43	750.74

Note: *FOB: Free on Board.
Source: PSA (2017).

4. Marketing

Palm oil production in the country is specifically geared towards the local market. Based on an industry report, present production of CPO (Crude Palm Oil) is not enough to address national demand. In past years, some local processing mill companies exported their CPO to other countries like Japan because of the increased value of the commodity on the global market.

Along with a sum of 265 MT per hour capacity, the nation is capable of generating 1,599, 910 metric tons of palm oil every year when fully used. This production capacity requires 86,660 hectares of palm oil plantation.

Table 4 shows the comparative global production of vegetable oil in terms of volume. Palm oil comprises the largest share at 32.28%, followed by soybean oil with 25.65%. Among all vegetable oils, palm oil is produced in large volumes primarily because of its high demand.

Table 4. Comparative Global Production Volume of Vegetable Oil

	Production	
Vegetable Oil	Volume (000 MT)	Percentage (%)
1. a. Palm	45,064	32.28
b. Palm Kernel	5,212	3.75
2. Soybean	35,805	25.65
3. Rapeseed	21,430	15.29
4. Sunflower	12,965	9.29
5. Cotton Seed	4,687	3.36
6. Groundnut	4,116	2.95
7. Coconut	3,223	2.31

Source: Schleicher et al. (2019).

Palm oil products in the Philippines are mostly absorbed by institutional buyers with more than approximately 90% consumed by the local market, while not more than 5% is earmarked for the export market. Based on research, palm oil mills in Mindanao satisfy demand within the region. Some of the product goes to Manila institutional buyers (i.e. supermarkets and hotels). Note that only 20% of fresh fruit bunches (FFBs) are converted to palm oil and palm kernel oil.

5. Product

The products produced from oil palm are crude palm oil (CPO), palm kernel (PK), and refined palm oil (RPO). As earlier mentioned, products are mostly absorbed by the domestic market and minimally, the export market. A bulk of the products, namely CPO, PK, and RPO, are absorbed by domestic institutional buyers based primarily in Mindanao and Manila. Only a small portion of the oil palm produced is exported to Singapore and Germany. ABERDI's palm oil products are consumed within Cagayan de Oro in Mindanao. Table 5 shows the products and markets of various kinds of palm oil.

Table 5. Oil Palm Byproducts and Markets in the Philippines

Products	Market
Crude Palm Oil (CPO)	Manila institutional buyers (PRC, P&G, URC ++) Mindanao institutional buyers (Pacific Oil Mill in General Santos City & Davao ++) Export market (Singapore, Germany++)
Palm Kernel (PK)	Manila institutional buyers Davao institutional buyers
Refined Palm Oil (RPO)	Manila institutional buyers (Jollibee, McDonalds) Mindanao (Butuan supermarkets and groceries, Gensan KCC, CDO supermarkets+++)

Source: Paragan (2014).

6. Price

The pricing of oil palm is highly dependent upon the world market and current exchange rates. Local pricing is guided by the formula presented below. Other assumptions considered in the computation are the extraction rate and milling charges, which are shouldered by the producer. The milling fee as of 2018 was pegged at USD 11.79 (Php 600/ton) in KIDI, and the recently proposed contract from Agumil was pegged at USD 14.73 (PhP 750).

Price formula (from the recent contract of Agumil)

[(A x B) + (C x D) – P750/MT] x 85%, where:

A the Selling Price per ton of crude palm oil or CPO (Net of Vat)

B the oil extraction rate based on Average OER in the mill or few new planting is (based on #1 below provided the crop quality does not exceed the limit as indicated in schedule B)

C the Selling Price per ton of Kernels (net of VAT)

D the average kernel extraction rate of KER

* milling fee per ton (subject to annual review based on escalation of cost in labour and materials which is estimated at 2% per year).
Marketing of oil based on weekly published oils and fats index.

1. The Oil Extraction Rate (OER) shall be based as follows:

3-4 years from field planting	15.0%
4-5 years from field planting	17.0%
5-6 years from field planting	18.0%
6-above from field planting	Based on Mill Actual KER

2. The Kernel Extraction Rate (KER) shall be based as follows:

3-4 years from field planting	3.0%
4-5 years from field planting	3.4%
5-above from field planting	Based on Mill Actual KER

Note that OER and KER shown above are for reference. Actual extraction is furnished from mill analysis.

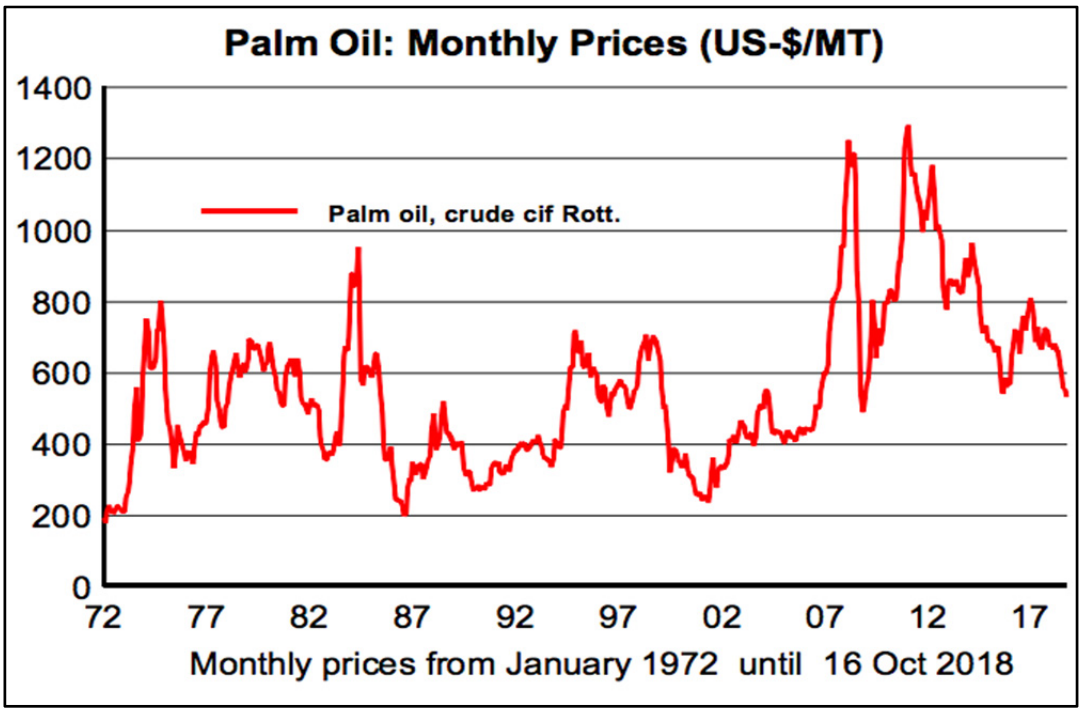
The Philippines does not have an edge when it comes to producing palm oil due to the high cost of production compared to Malaysia and Indonesia, where they experience economies of scale. Nevertheless, palm oil is considered a “sunrise industry” by the Philippine government since its byproducts are barely promoted.

The global price (Fig. 10) of palm oil highly fluctuates depending on the supply and demand situation. For 2018, palm oil prices declined and approached a 10-year low in the second quarter of the year, partly due to a reduction in world imports by 1 to 1.1 million tons compared to April and September of 2018 (Mielke, 2018).

World Production Share of Oils and Fats (1992/93 vs. 2018/19)

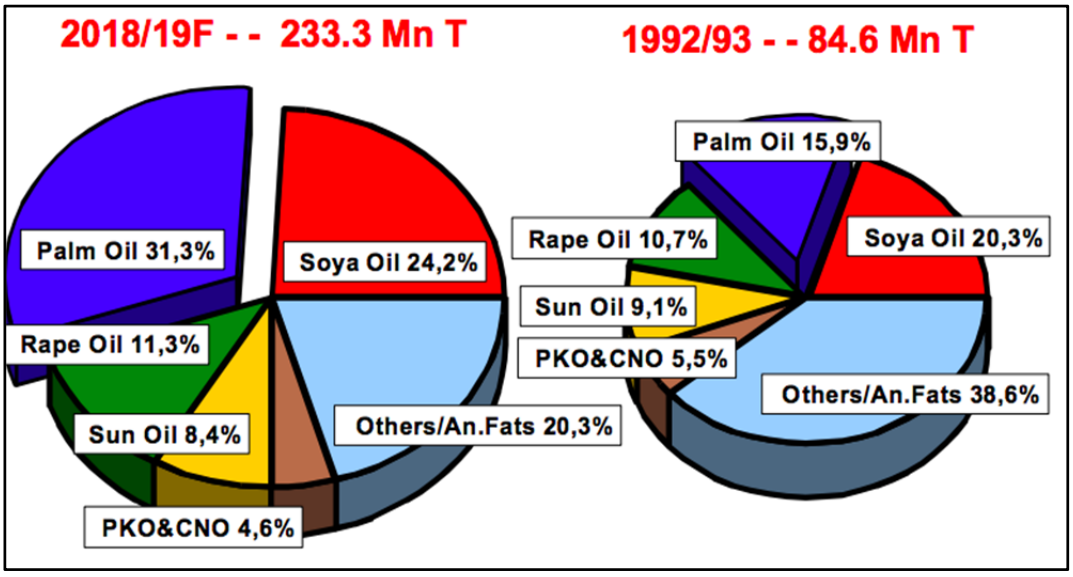
Fig. 11 shows the disparity in the volume of palm oil production between the 1990s (1992-1993) and 2000s (2018-2019). In the 1900s, other oils and animal fats dominated world production with a 38.6% share, while palm oil was merely 15.9%. In the 2000s, palm oil exceeded other oil sources and had the largest volume of production, accounting for a 31.3% share of world production.

Fig. 10. Monthly Palm Oil Prices (USD/MT)



Source: Mielke (2018).

Fig. 11. World Production of 17 Oils and Fats

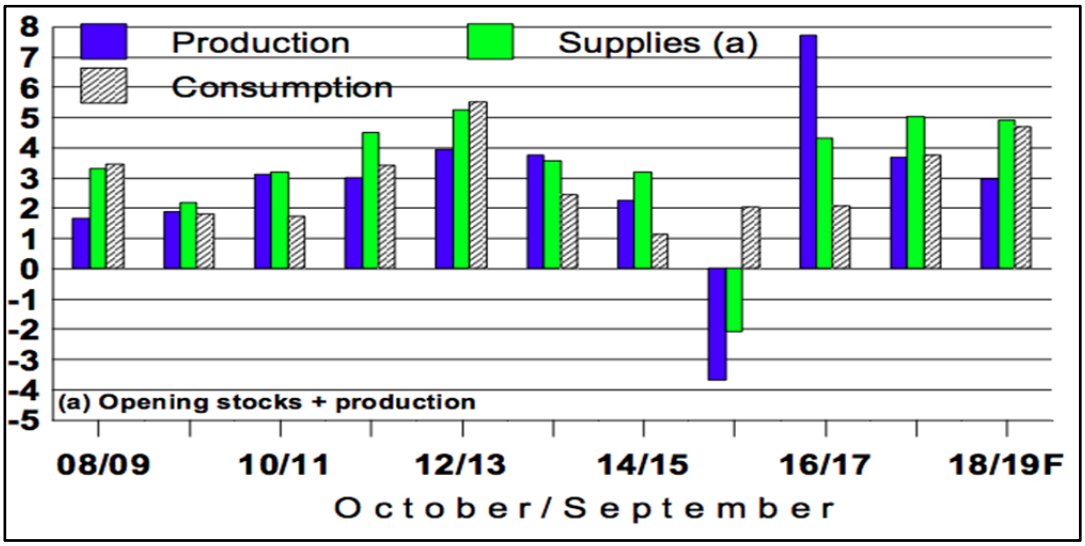


Source: Mielke (2018).

8. World Production, Consumption, and Supplies

Fig. 12 shows the production, consumption, and supplies of palm oil. There was a sharp increase of 4.7 million tons in consumption between the years 2018-2019. It is also expected that consumption growth will exceed production growth. Although prices are fluctuating and experienced an all-time low in the second quarter of 2018, it is expected to recover by 2019.

Fig. 12. Global Production and Consumption of Palm Oil (2018)



Source: Mielke (2018).

2.9. Projected Demand and Gap

As of 2010, the Philippines' supply was 40,000 MT of crude palm oil and 3,000 MT of palm kernel oil, which were entirely consumed by the domestic market. During the same year, imports amounting to 225,000 MT were valued at Php 6.7B. In 2012, imports totaled 500,000MT, valued at Php 17B, while it is projected that by 2022, the value of imports will be between Php 22-27B. By 2020, it is projected that the world will be short by 25.7M MT of palm oil if production areas were not expanded by 2012. Table 6 shows the demand for palm oil in metric tons for different time periods.

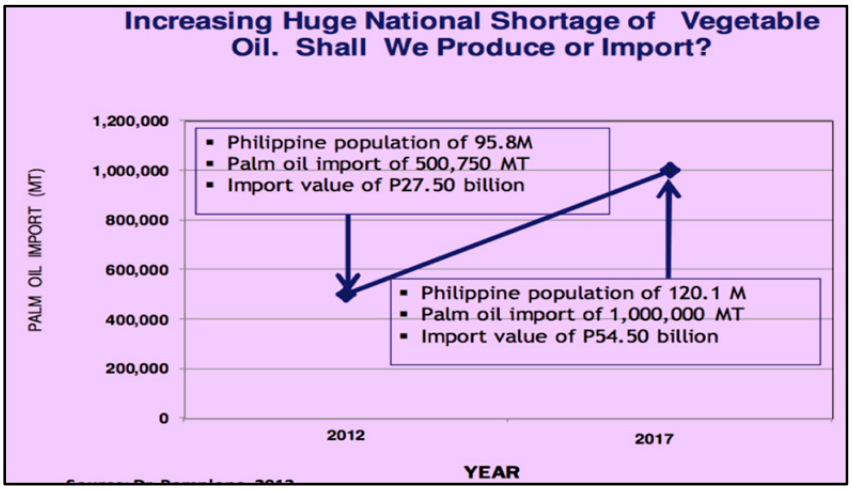
Table 6. Demand of Palm Oil (MT)

Year	Amount/Demand for Palm Oil (million tons)	Palm Oil Contribution as % of Total Oils & Fats
1980	4.6	8
1990	11.0	14
2000	21.9	21.9
2010	45.9	45.9
2011	50.4	50.4
2012	52.3	52.5
2020	78.0	56.0

Source: Thomas, as cited in Pamplona (2014).

The Philippine Oil Palm Road Map sets an ambitious land area of more than one million hectares to be planted with palm oil, 98% of which will be located in Mindanao, particularly in the CARAGA region (accounting for 39%). In Luzon, the prospective area is Palawan province, covering 100,000 HAs. Nonetheless, current oil palm production in the country is a little over 89,000 hectares. In 2012, palm oil imports reached 500,750 MT, valued at Php 27.50M. In 2017, the country imported 1,000,000 MT of palm oil valued at Php 54.50B (Pamplona, 2014). With the increasing domestic demand for palm oil, there really exists a huge gap (Fig. 13) compared to what the country can produce (supply).

Fig. 13. Demand Gap of Palm Oil Requirement



Source: Pamplona (2014).

Fig. 14. World Supply Demand Gap of Palm Oil in 2018

Annual growth in palm oil output to slow to +2.9 Mn in 18/19 +3.7 Mn T in 17/18

World PO stocks to peak in Nov /Dec 18 and fall in 2019

Accelerating world PO usage (+4.7 Mn T in 18/19)

PALM OIL: World Supply & Demand (Mn T)

	October / September			
	18/19F	17/18	16/17	15/16
Opening stocks	**13.26***	**11.32**	**9.99**	**13.39**
Production	**73.01***	**70.07**	**66.41**	**58.70**
Imports.	**51.21***	**49.05**	**48.41**	**45.25**
EU-28	*7.90**	*7.64**	*7.65*	*7.25*
China, P.R. . . .	*5.70**	*5.35**	*5.02*	*4.80*
India	*9.28**	*8.63**	*9.37*	*8.77*
Exports.	**51.53***	**48.93**	**48.96**	**44.89**
Indonesia	*28.30**	*26.74**	*27.54*	*23.76*
Malaysia	*17.50**	*16.36**	*16.31*	*16.67*
Disappearance	**72.92***	**68.26***	**64.53**	**62.47**
Indonesia . . .	*12.60**	*10.71**	*9.21*	*8.88*
India	*9.46**	*8.97**	*9.38*	*9.16*
EU-28	*7.82**	*7.52**	*7.42*	*7.17*
China, P.R.	*5.60**	*5.32**	*5.03*	*5.26*
Ending stocks	**13.03***	**13.26***	**11.32**	**9.99**
Stocks/usage	*17.9%*	*19.4%*	*17.5%*	*16.0%*

Source: Mielke (2018).

10. Global Imports and Exports of Palm Oil

Fig. 14 shows the world's palm oil supply and demand in 2018 - 2019 with Indonesia and Malaysia as the biggest producers at 28.30 and 17.50 million tons, respectively, while importing countries include India, Europe, and China with 9.28, 7.90 and 5.70 million tons, respectively. It is projected that this scenario will continue to persist following the provisions of the free trade agreements (FTAs).

Ⅲ. Related Competitiveness Studies on Palm Oil

In the 1970s, Malaysia was the primary producer and exporter of world palm oil. However, between 1975 to the present, the rates of Malaysia's oil palm, estate growth, and palm oil production and exports decreased relative to Indonesia (Hadi, 2004).

Subagyo (2002) asserted that the export duty for crude palm oil (CPO) and palm kernel oil (PKO) was initially implemented in 1989 for Malaysia and in 1995 for Indonesia, respectively. His study found that there was an increase in the average yearly export volume and net trade values of palm oil products, except for CPO in Malaysia and palm kernel in Indonesia. The average relative comparative advantage (RCA) for palm oil products, except for palm kernel cake for Malaysia and Indonesia, significantly increased with export tax imposition. Moreover, regression analysis showed that domestic production, domestic consumption, export price, and CM (competitive of index) had an effect on the export volume of CPO in Indonesia. As for PKO, foreign exchange rate and CM also had a significant positive effect on export volume. Likewise, domestic consumption, producer price, export price, and CM in Malaysia also affected the export volume of CPO. In the case of PKO, a significant effect on export volume was affected by foreign exchange rate, domestic production, domestic consumption, and CM.

The partial equilibrium resulted in showing that the imposition of an export tax on CPO and PKO in Indonesia reduced domestic production and increased domestic consumption. The welfare loss among producers, welfare gain among consumers, government revenues, net economic loss in production and consumption, and the net effect of the export tax increased with the hike in export tax rates on CPO and PKO. Additionally, the imposition of export taxes on CPO and PKO in Malaysia decreased domestic production while increasing domestic consumption. Consequently, the welfare loss to producer, welfare gain to consumers, government revenues, net economic loss in production and consumption, and net effect of the export tax increased the export tax rates on CPO and PKO.

In 2004, a comparative analysis study of competitiveness between Malaysia and Indonesia was conducted by Hadi. The study's specific objectives were to compute the production cost, measure production efficiency and productivity from the produced fresh fruit bunches (FFB) and crude palm oil (CPO), examine the export competitiveness of Indonesia's palm oil, and recommend policy alternatives. The Banker-Charnes-Cooper (BCC) model was used to measure production efficiency, along with export competitiveness, including the relative comparative advantage (RCA).

Hadi (2004) found that Indonesia's palm oil industry is more competitive compared to Malaysia. Indonesia was better off in terms of FFB yield, oil extraction rate (OER), and CPO yield with a lower cost of production of FFB and CPO over Malaysia. These were supported by the increasing trend of the export performance ratio (EPR) and the net export/total trade ratio (NEITT). Inefficiency in Indonesia's palm oil industry was due to inefficient utilization of production input and decreasing productivity of palm oil estates. Recommendations included the replanting of oil palm trees, application of optimum fertilizer, improving the harvesting and processing of FFBs, maintaining an account from the palm oil export tax, and determining the optimum export tax.

Zakaria, Sumri, Mohamed, and Balu (2018) assessed the competitiveness of Malaysian and Indonesian palm oil exports in the Balkans utilizing a constant market

share (CMS) analysis. CMS is often used to measure export performance and competitiveness. It was found that Malaysia showed better market effect and distribution effect performance compared to Indonesia in the Balkans, as evidenced by the results from the duration of analysis.

Ramadhani and Santoso (2019) analyzed the competitiveness of Malaysian and Indonesian palm oil exports focused on China, Singapore, India, Pakistan, and the Netherlands from 2001 to 2014. The methods revealed comparative advantage (RCA), symmetric comparative advantage (RSCA), and constant market share (CMS). Although RCA and RSCA were positive for both countries; it was found that Indonesia's indices from 2001-2014 were higher than those of Malaysia. The CMS computation showed that palm oil had a strong influence on both countries for the time period among the five importing countries, and both concentrated in growing export markets. Lastly, Indonesia's market for palm oil experienced rapid growth, while this stagnated in Malaysia. Overall analysis showed that Indonesia's palm oil was more competitive among five importing countries relative to Malaysia.

Most of the studies dealt with competitiveness, particularly between Malaysia and Indonesia, but this paper examined the Philippines' journey towards palm oil self-sufficiency, import dependence, and shifting patterns of comparative advantage, as well as other trade indicators relative to Malaysia and Indonesia.

Ⅳ. Methodology

1. Data Collection

Secondary data were utilized in the research. The main source for imports, exports, consumption, and production data were derived from Index Mundi, Philippine Coconut Authority (PCA), and the Philippines Statistics Authority (PSA). The data scope covered the period from 1964 until 2018 for the Philippines, as well as for the two other countries relevant in palm oil production, Indonesia and Malaysia.

2. Data Analysis

Descriptive statistics were used in deriving insights from the information gathered. Import, export, production, and consumption trend analysis were done. Aside from these production, consumption, and trade descriptive statistics, other trade indicator ratios were also computed to provide insights on the status of palm oil in the economy. This includes balance of trade (BOT), self-sufficiency ratio (SSR), import dependency ratio (IDR), and normalized trade balance measurement.

The Balance of Trade (BOT) measures the value of the net international trade transactions of the economy. BOT shows a trade deficit when imports exceed exports, and a trade surplus when exports exceed imports. It is computed using the following equation:

$$\text{BOT} = \text{Exports} - \text{Imports}$$

The self-sufficiency ratio (SSR) measures a country's reliance on its own domestic production relative to its consumption domestically. It is computed using the following equation:

$$\text{SSR} = \frac{\text{Production}}{(\text{Production} + \text{Imports} - \text{Exports})} \text{x } 100$$

The import dependency ratio (IDR) measures the country's reliance on imported commodities relative to consumption domestically. It is computed using the following equation:

$$\text{SSR} = \frac{\text{Imports}}{(\text{Production} + \text{Imports} - \text{Exports})} \times 100$$

The normalized trade balance ratio measures a country's shifting comparative advantage or disadvantage patterns. It represents transactions of a specific commodity, relative to its own trade. It is computed using the following equation:

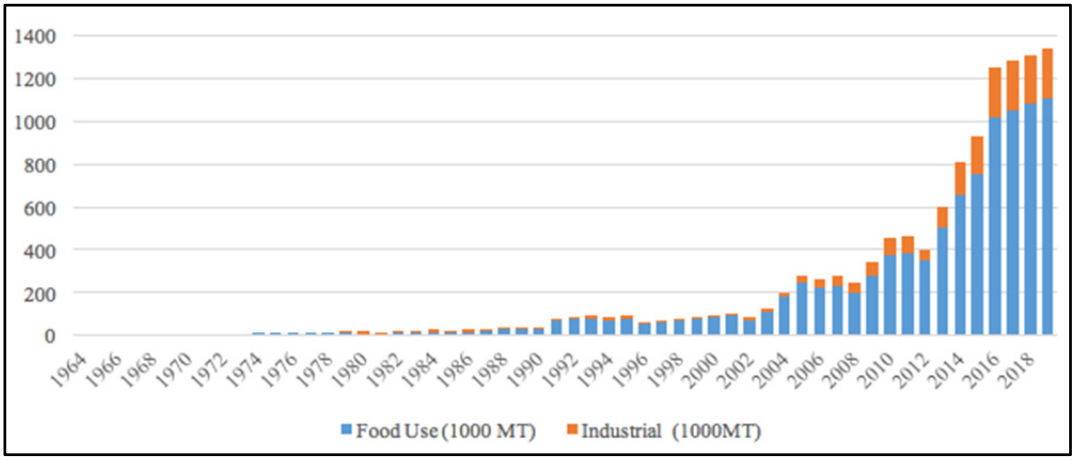
$$\text{Normalized Trade Balance} = \frac{\text{Export} - \text{Imports}}{(\text{Exports} + \text{Imports})}$$

V. Results and Discussion

1. Palm Oil Consumption in the Philippines

There is an increasing volume of consumption of palm oil in the Philippines (Fig. 15). Palm oil was utilized in the country in the 1970s, and since then, consumption increased steadily until the early 2000s. From 2006 onwards, a rapid growth rate has been observed and is evident in the current period.

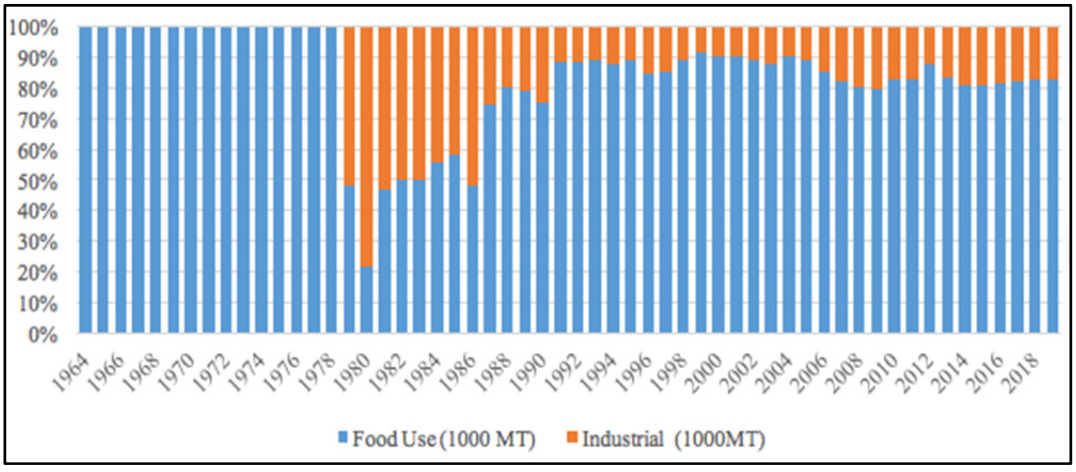
Fig. 15. Total Domestic Consumption in the Philippines (1964-2019)



Source: Index Mundi (2019).

Throughout the study period, the bulk of domestic usage (Fig. 16) for palm oil was for food. In the 1980's, from a purely food use, a surge in industrial utilization was seen, but this continued to decline over a ten-year period, until it stagnated to the current level. As of 2018, around 80% of consumption volume is allocated to food use.

Fig. 16. Annual Composition of Consumption of Palm Oil

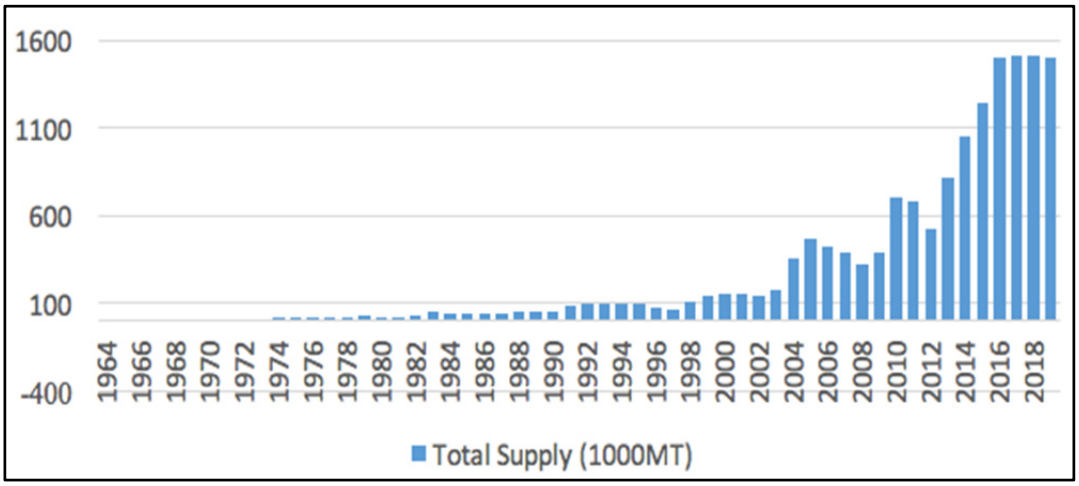


Source: Index Mundi (2019).

5.2. Palm Oil Supply in the Philippines

The palm oil industry in the Philippines has grown from a total supply of 6,000 MT in the 1960s to around 1.5 Million MT (Fig. 17). Currently, the levels of supply have been stable for the past 3-4 years, after a drastic supply volume increase from 2012. The current supply of palm oil is highly composed of imported oil. Despite a rapid supply increase in the country in the past decade, the Philippines has been steadily producing around an average of 96,000 MT domestically.

Fig. 17. Total Palm Oil Supply Volume (1964-2018)



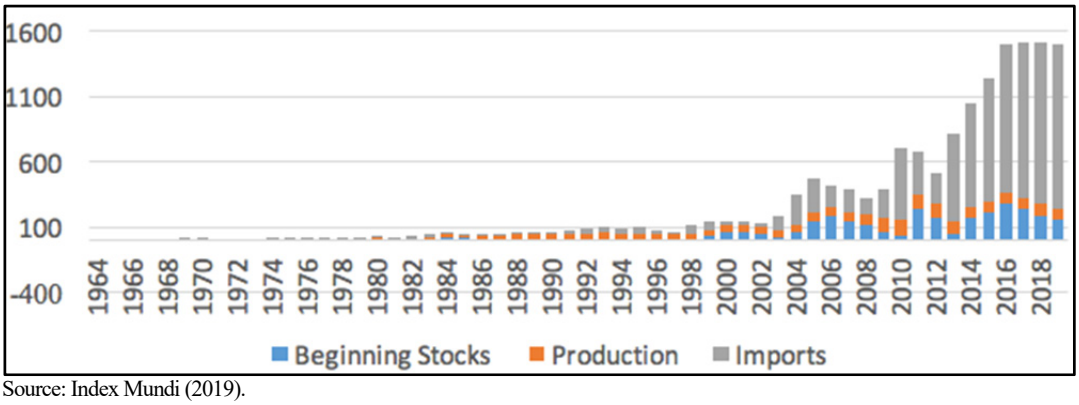
Source: Index Mundi (2019).

5.3. Supply Sources

The increase in supply (Fig. 18) can be highly attributed to an increase in imports; starting in the 2000s, imports have significantly increased over time. Domestic production, on the other hand, has remained constant.

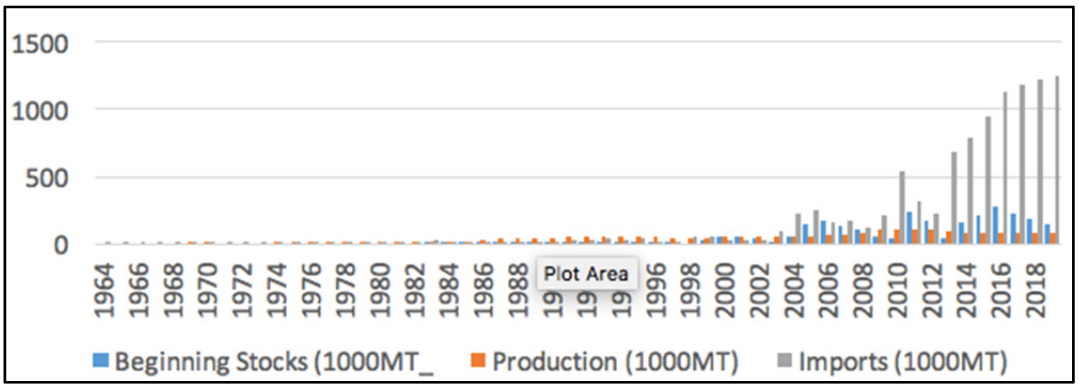
Looking at the disaggregated supply (Fig. 19), the volume of domestic production is relatively similar after growth during the 1980s. The current supply of palm oil is composed highly of imported oil. Though there was a rapid increase in supply in the country in the past decade, the Philippines has been steadily producing an average of about 96,000 MT domestically.

Fig. 18. Total Palm Oil Supply Volume and Specific Composition (1964-2018)



Source: Index Mundi (2019).

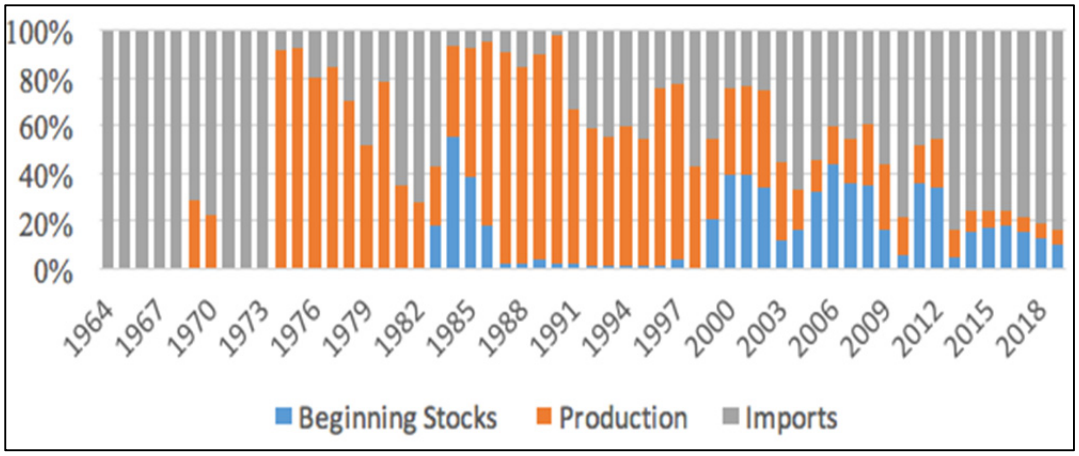
Fig. 19. Total Palm Oil Supply Volume per Source Category (1964-2018)



Source: Index Mundi (2019).

In terms of the yearly composition of supply (Fig. 20), palm oil in the Philippines has been composed mainly of imports. Domestic production started in the 1970s, and was the major source of the country until the late 1990s. From the early 1990s, imports have taken a big chunk of the total supply of palm oil, and this has been growing continuously to the present. This signals that the country has been increasingly reliant on importation, rather than producing its own palm oil, to sustain its supply. Also, this means that the majority of the palm oil in the market is sourced abroad.

Fig. 20. Total Palm Oil Supply Volume Percentage Composition (1964-2018)



Source: Index Mundi (2019).

4. International Trade

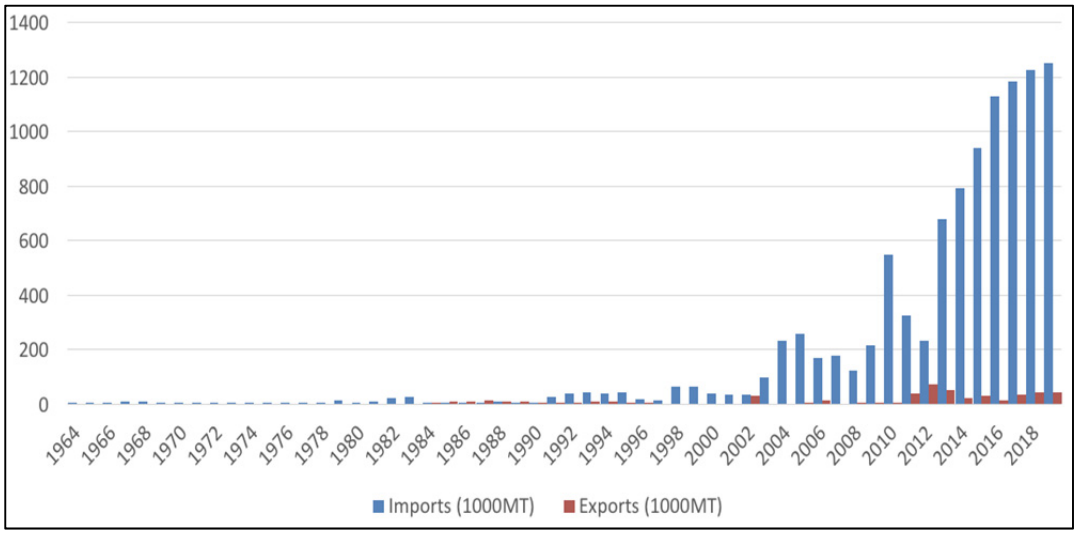
4.1. Import-Export Volume

As for international trade, palm oil imports outweighed exports in the Philippines (Fig. 21), thus leading to a trade deficit in terms of balance of trade. There are periods in the industry where the country has relied on its own production, even to a point where the country had a chance to export palm oil. Though, after this trade surplus, the country has been reliant on other countries for its palm oil requirements, causing a decline in attempts toward self-sufficiency. Currently, the import dependency ratio or measure validates this

reliance of the Philippines on other nations for its production shortfall.

Palm oil has been recorded to be imported in minute amounts from 1960 until 1990, though there is evidence of its exportation in the mid-1980s. Starting in 2012, the volume of imported palm oil continued to increase steeply, while the export volume remained at minimal levels.

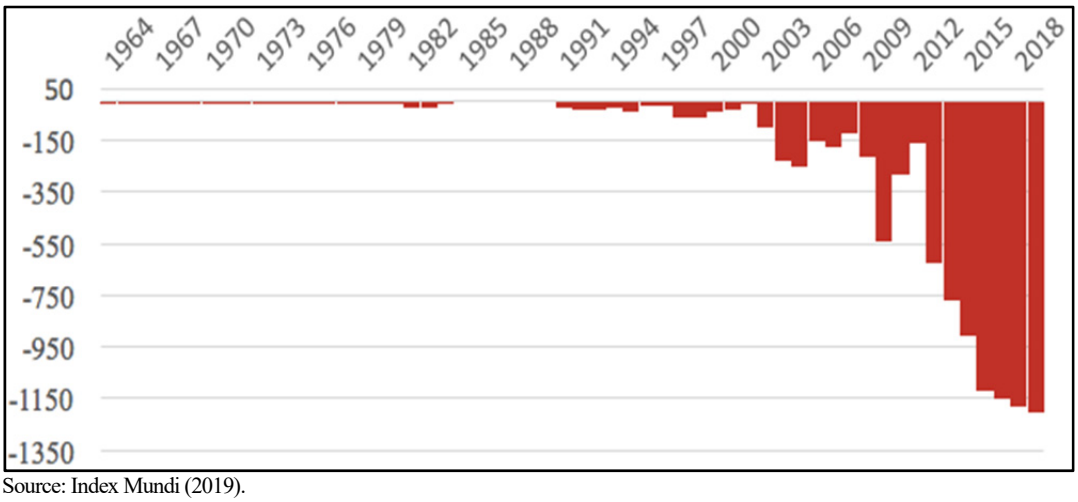
Fig. 21. Palm Oil Import and Export Volume (1964-2018)



Source: Index Mundi (2019).

In terms of the balance of trade, as expected, the prevalence of a trade deficit is exhibited in the economy throughout the period, except from 1985-1990, when a surplus of 2,000MT to 8,000MT was posted. After a half-decade of surplus, an increase in trade deficit, up to the most recent year, can be observed (Fig. 22).

Fig. 22. Palm Oil Import and Export Volume (1964-2018)

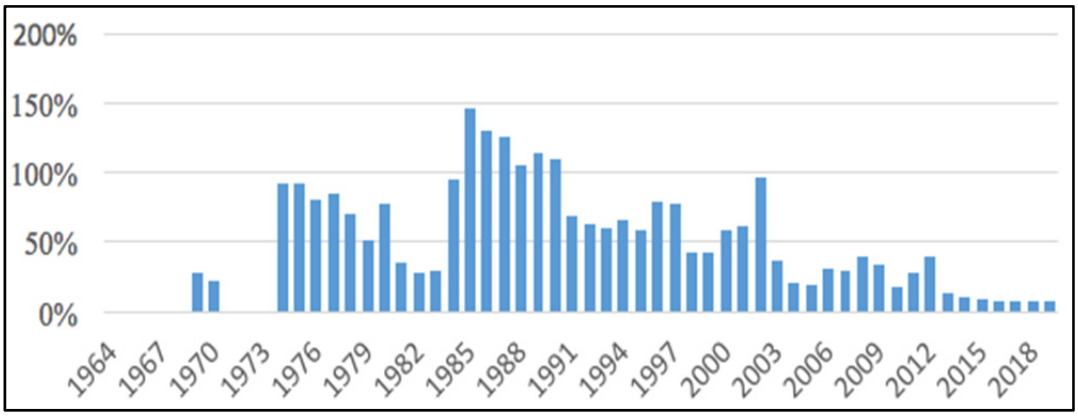


Source: Index Mundi (2019).

4.2. Self-sufficiency Ratio

From 1974, the country has been trying to be self-sufficient, but only during 1986-1990, when the Philippines had a trade surplus, did its self-sufficiency ratio exceeded 100%. However, the country's palm oil production did not keep up with the growing demand, and so the Philippines has remained reliant on imported palm oil, and this trend continues to the present time (Fig. 23).

Fig. 23. Palm Oil Self Sufficiency Ratio (1964-2018)

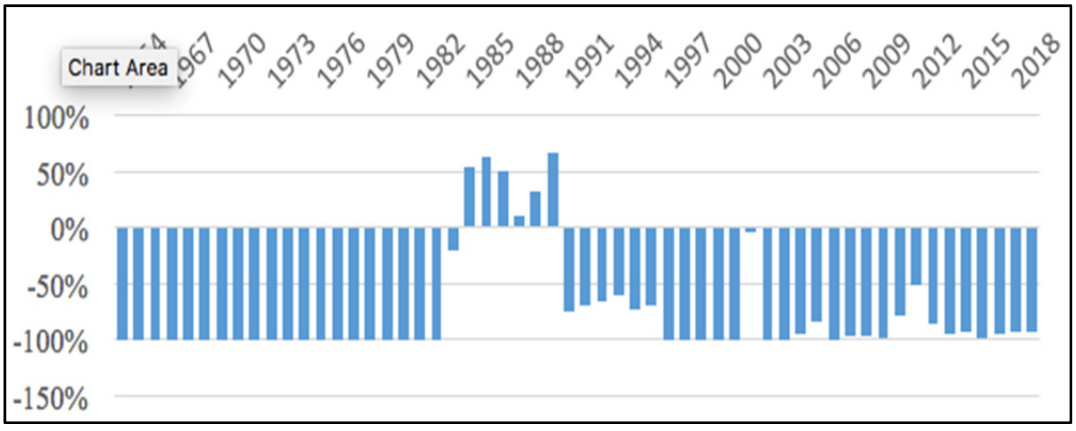


Source: Index Mundi (2019).

4.3. Net Export/Total Trade/Normalized Trade Balance Ratio

All throughout the period, except for the six years from 1985 to 1990, the total trade ratio (Fig.24) has been largely negative for the Philippines.

Fig. 24. Palm Oil Self Sufficiency Ratio (1964-2018)

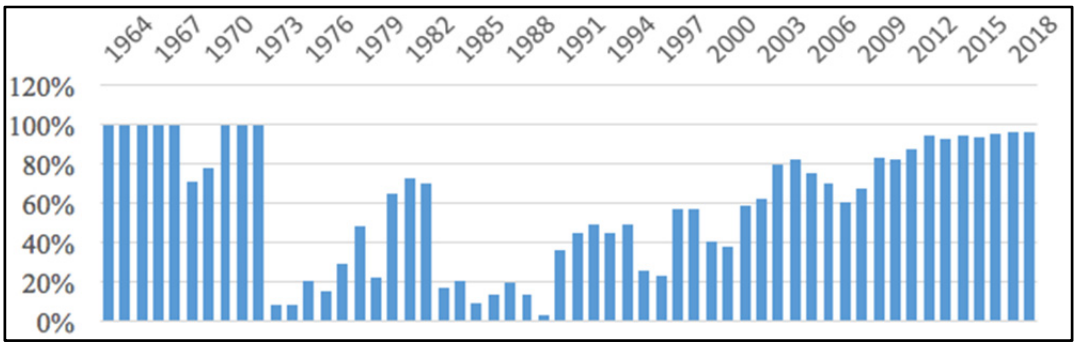


Source: Index Mundi (2019).

4.4. Import Dependency Ratio

As expected, the country is currently highly dependent on imports (Fig. 25). Though there were years where the Philippines was able to fully depend on its own production from the mid-1970s to 2000s, its palm oil industry trend seemed to be highly import-based.

Fig. 25. Import Dependency Ratio (1964-2018)



Source: Index Mundi (2019).

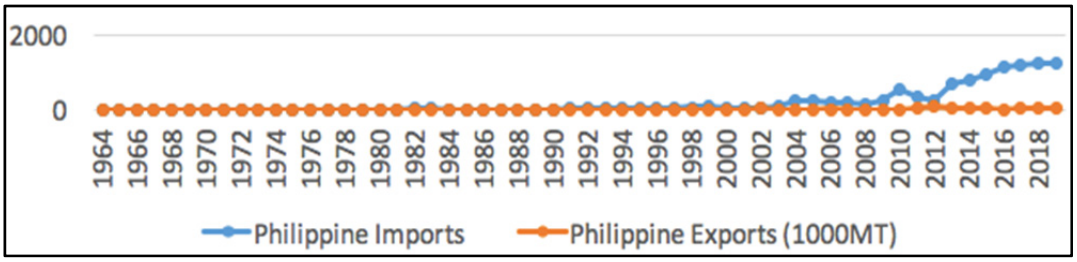
4.5. Comparative Palm Oil Trade of the Philippines, Indonesia and Malaysia

Compared to other ASEAN countries, namely Indonesia and Malaysia, the Philippine palm oil industry did not take off in a similar way to top producing countries. Instead, the Philippines remains an importing country (Fig. 26) while Malaysia and Indonesia have been supplying the world in significant and increasing volumes. This is primarily due to the limited land area allotted to develop oil palm plantations. The Philippines has only about 89,000 hectares of land planted with oil palm, and this is far below the national target of one million hectares.

In terms of the balance of trade (Fig. 27), a similar trend was exhibited with Malaysia and Indonesia having trade surpluses, compared to the Philippines, which has constantly faced increasing trade deficits.

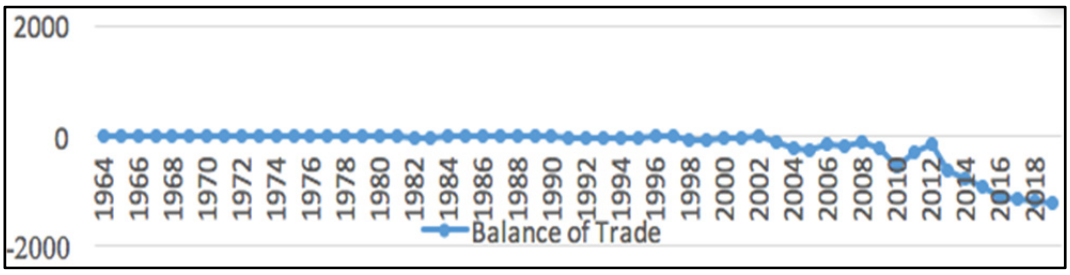
The Philippines' balance of trade seemed to close its trade gap until 2002, when import volumes of palm oil started exceeding export volumes.

Fig. 26. Palm Oil Import and Export Volume of the Philippines (1964-2018)



Source: Index Mundi (2019).

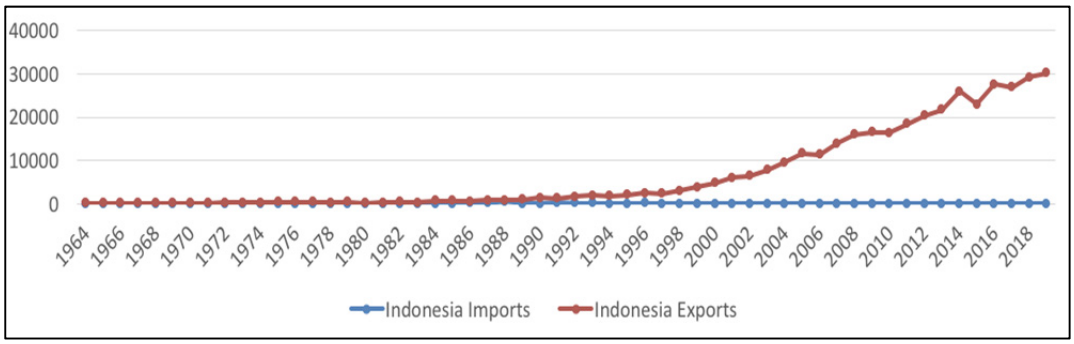
Fig. 27. Philippines' Balance of Trade



Source: Index Mundi (2019).

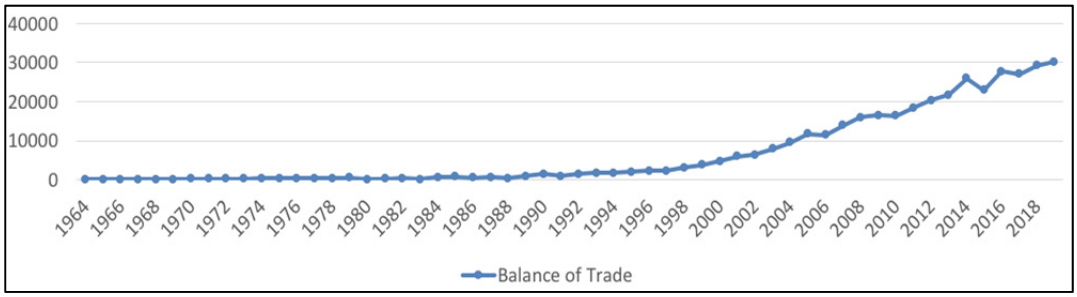
The opposite is true for Indonesia (Fig. 28), with imports at a constant volume per year, and exports increasing from the mid-1990s. During this time period, Indonesia's exports overtook its import volumes, and the widening gap between the two reflected a higher balance of trade position (Fig. 29). This can be attributed to Indonesia's continuous increases in its oil palm production area and utilizing state-of-the-art processing facilities, among others.

Fig. 28. Palm Oil Import and Export Volume in Indonesia (1964-2018)



Source: Index Mundi (2019).

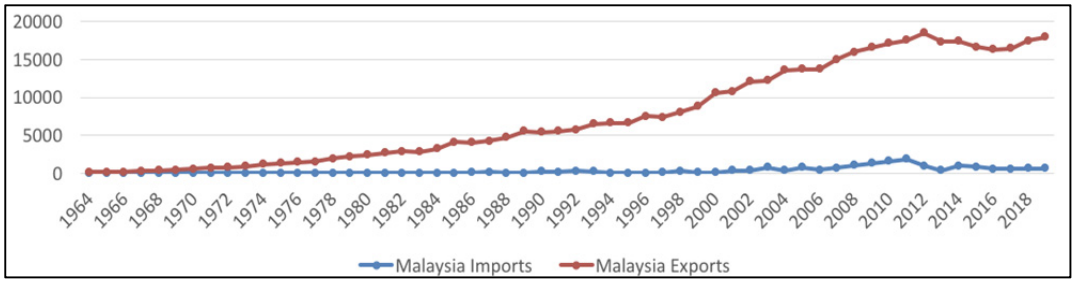
Fig. 29. Trend in Indonesia's Balance of Trade (1964-2018)



Source: Index Mundi (2019).

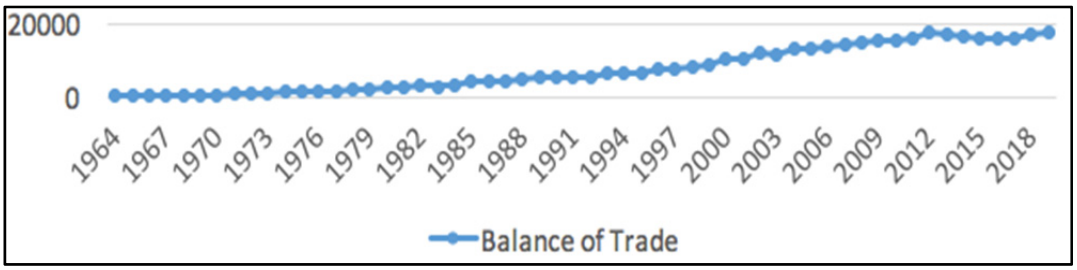
This is also true for Malaysia as it is a net exporter (Fig. 30). However, compared to Indonesia, Malaysia's balance of trade (Fig. 31) remains to be positive with its trade surplus position starting much earlier (late 1970s) compared to Indonesia (early 2000s).

Fig. 30. Palm Oil Import and Export Volume in Malaysia (1964-2018)



Source: Index Mundi (2019).

Fig. 31. Malaysia's Balance of Trade

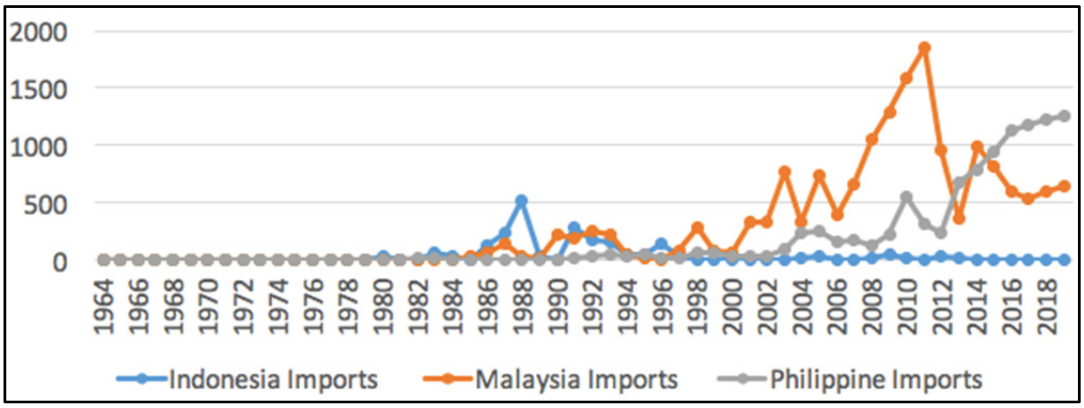


Source: Index Mundi (2019).

4.6. Comparative Imports of the Philippines, Indonesia and Malaysia

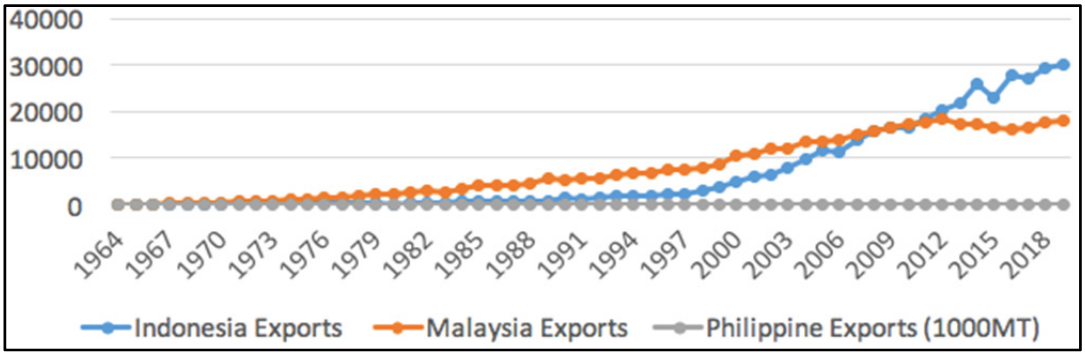
A comparison of the import data among the three countries of interest (Fig. 32) shows that currently, the Philippines has the highest incidence of palm oil importation, and this is expected to still increase in the coming years as local demand soars. Indonesia's exports are stable and are at smaller amounts compared to the three. For Malaysia, the volume of imports peaked drastically in 2010, but has somewhat dipped and showed erratic behavior in the years after.

Fig. 32. Palm Oil Imports among Indonesia, Malaysia, and the Philippines (1964-2018)



Source: Index Mundi (2019).

Fig. 33. Palm Oil Exports of Indonesia, Malaysia, and the Philippines (1964-2018)



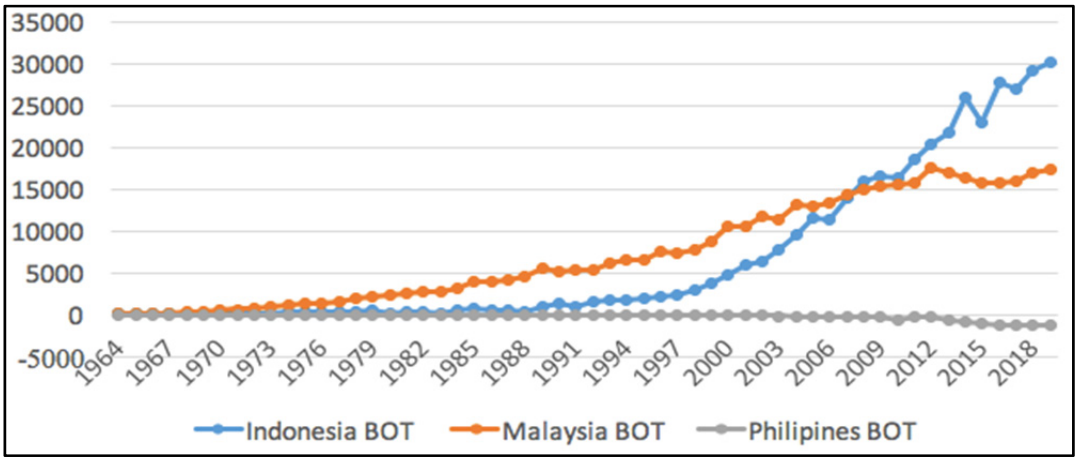
Source: Index Mundi (2019).

Conversely, it is Indonesia and Malaysia which are competing in palm oil exportation (Fig. 33). Though Malaysia's growing foreign exports have been leading the market for years, Indonesia recently overtook Malaysia in terms of export volume.

4.7. Comparative Balance of Trade

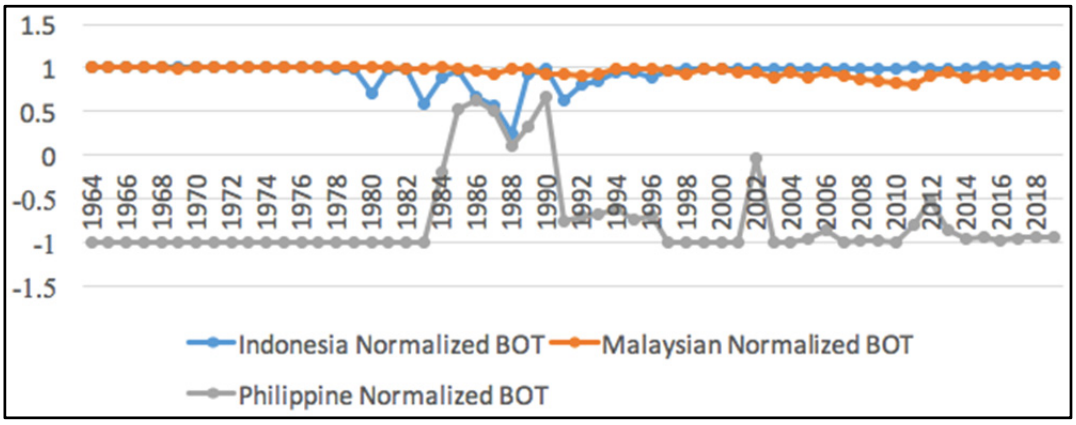
Considering the balance of trade (Fig. 34), both Indonesia and Malaysia have trade surpluses, which show increasing trends over time. The Philippines, on the other hand, is a net importer, unlike Indonesia and Malaysia.

Fig. 34. Palm Oil Balance of Trade of Indonesia, Malaysia, and the Philippines (1964-2018)



Source: Index Mundi (2019).

Fig. 35. Palm Oil Normalized Trade Balance Ratio of Indonesia, Malaysia, and the Philippines (1964-2018)



Source: Index Mundi (2019).

4.8. Balance Ratio

In terms of normalized trade balance (Fig. 35), Malaysia seems to be constantly having a trade surplus, unlike the Philippines, which is, most of the time, exhibiting a trade deficit. In the case of Indonesia, though it has trade balance fluctuations hypothetically related to that of the Philippines during the 1980-1990s, its trade surplus is more constant and consistent compared to Malaysia.

Ⅵ. Summary of Findings and Insights

The preceding discussion showed that the palm oil industry is growing in the Philippines and will continuously grow in the coming years. The past decade recorded an increase in the volume of the palm oil supply in the Philippines. However, the increase of such a supply in the Philippines is attributed to importation, and not domestic production. Thus, compared to other neighboring countries such as Malaysia and Indonesia, the Philippine palm oil industry still lags behind in international trade. The reason for this is because Indonesia and Malaysia have comparative advantages in terms of land area planted with oil palm, achieving economies of scale and state-of-the-art processing facilities, among others.

Nonetheless, these three countries started identically in terms of volume and growth until the last decade of the 21st century. Not only did the Philippines' growth remain stagnant in terms of its international trade of palm oil, Malaysia and Indonesia have overtaken the country significantly, and the trade gap is expected to continuously widen in the coming years.

The findings of this paper showed and interpreted various trade indicators such as balance of trade, self-sufficiency ratio, import dependency ratio, and normalized trade balance measurement in comparing the trade trends for palm oil import and export of the three countries involved.

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