

# A SUSTAINABLE ECONOMIC GROWTH IN ASEAN: FOREIGN DEBT AND INVESTMENT EFFICIENCY

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## A SUSTAINABLE ECONOMIC GROWTH IN ASEAN: FOREIGN DEBT AND INVESTMENT EFFICIENCY

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### Abstract:

This study examines the analysis of the efficiency of foreign debt and foreign investment on sustainable economic growth in form of economic welfare represented by Gross Domestic Product (GDP), Human Development Index (HDI), and the per-centage of the population working as benchmarks for the welfare of ASEAN developing countries, namely Malaysia, Thailand, the Philippines, Indonesia, Vietnam, Cambodia, and Laos. The variables studied were divided into two variables: input variable is foreign debt and foreign investment, while the output variable is GDP per capita, human development index, and working population. The method used is the Data Envelopment Analysis (DEA) used to measure the efficiency of an input variable to the output variable. In the theory of economic growth, Harrod-Domar stated investment is the key to the process of sustainable economic growth. The results of this study are, for six ASEAN developing countries such as Malaysia, Thailand, Vietnam, Philippines, Cambodia, Laos, and Indonesia there are indicated by the value of efficiency, which means foreign debt and investment is quite efficient in its management by increasing their sustainable economic growth as well as their economic well-being.

**Keywords:** Foreign Debt, Foreign Investment, Efficiency, Data Envelopment Analysis (DEA), Economic Well-Being

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### 1. Introduction

Sustainable economic growth is a process that must be done by the government of each country to realize the welfare of society. Especially for countries developing, in which to pursue a lagging economy that during this happen requires the acceleration of growth in the economy (Fadillah, 2018), such as the development of infrastructure and improvement in aspects of the sector public such as education, health care, Developing countries also have economic problems.

The sustainable economic growth can be measured by the development of the economy from one period to the period of the next. Sukirno (2014) in his analysis of the macroeconomic, the level of sustainable economic growth which is achieved by a country is measured from the development of gross domestic product who achieved a state where the process of increase in revenue and total revenue per capita to take into account the accretion population and is accompanied by a change fundamentally in the structure of the economy a country and income



distribution for the people of a country. Condition is, is shown by the entry of the flow of funds as capital into the system of the economy of a country. Development is done by a country in essentially financed from sources reception inside the country and outside the country (Imron, 2021). Source acceptance in the country comes from taxes, the result of the management of the source power of nature as well as the profits of SOEs. Meanwhile, the reception outside the country in the form of debt relief or grants from other countries and organizations supranational such as the International Monetary Fund (IMF), World Bank, Asian Development Bank (ADB), and others (Fadillah, 2018., Wildan, 2021).

Based on data sourced from the Indonesian Investment Coordinating Board, Indonesia which lies in the region of ASEAN becoming a haven for investing, many investors are foreigners who are interested to infuse their capital in Indonesia, to manage source power of nature that exist in Indonesia is optimal due to the lack of ability to source power human and technology in the country to process the source power of nature are available (Ighni, 2015). In addition to that, the State Thailand which is one of the countries developing another in the region of ASEAN has the rate of sustainable economic growth which is quite high in several years backward.

This was driven by manufacturing exports including clothing, integrated circuits, and electronic equipment parts. The number of exports is carried out by Thailand this is a matter that increases the sustainable economic growth in Thailand. Besides, it is also the sector of tourism that is qualified in the country and has made the interests of its own for investors to help provide capital to enable Thailand continues to evolve. There is also, Malaysia which is an agricultural country producing rice, rubber, and palm oil. Malaysia can attract the Foreign Investment to enter into the country to help cultivate plantations of rubber and palm oil which is a source of major income countries Malaysia (Ighni, 2015) So also with the Philippines that up to quarter three 2017 the sustainable economic growth reached 6.9%. Figures this is the largest in the ranks of the ASEAN countries and even a little more ahead of the growing economy of China. It is making the Philippines the area which is quite interested in the cultivation of capital (Sharif, 2019).

Here the data Foreign Direct Investment (FDI), which is believed to be one of the sources of important financing for countries developing including countries in ASEAN. FDI is expected to make a major contribution to increasing sustainable economic growth. Here accumulation of FDI in 4 countries growing which is in the region of ASEAN

**Table 1: Foreign Direct Investment (Million \$) of ASEAN Countries**

Country	2010	2011	2012	2013	2014	2015	2016	2017
Malaysia	3848.47	3378.15	3881.52	1395.77	1400.81	3710.05	4525.83	3990.29
Thailand	1764.74	-2209.66	1158.79	1012.05	3640.46	1137.66	3323.59	2370.54
Philippines	-76.68	-557.24	869.75	-335.66	518.55	855.85	317.37	374.00
Vietnam	413.57	288.29	430.65	339.72	327.14	397.49	305.69	418.60
Indonesia	1311.39	1858.33	6131.60	2352.61	1394.05	855.73	1620.57	702.30
Cambodia	17.15	33.08	2.38	-1.62	20.40	47.14	-7.38	20.36
Laos	34.46	0.36	0.07	1.06	1.85	2.24	23.86	6.70

Based on table 1, the FDI of ASEAN developing countries is still fairly volatile each year. Malaysia holds the highest number. But

in the year 2016, Indonesia has the figure the highest since the year 2010 up to 2017, which amounted to 6131.60. Laos has some FDI are



low but constant, while the Philippines holds the number of FDI very volatile since the year 2010 until in the year 2017. It is meant countries developing ASEAN quite well in terms of investment but the inconsistency of numbers of FDI makes the government not only relying on sources of financing of cultivation of capital alien alone.

In its development, countries growing more choose to use a method that is more instant to finance the economy, namely by doing a loan outside of the country. Where the case that the responsibility and strategic choice that has the government to finance the country remains in a condition is stable and the entire needs of the people can be fulfilled. The use of Foreign Debt in a period shorter or longer will have an impact of its own for the economy of the country. The output from the use of Foreign Debt could have implications on the sustainable economic growth is significant (Fadillah, 2018). By because it is, important to analyze the level of efficiency of the variable input Foreign Direct Investment to the Gross Domestic Product (GDP), Human Development Index (HDI) and Percentage of the employee in seven ASEAN countries developing, namely Malaysia, Philippines, Thailand, Indonesia, Vietnam, Cambodia, and Laos.

## 2. Literature Review

### Efficiency

Mahmudi (2011) defines efficiency is a process carried out as a measure and comparison between inputs and outputs, or measure the ratio between the output produced against the input used. Efficiency means to implement and produce all the things with the right, and efficient is also a comparison between the resources that are used by the output produced. Rosenwig (1979), there are three conditions to achieve efficiency, ie when using input together, can produce more substantial output, when using

input that is small can produce output that is the same, and when using inputs that big generates to output is large. Efficiency is a benchmark and can be used for various purposes. What course is included in the input, as well as how to obtain figures comparison it, will depend on the purpose of use starting measuring such. Although the elements that determine efficiency are diverse. However, the savings on the value of the input would correspond with the solution of the problem that we face when it (Okoro, 2013).

### Foreign Debt, Foreign Investment and Sustainable Economic Growth

Foreign Debt is one of the sources of financing outside the country as the budget of the government and development economics (Arsyad, 2010). Utilization of foreign debt used to finance expenditure the state to support the activities of the economy that would push the rate of sustainable economic growth. In terms of financing the budget of the government, foreign debt plays a role in financing the deficit budget which occurs due to the difference between the receipt of domestic and the government expenditure, the government expenditure is going to encourage the sustainable economic growth through productive expenditures (Arsyad, 2010). This condition is made a requirement for the government to manage the debt to the good so that it always can be used to fulfill the needs of financing the late set. Management of debt that includes the activities of planning, preparation of strategy, communication stakeholder interests included in the development of the market, the implementation of execution, issuance of debt, administration, payment obligations as well as the evaluation of debt (The Ministry of Finance, 2017).

There are two roles the principal of the foreign debt is to overcome the problem the gap between saving domestic and



investments and addressing the problems the gap between the needs of exchange of foreigners who have been targeted by the foreign exchange that has been obtained from the reception result export activities. These two problems are referred to as the two gaps problem (Sukirno, 2012). Foreign debt can be in the form of official development assistance (ODA), which is a loan that is granted by the governments of foreign and international financial institutions to government recipients aid such as loans from the IMF. Besides it also can be non-official development assistance (non-ODA), which is a loan that is received in bilateral from banks or creditors outside the country with the requirements by borrowing commercially including credit exports from outside the country (Malik, 2017).

Relation Theory between Foreign Debt and Sustainable economic growth, the use of foreign debt as capital can increase sustainable economic growth in the short run, but not necessary to improve in the long run when performed by continuously constantly. Consideration of the political economy becomes the reason for the high Foreign Debt that led to sustainable economic growth and the capital. The interest rate of foreign debt here is not internalized by the state (Saleh, 2016., Utomo 2021., Wildan 2021). Another thing is the debt overhang theory. The model is explained that the possibility of debt in the future will come to be more substantial than the ability of states to pay (Todaro, 2019) that need no explanation on the point of what the foreign debt can provide impact positively on the state and when the state had to lay off to continue using debt as a provider of capital for economic development.

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#### **The Human Development Index (HDI)**

HDI measures human development achievements based on many basic components of quality of life. As a measure of the quality of life, HDI is built through a basic three- dimensional approach. Dimensions of

these include age long and healthy, knowledge, and a decent life. The third dimension has a sense very broad because it related to many factors. To measure the dimensions of health are used a figure of hope alive when born. Next to measure the dimensions of knowledge using a combination of indicators of the average length of school and long school expectations. As for measuring the dimensions of life feasible to use indicators of the ability of power purchasing public to many needs of staple food and not the food, the views of the average amount of spending per capita as an approach to income that represents the achievements of development to live a decent (Yuniasih, 2011).

#### **Unemployment Rate**

Objectives The main development of the economy is not just growth of GDP alone, but also the alleviation of poverty, reduction of inequality of income and the provision of fieldwork in the context of the economy that continues to evolve (Todaro, 2018). There is a relationship that is closely once between the high levels of unemployment and poverty. Most great people who do not have a job permanent or only part-time is always to be among the group of very poor people (Saidah, 2017). The unemployment rate is the percentage of the workforce that does not have a job (Mankiw, 2019), while the labor force is the number of workers including those who have work or who do not have work. Opportunity employment is the number of people who can be accommodated to work at a company or an institution, an opportunity of work to accommodate all worker's work is available when the fieldwork that provided sufficiently or balanced by the number of personnel working are available (Dwi, 2015). Factors that affect the expansion of opportunities of work among others: development of the number of inhabitants and forced labor, the sustainable economic



growth, and the wisdom of the expansion of opportunities of work it themselves. Personnel work is one of the factors of production is very important in addition to a source of natural, capital, and technology. Personnel work has a role which is very important in the development, as actors of development. Labor problems can cause new problems both in the economic and non-economic fields. Levels of unemployment are high causing the low incomes that further trigger the emergence of poverty (Priyadi, 2019).

In a study, this using a method of analysis Data Envelopment Analysis (DEA) in which the operation using the variable input is Debt External land and foreign investment as well as using a variable output that is sustainable economic growth which is calculated by GDP per capita, Human Development Index and The percentage of the population worked. Countries developing in ASEAN in the study is that include Malaysia, Thailand, Philippines, Indonesia, Vietnam, Cambodia, and Laos. Sources of financing outside the country that used to cover the shortfall of funds from savings domestic which are a source of financing in the country. Then, allocated in the flow of capital and expenditure of the government for the benefit of the sector public such as the construction of infrastructure (construction of bridges, highways or road tolls), guarantee the education and health as well as the protection of social to generate GDP per capita, Human Development Index and availability of fieldwork as output. Factors other than the variable input that is saving the domestic and the balance of trade (exports and imports), which also became the support in streamflow of capital and also the sector public (Solihin, 2017). The variable output itself is an achievement of a growing economy that is derived from the input of Foreign Debt or the Foreign Investment who carried the state develops in the region of ASEAN to

address the problem economies such, the gap between the investment with savings or imbalance between exports and imports. Once done if the data through methods DEA then the level of efficiency and inefficiency shown from the results of the data variable input data and variable output and then will conclude the level of efficiency of some input in generating much output according to the data states developing in the region ASEAN.

### 3. Method

This research is using the secondary data that is data published by the agency or organization that is not the organizer and reports annual that exist in the local area. The data used in the study is that derived from Ceicdata which is a company multinational that is engaged in the field collection of the economy and finances data of countries in the whole world. The data is used among others is Foreign Debt, Foreign Investment and GDP Per Capita countries are developing in the region ASEAN (Malaysia, Thailand, Philippines, Indonesia, Vietnam, Laos, and Cambodia). In the study of this method that is used is the method of Data Envelopment Analysis (DEA), the method requires a data variable that consists of variable input and variable output, and Economic Activity Unit (EAU). Input Variables are Foreign Debt and Foreign Direct Investment and Output Variables are Gross Domestic Product per capita, Human Development Index and Working population.

In this study, we used the Data Envelopment Analysis (DEA) as a research method. DEA is a methodology that is used to determine the efficiency of a unit making decisions or units of work that are responsible for using many inputs to obtain an output target. The DEA calculates efficiency measures in a scalar manner and determines efficient input and output levels for the unit being evaluated. DEA method was created as a performance evaluation tool for an activity in an entity unit (organization), hereinafter



referred to as the Decision-Making Unit (DMU). Simply stated, this measurement is expressed as an output/input ratio, which is a measurement of efficiency or productivity.

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The essence of DEA is to determine the weights or scales for each EAU output and input. These weights have the following properties (Priyadi, 2019):

- a. Not negative
- b. Be universal, meaning that each EAU in the sample must be able to use the same set of weights to evaluate its ratio

DEA is a calculation of efficiency, relative technique. The hypothesis for the DEA calculation results is:

- a. EAU is less efficient if efficiency < 100%
- b. EAU is efficient if efficiency = 100%

### 6 DEA Mathematic Model

#### Constant Return To Scale (CRS) Model

The model constant return to scale developed by Charnes, Cooper, and Rhodes (CCR model) in the year 1978. The model is to assume that the ratio between the addition of the input and output are the same (constant returns to scale). That is, if there is additional input by x times, then the output is also experiencing an increase of x times. Another assumption used in this model is that each company or Decision-Making Unit (DMU) operates at an optimal scale.

The formula of constant return to scale can be written as follows:

#### Max $\theta$ (DMS Efficiency CRS Model)

$$\begin{aligned} \sum_i 1x_{ij} \theta &\geq \theta i_0 n_j & i = 1, 2, \dots, m \\ \sum_r 1y_{rj} \theta &\geq y_{r0} & r = 1, 2, \dots, s \\ \sum_j 1j' &\geq 0 n_j & j = 1, 2, \dots, n \end{aligned}$$

Where:

$\theta$  = technical efficiency (CRS)

n = number of DMU

m = number of inputs

s = number of outputs

$x_{ij}$  = number of i-year inputs from DMU to -j

$y_{rj}$  = DMU weighting j for the calculated DMU

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Efficiency values are always less or equal to 1. DMU whose efficiency value is less than 1 means inefficiency, while DMU whose efficiency value is equal to 1 means efficient.

#### Variable Return To Scale (VRS) Model

The model is developed by Banker, Charnes, and Cooper (BCC models) in the year 1984 and the development of the model before that, CCR models. This model assumes that the company has not operated at an optimal scale. The assumption of this model is that the ratio between the addition of inputs and outputs is not the same amount (variable return to scale). That is, the additional input of x times is not going to cause output to rise by x times, can be small or more

(total weight output/total weight input) and the ratio must not be more than 1 (total weighted output/total weighted input  $\leq 1$ ).

The DEA (Data Envelopment Analysis) for an Economic Activity Unit (EAU) can be formulated as a fractional linear program, the solution of which can be obtained if the model is transformed into a linear program with the weight of input and output of the Economic Activity Unit (EAU) as a decision variable (Danu, 2013).



substantial than x times. Increasing the proportion may be increasing returns to scale (IRS) or are decreasing returns to scale (DRS). The results of this model add a convexity condition for the weight values, by including in the following figures:

$$\sum x_j = 1 \quad n_j = 1$$

Furthermore, the BCC model can be written with the following equation:

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Max ( DMU Model VRS Efficiency )

$$\sum = 1x_{ij} 'j \geq x_{i0} n_j \quad i = 1, 2, \dots, m$$

$$\sum = 1y_{rj} 'j \geq y_{r0} n_j \quad r = 1, 2, \dots, j$$

$$\sum = 1'j' \geq 1 n_j \quad (\text{VRS})$$

$$\sum = 1'j \geq 0 n_j \quad j = 1, 2, \dots, n$$

Where:

$\theta$  = technical efficiency (VRS)

n = number of DMU

m = number of inputs

s = number of outputs

$x_{ij}$  = number of i-year inputs from DMU to -j

$y_{rj}$  = number of output to -r from DMU to -j

$\lambda_j$  = DMU weighting j for the calculated DMU

Efficiency values are always less or equal to 1. DMU whose efficiency value is less than 1 means inefficiency, while DMU whose efficiency value is equal to 1 means efficient.

In general, an economic activity unit (EAU) or decision-making unit (DMU) used the CCR model reflects technical efficiency and scale efficiency, while the BCC model reflects technical efficiency only so that relative scale efficiency is the ratio of the efficiency of the CCR model and the BCC model.

$$S_k = q_k, \text{CCR} / q_k, \text{BCC}$$

If the value of S=1 means that the EAU that operates on the size of the efficiency scale best. If the value of S is less than one means that still there is an inefficiency scale of the EAU that. Thus, the value of (1-S) indicates the level of inefficiency scale of EAU. So, an efficient EAU with the CCR model also means scale efficiency. Meanwhile, an efficient EAU with the BCC model but not efficient with the CCR model means it has scale inefficiencies. It is because of EAU are efficient in technical, so the efficiency is derived from the scale.

#### 4. Research Results and Discussion

##### Data Analysis

In a study of this, the data used writer is the data from the years 2016 - 2018 with the object of study seven countries growing in the region of ASEAN are Malaysia, Thailand, Philippines, Indonesia, Vietnam, Cambodia, and Laos. The data is used and taken from the years 2016 - 2018 was obtained from reports that have been published by Ceicdata and Trading economics report. In this study, the author uses Variable Input Foreign Debt and Investment of capital foreign. While a variable output that is used in research this is GDP per capita, the Human Development Index, and Percentage of Working Population as a starting measure the sustainable economic growth.





**Foreign Debt**

Here is the data Foreign Debt in 7 countries developing that is in the region of ASEAN namely Malaysia, Thailand, Philippines, Indonesia, Vietnam, Cambodia, and Laos. The data used in research is the data of secondary that is obtained from Ceicdata ranging from the year 2016 until the year 2018

**Table 2: Foreign Debt of ASEAN Countries**

Year	Foreign Debt						
	Country (USD)						
	Malaysia	Thailand	Philippines	Indonesia	Vietnam	Cambodia	Laos
2016	213785	138796	7389,3	296572.5	52313.6	10281	8112.7
2017	228543	153213	75421	349231.2	54467.8	12782	8561.2
2018	221825	161014	78959.6	376839.3	57564.9	13144	9761.5

Based on the data obtained as in Table 2 the Foreign Debt of ASEAN Countries has various numbers to the needs of the proportion of countries developing it themselves. The state develops which has a Foreign Debt with a nominal high is Indonesia where the amount of Foreign Debt reached USD 296,572.5 in the year 2016 and experienced a rise in the year 2017 became USD 349,231.2 and back increases in the year 2018 amounted to USD 376,839.3. For a country with nominal Foreign Debt 's smallest is the Philippines where the amount of Foreign Debt in 2016 amounted to USD 7389.3 and experienced a rise in the years 2017 and 2018 respectively was USD 75 421 and USD 78959.6. For the Malaysian state experienced a decrease in Foreign Debt from year to year until the nominal USD 221 825 in the year 2018. Countries Thailand, Vietnam, Laos, and Cambodia experienced a rise in Foreign Debt is significantly each year. On average in ASEAN countries, each year has a rise in Foreign Debt. It is because the members of ASEAN most substantial is included in the group of countries was growing so that in the implementation of development most major countries that use the Foreign Debt.

**Foreign Investment**

Here is the data Foreign Investment in ASEAN countries namely, Malaysia, Thailand, Philippines, Indonesia, Vietnam, Laos, and Cambodia. The data used in research is the data of secondary that is obtained from the Ceicdata period 2016 – 2018

**Table 3: Foreign Direct Investment of ASEAN Countries**

Year	Foreign Direct Investment						
	Country (USD)						
	Malaysia	Thailand	Philippines	Indonesia	Vietnam	Cambodia	Laos
2016	2567.95	2897.65	567.8	2876.7	2900	692.5	103.39
2017	2783.76	3006.8	584	3056.8	3630	789	256.7
2018	2907.9	3148.4	602.6	3708.5	4250	865	415.2

Based on the data obtained as in Table 3, FDI of ASEAN countries has varied numbers to the proportion of countries developing it themselves, and each country experiencing fluctuations in each year. Countries growing by the foreign investment of the highest in the year 2016 were Thailand which reached USD 2897.65 and in the year 2016 with foreign investment most low is Laos, which



amounted to USD 103.39. Later in the year 2017, Indonesia became the country with the Foreign Investment whose height reached USD 3056.8 and foreign investment lows were in the Laos which amounted to USD 256.7. Later, in the year 2018 Indonesia back into the country with the Foreign Investment whose highest among the six countries developing more, to reach USD 3708.5 and the Philippines back holding nominal smallest planting of capital foreign amounted to 415.2.

### Gross Domestic Product Per Capita

GDP per capita in ASEAN countries such as Malaysia, Thailand, Philippines, Indonesia, Vietnam, Laos, and Cambodia. The data used in research is the data of secondary that is obtained from Ceicdata ranging from the year 2016 until the year 2018

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**Table 4:Gross Domestic Product Per Capita of ASEAN Countries**

GDP Per Capita							
Year	Country (USD)						
	Malaysia	Thailand	Philippines	Indonesia	Vietnam	Cambodia	Laos
2016	8976.536	6583.76	2765.88	3788.21	2389	1330	2408
2017	9965.354	6882.839	2989.09	3877.29	2587	1429	2468
2018	11079.266	7605.03	3104.263	3932.21	2658	1561	2501

Based on the data obtained as in table 4, the GDP per capita of each ASEAN developing countries has several which varies by the proportion of countries developing it themselves. Negara Malaysia became the country with GDP per capita the highest among the four countries growing more in the years 2016 to 2018 the successive amounted to USD 8976.536, USD 9965.354 and USD 11079.266. Country Cambodia into a country with a GDP per capita the lowest of the year 2016-2018 which range in nominal USD 1330, USD 1429, and USD 1561.

### 11 Human Development Index

Here are the data of the Human Development Index in ASEAN countries such as Malaysia, Thailand, Philippines, Indonesia, Vietnam, Laos, and Cambodia. The data used in research this is the data of secondary that is obtained from UNDP started from 2016 - 2018

**Table 5: Human Development Index of ASEAN Countries**

Human Development Index							
Year	Country						
	Malaysia	Thailand	Philippines	Indonesia	Vietnam	Cambodia	Laos
2016	0.799	0.748	0.696	0.691	0.689	0.576	0.852

Based on the data obtained in ASEAN countries, with HDI highest in years 2016-2018 is Laos at 0.852, 0.853, and 0.856, and the lower one is Cambodia at 0.576, 0.582 and 0.59. An average of ASEAN countries that have HDI increased every year.

### Percentage of Working Population



Here is the data Percentage of Population Working in ASEAN countries such as Malaysia, Thailand, Philippines, Indonesia, Vietnam, Laos, and Cambodia. The data used in research this is the data of unemployment are obtained from UNDP started from the 2016 - 2018. Percentage of Population Work obtained from a reduction in the percentage of the number of residents with a percentage of the number of employed:

**Table 6: Working Population of ASEAN Countries**

Working Population							
	Country (percent)						
Year	Malaysia	Thailand	Philippines	Indonesia	Vietnam	Cambodia	Laos
2016	96,17	98,9	94,66	94,48	96,62	99,86	99,2
2017	96,68	98,98	94,9	94,5	96,82	99,92	99,4
2018	96,7	99	94,8	94,66	96,9	99,96	99

Based on the data obtained, showed that the percentage of the population worked from the year 2016-2018 the highest in Cambodia, with a percentage of 99.86%; 99.92%, and 99.96%. Countries with the percentage of the population worked lows are Indonesia is at 94.48, 94.5, and 94.66, the matter is due to Indonesia is a country growing with the number of residents of the largest in the country members of ASEAN more. On average of ASEAN countries have an increase in the percentage of working population each year. However, the Country Philippines experienced a rise in unemployment or a decrease in the percentage of the number of people working in the year 2018, ie in the year, 2017 amounted to 94.9% into 94.8%.

**Test Results**

In this study using DEA analysis tools, and using DEAP software version 2.1 which uses the calculation of a variable return to scale oriented to the output approach. Based on the results of the calculation of the efficiency of using the DEA, the level of efficiency in 5 countries developing in the region ASEAN namely Malaysia, Thailand, Philippines, Indonesia, Vietnam, Laos, and Cambodia from the year 2016 up to 2018 can be seen as follows

**Table 7: The Efficiency of Malaysia**

Year	Technical Efficiency	Scale Efficiency (drs)	Variable	Original Value	Radial movement	Slack movement	Projected value
2016	1.000	0.090	Output 1	0.000	0.000	0.000	0.000
			Output 2	0.799	0.000	0.000	0.799
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	0.000	0.000	0.000	0.000
2017	1.000	0.794	Output 1	0.000	0.000	0.000	0.000
			Output 2	0.802	0.000	0.000	0.802
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	17972931 34.180	0.000	0.000	179729313 4.180
2018	1.000	0.738	Output 1	0.000	0.000	0.000	0.000



			Output 2	0.803	0.000	0.000	0.803
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	0.000	0.000	0.000	0.000

Based on table 7 results of testing the efficiency of Malaysian the period 2016 to 2018 above, Malaysia in the sources of financing outside the country that the foreign debt and foreign investment as an input to the sustainable economic growth, human development index and percentage of the population worked, as output is technically quite efficient is indicated by a nominal of 1.000. The resulting original value is proportional to the projected value each year.

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**Table 8: The Efficiency of Thailand**

Year	Technical Efficiency	Scale Efficiency (crs)	Variable	Original Value	Radial movement	Slack movement	Projected value
2016	1.000	1.000	Output 1	0.000	0.000	0.000	0.000
			Output 2	0.748	0.000	0.000	0.748
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	0.000	0.000	0.000	0.000
2017	1.000	1.000	Output 1	0.000	0.000	0.000	0.000
			Output 2	0.755	0.000	0.000	0.755
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	31650052 32.200	0.000	0.000	31650052 32.200
2018	1.000	1.000	Output 1	0.000	0.000	0.000	0.000
			Output 2	0.757	0.000	0.000	0.757
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	44895396 30.640	0.000	0.000	44895396 30.640

Based on table 8, the efficiency of Thailand period 2016 to 2018 above, Thailand in the sources of financing outside the country that the Foreign Debt and Foreign Investment as an input to the sustainable economic growth, human development index and percentage of the population worked as output is technically quite efficient indicated by a nominal of 1.000. The resulting original value is proportional to the projected value each year.

2  
**Table 9: The Efficiency of Indonesia**

Year	Technical Efficiency	Scale Efficiency (drs)	Variable	Original Value	Radial movement	Slack movement	Projected value
2016	0.908	0.036	Output 1	0.000	517669664 4.822	0.000	0.000



			2 Output 2	0.691	0.070	0.000	0.761
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	87389924 29.110	0.000	0.000	87389924 29.110
2017	0.865	0.047	2 Output 1	0.000	0.000	0.000	0.000
			Output 2	0.694	0.108	0.000	0.802
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	0.000	0.000	0.000	0.000
2018	0.866	0.246	2 Output 1	0.000	0.000	0.000	0.000
			Output 2	0.695	0.108	0.000	0.803
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	0.000	0.000	0.000	0.000

Based on table 9, the efficiency of the Indonesia period 2016-2018 above, the Indonesian state in the sources of financing outside the country against the sustainable economic growth and the reception countries are technically still not efficient. In the year 2016 is shown with a nominal 0.908, the year 2017 amounted to 0.865 and the year 2018 amounted to 0.866. the thing this shows their inefficiency as much as 0.092 in the year 2016, where there is a radical movement or the need for an increase in output in Gross Domestic Product (GDP) amounted to USD 1766,822 and also a slack movement of waste in the input GDP so should the reduction in funds less necessary. In the external debt input variable, there is also a slack movement or waste. Besides, the output index construction humans also are radial movement or the need for an increase by 0.070 to achieve the result that efficient.

In the year 2017, it occurred inefficiency of 0.135 that indicated by the presence of radial movement or the need for an increase of USD 6039,162. The Human Development Index output also has a radial movement of 0.108. On the debt inputs outside the country and also the planting of capital, strangers are slack movement or waste that needs to be any reduction in the less necessary. In the year 2018, occurred inefficiency of 0.134 is indicated by radial movement or the need for an increase of USD 8713.62 on GDP output. The human development index output also experienced the same radial movement as the previous year which was 0.108, and to input the foreign debt and foreign investment there is slack movement or waste that needs to be the reduction of funds less necessary

8  
**Table 10: The Efficiency of Philippines**

Year	Technical Efficiency	Scale Efficiency (crs)	Variable	Original Value	Radial movement	Slack movement	Projected value
2016	1.000	1.000	Output 1	0.000	0.000	0.000	0.000
			Output 2	0.696	0.000	0.000	0.696
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000



			Input 2	88555208 83.850	0.000	0.000	88555208 83.850
2017	1.000	1.000	Output 1	0.000	0.000	0.000	0.000
			Output 2	0.699	0.000	0.000	0.699
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
2018	1.000	1.000	Input 2	96579444 .930	0.000	0.000	96579444 .930
			Output 1	0.000	0.000	0.000	0.000
			Output 2	0.701	0.000	0.000	0.701
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
2018	1.000	1.000	Input 2	86776766 73.430	0.000	0.000	86776766 73.430

Based on table 10, the efficiency data of Philippines on period 2016 to 2018 above, the Philippines in the sources of financing outside the country that the Foreign Debt and Foreign Investment as an input to the sustainable economic growth and the human development index as output is technically quite efficiently demonstrated with a nominal 1.000. The resulting original value is proportional to the projected value each year

8  
**Table 11: The Efficiency of Vietman**

Year	Technical Efficiency	Scale Efficiency (crs)	Variable	Original Value	Radial movement	Slack movement	Projected value
2016	1.000	1.000	Output 1	0.000	0.000	0.000	0.000
			Output 2	0.582	0.000	0.000	0.582
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	88555208 83.850	0.000	0.000	88555208 83.850
2017	1.000	1.000	Output 1	0.000	0.000	0.000	0.000
			Output 2	0.599	0.000	0.000	0.599
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	96579444 .930	0.000	0.000	96579444. 930
2018	1.000	1.000	Output 1	0.000	0.000	0.000	0.000
			Output 2	0.601	0.000	0.000	0.601
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	86776766 73.430	0.000	0.000	86776766 73.430



Based on table 11, the efficiency of the Vietnam period 2016-2018 above, the Vietnam in sources of financing outside the country that the Foreign Debt and Foreign Investment as an input to the sustainable economic growth and the human development index as output is technically quite efficiently demonstrated with a nominal 1.000. The resulting original value is proportional to the projected value each year

**Table12: The Efficiency of Cambodia**

8

Year	Technical Efficiency	Scale Efficiency (crs)	Variable	Original Value	Radial movement	Slack movement	Projected value
2016	1.000	1.000	2 Output 1	0.000	0.000	0.000	0.000
			Output 2	0.652	0.000	0.000	0.652
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	76898720 883.850	0.000	0.000	76898720 883.850
2017	1.000	1.000	2 Output 1	0.000	0.000	0.000	0.000
			Output 2	0.679	0.000	0.000	0.679
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	86979324 .930	0.000	0.000	86979324 .930
2018	1.000	1.000	2 Output 1	0.000	0.000	0.000	0.000
			Output 2	0.721	0.000	0.000	0.721
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	89986567 3.430	0.000	0.000	89986567 3.430

Based on table 12, the efficiency of Cambodia the period 2016 to 2018 above, the Cambodia in the sources of financing outside the country that the Foreign Debt and Foreign Investment as an input to the sustainable economic growth and the human development index as output is technically quite efficiently demonstrated with a nominal 1.000. The resulting original value is proportional to the projected value each year

**Table 13: The Efficiency of Laos**

8

Year	Technical Efficiency	Scale Efficiency (crs)	Variable	Original Value	Radial movement	Slack movement	Projected value
2016	1.000	1.000	2 Output 1	0.000	0.000	0.000	0.000
			Output 2	0.429	0.000	0.000	0.429
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	67489690 453.250	0.000	0.000	67489690 453.250
2017	1.000	1.000	12 Output 1	0.000	0.000	0.000	0.000



			Output 2	0.573	0.000	0.000	0.573
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	79873567 135.670	0.000	0.000	79873567 135.670
2018	1.000	1.000	Output 1	0.000	0.000	0.000	0.000
			Output 2	0.688	0.000	0.000	0.688
			Output 3	0.000	0.000	0.000	0.000
			Input 1	0.000	0.000	0.000	0.000
			Input 2	86261416 4.270	0.000	0.000	86261416 4.270

Based on Table 13, the efficiency of Laos period from 2016 to 2018 above, the Laos in the sources of financing outside the country that the Foreign Debt and Foreign Investment as an input to the sustainable economic growth and the human development index as output is technically quite efficiently demonstrated with a nominal 1.000. The resulting original value is proportional to the projected value each year.

**Table 14: The Efficiency of ASEAN Developing Countries 2016-2018**

Year	Country						
	Malaysia	Thailand	Philippines	Indonesia	Vietnam	Cambodia	Laos
2016	1.000	1.000	1.000	0.908	1.000	1.000	1.000
2017	1.000	1.000	1.000	0.865	1.000	1.000	1.000
2018	1.000	1.000	1.000	0.866	1.000	1.000	1.000

Based on the results of the efficiency of data that has been processed using DEAP 2.1 are ASEAN developing countries, namely Malaysia, Thailand, and the Philippines, Vietnam, Cambodia, and Laos. Classified quite efficient while to the Indonesian state is still not efficient in the allocation of sources of financing outside the country that the Foreign Debt and Foreign Investment to the sustainable economic growth based on GDP Per Capita and Human Development Index (HDI).

In Malaysia, the level of efficient 1,000 in the year 2016 until 2018, seen from the original value of the variable inputs and outputs that are generated equivalent to the projected value. It is referring to the GDP Per Capita Malaysia are relatively high. As a result of the demand for domestic are growing very rapidly due to the increase in consumption of private

as well as the activities of investment. In addition to that, spending consumers are strongly followed by a recovery of export agriculture, especially the production of rubber and oil palm which sustains the economy of Malaysia to make the value of the gross domestic product per capita in Malaysia into a high (Tobias, 2017). So also with the Human Development Index in Malaysia was included in the very high human development category. Figures poverty in Malaysia also recorded the lowest that only amounted to 3.8% when compared with Indonesia, Thailand, or the Philippines. Followed by the numbers of hope alive in Malaysia reached 74.5 years, the numbers of hope old school for 13.7 years, figures the average length of school 10.2 years and the income per capita which reached \$26.107 which make Malaysia a high-income country (UNDP, 2018). It



indicates the level of welfare of people in Malaysia are relatively quite high. Planting capital alien that high in some periods and also the increase in GDP per capita as a result of export agriculture makes economic Malaysia in the year 2016 until the time it grows in the rate of the fastest of the year before. Development infrastructure is intensively carried out to increase the power of competitiveness globally as well as a sign of Foreign Debt who do the government the right targets in support of the sustainable economic growth in Malaysia (Tobias, 2017). Foreign Debt which do the government of Malaysia and Foreign Investment proved comparable and quite efficient with level sustainable economic growth through GDP per capita which continues to increase and the level of public welfare is high in Malaysia.

In Thailand the country, generating value for the efficiency of 1,000 from the year 2016 until 2018 seen from the original value of the variable inputs and outputs that are generated equivalent to the projected value. It is due to increasing foreign investment and GDP Per Capita is also experiencing an increase every year, making the sustainable economic growth quite rapidly, due to the number of exports and also program the increase in investment by Thailand. Besides that, the development of infrastructure is also much to do in an increase in the sector of tourism in Thailand to attract the interest of investors private. The increase in the sector of tourism in Thailand is also a factor that led to the sustainable economic growth grew by 3.9% which is the rate of the fastest since the year 2013 (IMF, 2018) Human Development Index Thailand are also classified in very high human development category with a figure of hope alive reach the age of 75.5 years, the numbers of hope old school up to 14.7 years, the average length of school 7.6 years and income per capita which reached \$ 15.516 (UNDP, 2018) it is demonstrated people well-being of Thailand is quite high. Foreign Debt in

a number of the large followed by Foreign Investment who rapidly due to the sector of tourism that is developed in Thailand, proved to be balanced and fairly efficient with a GDP per capita of Thailand that experienced an increase, as well as the level of welfare of the people of Thailand, are high.

Indonesian produces a value is not efficient, 0.908 in the year 2016, 0.865 in the year 2017, and 0.866 in the year 2018. Figures inefficiency that generated referring to the Foreign Debt who do Indonesia so much. In the research, there is also a slack movement or waste of foreign debt which is carried out in a certain period, which means the need to reduce the funds that are less needed on Indonesia's foreign debt. In addition to that, GDP Per Capita Indonesia is still very low when compared with the countries of Malaysia, Thailand and the Philippines seen from the radial movement or the need for improvement that should be done to achieve the results that suit and also a slack movement or wastage which means the need for a reduction in the funds less necessary from the year 2016 until 2018. In the variable input cultivation of capital alien also occur slack movement of waste in the period 2017 to 2018 when based on the data of FDI, Indonesia became one of the countries that have the Foreign Investment that high. Wastage that occurs can be caused by the Foreign Investment who recorded transcend from the results optimal because the term length of cultivation of capital alien it can suck in exchange for obligations of delivery of dividends to the origin. It is also the cause number inefficiencies that more big happened in the year 2017 to 2018. The Human Development Index of Indonesia also only included in the middle category, with a figure of hope to live 69.4 years, the numbers of hope old school for 12.8 years, the average length of school is 8 years seta income per capita which reached \$ 10,846 by the UNDP (2018). When compared with Malaysia and



Thailand, Indonesia still somewhat lagging in the level of welfare of the society. Evidenced by the existence of radial movement or the need for an increase in the HDI output variable. Performance exports are still weak and prices of commodities worldwide slump, turmoil strengthening of the value exchange US dollars also be a factor else other than the variable input bolster the slowing economy Indonesia (Hanung, 2018). Foreign Debt are carried out by the government and the Foreign Investment in Indonesia have not been empowered are optimal and efficient to achieve the sustainable economic growth and the level of welfare of the people who correspond.

In the Philippines, generating value for the efficiency of 1.000 from the year 2016 until 2018 seen from the original value of the variable inputs and outputs that are generated equivalent to the projected value. This is because the foreign debt incurred by the Philippines is not so large and is proportional to the GDP per Capita of the Philippines. Seen from the economy of the Philippines grew by direction progressively until the year 2017 reached 6.7% where the figure this is the largest in the ranks of the ASEAN countries and even a little more ahead of the growing economy of China (Sharif, 2019). Investment capital alien in the Philippines is still relatively low and The human development index in the Philippines belongs to the middle human development category, followed by a life expectancy of 69.2 years, and expected length of school life of 12.6 years, an average length of school reaching 9.3 years and a per capita income of \$ 9,154 (UNDP, 2018) It can be concluded that the development index human and also Foreign Investment who performed the Philippines is lower than Indonesia. However, the construction of infrastructure that runs fast is a sign that the Foreign Debt is managed quite efficiently. Besides that, the development of infra-structure that goes,

financing that is used is a mixture between the receipt of taxes and loans, including aid development official who offers the rate of interest which is much lower than the rate of commercial, an increase in the sectors of manufacturing and investment as well as consumption of home stairs also be driving the sustainable economic growth Philippines (Jatmiko, 2016) it is proved that the Foreign Debt and the Foreign Investment who conducted by the government the Philippines can be managed in an efficient and balanced against the sustainable economic growth and the level of prosperity for the people of the Philippines.

In Vietnam, generating value efficiency of 1.000 from the year 2016 until 2018 seen from the original value of the variable inputs and outputs that are generated equivalent to the projected value. It is because of Foreign Debt who do Vietnam comparable with the GDP per capita, meaning that is the State Vietnam succeeded in the management of Foreign Debt or efficient in its management of the sustainable economic growth.

Cambodia generates a value efficiency of 1.000 from the year 2016 until 2018 seen from the original value of the variable inputs and outputs that are generated equivalent to the projected value. This is because the foreign debt incurred by Cambodia is proportional to GDP per capita, meaning that Cambodia is efficient in its management of sustainable economic growth

In Laos, generating value for the efficiency of 1.000 from the year 2016 until 2018 seen from the original value of the variable inputs and outputs are generated equivalent to the projected value. It is because of Foreign Debt who do Laos is very little compared with the countries members of ASEAN more.

The results of the study above by the theory of the sustainable economic growth Harrod-Domar which stated investment as the key to the process of sustainable economic



growth. It looks at Malaysia, Thailand, Indonesia, Philippines, and Vietnam where Foreign Investment as input is very influential on the value of efficiency which resulted in the sustainable economic growth. For six ASEAN developing countries such as Malaysia, Thailand, Vietnam, Philippines, Cambodia, Laos, and Indonesia it is indicated by the value of efficiency perfect which means Foreign Investment quite efficient in its management.

The results of this study also refer to the previous research of Rifai Arifin (2008) on "International Trade, Foreign Investment, and Economic Efficiency of ASEAN Countries". The result is that the level of efficiency in ASEAN countries in the 1995-2005 period is spread from the highest are Singapore, Malaysia, and Thailand while the lowest are the Philippines, Vietnam, Cambodia, Laos, and Indonesia. It the support of research this, where Malaysia and Thailand have a value of efficiency is perfect, while the Philippines, Vietnam, and Indonesia as the data are still in a stage that is not much different, but for the Philippines, Vietnam, Laos, and Cambodia already have a value of efficiency that is perfect compared to Indonesia in the period of the current.

Besides that, the results of research it also refers to the study Hanif Fadhilah (2018) on "Analysis of Relationship Foreign Debt Against Growth of Economy in Countries Emerging" which is assumed to increase in Foreign Debt followed by the increase in GDP will increase the sustainable economic growth. three of the countries developing that exist in the research are that Malaysia, Thailand, and the Philippines have the number of Foreign Debt increased, but was offset by the GDP also increased causing the sustainable economic growth which grew by efficient (Fadhilah, 2018).

The results of the study are also similar to those performed by Siti Munifah (2019) on "Analysis of ICOR Against Efficiency Growth of Economy in Indonesia". Where the result is the value of the ICOR coefficient in Indonesia

in the 2005-2017 obser-vation period there was the inefficiency of 6.56. In a study that explained that should the increase in productivity, the use of capital (investments) in Indonesia, which is used to encourage the sustainable economic growth. In a study of this, Indonesia still has a value of inefficiency, but much lower than the study earlier. And increase the productivity of investment needs to be managed in a more efficient so that the sustainable economic growth can be achieved by optimal (Munifah, 2019).

The study is also the same with the research that made Muhammad Dandy Kartarineka Son and Sri Sulasmiyati (2018) on the "The Effect of Foreign Investment And Foreign Debt to the Economy Growth of Indonesia," which produces a variable value of Foreign Investment (FI) and the Foreign Debt contributed by 79.9% against the Growth Economy of Indonesia, while the remaining 20.1% is explained by the variable-bullies. In the study of this, Foreign Debt and foreign investment highly influential to the sustainable economic growth country develops that exist in the region of ASEAN, proved to be of value efficiency perfect which is produced by Malaysia, Thailand, Philippines, Laos, and Cambodia. However, the turmoil of the economy globally or problems of balance of trade internationally as weak exports also affect the sustainable economic growth and make the score inefficiencies that occur in Indonesia (Syarif, 2019).

## 5. Conclusion

The efficiency of Malaysia in 2016-2018 resulted in the value of efficient 1.000 which means the Foreign Debt and the Foreign Investment who carried the state is efficient in the formation of GDP per capita and Human Development Index. It is because Malaysia optimal in empowering input Foreign Debt and Foreign Investment to the output sustainable economic growth.



The efficiency of Thailand in 2016-2018 resulted in the value of efficient perfect 1.000 which means the Foreign Debt and the Foreign Investment who performed Thailand efficiently with GDP per capita and Human Development Index Thailand. It is because Thailand is quite optimal in empowering input Foreign Debt and Foreign Investment to the output sustainable economic growth.

The efficiency of Indonesia in 2016-2018 resulted in an inefficient value, which amounted to 0512 in the year 2016, 0441 in the year 2017 and 0488 to the year 2018 means the Foreign Debt and the Foreign Investment who conducted the Indonesian state is not efficient with GDP per capita and Human Development Index Indonesia. It is because Indonesia has not quite optimal in empowering input Foreign Debt and Foreign Investment to the output sustainable economic growth. Indonesia in the years 2016-2018 to add Foreign Debt that used for the construction of infrastructure is massive.

The efficiency of the Philippines in 2016-2018 resulted in the value of efficiency is perfect 1.000 which means the Foreign Debt and the Foreign Investment who performed the Philippines efficiently with GDP per capita and Human Development Index Philippines. It is because the Philippines is quite optimal in empowering input Foreign Debt and Foreign Investment to the output sustainable economic growth.

The efficiency of Vietnam in 2016-2018 resulted in the value of efficiency is perfect 1.000 which means the Foreign Debt and the Foreign Investment who carried out Vietnam efficiently with GDP per capita and Human Development Index Vietnam. It is because Vietnam is quite optimal in empowering input Foreign Debt and Foreign Investment to the output sustainable economic growth.

The efficiency of Cambodia in 2016-2018 resulted in the value of efficiency is perfect 1.000 which means the Foreign Debt and the

Foreign Investment who carried Cambodia efficiently with GDP per capita and Human Development Index Cambodia. It is because Cambodia is quite optimal in empowering input Foreign Debt and Foreign Investment to the output sustainable economic growth.

The efficiency of Laos in 2016-2018 resulted in the value of efficiency is perfect 1.000 which means the Foreign Debt and the Foreign Investment who carried the state Laos efficiently with GDP per capita and Human Development Index Laos. It is because Laos is quite optimal and precise goals in empowering input Foreign Debt and Foreign Investment to the output sustainable economic growth.

### Implications

This research is explained that the foreign debt and the foreign investment need to be managed and offset are optimized with GDP Per Capita and Human Development Index for countries developing in the region ASEAN so that the economy can grow is efficient. By because it is, the government states developing in the region ASEAN namely Malaysia, Thailand, Philippines, Vietnam, Laos, Cambodia and especially Indonesia is expected to allocate funds financing that comes from outside the country with the right target so that the development of the economy can be run in an optimal and generate growth in the economy that good enough.

### 6. Patents

Conflicts of Interest: The authors declare no conflict of interest and the funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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