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Factors Influencing Economic Growth in ASEAN Countries 1999-2019

Kevin Eric Andrawina[1], Siti Aisyah Tri Rahayu[2], Lukman Hakim[3]
Fakultas Ekonomi dan Bisnis, Universitas Sebelas Maret, Indonesia
E-mail: keric689689@gmail.com

Abstract

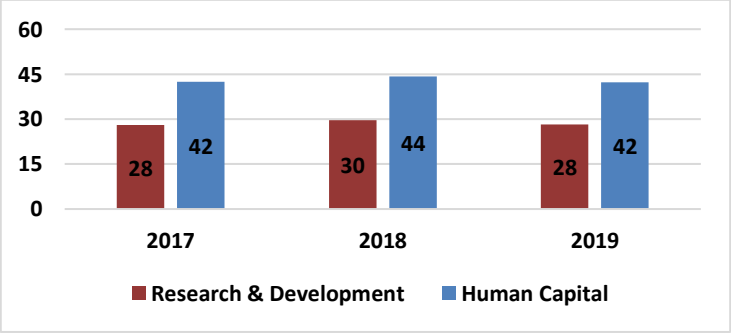
This research focuses on how technology, human capital, and investment influence economic growth in ASEAN countries from 1999 to 2019. This research uses panel data regression analysis. The research results show that technology has a significant positive effect on economic growth. Meanwhile, human capital has a significant negative effect on economic growth and investment has no significant effect on economic growth.

Keywords *Economic Growth, Technology, Human Capital, Investment*

INTRODUCTION

Romer (1994) within the framework of Endogenous theory, it is emphasized that technological progress has a significant role in changing production results. Increasing the use of technology not only has an impact on increasing investment, which in turn increases the amount of capital. With increased investment, there will also be a positive influence on economic growth. In addition, investment in technological development also contributes to cultural exchange, especially in the context of human capital in the field of education. The development of sophisticated technology requires quality human resources, so that the application of technology in the production process can achieve optimal levels of effectiveness and efficiency. Based on technology research, a number of studies show mixed results regarding its impact. Several studies highlight that technology has a positive influence on economic growth, Furkova & Chocholata (2017) in European Union regional countries, Yazgan & Yalcinkaya (2018) in OECD countries. Other different research results state that technology has a negative influence on economic growth, namely Haldar et al. (2023) in emerging countries. But in fact, the condition of research and development and human capital scores in Figure 1 can be said to have not been optimal and experienced fluctuations from 2017 to 2019, therefore there needs to be an increase in the technology sector and the quality of human resources in ASEAN countries because technology is mutually sustainable with quality human capital.

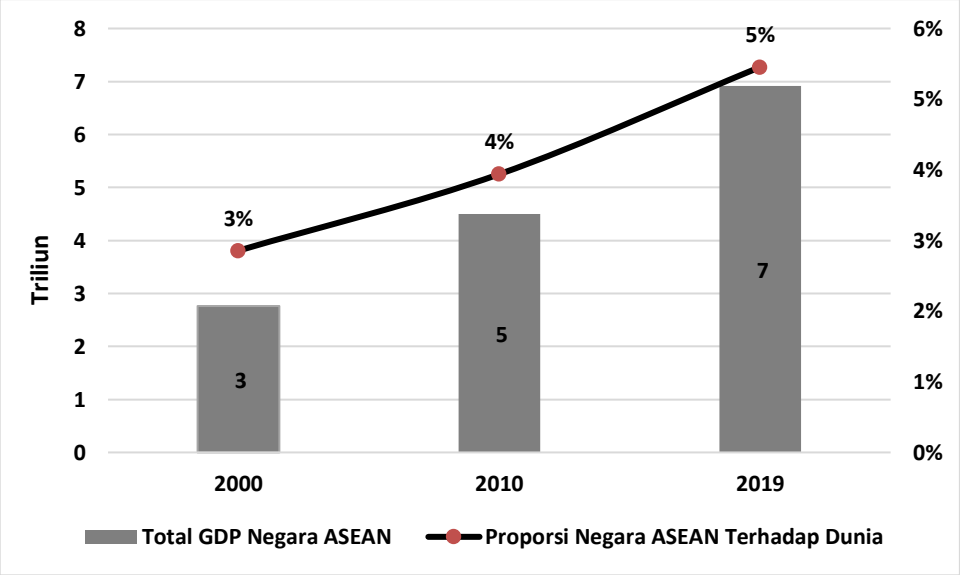
Figure 1. Average Score of ASEAN Countries (Score 1-100)



Data source: (WIPO, 2023)

GDP is an important indicator used to measure a country's national income. Based on data from the World Bank, in 2019 the contribution of Gross Domestic Product (GDP) from these countries reached 5% of total global GDP. Figure 2 depicts the proportion of GDP in these countries from 2000 to 2019 which has increased. This shows that ASEAN countries are making serious efforts to catch up with the group of developed countries. Although several challenges still need to be overcome, the GDP proportion of ASEAN countries shows that the development steps taken have had a positive impact in improving the welfare of people in the region.

Figure 2. GDP and GDP proportion of ASEAN countries to world GDP



Data source: (World Bank, 2023a)

LITERATURE REVIEW

Economic growth

Romer (1994) Endogenous growth theory, formulated by Paul Romer and Robert Lucas, is a development of Solow's economic growth theory. This theory attempts to identify and analyze factors that can influence the process of economic growth originating from within (endogenous) the economic system itself. The Solow growth model is considered insufficient to explain the concept of economic growth accurately, because the level of technological progress is considered an exogenous variable that can influence economic growth. In endogenous growth theory, it is explained that the level of technological progress is considered an endogenous variable that is capable of producing better output. This theory assumes that technological progress is endogenous, where the process of economic growth is seen as the result of the decisions of economic actors who invest in the field of science. Thus, technological developments are considered to encourage the development of innovation, increase productivity, and ultimately encourage economic growth.

Apart from that, in this theory, capital has a broader meaning, not only limited to physical capital, but also includes human capital. This growth model views knowledge as a

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form of capital, where knowledge is a key factor that supports the production process. The existence of knowledge allows someone to create new methods that can increase the efficiency of the production process, thereby obtaining certain economic benefits. Science and technological progress are considered factors that determine the speed of a country's economic growth. Thus, this growth theory emphasizes the role of human capital and research and development (R&D) in driving economic growth Jones & Vollrath (2013).

The Relationship between Technology and Economic Growth

KBBI (2023) The word "technology" in Indonesian is an absorption of the word "technology" in English. In general, the term "technology" is used to refer to anything that has a technical nature and can make human work easier. Technology is also considered as a result of human culture, whether created intentionally or unintentionally. There is a belief that the word "technology" also comes from the Greek, namely "Technologia", which arises from the word "techne" which means discourse on art. Study Yazgan & Yalcinkaya (2018) using indicatorsreal investment R&D with engineeringpanel data analysis accompanied by the Granger Causality model. In the private sector, the use of technology and innovation, especially through research and development (R&D) activities, shows differences in quality between OECD 9 and OECD 20 member countries, which ultimately influences the different levels of per capita income between the two. Even though there are disparities in income, research and development (R&D) still has a positive impact on economic growth.

Zhang et al. (2014) using expenditure indicatorsgovernment in the sectorR&D with analytical techniquespanel data withFixed Effects Model (FEM) and Generalized Method of Moments (GMM). Economic growth in China is driven by Total Factor Productivity (TFP) through technological advances that vary between regions in the country. This factor is strengthened by the availability of abundant human resources, as well as research and development (R&D) efforts. Furkova & Chocholata (2017) using expenditure indicatorsgovernment in the sector R&D with analytical techniquesbeta convergence.With R&D, it can be concluded that innovation and technology have a central role in economic growth performance in various regions in the European Union (EU). From a spatial perspective, the research results show that the convergence process is not only influenced by initial income and other specific factors in a region, but is also fundamentally influenced by economic growth in the surrounding area.

The Relationship between Human Capital and Economic Growth

Todaro & Smith (2015) presents the differences between the concepts of human capital and human resources. Human capital refers to various aspects such as skills, abilities, ambition, and health that are the result of investments in education, job training, health programs, and personal development efforts. In other words, human capital is the product of expenditure or expenditure in various fields that contributes to increasing individual abilities and capacities. On the other hand, human resources refer to the quantity and quality of the workforce in a country. This concept covers the entire workforce population, including

trained and untrained, taking into account their various characteristics and abilities. Human resources emphasize the number and quality of the workforce available in a country, involving aspects such as the level of education, skills, productivity and economic potential possessed by these individuals. So, the difference between human capital and human resources lies in their focus. Human capital highlights investments and expenditures in individual development, such as education and health, that contribute to increasing individual capabilities. In contrast, human resources involve both quantitative and qualitative aspects of the overall workforce within a country.

Ahmed et al. (2013) using GDP percentage indicators in education and health with the Two Stage Least Squares (2SLS) simultaneous analysis technique. Education is considered an integral part of human capital. The educational process has the potential to increase the capacity of the workforce so that they become more productive. Workers who have a good educational background tend to have better literacy and numeracy skills. This should make them more trainable, able to master more complex tasks, and have better work habits, including awareness of time and dependencies. Increasing the average education level of the workforce nationally can have a positive impact on national income. As a result, this can affect the economic growth of the country of Sudan. Increased education makes a significant contribution to increasing productivity, innovation and a country's competitiveness in the global market. Therefore, investment in the education sector is expected to have a positive impact in raising the level of social welfare and economic progress in the country of Sudan.

Jagodka & Snarska (2021)using indicators of length of study time in education with multiple regression analysis techniques with the Ordinary Least Square (OLS) model. Innovation in the economy is highly dependent on the existence of quality human capital, which directly influences the level of creativity and the ability to absorb new technology. Innovation is often difficult to achieve without human resources who have adequate skills and knowledge. In Poland, the success of good human capital can be measured by the number of residents who receive higher education. Moreover, geography, living in an urban area, also has a positive impact on economic growth. The presence of an educated population in urban areas can create an environment that supports collaboration, exchange of ideas, and better access to innovative resources and opportunities. Thus, superior human capital in Poland can be the main driver for innovation and sustainable economic growth.

The Relationship between Investment and Economic Growth

Mankiw (2020) investment refers to the purchase of capital or assets used to produce goods and services, with the aim of supporting economic activity and gaining future profits. Nip et al. (2013) using indicators of gross domestic private investment with panel data analysis techniques such as the Common Effect Model, Fixed Effect Model and Random Effect Model. Investment has a positive impact on a country's economic growth in various ways. Building new factories can increase production capacity and create jobs, while investment in new technology and equipment can increase industrial efficiency and competitiveness. Increased amounts of capital, including equipment and infrastructure, can also make a significant contribution to economic growth. Additionally, investing in new

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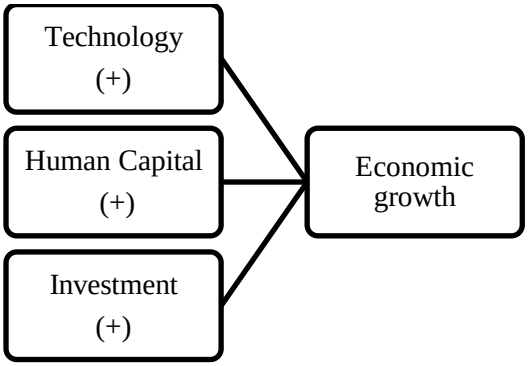
inventory can meet market demand and support smooth business operations. Investment in research and development can also encourage innovation and a country's competitive advantage in the global market. Thus, wise and strategic investment can be the main driver for sustainable economic growth.

Anyanwu (2014) using domestic investment indicators with PLS or OLS analysis techniques, Feasible Generalized Least Squares (FGLS), Two-Stage Least Squares instrumental variables (2SLS) and Generalized Method of Moments Instrumental Variables (IV-GMM). Domestic investment has a large role in a country's production capacity because it functions as the main driver of economic activity. Investment not only contributes to increasing the number of production factors, but also to improving the quality of these production factors. Investment acts as an economic driver by opening up opportunities to increase production factors, such as building new factories, modern equipment and advanced technology, which directly increases production capacity. This not only creates new jobs, but also increases overall productivity. Apart from that, investment also has a positive impact on improving the quality of production factors. In this way, investment plays a role as an important catalyst in developing production capacity, strengthening economic competitiveness, and creating conditions that support sustainable growth in countries in the African region and China.

Figure 3. Research Thinking Framework



METHOD

The scope of this research includes analysis of the role of technology, human capital, investment on economic growth in ASEAN countries. The dependent variable in this research is economic growth which is represented by economic growth (Economic Growth) as the dependent variable and total factor productivity (Technology), human capital index (Human Capital), gross capital formation (Investment). The objects of this research are the 5 founding countries of ASEAN, namely Indonesia, Malaysia, the Philippines, Singapore, Thailand. The analysis technique used is a panel data analysis technique. This research uses a quantitative approach, where this approach examines and explains certain theories using numerical data. This method helps in identifying and analyzing relationships between variables better. This research is included in the type of secondary data research whose data

was obtained from the World Bank and Penn World Table in 1999-2019 which can be explained in the table below.

Table 1. Operational Definition of Variables

No	Variable	Understanding	Empirical Indicators	Source
1	Economic growth	Economic growth is the increase in the sum of gross value added by all producers, plus product taxes and minus subsidies not included in the value of products, at constant prices.	Real GDP growth at constant market prices in 2015 based on local currency	(World Bank, 2023b)
2	Technology	*Total factor productivity*(TFP) at constant prices with a base year of 2017.	*Total factor productivity*(TFP) at constant prices in 2017	(Penn World Table, 2023b)
3	Human Capital	*Human capital index*which is measured based on years of schooling and return to school.	*Human capital index*(HCI)	(Penn World Table, 2023a)
4	Investment	The proportion of spending on additions to the economy's fixed assets plus the net change in inventory levels, to total GDP.	*Gross capital formation*	(World Bank, 2023c)

Thus, the panel data equation model for this research is structured as follows: $Economic\ growth = \beta_0 + \beta_1 Technologyit + \beta_2 Human\ Capitalit + \beta_3 LN\_Investment_{it} + \varepsilon_{it}$

Information:

Economic growth	= Economic growth of ASEAN countries
β_0	= Constant
β_i	= Regression coefficient of the ith variable, with i=1, 2, 3,
Technology	= *Total factor productivity* (TFP)
Human Capital	= *Human capital index* (HCI)
LN_Investment	= *Gross capital formation*

Selection of the Best Model

Selection of the best model is useful for determining the model that will be used in panel data regression. Several tests carried out include the Chow test, Hausman test, Lagrange Multiplier (LM) test. From the results of tables 2, 3 and 4, it can be concluded that

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the best model selection is the Common Effects Model (CEM),
through the Lagrange Multiplier (LM) test where the significance value is more than α by 5%.

Table 2. Chow test Table 3. Hausman test

Effect Test	Significance Levels
Cross-section F	0.2721
Chi-square cross-section	0.2380

Effect Test	Significance Levels
Random Cross-Section	0.2447

Table 4. Lagrange Multipliers test

Effect Test	Significance Levels
Breusch-Pagan Cross-Section	0.5957

Classic assumption test

After identifying the best model, the next step is to carry out classical assumption tests to ensure that the data used has accurate estimates, does not contain bias, and is consistent.Gujarati & Porter (2009)The two classic assumption tests carried out in this context are the multicollinearity test and the heteroscedasticity test. The multicollinearity test aims to evaluate the extent to which the independent variables are correlated with each other, while the heteroscedasticity test aims to assess whether the variance of the residual values is homoscedastic or heteroscedastic. By carrying out these two tests, research can verify and confirm the validity of the basic assumptions underlying regression analysis, so that the estimation results and model interpretation can be relied on.

Table 5. Multicollinearity test

	TEC	H.C	LN_INV
TEC	1,000000	0.549131	0.360198
H.C	0.549131	1,000000	0.056822
LN_INV	0.360198	0.056822	1,000000

The tests carried out in Table 5 indicate that there is no correlation between the independent variables, so it can be concluded that multicollinearity does not occur. This is reinforced by the correlation coefficient values between independent variables, all of which do not exceed 0.9. Thus, these results indicate that the independent variables in the model do not have a strong linear relationship with each other, meeting the basic assumption of uncorrelation among the independent variables in regression analysis.

Table 6. Heteroscedasticity test

Effect Test: Glejser Test	
Variables	**Significance Levels**
TEC	0.1564
H.C	0.3938
LN_INV	0.5064

The results of the heteroscedasticity test above show that all independent variables do not have heteroscedasticity problems, this is indicated by the probability value of each variable being greater than the α value of 5 percent.

Table 7. Common Effect Model Regression Results

Variables	Coefficient	Std. Error	T-Statistics	Prob
C	0.002293	3.876946	0.000591	0.9995
TEC	12.71957	3.143032	4.046911	0.0001 ***
H.C	-2.065331	0.646073	-3.196745	0.0019 ***
LN_INV	-0.459678	1.245888	-0.368956	0.7129
Total Obs		105		
Total Cross Section		5		
R2		0.159711		
Adj. R2		0.134752		
Prob (F-Statistic)		0.000517		
*** the test is significant at α = 1%				

Based on Table 7, the Adjusted R-Squared coefficient of determination is 0.134752, which means the ability of the independent variables to explain the dependent variable is 13.47% in the model, 86.53% is explained by variables outside the model. The results of the Common Effects Model (CEM) test show that simultaneously the independent variables used in the model have a significant influence on the dependent variable because the prob value. The F-statistic is 0.000517, where this value is less than α (0.05). Followed by a partial significance test or each variable, based on the results of the Common Effects Model (CEM), it was concluded that technology has a coefficient of 12.71957 and a probability of 0.0001 smaller thanα 5%, so that the technology variable partially has a positive effect on economic growth. It is known that the human capital variable hascoefficient of -2.065331 and probability of 0.0019 is less than α 5%, so that the human capital variable partially has a negative effect on economic growth. And finally the investment variable hascoefficient of -0.459678 andprobability0.7129 is greater thanα 5%, so it partially has no effect on economic growth.

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Based on the CEM regression results in Table 7, the following is a discussion of the influence of technology, human capital and investment in ASEAN countries in 1999 – 2019:

1. The Influence of Technology on Economic Growth

Based on the estimation results using the CEM model in Table 5, it shows that there is a positive and significant relationship between technology and economic growth in ASEAN from 1999 to 2019, with a significance level of 1%. The coefficient value of 12.71957 explains that when there is an increase in technology of 1% it will increase economic growth by 12.71957. These results are in accordance with the research hypothesis and are in line with previous research conducted by Yazgan & Yalcinkaya (2018), Zhang et al. (2014), Furkova & Chocholata (2017) Economic growth is driven by Total Factor Productivity (TFP) and (R&D) through technological advances that vary between countries. This factor is strengthened by the availability of abundant human resources, as well as research and development (R&D) efforts accompanied by increased innovation. (R&D) it can be concluded that innovation and technology have an important role in economic growth performance. From a spatial perspective, the research results show that the convergence process is not only influenced by initial income and other specific factors in a region, but is also fundamentally influenced by economic growth in the surrounding area.

2. The Influence of Human Capital on Economic Growth

Based on the estimation results using the CEM model in Table 5, it shows that there is a negative and significant relationship between human capital and economic growth in ASEAN from 1999 to 2019, with a significance level of 1%. The coefficient value of -2.065331 explains that when there is an increase in technology of 1% it will reduce economic growth by -2.065331. These results are in accordance with the research hypothesis even though human capital has a negative effect on economic growth. Firstly, human capital is an important aspect of the workforce, a workforce with good quality education that improves over time will make a significant contribution to increasing productivity, innovation and competitiveness of a country in the global market. Ahmed et al. (2013), however, another factor that influences the negative impact is health. Gori & Sodini (2014, 2018, 2020) Health also affects the productivity of a worker in doing work. In the long term, health is something that causes concern because a worker also ages. Research states that as age increases, the first is the income that a person gives to the state in the form of taxes. will decrease, which will also have an impact on reducing savings and capital accumulation. Therefore, health is also needed apart from education in increasing economic growth.

3. The Effect of Investment on Economic Growth

Based on the estimation results using the CEM model in Table 5, it shows that there is no significant and negative relationship between investment and economic growth in ASEAN from 1999 to 2019, with a significance level of 10%. The coefficient value of -0.459678 explains that when there is an increase in investment of 1% it will reduce economic

growth by -0.459678. This result is not in accordance with the research hypothesis, it is thought that the first is because in the short term domestic investment in the service sector or in the agricultural sector does not contribute to economic growth, the second reason is because the country is very dependent on foreign investment. This is because foreign investment can provide additional capital for infrastructure development. So it can be concluded that domestic investment is not the main determinant in increasing economic growth, this is in accordance with research (Ayunda & Sari, 2021; B & K, 2020).

CONCLUSION

From time to time, the factors that influence growth are not always the same because they follow developments over time. In this research, the author aims to analyze the factors that influence the economic growth of ASEAN countries in 1999-2019, so conclusions can be drawn:

1. Technological variables have a positive effect on economic growth in ASEAN countries in 1999-2019
2. The human capital variable has a negative effect on economic growth in ASEAN countries in 1999-2019
3. The investment variable has no effect on economic growth in ASEAN countries in 1999-2019

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