**THE IMPACT OF DIGITALIZATION ON ECONOMIC GROWTH IN ASEAN COUNTRIES**

**Abstract**

Digitalization with the Sustainable Development Goals (SDGs) Program is an essential means of encouraging the government to operate more openly and effectively, which can increase global economic growth. This study aims to determine the impact of education, digitalization and trade openness on ASEAN's economic growth. This study uses independent variables in the form of government spending on education, cell phone users, individual internet users, foreign direct investment and consumer price inflation. The dependent variable is economic growth. This study uses the panel data regression method, from 2001 to 2020, with a cross-section of7 ASEAN countries (Indonesia, Malaysia, Thailand, Laos, Singapore, the Philippines and Cambodia).

The analysis shows that government spending on education, cell phone users, individual internet users, and foreign direct investment significantly affects economic growth in 7 ASEAN countries. Digitalization is proven to impact the economy and society by reducing unemployment, improving quality of life, and increasing access to knowledge and other public services. In addition, digitalization makes it easier for people to educate and study various aspects and activities in conducting trade that can increase economic growth.

Keywords: Digitalization, economic openness, economic growth, ASEAN

**INTRODUCTION**

The Sustainable Development Goals2030 program continues the global millennium development goals (MDGs), which ended in 2015. The SDGs are a framework of reference for development until 2030. There are 17 goals and 169 achievement targets in the 2030 SDGs related to changes in the world situation, which are committed globally and nationally to sustainable development worldwide (Gusdwisari, 2020). The agreement and goals set out in SDGs 2030, indirectly in the current era of digitalization, requires young people around the world to master technology and information so that they can compete globally (Gusdwisari, 2020). The sophistication of technology and information in the digitalization era can facilitate the education sector, where quality education is one of the target objectives of the 2030 SDGs program. Education is a structured form of business and awareness that can develop the abilities of every human being; through education, each individual can design existing capabilities within himself to play a role in the community environment (Pratomo & Herlambang, 2021).

Education plays a vital role for individuals and groups that can increase human resources (HR) and influence the overall growth of the nation and state, so education affects productivity and facilities in society (Safitri et al., 2022). Quality education is undoubtedly desired for the progress of a nation; education is not only a means of *'agent of change'* for the younger generation who will become the successors of a nation but also must become an *'agent of the producer'* to create a fundamental transformation. Innovative and quality education will motivate someone's creativity, especially the younger generation, to encourage their curiosity as innovators who can play an important role and use the concept of sustainable development (Safitri et al., 2022). So to improve the quality and quality of education, the Sustainable Development Goals (SDGs) program is implemented so that it can improve and advance people's welfare (Humaida et al., 2020).

The digital era has changed the world with various technological sophistication that can help facilitate public activities and services. The increasingly widespread use of digitization is one of the most impressive developments. Digitization is changing printed, audio or video information into a digital format. Digitalization can improve living standards and reduce unemployment, and it is one of the main factors driving and triggering economic and social activities in various developed and developing countries. The use of digital technology can influence economic growth in the form of digital trade transactions and online business, facilitating the flexibility of banking operations and facilitating communication, which can increase economic growth and productivity (Habibi & Zabardast, 2020).

When the world economy is sluggish, you can take advantage of digital technology as a means to increase economic activity. The deployment of ICT significantly increases the efficiency of resource allocation, reduces production costs, and increases demand and investment in all sectors of the economy to a greater extent (Khan et al., 2015). The mass adoption of digital technologies through connected services and devices has accelerated economic growth and facilitated job creation. Still, the impact across countries is different (Khan et al., 2015). Developed countries can enjoy the benefits of digitalization, such as higher economic growth and productivity while developing countries obtain fewer jobs due to differences in the economic structure of developed and developing countries (Sabbagh et al., 2013). Booz & Company found that digitalization provided a US$193 billion boost to world economic output despite the unfavourable global economic climate and created 6 million jobs globally in 2011 (Sabbagh et al., 2013).

With the rapid development of digital technology today, the internet has become a critical need for every human being to make it easier to quickly access various kinds of information in various parts of the world. In addition, the internet is permanent, and internet users can access it 24 hours a day. Individual internet users around the world have increased every year. In 2021 internet users will increase by 7.7% to 4.76 billion, whereas in 2020, internet users were 4.42 billion. Based on data for 2022, the largest internet user region in the world is Northern Europe, with 98% of the total population (Pahlevi, 2022). Meanwhile, in 7 ASEAN countries, the average internet user is only 31.78% of the total population, with Singapore in 2020 as the most significant internet user country, with a percentage of 92% of the total population. ASEAN countries have a digital divide due to uneven access to digitalization development (Mubah et al., 2017).

Figure 1. Percentage of Internet Users in 7 ASEAN Countries (% of Total population)

Source: *World Bank*, 2020

Figure 1 also shows that in 2020 Malaysia had the second highest internet users, with 89.55% of the total population., then followed by Thailand as the third largest country of internet users in ASEAN countries, amounting to 77.84% of the total population. Indonesia, one of the ASEAN countries, has the most significant internet users after Thailand, with 53.72% of the total population. Meanwhile, Cambodia has internet users of 33.8% of its total population, which is the lowest figure compared to other ASEAN countries. According to *the Speedtest Global Index* 2021, as the country with the highest number of internet users, Singapore has adequate internet facilities using *fixed broadband*, judging from the average download speed of 262.20 *Mega Bytes per Second (MBps)* and an average upload speed of 236. 81 Mbps. Singapore is a developed country with a much higher index than other ASEAN countries. Besides, Singapore is in a solid political and regulatory area and is very supportive of innovation and business (Mubah et al., 2017). Singapore applies internet quota rates at low prices so that Singaporeans can access the internet quickly and without obstacles (Mubah et al., 2017). Meanwhile, Cambodia has the lowest number of internet users due to weak regulations that provide the foundation for the spread of the telecommunications market; international bandwidth is felt to be lacking where the Cambodian state refuses a competitive market for ISPs (Mubah et al., 2017). In addition, the Government of Cambodia, in 2021, determined to form a *National Internet Gateway (NIG),* which will give control over the flow of information on the internet and the power to block harmful content and sites.

The emergence of digitalization with the ease of accessing the internet not only affects economic growth in a country but can also affect developments in the field of education. Education is an important force for technological innovation and long-term economic growth in society (Habibi & Zabardast, 2020). Education as a life chain can increase the human capital of the workforce and create a class of educated leaders to fill vacancies in government services, public companies, domestic and foreign private businesses, and professions, which will increase labour productivity and economic growth rates (Habibi & Zabardast, 2020). The breadth of access to digital technology is expected to be carried out by transferring and updating globally by utilizing information technology in educational activities. Apart from that, with the ease of accessing the internet, education can be accessed through Zoom Online Meetings, Google Meetings, Google Classroom, Google Form, and other platforms that can increase the efficiency of the learning process (Sardiana & Moekti, 2022).

The development of science and technology in the world economy can create the concept of a digital economy as an economic and business activity that utilizes internet-based markets. The development of the digital economy is an opportunity for local and foreign investment in developed and developing countries. According to the OECD, foreign direct investment is a cross-border investment made directly by an actor *(direct investor)* who will invest in one of the other actors *(direct investment enterprise)* to obtain long-term profits. In *the ASEAN Investment Report* for 2022, the ASEAN Secretariat said that foreign direct investment in 2020 has decreased in ASEAN countries due to Covid-19, but in 2021 it experienced a rapid increase. Throughout 2021 ASEAN member countries will receive foreign *direct investment (FDI)* or foreign direct investment with a total value of US$174 billion (Ahdiat, 2022). According to the Ministry of Investment/Investment Coordinating Board (BKPM) in 2021, one of the most significant foreign investments in ASEAN was Singapore to Indonesia in the third quarter of 2021, which was recorded at US$ 2.6 billion; this investment value is equivalent to 36.2% of the total capital realization in the previous quarter. The capital is provided through 5,145 projects in the country (Jayani, 2021). Many essential benefits are generated by foreign direct investment. Foreign direct investment is important in achieving sustainable development targets and increasing economic growth for all countries (Todaro, 2006).

Advances in digital technology are very fast affecting the improvement of the world economy. Digitalization can facilitate access to various information using the internet. Digitalization is proven to have a significant positive effect not only on growth but also on education and international trade. Digital technology is a significant factor in economic and social activities in both developing and developed countries. Important factors influencing digitalization on economic growth are ways of transacting through electronic commerce and online business, facilitating flexibility in banking operations, and improving communication, ultimately driving productivity and economic growth (Habibi & Zabardast, 2020).

This study aims to analyze the existence of a significant and positive influence on advances in digitalization technology with the ease of accessing the internet. Ease of internet access can influence developments in education with the development of science. Ease of internet access can create a digital economy and have a significant positive effect on economic growth.

**LITERATURE REVIEW**

*Education and Economic Growth*

Neo-classical growth theory explains that education as a material human capital is critical in the primary determinant of long-term economic growth and plays an important role in technological development (Samuelson & Solow, 1956). Education plays an important role in the progress and prosperity of a country, shaping humans, so they have skills and aspects of knowledge and become valuable individuals who provide benefits and can contribute sustainably (Salsabila et al., 2021). The theoretical literature on education and economic growth shows that education is important in increasing economic growth. Habibi & Zabardast (2020) found that education has a positive influence in Middle Eastern countries; a 10% increase in gross enrollment in primary schools will generate around 0.035% increase in per capita GDP growth (Habibi & Zabardast, 2020). Another research study conducted by Nugroho (2014) on the effect of education on economic growth from 2004 to 2012 found that education in the proxy with Literacy Rate (AMH) positively and significantly affects economic growth. The government also needs to continue encouraging efforts to improve education quality and equity, which are the main problems of education in Indonesia, so that its contribution can still be optimally increased for economic growth and equity (Nugroho, 2014).

*Mobile Phone Use and Economic Growth*

Advances in digitalization technology have been carried out in various fields that have changed various forms of daily life in business, government, and social life in society. One of the conveniences of digital technology is the widespread use of cellular phones. The rapid growth of digital technology has made cellular phones available to access the internet in various parts of the world. A survey conducted by the Indonesian Telematics Society (MASTEL) with the University of Indonesia's Economic and Social Research Institute (LPEM UI) found that using cell phones in Indonesia can improve the national economy's GDP. Kurniawati (2022) found that telephone line penetration and mobile phones can drive economic growth in middle-income Asian countries. Habibi & Zabardast (2020) also found that using mobile phones significantly contributed to economic growth in the Middle East and OECD countries.

*Individual Internet use and economic growth*

With the development of today's era, almost all aspects of human life can be connected to the internet, which can facilitate human work. The internet is a medium in every sector of today's life, from the political sector and education to defence. In contrast, the biggest impact of internet users is the sector trade and the economic sector has all been digitized. According to Weriemmi et al. (2020), digitalization using individual internet users significantly positively affects economic growth in 10 Asian countries. Digitalization is an important capability that underpins all other national economic endeavours. Digitalization can generate significant economic and social benefits for people and communities (Weriemmi et al., n.d.).

*Foreign Direct Investment and Economic Growth*

The development of technology and science brings very rapid changes in maintaining long-term economic growth. One of the drivers of economic development in a country can be carried out by foreign direct investment. As one of the drivers of increasing a country's economic performance, the investment must be distributed optimally so that economic added value can encourage increased economic growth (Jufrida et al., 2017). *Foreign Direct Investment (FDI)* or foreign direct investment can increase productivity and provide access to technology transfer. Besides, FDI can increase competitiveness so that domestic products become superior products. FDI is essential to economic growth (Jufrida et al., 2017). Kurniawati (2022) found that financial development, trade openness, and FDI significantly impact economic growth. However, FDI has a more significant effect on middle-income countries than on high-income countries, meaning that foreign capital has a bigger role in boosting the economy in middle-income countries (Kurniawati, 2022).

*Inflation and Economic Growth*

Inflation is when increasing prices are higher than before, which occurs in the price of goods followed by the price of other goods. Inflation occurs continuously. In a country, inflation can affect the stability of the economy. However, judging from the principle of inflation, not all inflation negatively impacts a country's economy; if mild inflation occurs, it can encourage economic growth (Indriyani, 2016).

In this study, we adopted research conducted by Weriemmi et al. (2020), Habibi & Zabardast (2020) and Kurniawati (2022) using cellular subscriptions (per 100 people), individual internet users (% of the population), and foreign direct investment (FDI). The research modifies the research objects, years and research methods. This study modified the research method using panel data analysis because it can show heterogeneity between individuals. Besides that, combining cross-section data and time series data makes the model more informative and varied, reducing collinearity, multiplying degrees free, and being more efficient.

**RESEARCH METHODS**

*Data*

This study examines the independent variables in the form of government spending on education, cell phone users, individual Internet users, foreign direct investment and consumer price inflation. The dependent variable is economic growth. We use secondary data obtained from the official website of the World Bank, from 2001 to 2020, with a cross-section of 7 ASEAN countries (Indonesia, Malaysia, Thailand, Laos, Singapore, Philippines, and Cambodia). This study uses the panel data analysis method. Panel data regression in this study is used to determine whether the variables of government spending on education, cell phone users, individual Internet users, foreign direct investment and consumer price inflation affect economic growth in 7 ASEAN countries. Statistical data processing and analysis are done with the program and E-Views 10.

**Method of Analysis**

*Panel Data Regression Analysis*

Panel data is a type of data that has more than one individual dimension (cross-section) and more than one-time dimension (time series). One of the advantages of the panel data model is that it can show heterogeneity between individuals. In addition, the combination of cross-section and time series data makes panel data a type of model that is more informative, more varied, can reduce collinearity, increasing degrees of freedom and is more efficient.

Panel data model form for one independent variable, namely :

The form of the equation of the panel data regression in this study is as follows:

Where α\_i is a constant, while β1 β2 coefficient and ε is the standard error in the panel data regression equation, variable Economic growth refers to GDP per capita (%). In the Neo-classical growth model, long-term economic growth is explained by capital accumulation, population growth or technological progress, all considered exogenous (Samuelson & Solow, 1956). The education variable refers to government spending on education. The modern human capital theory provides fundamental support for investigating how educational variables influence and support economic growth from an empirical research perspective (Mahmudah & Prasojo, 2016). Whereas in digitization, this research adopts the study of Habibi & Zabardast (2020), where this research includes cellular variables (cell phone users) and Internet variables (individual internet users). According to the Solow model, only technological progress can explain the continuous increase in living standards (Mankiw & Scarth, 2010). Economic openness is explained by the investment variable, which refers to foreign direct investment and the inflation variable, which refers to consumer price inflation which this research adopts from Kurniawati's (2022) research study.

*Normality test*

One of the assumptions of the classical linear regression model is that the errors/residuals must be normally distributed. Error normality can be tested using the JarqueBera test. Testing hypothesis:

H0 = normally distributed error

H1 = errors are not normally distributed

In making a decision, the normality test is if the Jarque-Bera probability <0.05, then H0 is rejected, which means that the errors are not normally distributed. So that when the data is declared not normally distributed, it must need a normality handler. By looking at outlier/outlier data (data values that come out of the average). If the Outliner value is more than one, then normality is handled by removing the data affected by the outliner and selecting normal data

Table 1: Variable Definitions and Summary of Data Sources

|  |  |  |  |
| --- | --- | --- | --- |
| No | Variables | Definition of Variables | Source |
| 1 | Growth | GDP growth per capita (annual %) | World Bank |
| 2 | Education | Government spending on education, total (% of GDP) | World Bank |
| 3 | Mobile | Cell Phone Users (per 100 people) | World Bank |
| 4 | Internet | Individual Internet Users (% of the population) | World Bank |
| 5 | Investment | Foreign Direct Investment (% of GDP | World Bank |
| 6 | Inflation | Consumer Price Inflation (% Annual) | World Bank |

Source: Built by the Author

**Results and Discussion**

Based on Table 2, the economic growth in ASEAN countries rapidly grows. The maximum growth rate is 4.94, while some economies are performing poorly because the minimum value is only -3.10, with an average of 3.57, where there is a downward slope left because of the negative skewness value. The minimum value of education (government spending on education) is 2.46, and the maximum value is 3.58, with an average of 3.04.

**Table 2: Descriptive Statistics**

Source: Processed Data E-Views 10

While other variables such as mobile (cellular phone users) have an average of 81.03, Internet (Individual Internet users) have an average of 16.45 per 100 people, Investment (foreign direct investment) and inflation (inflation, consumer prices) show an average of 1.49 and 5.51.

**Table 3: Panel Regression Results**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Model 1 |  | Model 2 |  |
| Variables |  | Chow test |  | Hausman test |  |
| growth |  |  |  |  |  |
| Education |  | 0.0321 |  | 0.0362 |  |
| Mobile |  | 0.0001 |  | 0.0001 |  |
| Internet |  | 0.0000 |  | 0.0000 |  |
| Investments |  | 0.0001 |  | 0.0001 |  |
| inflation |  | 0.2868 |  | 0.2979 |  |
| Cross-section F (Prob) |  | 1.0000 |  | 1.0000 |  |

Source: Processed Data E-Views 10

Table 3 shows three different approaches using three models: common effect, fixed effect and random effect. Model 1 shows the results of the Chow test or Likelihood ratio test, which are carried out to select the best model between the fixed effect model and the common effect by looking at the probability of the F-Statistic. Model 2 is a Hausman test or Hausman test, which is carried out to choose the best model between the fixed effect model or the random effect model with the same conditions as the Chow test said that the RE model is more appropriate used than models FE. While Model 3 presents the Breusch -Pagan LM test, which is carried out to choose the best model between the common effect model or the Random Effect model with conditions such as model 1 indicating that the CE model is more appropriately used than the RE model. Cross section with the criterion H0 is rejected if the probability <; (α=0.05), where the common effect or CE model is more appropriate.

**Table 4: Normality Test**

*Source: Processed Data E-Views 10*

The normality test determines whether the errors are normally distributed; it can be tested using the Jarque-Bera Test. Table 4 on the normality test shows that the p-value of the jarque-bera test statistic is 0.075764; the value is > 0.05. Thus, the error/residual normality assumption is fulfilled (data is normally distributed).

**Table 5: Common Effect Model Hypothesis Test**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | |  |  |  |  | |
|  | |  |  |  |  | |
| Variables | | coefficient | std. Error | t-Statistics | Prob. | |
|  | |  |  |  |  | |
|  | |  |  |  |  | |
| C | | 1.887905 | 0.137353 | 13.74487 | 0.0000 | |
| X1\_EDUCATION\_\_\_\_ | | -0.218313 | 0.040815 | -5.348792 | 0.0000 | |
| LOGMOBILE | | 0.079518 | 0.024149 | 3.292786 | 0.0013 | |
| X3INTERNET\_\_\_\_ | | -0.007112 | 0.001235 | -5.760311 | 0.0000 | |
| LOGINVESTMENT | | 0.078073 | 0.014744 | 5.295152 | 0.0000 | |
| LOGINFLATION | | -0.039673 | 0.033993 | -1.167081 | 0.2456 | |
|  | |  |  |  |  | |
|  | |  |  |  |  | |
| R-squared | | 0.546289 | Mean dependent var | | 1.390636 | |
| Adjusted R-squared | | 0.526213 | SD dependent var | | 0.134468 | |
| SE of regression | | 0.092557 | Akaike info criterion | | -1.872876 | |
| Sum squared residue | | 0.968052 | Schwarz criterion | | -1.732752 | |
| Likelihood logs | | 117.4361 | Hannan-Quinn criter. | | -1.815976 | |
| F-statistics | | 27.21146 | Durbin-Watson stat | | 2.238172 | |
| Prob(F-statistic) | | 0.000000 |  |  |  | |
|  | |  |  |  |  | |
|  |  |  |  |  |

Source: Processed Data E-Views 10

Table 5 shows that four of the five variables have a significant positive effect, and only one variable, namely inflation, does not have a statistically significant effect.

Education is one of the important strength factors for long-term growth. The existence of proper education can contribute to economic growth. Based on the results of hypothesis testing, education has a positive and significant influence on economic growth. These results align with the research conducted by Habibi & Zabardast (2020) that education has a significant positive effect on economic growth. At the same time, countries with good access to the education cause digital technology also positively affect economic growth. In addition, Nugroho (2014) also stated that education has a positive and significant effect on economic growth.

Cellular phones, as digital tools, provide information and communication that can facilitate the activities of every human being capable of increasing economic growth. The number of cellular phone users positively and significantly impacts economic growth in 7 ASEAN countries. These results are in accordance with research conducted by Kurniawati (2022) that the penetration of cellular phone users has a positive and significant effect on economic growth. Thus, cellular telephone penetration greatly encourages economic growth in Central Asian countries. In addition, Vickers (2017) also stated that cellular telephones have a positive and statistically significant impact on economic growth.

Based on the hypothesis test of the internet variable, which refers to individual internet users, it has a positive and significant effect on economic growth, where every life can be connected with internet access. Many digital applications and services that use the internet can make it easier for people to carry out product promotions, marketing and transactions to encourage economic growth. These results are under the research of Weriemmi et al., n.d.(2020) shows that digitalization, which refers to individual internet users, positively impacts economic growth. In addition, Kurniawati (2022) also said that high-income Asian countries had achieved positive and significant economic development from high Internet penetration.

The investment shows a positive and significant influence on economic growth. The foreign direct investment provides long-term benefits expected to achieve development targets and increase economic growth in a country. The results are consistent with research conducted by Kurniawati (2022), showing that foreign direct investment has a significant positive effect on economic growth in ASIA countries. Apart from that, Maslukhah (2019) also said that simultaneously and partially, foreign direct investment has a positive and significant effect on economic growth in ASEAN. The inflation variable, which refers to consumer price inflation on a hypothetical test, does not significantly affect economic growth in the 7 ASEAN countries, meaning that if the inflation variable increases, economic growth will decrease.

**Conclusion**

The development of digitalization not only increases economic growth but also facilitates activities in education and trade economic activities globally. With the existence of the Sustainable Development Goals (SDGs) Program, this research study empirically examines the impact of digitalization on economic growth in ASEAN countries using panel data in 7 ASEAN countries (Indonesia, Malaysia, Thailand, Laos, Singapore, Philippines, Cambodia). The results can be concluded that education significantly positively affects economic growth. Second, digitalization, as measured by the variables of cellular phone users and individual internet users, has a positive and significant effect on economic growth. Third, trade openness, as measured by the variable foreign direct investment and consumer price inflation, has different results where the foreign direct investment variable has a significant positive effect on economic growth. In contrast, consumer price inflation does not significantly influence economic growth in ASEAN.

**Suggestion**

Digitalization is a driving force for developments in education, trade openness, and economic growth. It is hoped that the government will develop digital technology that every community can obtain to compete in the digital era. In addition, the government must strengthen digital infrastructure, develop digital competencies, and enact appropriate laws to complement primary regulations, so that digital discrepancies do not occur.

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