Print ISSN: 2288-4637 / Online ISSN 2288-4645
doi:10.13106/jafeb.2021.vol8.no7.0043

# Effects of Human Capital and Innovation on Economic Growth in Selected ASEAN Countries: Evidence from Panel Regression Approach*

Nor Fatimah CHE SULAIMAN[1], Jumadil SAPUTRA[2], Suriyani MUHAMAD[3]

**Received:** March 20, 2021 **Revised:** May 22, 2021 **Accepted:** June 01, 2021

## Abstract

Human capital and innovation capacities are essential elements and one of the sustainable approaches to driving economic growth. However, there is debate among scholars concerning these two factors in fostering economic growth. This study investigates the relationships between human capital and innovation capacity and economic growth in selected ASEAN countries, namely, Malaysia, Thailand, and Indonesia. Economists widely discussed the interrelation of human capital and innovation. A large body of literature stated that human capital is an essential factor and engine of economic growth. Innovation has become key in transforming the economic development of developing countries. We analyze human capital (HC) and innovation capacity (INC) using static panel data analysis. The data analysis shows that the fixed-effect model is the best model in this study. Further, human capital (HC) has a significant positive relationship with economic growth. Meanwhile, innovation capacity has no significant relationship with economic growth. We also found that Malaysia's coefficient of human capital and innovation capacity is higher and more efficient than in Thailand and Indonesia. In conclusion, human capital and innovation capacity are crucial elements for measuring economic growth. Skilled human capital contributes significantly to the economic growth and economic development of a nation.

**Keywords:** Human Capital, Innovation, Economic Growth, ASEAN, Panel Regression Approach

**JEL Classification Code:** B22, C23, J24, O11

## 1. Introduction

ASEAN countries have experienced remarkable growth in gross domestic product (GDP). In 2016, ASEAN remained the sixth richest economy globally and third among Asian countries after China and Japan (ASEAN Secretariat, 2017). It continues to grow in active trade and domestic consumption, with the projections remaining robust over the medium term from 2018 to 2022 (OECD, 2018). The ASEAN economic growth still depends largely on trade as the primary contributor. One of the often-overlooked aspects of growth is how the economy can propel the knowledge-based economy. In other words, moving from a resource and investment-based economy to a knowledge-intensive innovation economy as a primary driver for economic growth. Based on World Economic Forum (2017), the Global Competitiveness Index (GCI) indicated that other Asia countries such as Japan, South Korea, and Taiwan are categorized as 'innovation-driven economies' while Singapore is considered the only ASEAN countries listed as

***Acknowledgements:**
The authors would like to thank Universiti Malaysia Terengganu's Centre for Research and Innovation Management, which supported this research publication, as well as the editor and anonymous reviewers for their valuable comments.

[1]First Author. Assistant Professor, Department of Economics, Faculty of Business, Economics and Social Development, Universiti Malaysia Terengganu, Malaysia. Email: n.fatimah@umt.edu.my
[2]Corresponding Author. Assistant Professor, Department of Economics, Faculty of Business, Economics and Social Development, Universiti Malaysia Terengganu, Malaysia [Postal Address: Faculty of Business, Economics and Social Development, Kuala Nerus, Terengganu, 21030, Malaysia]
Email: jumadil.saputra@umt.edu.my
[3]Associate Professor, Department of Economics, Faculty of Business, Economics and Social Development, Universiti Malaysia Terengganu, Malaysia. Email: suriyani_md@umt.edu.my

being driven by innovation (refer to Appendix 1). The GCI outlines four pillars of competitiveness: higher education and training, labor market efficiency, technological readiness, and innovation. It indicates that higher education and training, labor market efficiency and technological readiness are critical factors for efficiency-driven economies. At the same time, innovation is the contributor to innovation-driven economies (refer to Appendix 2). In general terms, human capital, technology, and innovation factors are crucial in leapfrogging the economic growth from a resource-based to a knowledge-based economy.

Economists widely discussed the interrelation of human capital and innovation. Much literature stated that human capital is an essential factor and engine of economic growth (Tsaurai & Ndou, 2019; Musibau, Yusuf, & Gold, 2019; Riley, 2014; De la Fuente & Doménech, 2006; Mankiw, Romer, & Weil, 1992; Lucas, 1988) where it denoted the level of workforce efficiency and productivity (Sara, Saputra, & Utama, 2021; Mankiw et al., 1992; Romer, 1990). Human capital contributes to a competitive advantage over the diffusion of innovation and technology (Pistorius, 2004; Siggel, 2000, 2001; Horwitz, 2005). Mincer (1996) states that higher growth of technological change in a sector can significantly demand an educated and trained workforce. Most economists agree with the idea of human capital as a critical factor in explaining the status of rich and developing countries (Acemoglu, Gallego & Robinson, 2014; Gennaioli, La Porta, Lopez-de-Silanes, & Shleifer, 2013; Oded, 2011; Jones & Romer, 2010; Hanushek & Woessmann, 2008; Glaeser, Porta, de Silanes, & Shleifer, 2004; Goldin & Katz, 1998; Lucas, 1988).

Though, there is debate concerning which human capital fosters economic growth. On the one hand, human capital is interpreted as an independent factor of production, which increases productivity for a given level of technology (Mankiw et al., 1992; Lucas, 1988). On the other hand, human capital is seen as an input in the innovation process and, therefore, as a balance to technology (Benhabib & Spiegel, 1994; Romer, 1990; Nelson & Phelps, 1966). Hence, higher levels of human capital lead to the generation or diffusion of new technologies, thus shifting the frontier of the production possibility set outwards. Bundell, Lorraine, Meghir, and Sianesi (1999) revealed that a growth rate depends on accumulating human capital and innovation. The stock of human capital through education level affects labor productivity. These findings are supported by Cinnirella and Streb (2017) on the impact of human capital on growth, which involves multiple channels. This study found an increase in human capital directly affects economic growth by enhancing labor productivity in production. Moreover, human capital through incremental labor productivity is essential for research & development (R&D), which accelerates technological change. Public spending through research & development (R&D) has a significant effect on economic growth (Muhammad, Zulham, Sapha, & Saputra, 2019; Le, Ngo, Nguyen, & Nguyen, 2021; Golder, Sheikh, & Sultana, 2021).

Innovation has become key in transforming the economic development of countries. East Asia is becoming an important engine of innovation. Many East Asian countries are ranked within the top 20 in the 2018 Global Innovation Index (GII): Singapore (5th), South Korea (12th), Japan (13th), Hong Kong (China) (14th), and China (17th). They are progressing alongside high-income economies in other regions, mainly North America and Europe. These countries are now taking the lead in fostering economic development through innovation (Global Innovation Index, 2018). Meanwhile, among ASEAN countries, Singapore leads, followed by Malaysia, Thailand, Vietnam, Brunei Darussalam, the Philippines, Indonesia, and Cambodia. Singapore has been ranked consistently in the top 10 in the GII with a strong performance in many aspects. It ranks first among all nations considered in FDI net outflows, government effectiveness, regulatory quality, cost of redundancy dismissal, PISA scales, tertiary inbound mobility, ease of protecting minority investors, applied tariff rate, and IP payments. Unexpectedly, Singapore's position in education is relatively weak, as it ranks 76th overall except for PISA results (Dutta & Cornell 2018).

The efforts of other ASEAN economies are also evident. Malaysia, Thailand, Vietnam, the Philippines, Indonesia, and Cambodia are improving their innovation performance. Specifically, Malaysia has top cluster development and ICT use. Thailand is ahead in quality of publications and trademarks, and Cambodia, which only recently began focusing on innovation activities, benefits from high FDI inflows (GII, 2018). Despite economic growth and increases in R&D spending and outputs in individual ASEAN countries, innovation policy remains weak at the regional ASEAN level. The economic integration of the ASEAN Economic Community (AEC) is progressing slowly (Degelsegger, Remoe, & Trienes, 2018). They argued that international cooperation in knowledge production connects ASEAN countries with non-ASEAN partners, but is comparatively weak within ASEAN. Therefore, innovative economies will complement AEC through goods, investment, and skilled labor (Muhamad, Sulaiman, & Saputra, 2018).

While studies were undertaken in other parts of the world such as Europe, Northern America, and South East Asia on human capital, innovation factors and economic growth (Wiston & Edgar, 2019; Sukono, Subartin, Ambarwati, Napitupulu, & Saputra, 2019; Alpaslan & Ali, 2018; McCann & Ortega-Argilés, 2013; Fleisher, Li, & Zhao, 2010; Benhabib & Spiegel, 2005; Bilbao-Osorio & Rodriguez-Pose, 2004; Howells, 2002; Barro, 2001; Kim & Nelson, 2000), comparatively fewer studies were undertaken on the ASEAN region. Some studies addressed the importance of human capital on economic growth (Baharudin, Ghani, & Ghani, 2016; Thangavelu & Narjoko, 2014; Tsen & Fukuoka, 2005; Yussof & Ismail, 2002). A lot had been written on innovation issues, particularly on innovation system (Hu, 2015; Nguyen & Pham, 2011; Srinivasan, Kalaivani, & Ibrahim, 2010; Chaminade & Vang, 2007; Frankema & Linblad, 2006; Joseph, 2006; Lee & Tan, 2006; Hu & Mathews, 2005). There are limited studies in ASEAN countries looking at the relationship between human capital and innovation factors toward economic growth. This paper seeks to investigate the relationship between human capital and innovation capacity, and the economic growth in Malaysia, Thailand, and Indonesia or ASEAN-3. These countries are selected based on their development stage. Malaysia is transitioning from an 'efficiency-driven economy' to an 'innovation-driven economy', and Thailand and Indonesia are under 'efficiency-driven economies (refer to Appendix 1). The next section presents the materials and methods employed in this paper. Section 3 contains the results and discussion. Section 4 concludes the study.

## 2. Research Methods and Materials

### 2.1. Data and Definitions of Variable

This study uses the World Development Indicator (WDI) from the World Bank from 1985 until 2018. We also utilize reliable and prominent proxies for representing the variables of human capital and innovation capacity such as the Human Development Index (HDI) and education expenditure (EDEX) as a proxy for human capital and the Innovation Capacity involves the trademark application (TRMK) and a scientific and technical journal article (STJNL). The variable of innovation capacity, namely, R&D expenditure, was considered, but omitted as not adapted for this study due to the absence of data, especially in middle-income countries like Malaysia, Indonesia, and Thailand. As for economic growth, it is measured by gross domestic product per capita (GDP). All variables are transformed to the form of the logarithm. Table 1 shows definitions of the variables.

**Table 1:** Definitions of Variable

| Variables | Dimension/ Proxied by | Definitions of Variables |
|---|---|---|
| **Independent Variables** | | |
| Human capital | Human Development Index (HDI) | The Human Development Index (HDI) is a statistic (composite index) of life expectancy, education, and per capita income indicators used to rank countries into four tiers of human development. A country scores higher HDI when the lifespan is higher, the education level is higher, and the GDP per capita is higher. |
| | Education Expenditure (EDEX) | Education expenditure refers to current operating expenditures in education, including wages and salaries and excluding capital investments in buildings and equipment. |
| Innovation Capacity | Trademark Application (TRMK) | Trademark applications filed are applications to register a trademark with a national or regional Intellectual Property (IP) office. A trademark is a distinctive sign which identifies certain goods or services as those produced or provided by a specific person or enterprise. A trademark provides protection to the owner of the mark by ensuring the exclusive right to use it to identify goods or services or to authorise another to use it in return for payment. The protection period varies, but a trademark can be renewed indefinitely beyond the time limit on payment of additional fees. |
| | Scientific and Technical Journal Article (STJNL) | Scientific and technical journal articles refer to the number of scientific and engineering articles published in the following fields: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences. |
| **Dependent Variable** | | |
| Economic Growth | Gross Domestic Product per capita (GDP) | GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. |

## 2.2. Econometric Model

This study adopts a quantitative approach by utilizing secondary data. The data were collected from the World Bank and the United Nations Development Program. For empirical analysis, this study uses the panel data of three countries in South-East Asia, namely, Indonesia, Malaysia, and Thailand, from 1985 to 2018, using STATA 13. This study focuses on human capital and innovation capacity. To measure both variables, we use several reliable and prominent proxies. Human capital is reflected by the education expenditure (EDEX) and Human Development Index (HDI).

Further, innovation capacity is represented by the trademark application (TRMK) and the number of scientific and technical journal articles (STJNL). Economic growth is measured by annual Gross Domestic Product per capita (GDP). All variables are transformed to natural log for expressing the real terms. Further, this study uses a panel data regression to analyze the data. It is a statistical method used widely to analyze two-dimensional (typically cross-sectional and longitudinal) panel data (Maddala, 2001). The data are usually collected over time and by the same individual. Panel data regression is appropriate for running over these two dimensions (Davies & Lahiri, 1995). The common mathematical model for panel data regression is as follows:

$$y_{it} = \beta' x_{it} + \alpha_i + \lambda_i + u_{it} \quad (1)$$

In panel data (Equation 1), the model assumes that the effects of observed explanatory variables, $x$, are identical across cross-sectional units, $i = 1, \ldots, N$ and over time, $t = 1, \ldots, T$. Further, the effects of omitted variables can be decomposed into the individual-specific effects, $\alpha_i$, time-specific effects, $\lambda_t$, and individual time-varying effects, $u_{it}$ or $\delta_{it}$. Through the panel analysis, the model can be estimated using three-panel regression methods, i.e., Pooled Ordinary Least Square (POLS), Fixed Effects (FE), and Random Effects (RE). The mathematical model for a method of Pooled Ordinary Least Square (POLS) can be rewritten as follows:

$$y_{it} = \beta' x_{it} + u_{it} \quad (2)$$

Equation 2 shows that the effects of observed explanatory variables, $x$, are identical across cross-sectional units, $i = 1, \ldots, N$ and over time, $t = 1, \ldots, T$. Further, the dependent variable denoted as $y$, the coefficient regression is $\beta$ and disturbance term (residual error) is $u_{it}$. Put simply, one condition of the pooled regression is that it assumes homogeneity for all countries, which does not permit control of the individual-specific effects. Besides that, from equation 2, we add the individual-specific effects, $\alpha_i$, thus, the mathematical model for the fixed effect model is as follows:

$$y_{it} = \beta' x_{it} + \alpha_i + u_{it} \quad (3)$$

In equation 3, the model assumes that the effects of observed explanatory variables, $x$, are identical across cross-sectional units, $i = 1, \ldots, N$ and over time, $t = 1, \ldots, T$. The dependent variable is denoted as $y$, the coefficient regression is $\beta$ and disturbance term (residual error) is $u_{it}$. Further, the effects of omitted variables can be decomposed into the individual-specific effects denoted as $\alpha_i$. Finally, the general mathematical model of random effect method can be written as follows:

$$y_{it} = \beta' x_{it} + \alpha + u_{it} + \delta_{it} \quad (4)$$

Equation 4 shows that the formula considers the individual-specific effects, denoted as $\alpha_i$ and two disturbance term (residual error) such as $u_{it}$ which represents between entity error and $\delta_{it}$ describes within entity error. Further, the model assumes that the effects of observed explanatory variables, $x$, are identical across cross-sectional units, $i = 1, \ldots, N$ and over time, $t = 1, \ldots, T$. The dependent variable is denoted as $y$, the coefficient regression is $\beta$ and the effects of omitted variables can be decomposed into the individual-specific effects denoted as $\alpha_i$. From the general equation, we use a specific variable to represent the econometric model under panel data regression. Using equation 2, the econometric model for Pooled Least Square method can be written as below:

$$\begin{aligned} \text{GDP}_{it} &= \beta_0 + \beta_1 \text{HDI}_{it} + \beta_2 \text{EDEX}_{it} + \beta_3 \text{STJNL}_{it} \\ &\quad + \beta_4 \text{TRMK}_{it} + u_{it} \end{aligned} \quad (5)$$

Equation 5 shows the effects of observed explanatory variables, HDI, EDEX, STJNL, TRMK are identical across cross-sectional units, $i = 1, \ldots, N$ and over time, $t = 1, \ldots, T$. Further, the dependent variable us denoted as *GDP*, the coefficient regression is $\beta_i$, $i = 1, \ldots, x$ and disturbance term (residual error) is $u_{it}$. Further, using equation 3, the specific econometric model for the fixed effect method can be seen as follows:

$$\begin{aligned} \text{GDP}_{it} &= \beta_0 + \beta_1 \text{HDI}_{it} + \beta_2 \text{EDEX}_{it} + \beta_3 \text{STJNL}_{it} \\ &\quad + \beta_4 \text{TRMK}_{it} + \alpha_i + u_{it} \end{aligned} \quad (6)$$

Equation 6 shows the effects of omitted variables, which can be decomposed into the individual-specific effects denoted as $\alpha_i$. The dependent variable is denoted as GDP, the coefficient regression is $\beta_i$, $i = 1, \ldots, x$ and disturbance term (residual error) is $u_{it}$, and the effects of observed explanatory variables, HDI, EDEX, STJNL, TRMK are identical across cross-sectional units, $i = 1, \ldots, N$ and over time, $t = 1, \ldots, T$. Further, utilizing equation 4, the specific econometric model for random effect method can be written as follows:

$$\mathrm{GDP}_{it} = \beta_0 + \beta_1 \mathrm{HDI}_{it} + \beta_2 \mathrm{EDEX}_{it} + \beta_3 \mathrm{STJNL}_{it} + \beta_4 \mathrm{TRMK}_{it} + \alpha + u_{it} + \delta_{it} \quad (7)$$

Equation 7 considers the individual-specific effects denoted as $\alpha$, and two disturbance term (residual error) such as $u_{it}$ which represents between entity error and $\delta_{it}$ describes within entity error. Then, the effects of omitted variables, which can be decomposed into the individual-specific effects is denoted as $\alpha_i$. The dependent variable is denoted as *GDP*, the coefficient regression is $\beta_i$, $i = 1, \ldots, x$ and disturbance term (residual error) is $u_{it}$, and the effects of observed explanatory variables, HDI, EDEX, STJNL, TRMK are identical across cross-sectional units, $i = 1, \ldots, N$ and over time, $t = 1, \ldots, T$.

The issue of the random-effect method presents a bias in the estimator due to a correlation between the explanatory variables and unobservable effects (Cheng & Wall, 2005). In contrast with the FE method, it introduces the country-specific effect by estimating different intercepts for each pool member country and provides consistent estimates regarding the correlation between the specific effects and the explanatory variables. Besides that, the RE method is based on the Generalised Least Squares (GLS), which considers time-series and the cross-sectional dimension of the data and treats intercepts as random variables across the pooled member countries.

The RE method provides efficient estimation, especially when there is little time-series variant. However, biased, and inconsistent estimates occur when the specific effect is correlated to some of the explanatory variables. Hence, it is necessary to test the presence of this bias by using the Hausman test, which has a $\chi^2$ distribution under the null hypothesis of no correlation between the individual effects and the explanatory variables. If the calculated test statistic rejects the null hypothesis, the FE method is more efficient than the RE method.

### 2.3. Hypothesis Development

In conjunction with the previous elaboration, this study seeks to propose some research hypotheses, as follow:

***H1:*** *Human Capital (HC), which consists of the Human Development Index (HDI) has a significant positive effect on economic growth (GDP).*

***H2:*** *Human Capital (HC), which consists of Educational Expenditure (EDEX), has a significant positive effect on economic growth (GDP).*

***H3:*** *Innovation capacity (INC) comprising Trademark Application (TRMK) has a significant positive effect on economic growth (GDP).*

***H4:*** *Innovation capacity (INC) comprising Scientific and Technical Journal (STJNL) has a significant positive effect on economic growth (GDP).*

## 3. Results and Discussion

This study presents the results according to the descriptive statistics, correlations and panel data regression analyses. It uses several proxies for measuring human capital involving the Education Expenditure (EDEX) and Human Development Index (HDI). Further, the innovation capacity is proxied by Trademark Application (TRMK) and Scientific and Technical Journal (STJNL). Besides that, economic growth is measured by Gross Domestic Product (GDP).

Table 2 displays the descriptive statistics for three selected countries (Indonesia, Malaysia and Thailand). The mean of GDP per capita is USD5,747.52, with the value of standard deviation being USD2,586.81. Further, the mean value of the Human Development Index (HDI) is 71.00, with the standard deviation equal to 5.00. The Education Expenditure (EDEX) is USD35.55, and the standard deviation as much as USD11.20. The mean value of Scientific-Technical Journal is 5,583.74, with the standard deviation value equal to 4,731.19. Lastly, the Trademark Application has a mean value of 38,760.57 with a standard deviation of 10,530.64. ASEAN countries such as Singapore and Malaysia are identified as the Asian Tigers because of their innovation agendas. Further, Thailand, Indonesia, Philippines, and Vietnam are well known as 'new Asian Tigers' on the rise because their economies are participating more in regional and global value chains, including some in relatively high-tech sectors. However, Malaysia, the Philippines, Thailand, Indonesia, and Vietnam are still experiencing low innovative

**Table 2:** The Result of Descriptive Statistics Analysis

| Variables | Mean | Standard Deviation | Min | Max |
|---|---|---|---|---|
| GDP Per Capita | 5,747.52 | 2,586.81 | 2,524.61 | 10,512.14 |
| Human Development Index | 71.00 | 5.00 | 63.00 | 79.00 |
| Education Expenditure | 35.55 | 11.20 | 17.26 | 52.75 |
| Scientific and Technical Journal | 5,583.74 | 4,731.19 | 468.60 | 17,720.10 |
| Trademark Application | 38,760.57 | 10,530.64 | 22,147.00 | 62,455.00 |

capacities such as R&D, citable scientific and technical journals, resident patenting levels and trademark counts (International Monetary Fund, 2016).

In addition, this study also examines multiple correlation analysis among variables to determine the correlation coefficient among them. The results of correlation analysis are seen in Table 3.

Table 3 shows the human capital consisting of Educational Expenditure (EDEX) and Human Development Index (HDI) has a significant positive correlation with economic growth. The correlation coefficient between Educational Expenditure (EDEX) and Economic Growth (GDP) is 0.492. It indicates that when Education Expenditure (EDEX) increases, then Economic Growth (GDP) increased as much as 49.2% and conversely. Similar to the Human Development Index (HDI), the correlation coefficient between HDI and Economic Growth (GDP) is 0.972. When the Human Development Index (HDI) increases, then the Economic Growth increased as much as 97.2% and reversely. Through this correlation analysis, we found the Human Development Index (HDI) is highly correlated to the Economic Growth (GDP) when compared with the Educational Expenditure (EDEX).

**Table 3:** The Result of Correlation Analysis

| Variables | Coefficient (*r*) |
|---|---|
| Educational Expenditure (EDEX) | 0.492 |
| Human Development Index (HDI) | 0.972 |
| Scientific and Technical Journal (STJNL) | 0.830 |
| Trademark Application (TRMK) | –0.807 |

Further, correlation analysis for innovation capacity comprises Trademark Application (TRMK) and Scientific and Technical Journal (STJNL). We found two interesting findings. First, the Scientific and Technical Journal (STJNL) has a positive and significant correlation with Economic Growth (GDP). Meanwhile, Trademark Application (TRMK) has a significant negative correlation with Economic Growth (GDP). Both have a correlation coefficient of 0.8 (STJNL is 0.830 and TRMK is –0.807). Based on the correlation result of innovation capacity, the correlation between Scientific and Technical Journal (STJNL) and Trademark Application (TRMK) and the Economic Growth (GDP) can be categorized as high. However, when the Trademark Application (TRMK) increases as much as 0.807, then the Economic Growth (GDP) decreased to 0.807. In contrast, the Scientific and Technical Journal (STJNL) increased to 0.830, then the Economic Growth (GDP) is 0.830 or 83% and reversely. For analyzing the relationship between human capital and innovation capacity on economic growth, the result of panel regression analysis is presented in Table 4.

The result of the data analysis includes three static panel models, namely, Pooled Ordinary Least Square, Fixed-Effect, and Random-Effect Models. Table 4 determines the best model from three static models. Using the Hausman test, we determine the best model between the fixed-effect and random-effect models. The result of the Hausman test shows the significant value is less than 1 percent ($\alpha < 0.01$). Thus, the null hypothesis is rejected, and we conclude that the fixed-effect model (FEM) is the best. Further, to

**Table 4:** Result of Hypotheses Testing

| Variables | Model 1 (POLS) | Model 2 (FE) | Model 3 (RE) |
|---|---|---|---|
| Human Capital (HC) | | | |
| Human Development Index (HDI) | 13.83*** | 8.63*** | 9.31*** |
| Educational Expenditure (EDEX) | 26.73*** | 2.63** | –0.18 |
| Innovation Capacity (INC) | | | |
| Scientific and Technical Journal (STJNL) | 4.53** | –0.12 | 4.53*** |
| Trademark Application (TRMK) | 6.59*** | 1.42 | –1.29 |
| Constant | 8.79*** | 4.68** | 1.70* |
| $R^2$ | 0.996 | 0.935 | 0.827 |
| *F*-test | | 43.33*** | |
| LM test | | | 318.64*** |
| Hausman test | | | 52.347*** |

Note: ***Significant at the level 1%; **significant at the level 5% and *significant at the level 10%. Dependent variable: Economic Growth (GDP).

choose the best model between Pooled Least Square model (POLSM) and FEM, this study uses Breusch and Pagan Lagrangian Multiplier test. The result of the Breusch and Pagan Lagrangian Multiplier test shows the significant value prob. > $\chi^2$ = 318.64. Thus, the null hypothesis was accepted. Based on both Hausman and Breusch and Pagan Lagrangian Multiplier (Breusch-Pagan LM) tests, the best model is the fixed-effect model (FEM). Using the FEM coefficient determination, this study found that human capital (HC), which consists of the Human Development Index (HDI) and Educational Expenditure (EDEX), can explain its relationship to economic growth (GDP) as much as 93.5 percent. Therefore, there are 6.5 percent explained by other variables, which are not considered and included in this research.

In other words, there is a country-specific effect in this panel regression. Further, this study tests hypotheses to determine the best model. Table 4 provides the effect of explanatory variables on the dependent variable. The result of hypothesis testing shows that Human Capital (HC), which consists of the Human Development Index (HDI) and Educational Expenditure (EDEX), has a significant positive effect on Economic Growth (GDP). Meanwhile, Innovation Capacity (INC) comprising Trademark Application (TRMK) and Scientific and Technical Journal (STJNL) does not have a significant effect on Economic Growth (GDP). Thus, following the discussion above, the determinant with the greatest influence on economic growth in Indonesia, Malaysia, and Thailand is Human Capital (HC). The highest regression coefficient comes from the Educational Expenditure (EDEX) with 26.73 and significance at 1% ($\alpha < 0.01$).

This finding is supported by many theoretical models of economic growth (Becker, Murphy, & Tamura (1990), Rebelo (1992); and Mulligan & Sala-i-Martin (1993), which highlighted the role of human capital proxied by using the educational attainment. Further, the empirical studies of Romer (1990), Barro (1991), Kyriacou (1991), and Benhabib and Spiegel (1994) used the growth of a broad cross-section of countries as proxies for human capital. Barro and Lee (1994) provided better estimates of educational attainment for assessing the interplay between human capital and economic growth by sampling many countries over 25 years. Also, economic theory indicates that human capital is an important determinant of economic growth and supports the linkage between human capital and economic growth in a broad group of countries (Barro, 1991; Ranis, Stewart, & Ramirez, 2000; Castelló & Doménech, 2002).

Countries that start with a higher level of educational attainment grow high speed for a given level of initial per capita GDP and given values of policy-related variables. The channels of effect involve the positive effect of human capital on physical investment, the negative effect of human capital on fertility, and an additional positive effect on growth for given values of investment and fertility (Barro, 1991). This finding is also empirically supported by Muhamad et al. (2018), who found substantial evidence that human capital reflected by tertiary enrolment (TER) and innovation capacity indicated by high technology exports (HEX) and patent application (PTT) has a significant positive influence on the economic growth (GDP) in the long-term for Indonesia and Thailand. Meanwhile, the human capital measured by government expenditure on education (GEX) is not a significant relationship in the long run with the economic growth for Malaysia.

Besides that, Japan, Korea, and Singapore led a few collaborative R&D projects with newcomers in innovation at both company and country levels. Consequently, the potential of intra-regional innovation networks in Asia is not fully utilized. It differs from China, Japan, and the Republic of Korea. The increasing manufacturing activities result in a potentially stronger pan-Asian innovation network, including technology-intensive sectors in neighboring Asian countries leading to regional production and innovation networks (Wunsch-Vincent, Lanvin, & Dutta, 2015). On the other hand, Chinese, Japanese and Korean firms choose to manufacture in these intra-regional production activities, such as Malaysia, Vietnam, and Thailand, to benefit from excellent framework conditions and lower wages. These leading Asian nations are mostly concerned with low-skill and low-wage assembly operations (Innovation Capacity Index, 2011). Further, Table 5 shows the countries-specific effects.

Table 5 indicated that Malaysia's human capital capacity and innovation capacity are higher and more efficient than Thailand and Indonesia. The country-specific effect in Malaysia is 0.048, Thailand –0.397 and Indonesia –0.964. This result indicates that Malaysia is growing stronger in achieving economic development regarding human capital and innovation capacity than Thailand and Indonesia. This result is consistent with the findings from the Global Competitiveness Index, GCI (2018). Among these three countries, Malaysia ranked 23rd, Thailand ranked 32nd, while Indonesia ranked 36th. Although Malaysia is the most efficient than Thailand and Indonesia, compared to other developed countries like Singapore (3rd) and Japan (9th), Malaysia still lags. To transition to a higher income nation, Malaysia needs to improve its human capital capacity and innovation capacity.

**Table 5:** Result of Countries-Specific Effect

| Country | Coefficient |
|---|---|
| Malaysia | 0.048 |
| Thailand | –0.397 |
| Indonesia | –0.964 |

## 4. Conclusion

In line with 'newly emerging Asian economies', this study investigated the relationships of human capital and innovation capacity on the economic growth of Malaysia, Thailand, and Indonesia. Using the analysis of panel data regression, we found that Human Capital (HC) reflected by Human Development Index (HDI) and Educational Expenditure (EDEX) have a significant positive effect on Economic Growth (GDP). Meanwhile, Innovation Capacity (INC) proxied by Trademark Application (TRMK) and Scientific and Technical Journal (STJNL) does not have a significant effect on Economic Growth (GDP). Many developing nations have thus realized that the principal mechanism for developing human knowledge is the education system. Therefore, they invest huge sums of money in education, not only as an attempt to impart knowledge and skills to individuals but also to impart values, ideas, attitudes, and aspirations that may be in the nation's best developmental interest. The countries that succeed in developing and sustaining strong human capital and innovation capacity do well economically, while those that fail tend to fall behind.

However, poorer countries find it hard to develop the capabilities and a well-functioning innovation system, which is something that is built incrementally over many years. This study only shows the evidence that human capital and educational systems work beautifully to develop individuals and nations, especially developing countries. Overall, we conclude that human capital and innovation capacity are crucial elements for measuring economic growth. Skilled human capital contributes significantly to the economic growth and development of the world economy. Developing economies, especially Malaysia, should be more creative and innovative to improve their economy. Future research can compare based on the development stage, i.e., transition efficiency-driven and innovation-driven for developed and developing countries using dynamic panel data regression and grouped testing. It aims to identify the long and short-run relationship and specific effect within and between countries. However, there are implications, especially concerning the differences in policies and expenditures in education. The human capital theory emphasizes the need for policymakers to allocate significant resources to expanding educational systems. Meanwhile, some governments may be reluctant to invest in education, the positive returns from this investment will significantly outweigh the costs.

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## Appendixes

### Appendix 1: Classification by Each Stage of Development

| Stage 1 (Factor-driven) | Transition from stage 1 to stage 2 | Stage 2 (Efficiency-driven) | Transition from stage 2 to stage 3 | Stage 3 (Innovation-driven) |
|---|---|---|---|---|
| Bangladesh | Algeria | Albania | Argentina | Australia |
| Benin | Azerbaijan | Armenia | Chile | Austria |
| Burundi | Bhutan | Bosnia and Herzegovina | Costa Rica | Bahrain |
| Cambodia | Botswana | Brazil | Croatia | Belgium |
| Cameroon | Brunei Darussalam | Bulgaria | Hungary | Canada |
| Chad | Honduras | Cape Verde | Hungary | Cyprus |
| Congo | Kazakhstan | China | Latvia | Czech Republic |
| Ethiopia | Kuwait | Colombia | Lebanon | Denmark |
| Gambia | Mongolia | Dominican Republic | Lithuania | Estonia |
| Ghana | Nicaragua | Ecuador | Malaysia | Finland |
| Guinea | Nigeria | Egypt | Mauritius | France |
| Haiti | Philippines | El Salvador | Oman | Germany |
| India | Ukraine | Georgia | Panama | Greece |
| Kenya | Venezuela | Guatemala | Poland | Hong Kong SAR |
| Kyrgyz Republic | Viet Nam | Indonesia | Romania | Iceland |
| Lao PDR | | Iran, Islamic Rep | Saudi Arabia | Ireland |
| Lesotho | | Jamaica | Seychelles | Israel |
| Liberia | | Jordan | Slovak Republic | Italy |
| Madagascar | | Mexico | Trinidad and Tobago | Japan |
| Malawi | | Montenegro | Turkey | Korea, Republic |
| Mali | | Morocco | Uruguay | Luxembourg |
| Mauritania | | Namibia | | Malta |
| Moldova | | Paraguay | | Netherlands |
| Mozambique | | Peru | | New Zealand |
| Nepal | | Russian Federation | | Norway |
| Pakistan | | Serbia | | Portugal |
| Rwanda | | South Africa | | Qatar |
| Senegal | | Sri Lanka | | Singapore |
| Sierra Leone | | Swaziland | | Slovenia |
| Tajikistan | | Thailand | | Spain |
| Tanzania | | Tunisia | | Sweden |
| Uganda | | | | Switzerland |
| Yemen | | | | Taiwan, China |
| Zambia | | | | United Arab Emirates |
| Zimbabwe | | | | United Kingdom |
| | | | | United States |

Note: Global Competitiveness Index.

**Appendix 2: The Global Competitiveness Index Framework**