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How Do Innovation and Technology Trade Affect Economic Growth Performance in Indonesia?

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Abstract

Innovation is a driving factor for a country's economic growth. It can provide carrying capacity for productivity, efficiency, and performance effectiveness in each industry. To improve production, we need research and innovation. This study empirically estimates the impact of technological innovation and trade on economic growth. The data used is time series data with a quantitative method using Autoregressive Distributed Lag (ARDL) for long-term analysis and Error Correction Model (ECM) for short-term study. This current study empirically found that in the long-term research, the innovation stated in the number of patents will significantly affect economic growth when technology imports occur. Meanwhile, innovation will significantly and negatively affect grant financing in the event of an increase in the technology trade. This result indicates that reducing grants by increasing the quality of research through the efficiency of research grants will promote economic growth. On the other hand, in the short-term analysis, innovation does not affect economic growth, whereas only information and communication technology (ICT) export can support economic growth. Another empirical study found that institutions and population growth do not affect economic growth regarding innovation and technology. The government must increase technology transfer abroad for domestic research purposes and increase demand for technology exports to become an incentive for the more effective and efficient use of grant funds.

Keywords Economic Growth; Innovation; Patent; Grant; Technology

INTRODUCTION

There are always two policy options in economics: policies that support economic growth and development. Economic growth is an increase in output from year to year due to a rise in productivity. Meanwhile, economic development means an increase in output from year to year accompanied by improvements in production to gain welfare. These two concepts provide a paradigm that growth only looks at the point of view of increasing material output and does not consider whether high growth will also increase the level of welfare or even harm society.

Economic growth is seen and measured by comparing components representing the current state of a country's economy and the previous period. The element used to measure economic growth is gross national product (GNP) or gross domestic product (GDP).

Expressed in percentage units, gross domestic product (GDP) calculates economic growth in terms of physical output. On the other hand, development economics sees an increase in production and an improvement in welfare. This improvement mainly solves economic problems such as poverty, unemployment, health insurance, alleviating malnutrition, high inflation, etc. In analyzing economic development, experts use various indicators such as the human development index (HDI) for measuring the human resource aspect. Besides that, other indexes, like the Indonesia democracy index, gender development index, and anti-corruption behavior survey (SPAK), are relevant in analyzing economic development according to the research field.

Data on economic growth in Indonesia shows sharp fluctuations from year to year. Many factors can cause this. Factors like population, sociocultural aspects, amount of capital goods, land area and natural resources, innovation, and technology can affect economic growth and development. Figure 1 shows Indonesia's economic growth from 2005 to 2018.

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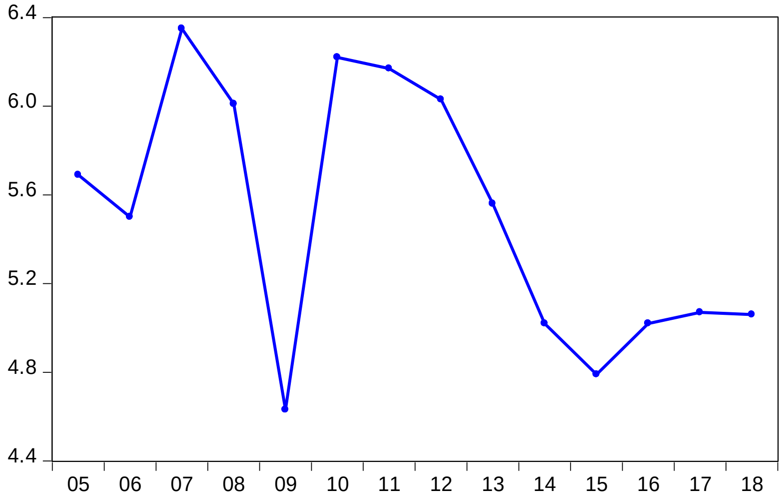
Figure 1. Indonesia's Economic Growth Period 2005-2018



Source: Central Bureau of Statistics, Republic of Indonesia

Innovation has an impact on economic growth. In Kenya, financial innovation has significantly impacted economic growth through broader market options for customers to shop, resulting in increased demand and, thus, productivity (Mwinzi, 2014). In a middle-income country (or a country with a more advanced economic level but still categorized as a developing country) such as Malaysia, the total grants calculated through the quality of innovation are significant to the performance of economic growth. (Law, Sarmidi, & Goh, 2020). Innovation has an impact on productivity and increases human resources. In Portugal, innovation in improving human capital (expertise, performance efficiency) had more impact than the innovation capacity of patents and grants (Teixeira & Fortuna, 2003). Petrariu, Bumbac, & Ciobanu (2013) found that innovation impacts economic growth and contributes to countries in central and eastern Europe. In SMEs in Pakistan, innovation works if SMEs least participate in alliances for innovative projects. Therefore, the current study's findings suggest upgrading their dynamic knowledge management capability by building their structural, technological, and entrepreneurial capabilities (Hassan & Iqbal, 2020).

Discussing the micro sector affected by innovation from an economic perspective, Firmansyah (2018) analyzes the characteristic of politics to technology and political entertainment. He found that the technology approach (using innovation such as TV, radio, smartphone, e-news, etc.) does not directly affect political polarization. So sectors such as politics received indirect effects from innovation in economics. However, its characteristics show that high economic growth is not a direct impact of innovation but an additional industrial output caused by the implementation of innovation.

Innovation enhances human capital's capacity and promotes economic production performance. It can also drive economic growth. To reach such conditions, the government should provide patents for industry and fulfilling sufficient grants for research and development.

Understanding the relationship between innovation and technology trade to economic growth performance, we must build the assumption to trust the applicable model framework. The assumption for innovation is that society will adopt it immediately right after the provision of the innovation. On the other hand, the assumption for technology trade is the countries that made the trade relation for information and communication technology (ICT) is to adopt it for national technology development. This research aims to see the effect of innovation and technology trade on economic growth performance in Indonesia, assuming that innovation and technology support all economic growth sectors. The model proposed by Law, Sarmidi, & Goh (2020) implemented research based on the Indonesia case. These are the research objectives: (a) to find out the relationship and the effect of innovation and technology trade on economic growth performance in Indonesia; (b) To explore the role of innovation by differentiating it with total patent and total grants and also to find the result interaction

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both of variables to economic growth performance by assumption to adopt research and innovation on the economic sector; (c) To explore the role of technology trade by different it with ICT import and ICT export and also to discover how the impact of both variables to economic growth performance by assumption adopted technology development; and (d) To identify and test the relationship between innovation and technology trade to economic growth performance.

LITERATURE REVIEW

2.1 Basic Theory of Economic Growth

Economic growth is a national economic phenomenon and a dynamic regional change in output. We use the gross domestic product to analyse economic growth and development. Economic growth is broadly defined as additional output, which is more prominent now than in the previous year, or technically, the real GRDP one year with the real GRDP the last year. (Sukirno, 2004). The main objectives of developing countries are economic growth and economic development, in which a growing economy does not necessarily have improvements in economic development (Nafziger, 2005).

$$Economic\ Growth\ \rightarrow EG = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} \qquad (1)$$

Mourad and Trabulsi (2019) stated that from an economic perspective, the gross domestic product has a positive impact on household final consumption expenditure ($HFCE_t$), money supply (M_{lt}), inflation measured by the consumer price index (CPI_t), interest rates (rir_t) and other variables. The specific relationship between GDP, expenditure, and gross domestic savings (GDS_t) is as follows:

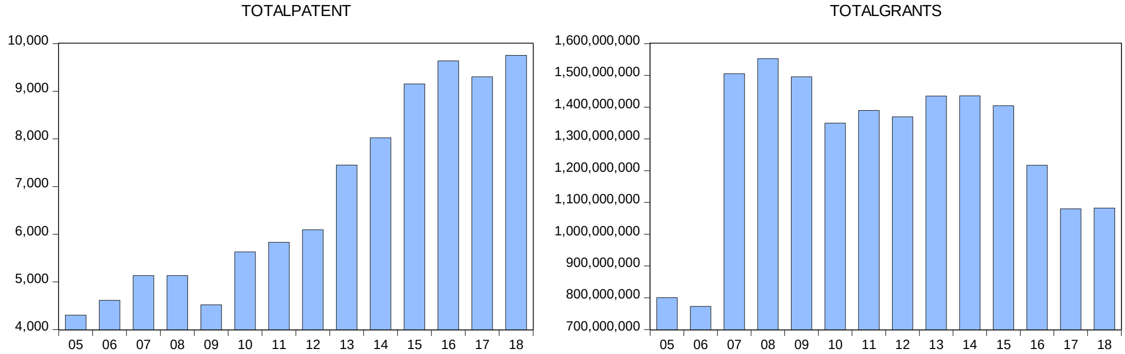
$$income\ identity \rightarrow GDP_t = GDS_t + HFCE_t + GFCE_t \qquad (2)$$
$$GDP_t\ price\ is\ constant \rightarrow GDP_t = GDP_0(1+r)^t$$

Economic development is categorized as a scientific study that includes broad economics in the efficiency of allocating scarce productive resources, the sustainability of economic growth, and paying attention to social mechanisms that exist in both public and private sphere (Todaro & Smith, 2003). Economic development refers to economic growth accompanied by changes in the distribution and structure of the economy (Nafziger, 2005). Economic growth provides an analytical and technical picture of the economic development of a region which can then be further analysed whether economic development occurs after economic growth occurs. Economic development is a combination of growth and changes in the economic structure towards a better stage so that it also looks at the socio-economic aspects of society. Thus, economic development cannot be separated from economic growth, and vice versa.

2.2 Economy of Innovation

Innovation is creating new things, new ease, and something new (Hussain, Afzal, Asif, Ahmad, & Bilal, 2011). Generally, several parameters used in analysing innovation are R&D expenditures, R&D personnel, Patents, Scopus-indexed journals, Google Scholar-indexed journals, and so on that focus on the knowledge-based economic context (Korres & Drakopoulos, 2009). Hulya Ulku (2004) found that innovation and research were positively correlated in OECD and non-OECD countries in 1981-1997. The development of a country's competitive level is reflected, among others, by spending on R&D and innovation so that if a country has high productivity in innovation and research, it is always indicated as a country with good competitiveness. (Ildirar, Ozmen, & Iscan, 2016). Therefore, a government that is incompetent to meet its research and innovation targets will not promote contribution toward people's welfare significantly.

Figure 2. Total Patents and Total Grants of Indonesia for the Period 2005-2018



Source: World Development Indicator

Research is generally considered to be able to support economic growth, both in the short and long term. In the short term, more abundant and productive research receives sufficient grants, and problem-solving innovations can be directly implemented for the welfare of humankind (such as research on agriculture to be applied directly to increase production and efficiency). Its direct implementation is supported by government and community institutions that understand the performance of innovation and research. Although research is indicated to increase economic growth in the short term, on the other hand, research, grants, and innovations that are not yet optimal will not give meaning to economic growth. Examples of short-term research are innovations to develop, recycle, reduce and complement existing technology (supporting technology). In the short term, research and innovation tend to find conditions for higher efficiency, effectiveness, and productivity.

The increase in output for economic growth is strongly supported by sectoral performance. Thus, the role of production households (business, entrepreneurship, and trade) plays an essential part. Business innovation dramatically affects the level of output. Economic growth represents an increase in output and business productivity. Hussain, Afzal, Asif, Ahmad, & Bilal (2011) found a significant relationship between economic growth and entrepreneurship and a significant positive relationship between innovation and entrepreneurship. Innovations in increasing productivity and economic efficiency were also found to have an impact in Ildirar, Ozmen, & Iscan (2016), Qamruzzaman (2017), and Maradana, Pradhan, Dash, Gaurav, Jayakumar, & Chatterjee (2017). However, innovation does not yet have a reliable measure in analyzing tourism economics. The orientation of measuring innovation is more toward its impact on information technology and research rather than tourism. Tourism focuses more on customer satisfaction, so the study focuses more on a social approach (Firmansyah & Nasution, 2020).

In its development, we can see innovation in economic growth in two broad lines; influencing technical aspects and influencing data. Technically influencing, it can be measured micro-into the production activities in each factory, or each company is various. Tend to show research with small objects (company, factory). On the other hand, in general, researchers often use data influence as a technical basis for research, making data behavior part of the research hypothesis. This research tends to show research with large objects (macroeconomic variables).

2.3 Schumpeter Concept of Innovation

Regarding the definition of the economy of innovation, Schumpeter in Lazzarotti, Dafovo & Hoffmann (2011) create a lot of criteria support for covering innovation cases output from an economic perspective. It should cover five cases or areas from the perspective of creating new combinations: (a) introduction of new goods, (b) introduction of a new method or production process, (c) opening a new market, (d) acquiring a new source of raw materials or semi-manufactured goods, and (e) establishing a new organization of any industry, this case generally involves creating a new business or a new market structure which is characterized by a certain uniqueness of the firm - a monopoly - given the position it may occupy with the new organization.

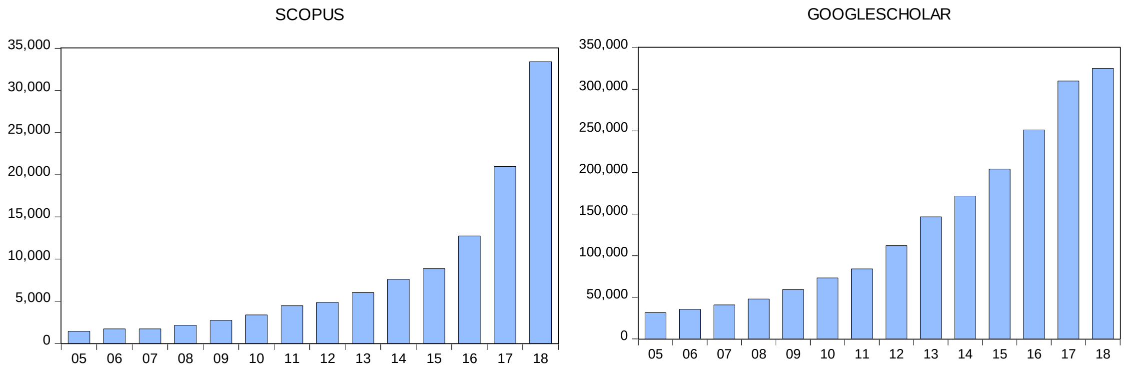
Schumpeter's (1934) original theory of innovative profits emphasized the role of entrepreneurship (his term was entrepreneurial profits) and the seeking out of opportunities for novel value-generating activities which would expand (and transform) the circular flow of income. Still, it concerns a distinction between invention or discovery on the one hand and innovation, commercialization, and entrepreneurship on the other. Growth in this area appears as a typical disruptive process, not an uninterrupted process, which Schumpeter (1943) later called "creative destruction." Although this term is also often misunderstood, as the deviation refers to circular flows; well-established market structures, the creative process tends to be cumulative growth.

The central aspect of Schumpeterian "creative destruction," a process strongly related to the nature of the market mechanism, is the discussion of the forms of competition that can ultimately improve the economy in both quantitative and qualitative terms. The entrepreneurial process makes up this explosive force that can disrupt the existing order because of its true creativity. It stands on the technological advantage, mainly from the company's internal potential and the potential to carry out research activities. That's why, according to Schumpeter, large companies, monopolies, and companies with more significant innovation potential are among the companies that have the potential to innovate.

2.4 Research and Technology in Economics

In Indonesia, research and grants are commonly driven by intensive activities in tertiary institutions (universities, colleges) led by professors, lecturers, and others. Higher education can be a forum for students, researchers, professors, and development activities to increase quality research outcomes (Bouhajeb, Mefteh, & Ammar, 2018). Bara (2016) in Qamruzzaman (2017) found that innovation can increase economic productivity in developing countries by adopting technology and information. Furthermore, updating appropriate models and systems. In Mitra & Jha (2015), looking at absolute times, it is indicated that innovation and technology can improve productivity through research and development results implemented in the industry. On the other hand, research and development spending significantly impacts economic growth but only for developed countries (Baneliene, Melnikas, Strazdas, & Tolocka, 2018).

Figure 3. Number of Scopus Indexed and Google Scholar Indexed Journal Outputs



Source: Science and Technology Affiliation (SINTA), Ministry of Research and Technology of the Republic of Indonesia

In a neoclassical economic growth, fiscal policy undertaken by the government can be assumed as an expenditure that impacts short-term demand accompanied by long-term economic growth. (Deledi, Mazzucato, Agnolucci, Lipsis, & Ryan-Collins, 2019). This theory places the role of the government in the provision of grants and encourages patents to innovate in both the short and long-term impacts to promote economic growth. The government plays an essential role in fostering good competition and innovation for development. Furthermore, government support through providing a capable innovation environment for business innovation, technology-based entrepreneurship, and the provision of public goods that support sustainable research and research. (Navarro, Benavente, & Crespi, 2016).

Implementing these innovations after government support tends to have a long-term and insignificant short-term impact on production. On the other hand, production determines the increase in output for economic growth (Blanco, 2013). Technical innovations can be divided into two that affect the short and long term. What can distinguish is that from its implementation, such as road innovation, the economic impact will be in the long term, in contrast to innovations in online-based finance that will be felt immediately when individuals try to use it for the first time.

The connection with technology variables is that some patents and grants are used to find new technologies for sectoral productivity. This phenomenon occurs in Indonesia's ICT Imports and ICT Exports. ICT Imports sees that sectors in Indonesia need technology and send it from abroad. In contrast, ICT Exports sees that technological advances in Indonesia (one of which is supported by patents and grants) have been able to be traded on the international market. The link between innovation (number of patents and grants) and technology (ICT Imports and ICT exports) is an indication that innovation and technology can support economic growth. In various production function models, technology is often included as one of the supporters of productivity.

In the long term, research supports a sustainability agenda, including local, national, and global plans. In the long term, innovation supported by good human resources will help economic growth (Diebolt & Hippe, 2016). Policy to support research sustainability includes fiscal policy support for financing and research funding (including subsidies, assistance, and research facilities as public goods for particular purposes). The implementation of planning in sustainability research refers to the protection of innovative thinking and can support economic growth over a long period. Examples of long-term research are renewable energy, green urban planning, electric transportation, and industrial robots. The agenda is industrialization, globalization, political unity, and economic unity.

Innovation is transformed as a production factor. Innovation is an effort to increase efficiency and output productivity in economic activities (Abeltina, 2007). Efficiency and increased productivity can be achieved through various innovations and research. Companies always consider minimum costs and optimal revenue (Mankiw, Quah, & Wilson, 2014; Amaliawaiati & Murni, 2019). Joseph Schumpeter in Dmitriev, Drigo, Kalinicheva, Shadoba, Ozherelieva, & Matyushkina (2016) formulates "Creative Destruction," which sees innovations that create new versions in production and aggregate output with a formula approach, namely as follows:

$$Y = L^{1-\alpha} \int_0^1 A(i)^{1-\pm} x(i)^{\pm} di \qquad (3)$$

Where L is the labor cost, x (i) is the ith input financing, and A is the characteristic parameter of the resource used. The relationship with the potential impact of innovation is when sector i consists of innovations in A (i) which can be higher than before on the fixed factor$\gamma > 1$ (Dmitriev, Drigo, Kalinicheva, Shadoba, Ozherelieva, & Matyushkina, 2016). If it is assumed that the probability of innovation in sector i occurs for the short term at time dt, which is the same as $\mu * dt$. So that the parameters are:

$$\frac{dA(i)}{A(i)} * \frac{1}{dt} = \begin{cases} (y-1) * \frac{1}{dt} \text{ with probability } \propto * dt \\ 0 \text{ with probability } 1 - \propto * dt \end{cases} \qquad (4)$$

According to equation (4), to estimate growth in A (i) is as follows:

$$E(g) = \mu(\gamma - 1) \qquad (5)$$

The probability of innovation in each sector will be proportional to the performance of the research and development costs incurred, namely: μ

$$\mu = \lambda R/A \qquad (6)$$

Where R is the total amount of research and development costs, with this assumption, there is theoretical support that economic growth can be supported by innovation and human resources through capital modeling as a provision for research and development of innovation and utilization of human resources.

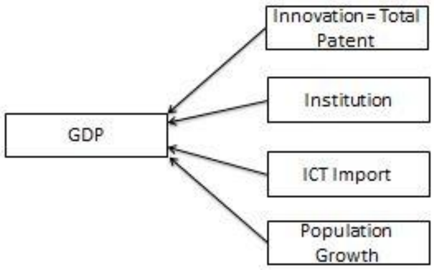
RESEARCH METHODS

3.1 Type of Data

This research uses a hybrid approach, combining proportionally quantitative and qualitative methods so that a more comprehensive approach is found in fact-finding and empirical evidence from the case studies used (Sugiyono, 2013). Data was sourced from the Central Bureau of Statistics of the Republic of Indonesia, World Development Indicators (WDI), and the International Country Risk Guide (ICRG). The data used in this study are data on Indonesia's economic growth (Gross Domestic Product according to constant prices) for 2005-2018, the ICT Imports sector in% of total goods imports, ICT Exports in% of real goods exports, the number of scientific journals indexed by Scopus Indonesia in 2005- 2018 in publication units, scientific journals indexed by Google Scholar for 2005-2018 in publication units, the predicate for Indonesian ICRG institution for 2005-2018, Indonesian Human Development Index for 2005-2018 and population growth rate for 2005-2018. The data comes from the Central Bureau of Statistics, SINTA (Science and Technology Index), Ministry of Research and Technology / National Research and Innovation Agency, and World Development Indicators. In table 1, data is available in descriptive statistics and table 2 shows the correlation number between the data used.

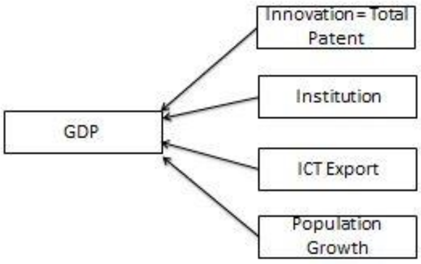
Research using the Autoregressive Distributed Lag (ARDL) method and the Error Correction Model has long been used simultaneously in economic research. ARDL is often used as a research analysis tool based on short-run and long-run dynamic coefficient interaction developed by Pesar et al. (2001), while ECM is often used as a research analysis tool based on the long-run dynamic coefficient. The use of these two methods is seemingly multipurpose to analyze the phenomenon of economic research. Fauzel uses examples from a multitude of research (2017) and Baig, Khan, Gilal, & Qayyum (2018) who analyze macroeconomic variables, economic growth on environmental issues with ARDL bound, and cointegration tests. ARDL and ECM can be used in inflation analysis as in Pahlavani & Mohammad (2009), the determination of interest rates by Bhasin & Nisa (2019), and research on financial reform and credit growth by Adeleye, Osabuohien, & Bowale (2018). In addition, research on economic growth, macroeconomics, and its impact using the ARDL and ECM approaches was used by Mohapatra, Giri, & Sehrawat (2016) and Iheanacho (2017). This proves that the use of both proportional and structured methods can be used in analyzing the phenomenon of economic research. The following is a research framework that uses this study's ARDL and ECM approaches.

Figure 4. Research Framework 1, Model A: Innovation (Total Patent) with ICT Import



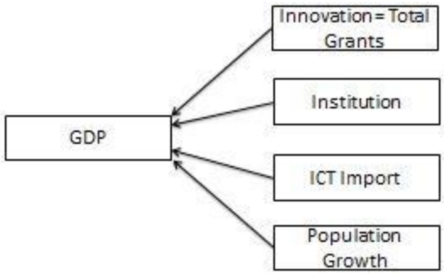
Source: Author's Documents

Figure 5. Research Framework 2, Model B: Innovation (Total Patent) with ICT Export



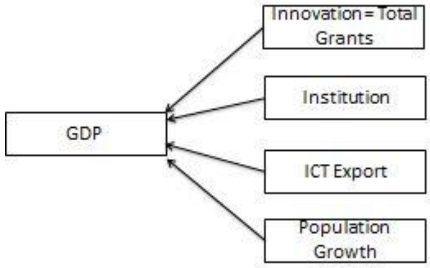
Source: Author's Documents

Figure 6. Research Framework 3, Model C: Innovation (Total Grants) with ICT Import



Source: Author's Documents

Figure 7. Research Framework 4, Model D: Innovation (Total Grants) with ICT Export



Source: Author's Documents

Where (Y) is the dependent variable and (X) is the independent variable. This study focuses on finding the impact of innovation and technology trade on economic growth, while other variables outside technology innovation and trade are supporting variables. In the research framework used for the ARDL approach in finding the short-run and long-run dynamic coefficient, the variables of Indonesia's GDP (Y), innovation (X1), technology trade (X2), institutions (X3) and population (X4) were used. Whereas for the ECM approach in finding the long-run dynamic coefficient, the variables of Indonesia's GDP (Y), innovation (X1), technology trade (X2), institutions (X3), population (X4) were used, in addition to analyzed in the long run we add research articles variable (X5) including total research article publish which indexing by Google Scholar and Scopus.

Table 1. Descriptive Statistics

	Mean	Median	Std Dev.	Min	Max
Indonesia's GDP	5.508571	5.53	5.53	4.63	6.35
Total patent *	6755.5	5962	5962	4304	9754
Total Grant **	1278021	1379610	1552870	773090	252726.7
HDI	69.54643	69,83500	1.636542	66.53	71.76
ICT Imports	7.025555	7,518669	1.776976	3,499214	9.061360
ICT Exports	4,494176	3.956987	1.470317	2.881949	8.106271
Institution	3.334416	3,342803	3,342803	3.018939	3.636364
Population Growth	0.013033	0.013354	0.013354	0.011402	0.013611

Table 2. Correlation

	GDP	Patent	Grant	HDI	ICT-I	ICT-E	INS	PG
GDP	**1**							
Patent *	-0.552	1						
Grant **	0.142	0.007	1					
HDI	-0.521	0.120	-0.135	1				
ICT-I	-0.241	0.387	0.645	0.020	1			
ICT-E	0.266	-0,839	-0,368	0.078	-0,592	1		
Institution	-0.448	0.502	0.131	-0.236	0.098	-0.363	1	
PG	0.547	-0,806	0.284	-0.511	-0.263	0.558	-0.100	1

Information: * = patents including residents and non-residents, ** = Grants including technical cooperation grants, ICT-I = ICT Imports, ICT-E = ICT Exports, HDI = Human Development Index, INS = Institution, PG = Population Growth.

3.2 Model and Data Processing

In finding the impact of innovation and technology on economic growth, Mankiw, Romer, and Well (1992), Knight, Loayza, and Villaneura (1993), Law and Azman-Saini (2013) and Law, Sarmidi, and Goh (2020) use the function formula. Cobb-Douglas production is as follows:

$$Y_t = K_t{}^{\alpha} H_t{}^{\beta} (P_t L_t)^{1-\alpha-\beta} \tag{7}$$

Whereas Y_t is GDP per capita, K is physical capital stock, H is human development, and L is labor. P is the labor-augmenting factor converted into technological progress (innovation), and research performance (institutional quality) in the contribution of research and economic studies and t is time (Law, Sarmidi, & Goh, 2020). It is assumed that this indicates a diminishing return in capital flows $\alpha + \beta < 1$ (Law, Sarmidi, & Goh, 2020). This model suggests that additional labor can be replaced through a capital increase. Suppose we assume that labor is the rate of population growth, and capital is the purchase of technology. In that case, the per capita GDP estimation model is a function of innovation and the use of human resources. The causal relationship between innovation and human resources will be in two parts: encouraging or not encouraging economic growth.

3.3 Autoregressive Distributed Lagged (ARDL)

A time-series data estimation models often give rise to regression models that include the current independent variable (present) and past independent variables (lagged, past, or according to time of $t-1, t-2, \dots, t-s$). This model is called a distributed lag model because of the influence of one independent variable (X) on the dependent variable (Y). Spread over several times (Aqibah, Suciptawati, & Sumarjaya, 2020). Estimates that cause this lag can use Autoregressive Distributed Lagged (ARDL), which is to find short and long-term forecasts using different stationary data applications, and there is cointegration between variables $t-1, t-2, \dots, t-s)$ (Widarjono, 2018). If the model represents two or more independent variables (with one previous year), the formulas described by Gujarati (2006) in Aqibah, Suciptawati, & Sumarjaya (2020) and Rangkuti (2007) are as follows:

$$Y_t = \beta_1 + \beta_{2\beta} X_t + \beta_3 Z_t + \beta_4 Y_{t-1} + u_t \tag{8}$$

Where Y_t is the dependent variable in the t-observation; $X_t Z_t$, is an independent variable; Y_{t-1} is the dependent variable in the t-1 observation, $\beta_1, \beta_2, \beta_3$ is the coefficient of the variable, and u_t is the error term. In ARDL, the dependent economic form of variable Y (dependent variable) is often carried out on other variables X (independent variable), where Y usually responds to X with a specific deadline (Ghozali, 2014).

In Pesar (2001) and Law, Sarmidi and Goh (2020) with the lag length (p, p, p, p, p,) which are as follows:

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$$RGDPC_t = \beta_0 + \sum_{i=1}^{p} \beta_i RGDPC_{t-i} + \sum_{j=0}^{p} \gamma_j \Delta INNO_{t-j} + \sum_{k=0}^{p} \delta_k \Delta INS_{t-k} + \sum_{I=0}^{p} \lambda_I \Delta K_{t-I} + \sum_{m=0}^{p} \varphi_m \Delta HC_{t-m} + \sum_{n=0}^{p} \eta_n \Delta PG_{t-n} + \theta_0 RGDPC_{t-1} + \theta_1 INNO_{t-1} + \theta_2 INS_{t-1} + \theta_3 K_{t-1} + \theta_3 HC_{t-1} + \theta_3 PG_{t-1} + e_t \quad (9)$$

In equation (1), Law, Sarmidi, and Goh (2020) estimate the influence of innovation, institution, physical capital, human capital, and population growth on economic growth in Malaysia. Autoregressive Distributed Lagged (ARDL) Model By taking ARDL (1,1,1,1,1,1) and changes in variables, the effect of the long-term coefficient is formulated as follows (Law, Sarmidi, & Goh, 2020):

$$RGDPC_t = \mu_i + \beta RGDPC_{t-1} + \delta_1 INNO_t + \delta_2 INNO_{t-1} + \delta_3 INS_t + \delta_4 INS_{t-1} + \delta_5 K_t + \delta_6 K_{t-1} + \delta_7 HC_t + \delta_8 HC_{t-1} + \delta_8 PG_t + \delta_8 PG_{t-1} + \varepsilon t \quad (10)$$

Referring to the Law, Sarmidi, & Goh (2020) model, t-1 (the previous first year) is used, which is the reference for the ARDL model. In equation (10) which is simpler to estimate in this study, the equation becomes as follows (by taking ARDL (1,1,1,1,1) in model A, model C and model D and ARDL (1,1,1,0,1) in model B):

$$RGDPC_t = \mu_i + \beta RGDPC_{t-1} + \delta_1 INNO_t + \delta_2 INNO_{t-1} + \delta_3 ICT_t + \delta_4 ICT_{t-1} + \delta_5 INS_t + \delta_6 INS_{t-1} + \delta_7 PG_t + \delta_8 PG_{t-1} + \varepsilon t \quad (11)$$

Where RGDP is Indonesia's GDP, INNO is total patents (in model A and model C) and total grants (in model B and model D), ICT is ICT Imports (in model A and model C) and ICT Exports (in model B and model D), INS is Institution and PG is population growth. In this study, a simpler ARDL model was used to see the long-term impact comprehensively. Based on equation (3), we use the following equation to determine the effect of long-run coefficients:

$$\varphi INNO = \frac{\gamma_1 + \gamma_2}{1 - \beta_i}; \varphi ICT = \frac{\delta_4 + \delta_4}{1 - \beta_i}; \varphi INS = \frac{\eta_1 + \eta_2}{1 - \beta_i}; \varphi PG = \frac{\theta_1 + \theta_2}{1 - \beta_i} \quad (12)$$

3.4 Error Correction Model (ECM)

An Error Correction Model (ECM) is used to find a long-term impact, which corrects short-term imbalances toward long-term equilibrium. Based on the equation Law, Sarmidi, and Goh (2020), the ECM equation used is as follows:

$$\Delta RGDPC_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta RGDPC_{t-i} + \sum_{j=0}^{q} \gamma_1 \Delta INNO_{t-j} + \sum_{k=0}^{r} \delta_1 \Delta ICT_{t-k} + \sum_{m=0}^{s} \eta_m \Delta HDI_{t-m} + \sum_{n=0}^{v} \theta_n \Delta INS_{t-n} + \sum_{o=1}^{w} \tau_1 \Delta PG_{t-0} + \varphi Z_{t-1} + e_t \quad (13)$$

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In equation (13), the variables Inscopus and Ingooglescholar are added so that the model is simplified by adding the test variables to equation (14). The ECM model requires a stationary test and the results after performing a stationary test found all stationary variables at the 2nd difference. The ECM model is used because it is a dynamic model that can correct short-term imbalances towards long-term equilibrium (Silasa, 2016). On the other hand, this model can overcome the slope regression that often occurs in time series data regression analysis (Silasa, 2016). In this study the formula is simplified by using the following model:

$$\Delta Y - t = \alpha + \beta_1 \Delta X_1 + \beta_2 \Delta X_2 + \beta_3 \Delta X_3 + \beta_4 \Delta X_4 + \beta_5 \Delta X_5 + \beta_6 \Delta X_6 \quad (14)$$

$$+\lambda \mathrm{et} - 1 + \varepsilon \mathrm{t}$$

Where:

$\Delta Y - t$	=	Ln (Y) form
ΔX_1	=	form Ln (X_1)
ΔX_2	=	form Ln (X_2)
ΔX_3	=	form Ln (X_3)
ΔX_4	=	form Ln (X_4)
ΔX_5	=	form Ln (X_5)
ΔX_6	=	form Ln (X_6)
α	=	constant
$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$	=	coefficients for each variable
λ	=	coefficient $\mathrm{et} - 1$
$\mathrm{et} - 1$	=	confounding variable
ε	=	*error term*

Where Ln (Y) is Indonesia's GDP, Ln (X_1) is innovation, Ln (X_2) is the number of Scopus-indexed journals, Ln (X_3) is the number of journals indexed by Google Scholar, Ln (X_4) is the human development index, Ln (X_5) is the institution, and Ln (X_6) is population growth. The classical assumption test must be fulfilled in econometric estimation using Ordinary Least Squares (OLS). This classical assumption test aims to produce parameter estimates that are BLUE (best linear unbiased estimator) or have unbiased, consistent, and efficient characteristics. The classical assumption test used is the normality test, heteroscedasticity test, autocorrelation test, and multicollinearity test.

RESULT AND DISCUSSION

4.1. Estimates Autoregressive Distributed Lagged (ARDL)

In the ARDL model, a stationarity test is required. This study used Augmented Dickey-Fuller (ADF) and Philip Perron (PP). It was found that the test variable was stationary in the 2nd difference. The ADP and PP unit root test results are as follows:

Table 3. ADF and PP Unit Root Test (Individual)

Variable	Level		2nd difference	
	ADF	PP	ADF	PP
Indonesia's GDP	-2,353 (0.17)	-2.313 (0.18)	-4.474 (0.01)	-11.449 (0.00)
Total Patent	-0.074 (0.93)	0.016 (0.94)	-4.310 (0.01)	-9.857 (0.00)
Total Grant	-4,762 (0.00)	-2.417 (0.15)	-3.951 (0.02)	-7.854 (0.00)
Institution	-1.969 (0.29)	-9.913 (0.00)	-7.690 (0.00)	-8.219 (0.00)
ICT Imports	-12.52 (0.00)	-3,026 (0.06)	-3,955 (0.01)	-4,983 (0.00)
ICT Exports	-3.131 (0.04)	-3.335 (0.03)	-6.883 (0.00)	-7.773 (0.00)
HDI	-1.635 (0.43)	-1.635 (0.43)	-5.172 (0.00)	-10.302 (0.00)
Scopus	3,251 (1.00)	3,292 (1.00)	-5.386 (0.00)	-5.564 (0.00)
Google Scholar	2,812 (0.99)	3,246 (1.00)	-4,526 (0.00)	0.913 (0.99)
Population Growth	3,791 (1.00)	1,687 (0.99)	-3.575 (0.03)	-1.293 (0.59)

Information: level of confidence 5% = 0.05

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In estimating the effect of innovation on economic growth, four models are formed as a comparison. Model A and Model B uses total patents as the innovation variable, while models C and D use total grants as the innovation variable. Model A and Model C use the ICT Imports variable, and Model B and D use the ICT Exports variable.

Table 4. Linear ARDL Estimation Results and Diagnostic Checks

Variable	Innovation = Total Patent		Innovation = Total Grants	
	Model A	Model B	Model C	Model D
Panel A: Coefficient Estimates of Linear ARDL				
Selected model	(1,1,1,1,1)	(1,1,1,0,1)	(1,1,1,1,1)	(1,1,1,1,1)
Constant	-6.05 (0.10)	5.94 (0.31)	-56.1 (0.32)	24.86 (0.04)
ln Indonesia's GDP				
ln Innovation	0.32 (0.02)	-0.60 (0.18)	0.68 (0.27)	-0.22 (0.17)
ln Institution	-0.26 (0.48)	0.84 (0.44)	0.72 (0.64)	-2.39 (0.04)
ln ICT Importst	0.01 (0.70)		-1.25 (0.31)	
ln ICT Exportst		-0.73 (0.09)		0.53 (0.15)
ln Population Growtht	21.12 (0.00)	-2.13 (0.25)	17.32 (0.13)	10.07 (0.01)
Indonesia's GDP-1	-0.73 (0.02)	0.21 (0.64)	-0.08 (0.81)	-0.79 (0.05)
Innovationt-1	0.66 (0.02)	-1.27 (0.06)	1.11 (0.36)	-0.38 (0.01)
Institutiont-1	0.68 (0.06)	2.61 (0.06)	2.72 (0.04)	3.39 (0.03)
ICT Importst-1	-0.44 (0.00)		-0.28 (0.33)	
ICT Exportst-1		-0.37 (0.21)		-0.81 (0.07)
Population Growtht-1	-21.3 (0.00)		-24.6 (0.18)	-6.88 (0.05)
Panel B: Diagnostic Results				
F-Statistic	83.01555	6.427767	4.926326	14.46589
Prob (F-Statistic)	0.001946	0.044870	0.108249	0.025018
R2	0.996001	0.927827	0.936625	0.977476
Adjusted R2	0.984003	0.783480	0.746498	0.909905
LM (2)	0.2662	0.2032	0.3276	0.1148
RESET Test	0.2986	0.5037	0.2784	0.7555
F-Bounds Test	104.5525	8.562584	8.830209	23,18599
CUSUM (CUSUM2)	S (S)	S (S)	S (S)	S (S)

Table 4 describes the empirical results of the ARDL estimation and diagnostic checks. By using the Ordinary Least Square (OLS) estimation, the estimation in table 4 has met the classic assumption requirements, including the normality test (Jarque-Bera test) and linearity test (Ramsey RESET Test). In addition, the model stability test has been carried out using the CUSUM of square test, which shows the four models are stable. The results show that in Model A, where the number of patents and technology explains the innovation variable by ICT imports, innovation affects economic growth, but technology does not affect economic growth. In model B, the innovation variable is defined by the number of patents and technology by ICT exports, and that innovation does not affect economic growth.

In contrast, technology affect economic growth. Furthermore, in model C, where the innovation variable is explained by the total cost of grants and technology by ICT imports, it is found that innovation has no effect on economic growth and technology has no effect on economic growth. The last model is model D, where the innovation variable is explained by the number of grant costs and technology by ICT exports, it is found that innovation has no effect on economic growth and technology has no effect on economic growth.

Table 5. Impact of the Mix of Innovation and Technology on Short-Term Economic Growth (ARDL Model)

Variable	Innovation = Total Patent Application		Innovation = Total Grants	
	Model A	Model B	Model C	Model D
ln Innovation	Take effect	No effect	No effect	No effect
ln Technology	No effect	Take effect	No effect	No effect

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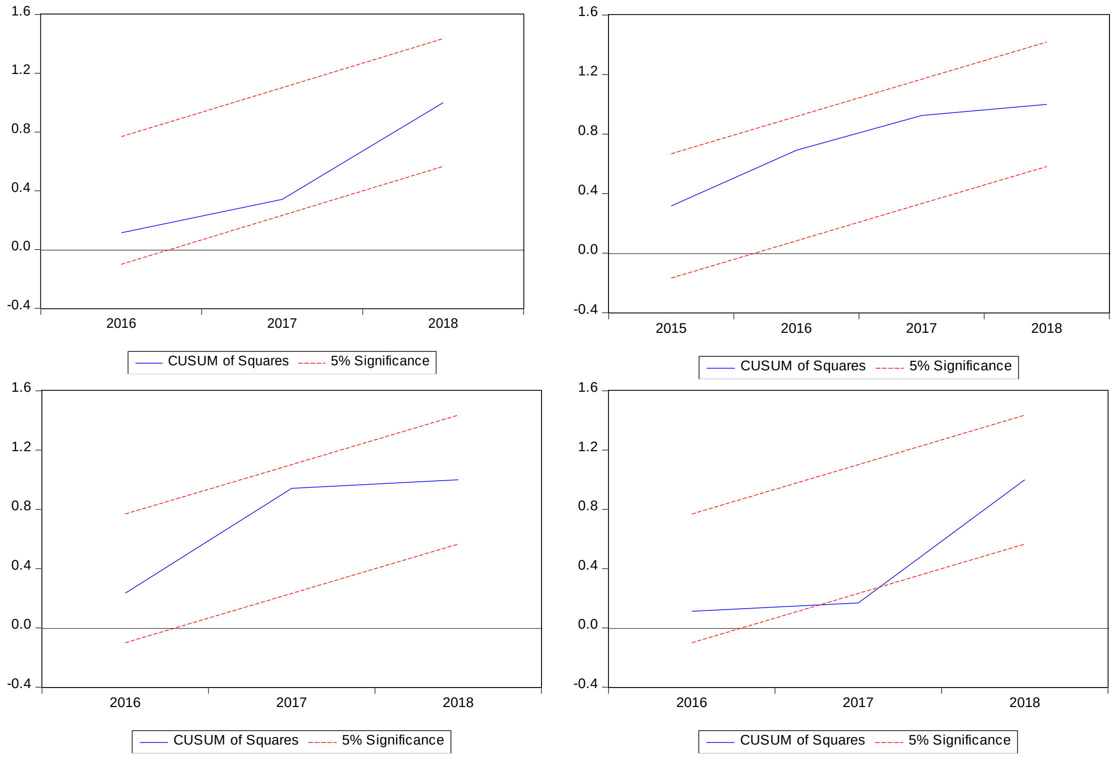
Table 6. Impact of the Mix of Innovation and Technology on Long-Term Economic Growth (ARDL Model)

Variable	Innovation = Total Patent Application		Innovation = Total Grants	
	Model A	**Model B**	**Model C**	**Model D**
ln Innovation	0.56 (0.00)	-2.39 (0.26)	1.67 (0.36)	-0.34 (0.02)
ln ICT Imports	-0.24 (0.00)		-1.42 (0.34)	
ln ICT Exports		-1.41 (0.23)		-0.15 (0.04)
ln Institution	0.24 (0.46)	4.41 (0.36)	3.18 (0.30)	0.55 (0.34)
ln Population Growth	-0.12 (0.72)	-2.72 (0.46)	-6.74 (0.37)	1.78 (0.02)

By doing long-term estimation, Table 6 shows that the relationship between economic growth and innovation (patents) is significantly positive (model A) is not significantly negative (model B). In contrast, the relationship between economic growth and innovation (grants) is not significantly positive (model C) and negative significance (model D). Meanwhile, the other test variables supporting the model, namely institution, are not significant in all models and population growth is only significant in model D.

In the results of other supporting variables, it is found that the institution variable does not affect economic growth. The population growth variable only has an effect at the time of innovation in grant financing and the significant effect of ICT exports on economic growth. This indicates that the bureaucracy does not influence promoting economic growth, and population growth will encourage economic growth if there is an increase in exports and a decrease in grants simultaneously.

Figure 8. CUSUM line on the ARDL Model Stability Test



Source: Author Processing Results

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4.1. Estimated Error Correction Model (ECM)

In time series data analysis, especially using an error correction model, it is necessary to test the stationarity of the data, which can be measured through the level, 1st difference and 2nd difference. This is useful for forming stationary data. Table 6 shows the results of the stationarity test of the data with the seven variables used in the study. The result was that in the 2nd difference. The results of the cointegration test using the Augmented Dickey-Fuller test are as follows:

Table 7. Augmented Dickey-Fuller Cointegration Test Results

		t-statistic	Prob. *
Augmented Dickey-Fuller test Statistic		-6.480109	0.0004
Test critical values	1%	-4.200056	
	5%	-3.175352	
	10%	-2.728985	

Information: level of confidence 95% = 0.05

There is a long-term relationship between test variables that can be used to correct short-term imbalances. In this study, we used the Augmented Dickey-Fuller cointegration test and the residual approach with long-term residuals to meet the stationary test. In Table 7, the results show that all the variables used have passed the cointegration test and can be used in further estimation. After going through the stationary test and cointegration test, it can be estimated through ECM multiple linear regression as follows:

Table 8. Estimation Result of Error Correction Model (ECM)

Variable	Innovation = Total Patent		Innovation = Total Grants	
	Model A	Model B	Model C	Model D
Panel A: Coefficient Estimates of Error Correction Model				
Constant	**0.215 (0.12)**	0.070 (0.41)	0.059 (0.64)	-0.049 (0.68)
ln Innovationt	**-0.341 (0.42)**	-0.492 (0.21)	0.172 (0.35)	0.160 (0.35)
ln Scopust	**-9.018 (0.04)**	-6.774 (0.02)	-4.658 (0.17)	-2.659 (0.35)
ln Google Scholar	**0.145 (0.70)**	0.324 (0.35)	0.231 (0.56)	0.319 (0.40)
ln HDI	**-5.463 (0.00)**	-5.415 (0.00)	-4.833 (0.00)	-4.553 (0.00)
ln ICT Importst	**-0.241 (0.17)**		-0.182 (0.21)	
ln ICT Exportst		-0.453 (0.06)		-0.298 (0.13)
ln Institution	**-2.114 (0.03)**	-1.011 (0.07)	-1.575 (0.04)	-0.750 (0.20)
ln Population Growtht	**-3.330 (0.09)**	-4.217 (0.03)	-2.592 (0.09)	-2,944 (0.05)
Panel B: Diagnostic Results				
F-Statistic	5.480621	8.012963	5,798219	6.800548
Prob (F-statistic)	0.039618	0.017922	0.035342	0.025407
R2	0.884698	0.918155	0.890321	0.904950
Adjusted R2	0.723275	0.803571	0.737670	0.771880

Description: has met the classical assumption test

Table 8 shows that the long-term estimation results show that innovation in models A, B, C, and D is insignificant to economic growth. Besides, in the short term, technology is not significant in models A, C, and D, but only in model B in the form of ICT Exports, which influences economic growth. In models A, B, C, and D, all variables are significant in economic growth. The results showed that the increase in total patents through increasing quality journals indexed by Scopus tends to be able to drive economic growth in the long term. In addition, it is found that in the long term, grants have not been able to contribute to driving economic growth.

CONCLUSION

Innovation is one way to increase the output capacity of each sector. Innovation can create new technologies and methods that can be implemented directly for the effectiveness and efficiency of production. With the

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relationship between innovation and productivity, in theory, there is hope for innovation to boost the quality of economic growth. This study examines the impact of innovation on the performance of economic growth in Indonesia from 2005-2018. Using time series data through short-term (Autoregressive Distributed Lag) and long-term (Error Correction Model) analysis, a pattern has been found with unique characteristics of the effect of innovation and technology on economic growth in Indonesia.

Current research findings have implications for scientists, researchers, other economic sector managers who apply ICT in their activity, and government/policymakers of high education institutions. Notably scientists/researchers and economic sector managers. Scientists/researchers may need to know if they want to start a research project with grants and if the output is patented. This must contribute to economic growth by creating relevant research and giving innovation to enter the market incrementally. It is also to develop straightforward economic offerings by achieving and sustaining competitive advantage in the economic sector; they need to use internal and external ideas to promote their innovative activities.

On the other hand, economic sector managers (managers in any sector of economic growth parameter such as the company in agriculture, mining, etc.) need to open their borders and place more confidence in ICT to support their productivity. Using innovation could discover and search for new collaborations and business connections, contributing to economic growth. Therefore, economic sector managers should take the ICT and innovation result as critical for the innovation that can be radical, transformative, proportionate, and disruptive to existing ways of the business cycle thing to do. The position of government/policymakers is to be a supporting system that supports the scientist, researchers, and other economic sector managers to implement and grow productivity by themselves with legal and other interventions in the government sector.

The number of patents can affect economic growth because they get a large portion of the contribution to the implementation of these sectors. Patents are the results of research (either funded by grants or independently financed) that provide increased productivity, efficiency, and performance effectiveness. This causes the number of patents to boost Indonesia's economic growth. Meanwhile, the amount of grant financing cannot stimulate economic growth. This assumption is valid given that grants are costs incurred by researchers to find valuable discoveries. However, not all grant funding will provide satisfactory research results and encourage sectoral performance.

In contrast, research on the influence pattern of economic growth in other countries shows the effect of good innovation. In the ARDL model, in the short-term analysis, it is found that innovation does not affect economic growth. This is due to the characteristics in Indonesia that are not quick to respond to research results, as evidenced by the highest number of Scopus and Google Scholar-indexed journals in Southeast Asia. Still, at the same time, Indonesia's economic growth is stagnant at 5.0% -5.3%. In addition, in the short-term technology, only exports have significance for economic growth with the innovation variable assumed by grants. This indicates that the need for grants that encourage technology exports will be able to boost economic growth. Then export-oriented innovation will be able to promote short-term economic growth in Indonesia.

In the ECM model, in the long-term analysis, it is found that innovation affects economic growth only if it is supported by technology transfer from abroad. On the other hand, innovation in grants will also be a driver of economic growth in the event of a surge in technology exports abroad. This indicates the characteristics of innovation and technology in Indonesia, namely that domestic innovation will increase in line with the increasing export demand for technology. In addition, the existence of technology transfer from abroad will respond with increased research and the number of domestic patents in the long term. In the long-term model of the ECM, it is found that in the long-term analysis, the increase in total patents through the improvement of quality journals indexed by Scopus tends to be able to drive economic growth in the long term. In addition, it was found that grants had not been able to contribute to stimulating economic growth. In the long-term ARDL and long-term ECM models, it is found that technology trade has a phenomenon where technology exports and imports have different characteristics in driving economic growth.

On the one hand, exports driven by grants can encourage economic growth, and imports are used as an increase in rights research. Patents are also able to promote economic growth. Besides the phenomena and scenarios in both cases, technology trade has not played enough role in driving economic growth in developing countries.

The current research, its suggestions, its findings, and empirical evidence tend by a literature review to be of great importance in the literature and practice due to their theoretical and practical implications. The current study and its findings will contribute to the literature and research by overcoming the existing gap in the literature with mediating roles of interaction between innovation to economic growth and technology trade to economic growth with an economic model. The proposed theoretical model is tested using an econometric technique focusing on an autoregressive distributed lag and error correction model. The empirical evidence supports the proposed theory explaining the mechanism of improving economic growth with implemented of innovation and the adoption of ICT technology with a trading approach. The model presented in this study will help policymakers, researchers, and practitioners understand innovation and technology trade's effect on economic growth performance.

Furthermore, these current findings will enhance the literature about the economy of innovation, technology trade, and economic growth. Practically, the study's results will help scientists, researchers, and other economic sector managers who apply ICT to their activity. The government as policymakers can use this study as a consideration in making policy regarding high education institutions; to understand how they can improve economic growth by implementing innovation and adopting technology trade in the economy. Developing and executing an effective business cycle and policies will be another requirement to support economic growth performance in future research.

REFERENCES

Abeltina, A. (2007). The Role of Innovation in Economic Development. *Ekonomika ir Vadyka: Aktualijos ir Perspektyvos*, 5-9.

Adeleye, N., Osabuohien, E., & Bowale, E. (2018). Financial Reforms and Credit Growth in Nigeria: Empirical Insights from ARDL and ECM Tehniques. *International Review of Applied Economics Vol. 32 Issue 6*, 1-15.

Ali, N., & Mingque, Y. (2018). An Application of Vector Error Correction Model Approach in Explaining the Impact of Foreign Direct Investment on Economic Growth of Asian Developing Countries. *International Journal of Economics and Financial Issues*, 133-139.

Aqibah, M., Suciptawati, N., & Sumarjaya, I. (2020). Model Dinamis Autoregressive Distributed Lag (Studi Kasus: Pengaruh Kurs Dolar Amerika dan Inflasi Terhadap Harga Saham Tahun 2014-2018). *E-Jurnal Matematika Vol. 9 No. 4* , 240-250.

Astuti, P. B., & Khasanah , N. (2020). Determinants of Indonesia's National Income: An Auto-Regressive Distributed Lag Analysis. *Signifikan: Jurnal Ilmu Ekonomi*, 207-218.

Baig, N., Khan, S., Gilal, N., & Qayyum, A. (2018). Do Natural Disasters Cause Economic Growth? An ARDL Bound Testing Approach. *Studies in Business and Economics*, 5-20.

Baneliene, R., Melnikas, B., Strazdas, R., & Tolocka, E. (2018). Innovation Activities and The Impact of Investment in R&D on Economic Growth: Assessment and Modelling. *Terra Economicus Vol. 16 No. 4*, 66-76.

Bhasin, K., & Nisa, S. (2019). Macroeconomic Variables and Their Impact on Exchange Rate Fluctuation: ARDL Bound Testing Approach. *International Journal of Scientific & Technology Research Vol. 8 Issues 12*, 2277-2282.

Blanco, L. (2013). The Impact of Research and Development on Economic Growth and Productivity in the US States. *Pepperdine Digital Commons, School of Public Policy Working Papers*, 1-54.

Bouhajeb, M., Mefteh, H., & Ammar, R. (2018). Higher Education and Economic Growth: The Importance of

Innovation. *Atlantic Review of Economics (ARoEc) Vol. 1*, 1-21.

Cantwell, J. (2001). Innovation, Profits, and Growth: Schumpeter and Penrose. *School of Economics, Henley Business Scholl, University of Reading*, 1-29.

Cetin, M. (2013). The Hypothesis of Innovation-Based Economic Growth: A Causal Relationship. *International Journal of Economic and Administrative Studies*, 1-16.

Chaudhry, N. I., Asad, H., Ch., M., & Hussian, R. (2020). Environmental Innovation and Financing Performance: Mediating Role of Environmental Management Accounting and Firm's Environmental Strategy. *Pakistan Journal of Commerce and Social Sciences Vol. 14*, 815-837.

Ciborowski, R. (2016). Innovation Systems in terms of Schumpeterian Creative Destruction. *EUREKA: Social and Humanities*, 29-37.

Daley, W. (2014). In Search of Optimality: Innovation, Economic Development, and Intellectual Property Rights. *GSDR Prototype Briefs*, 1-6.

Deledi, M., Mazzucato, M., Agnolucci, P., Lipsis, V., & Ryan-Collins, J. (2019). The Macroeconomic Impact of Government Innovation Policies: A Quantitative Assessment. *Policy Report, UCL Institute for Innovation and Public Purpose*, 1-52.

Diebolt, C., & Hippe, R. (2016). The Long-Run Impact of Human Capital on Innovation and Economic Development in The Regions of Europe. *Bureau d'economie theorique et appliquee*, 1-50.

Dmitriev, S., Drigo, M., Kalinicheva, V., Shadoba, E., Ozherelieva, M., & Matyushkina, I. (2016). Innovation, Economic Growth, and Inequality. *International Review of Management and Marketing*, 316-321.

Ekananda, M., & Suryanto, T. (2017). The Autoregressive Distributed Lag Model to Analyze Soybean Prices in Indonesia. *MATEC Web of Conference 150.* 1-5: MUCET.

Firmansyah, M. F. (2021). Analisis Pertumbuhan Ekonomi Dalam Penentuan Basis Ekonomi, Isu Ketimpangan Dan Lingkungan Di Jawa Barat Periode 2010-2019. *Jambura Economic Education Journal*, 3(1), 8-27.

Firmansyah, M. F. (2018). Pengaruh Komunikasi Politic Entertainment Melalui Iklan Terhadap Tingkat Keterpilihan Partai Politik pada Pemilihan Umum 2019. *Jurnal Gama Societa*, 9-18.

Firmansyah, M. F., & Maulana, H. Z. (2021). Empirical Study of E-Learning on Financial Literacy and Lifestyle: A Millenial Urban Generations Cased Study. *International Journal of Engineering, Science and Information Technology*, 1(3), 75-81

Firmansyah, M. F., & Nasution, F. (2020). Indeks Kepuasan Publik Bidang Pariwisata dan Strategi Pengembangan Pariwisata di Wilayah Priangan Timur. *Jurnal Welfare Vol. No.* , 118-131.

Fitria, A., & Rizki, C. (2018). Pengaruh Realisasi Belanja Modal Terhadap Pertumbuhan Ekonomi di Provinsi Aceh. *Jurnal Ilmiah Mahasiswa (JIM) Ekonomi Pembangunan Vol. 3 No. 4*, 506-513.

Ghozali, I. (2014). *Ekonometrika: Teori, Konsep dan Aplikasi dengan IBM SPSS 22.* Semarang: Badan Penerbit Universitas Diponegoro.

Gujarati, D. (2010). *Dasar-Dasar Ekonometrika.* Jakarta: Salemba Empat.

Hagedorn, J. (1996). Innovation and Entrepreneurship: Schumpeter Revisited. *Industrial and Corporate Change Vol. 5*, 883-896.

Hassan, M. u., & Iqbal, A. (2020). Open Innovation and Innovative Performance of Pakistani SMEs: Moderated Mediation of Knowledge Management Capability and Innovative Climate. *Pakistan Journal* *of Commerce and Social Sciences Vol. 14*, 962-990.

Hill, H. (2018). Economic Growth And Macroeconomic Management in An Uncertain Global Environment. *11th International Conference and Call for Paper Bulletin of Monetary Economics and Banking (BMEB)* (pp. 17-25). Jakarta: Bank Indonesia.

Hussain, M. F., Afzal, A., Asif, M., Ahmad, N., & Bilal, R. (2011). Impact of Innovation, Technology and Economic Growth on Entrepreneurship. *American International Journal of Contemporary Research Vol. 1 No. 1*, 45-51.

Iheanacho, E. (2017). ARDL Approach to Trade Liberalisation and Economic Growth in the Developing Country: Evidence from Nigeria. *African Research Review: An International Multi-Disciplinary Journal, Ethiopia*, 138-159.

Ildirar, M., Ozmen, M., & Iscan, E. (2016). The Effect of Research and Development Expenditure on Economic Growth: New Evidence. *International Conference on Eurasian Economies*, 36-43.

Ismail, M. (2014). *Sistem Ekonomi Indonesia.* Jakarta: Erlangga.

Jorgenson, D. W. (2011). Innovation and Productivity Growth. *Oxford University Press*, 276-296.

Josheski, D., & Lazarov, D. (2016). Empirical Estimation of IS-LM Model for The US Economy by Applying Jmulti. *Journal of Economics*, 1-13.

Khan, M. K., Teng, J.-Z., Parvaiz, J., & Chaudhary, S. (2017). Nexuses between Economic Factors and Stock Returns in China. *International Journal of Economics and Finance Vol. 9 No. 9*, 182-191.

Kindleberger, C. P. (1977). *Economic Development, Third Edition.* New York: McGraw-Hill.

Korres, G. M., & Drakopoulos, S. (2009). Economics of Innovation: A Review in Theory and Models. *European Research Studies Vol. 12 No. 3*, 25-38.

Kuncoro, M. (2010). *Ekonomika Pembangunan: Masalah, Kebijakan, dan Politik.* Jakarta: Erlangga.

Kurtovic, S. (2017). The Effect of Depreciation of the Exchange Rate on the Trade Balance of Albania. *Review of Economic Perspectives*, 141-158.

Lankauskiene, T. (2015). *Economic Structure and Economic Growth Evaluation.* Vilnius, Lithuania: Vilnius Gediminas Technical University.

Law, S. H., Sarmidi, T., & Goh, L. (2020). Impact of Innovation on Economic Growth: Evidence from Malaysia. *Malaysian Journal of Economic Studies*, 113-132.

Lazzarotti, F., Dalfovo, M., & Hoffmann, E. (2011). A Bibliometric Study of Innovation Based on Schumpeter. *Journal of Technology Management & Innovation*, 121-135.

Mankiw, G. (2013). *Pengantar Ekonomi Makro: Principles of Econonomics, An Asian Edition-Volume 2.* Jakarta: Salemba Empat.

Mankiw, N. G., Quah, E., & Wilson, P. (2014). *Pengantar Ekonomi Mikro.* Jakarta: Salemba Empat.

Maradana, R. P., Pradhan, R., Dash, S., Gaurav, K., Jayakumar, M., & Chatterjee, D. (2017). Does Innovation Promote Economic Growth? Evidence from European Countries. *Journal of Innovation and Entrepreneurship*, 1-23.

Mitra, A., & Jha, A. (2015). Innovation and Employment: A Firm-Level Study of Indian Industries. *Eurasian Business Review*, 45-71.

Mohapatra, G., Giri, A., & Sehrawat, M. (2016). Foreign Aid, Macroeconomic Policies and Economic Growth Nexus in India: An ARDL Bounds Testing Approach. *Theoretical and Applied Economics*, 183-202.

Mwinzi, D. M. (2014). The Effect of Financial Innovation on Economic Growth in Kenya. *Thesis*, 1-44.

Nafziger, E. W. (2005). *Economic Development.* Cambridge: Cambridge University Press.

Naude, W., & Nagler, P. (2017). Technological Innovation and Inclusive Growth in Germany. *IZA Institute of Labor Economics: Discussion Paper Series*, 1-57.

Navarro, J. C., Benavente, J., & Crespi, G. (2016). The New Imperative of Innovation: Policy Perspectives for Latin America and The Caribbean. *Inter-American Development Bank (IDB)*, 1-108.

Nurahman, M. C., Wahyuningsih, S., & Yuniarti, D. (2016). Dynamic Model: Autoregressive and Distribution Lag (Case Study: Effects of US Dollar Exchange Rate Against Gross Regional Domestic Product (GRDP)). *Jurnal Eksponensial Vol. 7 No. 2* , 139-146.

Nyumuah, F. S. (2017). An Investigation into The Interest Elasticity of Demand for Money in Developing Countries: A Panel Data Approach. *International Journal of Economics and Finance*, 69-80.

Pahlavani, M., & Mohammad, R. (2009). Sources of Inflation in Iran: An Application of The ARDL Approach. *International Journal of Applied Econometrics and Quantitative Studies Vol. 6*, 61-76.

Permatasari, G. M., & Filianti, D. (2020). The Determinant Analysis of Profitability in The Sharia Banking Industry in 2011-2018 Using Auto Regresive Distributed Lag (ARDL) Approach. *Jurnal Ekonomi Syariah Teori dan Terapan Vol. 7 No. 6*, 1102-1117.

Pesaran, M. H., Shin, Y., & Smith, R. (2001). Bounds testing approaches to the analysis of level. *Journal of Applied Econometrics Vol. 16 No. 3*, 289-326.

Petrariu, I. R., Bumbac , R., & Ciobanu, R. (2013). Innovation: A Path to Competitiveness and Economic Growth The Case of CEE Countries. *Theoretical and Applied Economics Vol. 20 No. 5*, 15-26.

Qamruzzaman, M. (2017). Innovation and Economic Growth: Evidence From Financial Institutional Innovation. *RISUS Journal on Innovation and Sustainability Vol. 8 No. 2*, 126-141.

Rangkuti, A. (2007). Kombinasi Penaksiran Model Lag Terdistribusi Dengan Ekspektasi Adaptif dan Penyesuaian Parsial. *Jurnal Matematika, Statistika dan Komputasi Vol. 3 No. 2*, 96-102.

Samueli, A. O. (2020). Does Government Spending Reduce Poverty in Nigeria? Evidence from Autoregressive Distributed Lag Specification. *Ekonomi Bisnis Vol. 25 No. 1*, 14-25.

Siburian, M. E. (2014). Forecasting Indonesian Money Demand Function with Autoregressive Distributed Lag (ARDL) Model. *Jurnal BPPK*, 111-122.

Sieng, L. W., & Yussof, I. (2014). Human Capital Accumulation and Economic Growth in Malaysia - Investigating the Long Run Nexus. *Jurnal Ekonomi Malaysia*, 155-165.

Silasa, H. A. (2016). Analisis Jangka Panjang dan Jangka Pendek Variabel Makrekonomi Dalam Upaya Menstabilkan Inflasi di Indonesia. *Jurnal Ilmiah Mahasiswa FEB Universitas Brawijaya*, 1-22.

Sipahutar, M. A., Oktaviani, R., Siregar, H., & Juanda, B. (2016). Effects of Credit on Economic Growth, Unemployment and Poverty. *Jurnal Ekonomi Pembangunan*, 37-49.

Sledzik, K. (2013). Schumpeter's View on Innovation and Entrepreneurship. *SSRN Electronic Journal*, 89-95.

Sohibien, G. P. (2017). Application of Threshold Vector Error Correction Model (TVECM) in Describing Adjustment of Interest Rate of Working Capital Credit to BI Rate Movement. *Journal of Science and Science Education*, 31-43.

Somantri, A., & Muhidin, S. A. (2014). *Aplikasi Statistika Dalam Penelitian.* Bandung: Pustaka Setia.

Stimson, R. J., Stough, R., & Roberts, B. (2006). *Regional Economic Development: Analysis and Planning Strategy.* New York: Springer Berlin Heidelberg.

Strauss, A., & Corbin, J. (2003). *Dasar-Dasar Penelitian Kualitatif, Tata Langkah dan Teknik-Teknik Teoritisasi Data.* Yogyakarta: Pustaka Pelajar.

Su, P., Jiang, X., & Sun, W. (2018). The Flexible Acceleration Mechanism of China's Capital Adjustment with the Goal of Consumption-Driven Sustainable Growth. *Sustainability*, 1-20.

Subramanian, K. V. (2018). Dismissal Laws, Innovation, and Economic Growth. *ADBI Working Paper Series*, 1-48.

Sugiyono. (2013). *Metode Penelitian Kuantitatif, Kualitatif dan R&D.* Bandung: Alfabeta.

Sukirno, S. (2004). *Pengantar Teori Makroekonomi.* Jakarta: RajaGrafindo Persada.

Syrquin, M. (2005). Kuznets and Modern Economic Growth Fifty Years Later. *Thinking Ahead: The Future of Development Economics* (pp. 1-15). Helsinki: WIDER Conference.

Teixeira, A., & Fortuna, N. (2003). Human Capital, Innovation Capability and Economic Growth Portugal 1960-2001. *Working Papers Da Fep, Investigacao*, 1-26.

Todaro, M. P., & Smith, S. C. (2003). *Pembangunan Ekonomi di Dunia Ketiga.* Jakarta: Erlangga.

Widarjono, A. (2018). *Ekonometrika.* Tangerang Selatan: Universitas Terbuka.

Yunanto, M., & Medyawati, H. (2014). Monetary and Fiscal Policy Analysis: Which is More Effective? *Journal of Indonesian Economy and Business*, 222-236.

Ziemnowicz C. (2013) Joseph A. Schumpeter and Innovation. In: Carayannis E.G. (eds) Encyclopedia of Creativity, Invention, Innovation and Entrepreneurship. Springer, New York, NY. https://doi.org/10.1007/978-1-4614-3858-8_476