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The Effect of Research and Development (R&D) Investment, E-Commerce Company Employee, And E-Commerce Transaction Volume On Economic Growth In Indonesia 2010Q1 – 2020Q4

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Abstract
Purpose: This study aims to analyze the effect of R&D investment, the volume of e-commerce transactions, and e-commerce companies' employees on economic growth in Indonesia for the period 2010Q1 – 2020 Q4.
Research methodology: The analytical method used in this study is OLS (Ordinary Least Square) and a method using time series data in the form of quarterly from 2010 to 2020. In conducting this research the author uses the help of the E-views 9 analysis tool.
Results: The results of this study are that the variables of R&D investment, e-commerce companies' employees, and the volume of e-commerce transactions have a partial or joint effect on economic growth in Indonesia from 2010 Q1 to 2020 Q4.
Limitations: This research is limited by several factors, among others; R&D investment, e-commerce companies' employees, and volume of e-commerce transactions.
Contribution: The results obtained from this research are expected to be one of the references in making policy directions based on the data presented to adjust the right policies, especially to achieve economic digitization in Indonesia.
Keywords: *Investment, E-Commerce, Economics Growth*
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1. Introduction

Technological progress has developed rapidly and comprehensively and knows no boundaries of time, region, and age. The development of technology has gone through several phases and stages, until the application of technology to all sectors and elements used by humans themselves. The application of technology in the economic field in particular, has a significant impact on the final productivity of the goods or services produced (Snowden, 2008). In the era of globalization of the digital economy, the success of economic activity is largely determined by the transformation process that can add added value to input goods to produce maximum output. Economic digitization was first introduced by Don Tapscott in 1995. Don Tapscott argues that the notion of the digital economy is a system of economic, political, and social which has the characteristic of being an information space from various instruments such as access, capacity, and existing information processing (Sayekti, 2020).

The digitalization of the economy is an indicator of a new direction of development towards an efficient and comprehensive economy. The challenge of economic digitization lies in the absorption and readiness of society in adapting to technology. Economic digitization supports various lines of the

economic sector, especially the creative industry and SMEs (Small and Medium Enterprises. Barriers to the creative industry and conventional MSEs are the distribution process and finding new markets in the midst of competition for existing products.

The technology that is currently one of the sources of transformation in the economic field is the internet. The internet is a network of computers or other electronic devices that are connected to each other (Chen & Kimura, 2020). The existence of an internet network can make connection and communication easier even though it is different in time and region. The integration between the internet and economic activities, especially in Indonesia, has been widely carried out. The perceived benefits of the internet enable individuals, households and companies to carry out their activities effectively and efficiently so that economies of scale can be realized more quickly.

All activities related to the use of technology in the economic sector in Indonesia are nothing but increasing the productivity of the goods and services produced. The resulting increase in output is closely related to conditions of economic growth. Economic growth is an increase in the ability to manage the economy to produce goods and services in a certain period of time (Pertiwi & Sustikarini, 2006). The following is the development of economic growth in Indonesia from the first quarter of 2010 to the fourth quarter of 2020:

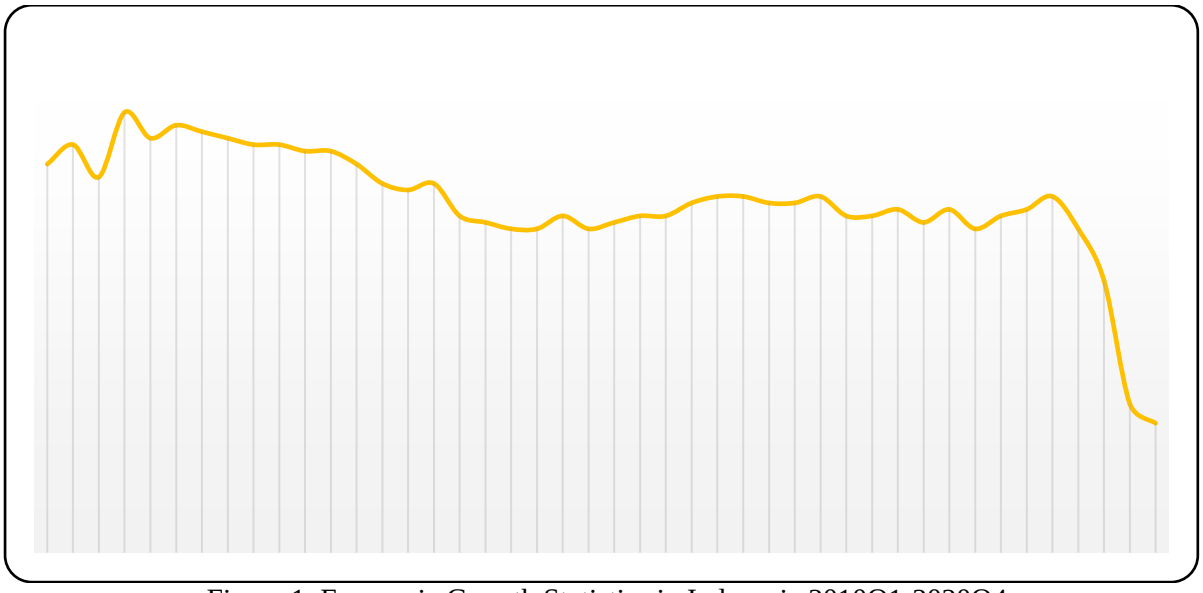

Figure 1. Economic Growth Statistics in Indonesia 2010Q1-2020Q4

The presence of technological advances such as the internet can bring convenience to economic transactions. The development of this technology must be accompanied by further development and research to be able to produce derivative products that can adapt to current and future conditions. Based on the endogenous growth model pioneered by Romer (1986) technological innovations are created in the Research and Development (R&D) sector. R&D is an investment activity or investment carried out to improve the quality of existing goods and services or to develop new products and services (Kutlača et al., 2020).

R&D investment always goes hand in hand with the maximum use of Human Resources (HR) and knowledge resources. Innovations made in the R&D sector lead to a sustainable increase in final goods and services to increase economic growth. R&D investment has an important role as well as an effective tool to determine the company's competitive advantage (Ulku, 2004). The expected output with the R&D investment made in the company is the emergence of innovations that will increase competitiveness so that the company has a competitive advantage in the economic field in particular.

Connolly and Hirschey (2005) state that R&D can change small companies to develop and generate higher returns and can cause large companies to maintain market share and competitive advantage.

The development of R&D investment in Indonesia has fluctuated movements. In 2015 there was a significant increase because R&D investment was focused by the Indonesian government on helping the realization of the digital economy (Dianari, 2019). The average R&D investment in Indonesia from 2010 to 2020 is 0.38%. This figure is still far adrift from countries around Indonesia such as Malaysia at 1.07% and Singapore at 2.6%. The movement of Indonesia's economic growth and R&D investment in 2010-2020 shows a positive relationship. This is confirmed by research conducted by Yang and Chen (2016) finding that there is a significant influence between R&D investment and economic growth in Indonesia. R&D investment is an investment made with the aim of developing various systems, especially technology as a tool to realize economies of scale. The impact of the R&D investment can provide effectiveness in production so as to increase the output of final goods and services, this will have an effect on increasing economic growth.

The success of R&D investment is influenced by various factors including the company's financial condition, funding sources, and support from the government. The research and development carried out by the company in R&D investment aim to be able to increase the scale of sales volume so that the company's financial condition is getting better and the workforce is more prosperous. Companies engaged in the retail of goods and services are currently taking full advantage of R&D investments for the development and further use of the internet. One of the sub-products produced by internet technology is e-commerce. E-commerce is a transaction of buying and selling goods or services through an integrated system with the internet or other computer networks (Achjari, 2000).

E-commerce is an online platform that is considered a means other than conventional markets in terms of product marketing. The advantages of e-commerce that can be accessed anytime, anywhere, and by anyone are considered very appropriate as a means of online marketing and can reduce production costs so that company profits can be maximized. Indonesia is a country that is a destination for e-commerce companies because the number of people and the tendency to consume is quite high (Pradana, 2016). Various advantages of using e-commerce are considered suitable for various businesses and businesses in Indonesia because they can be an alternative to solving the main problems in Small and Medium Enterprises, namely marketing. The dynamics of competition in the business world will be faced by economic actors both conventionally and digitally. Digital competition must be prepared by the Indonesian people for the development of business strategies and increasing added value. There are big e-commerce companies in Indonesia, including; Shopee, Tokopedia, Lazada, OLX, Bukalapak, and BliBli. These various e-commerce platforms produce output in the form of volume of the transaction value.

The volume of e-commerce transactions in Indonesia has increased significantly. This reflects that e-commerce provides an easy transaction, seller and buyer trust, and the right means to develop individual or company businesses. According to Bank Indonesia (2021), Indonesian people's preference for online shopping is increasing. Bank Indonesia (BI) estimates that the volume of transaction value in Indonesia's fourteen largest e-commerce platforms will reach 456 trillion throughout 2020. The volume of this transaction value has increased rapidly from the overall transaction value in 2019, which was 265 trillion rupiah. The pandemic conditions in 2020 the value of e-commerce transactions actually increased. This indicates that an e-commerce platform is an alternative place for buying and selling, finding new markets, and expanding marketing networks amidst uncertain economic conditions.

The movement of the volume of e-commerce transactions always increases from year to year but is not followed by an increase in economic growth. Research conducted by Qu & Chen (2014), Sixun Liu (2013), and Dianari (2019) found that there is a positive influence between the volume of e-commerce transactions and economic growth. The more people who access, use, and transact on e-commerce platforms, the volume of transactions will also increase. This increase in transaction volume in e-

commerce will be recorded as an increase in consumption on the macroeconomic side. This causes an increase in the value of final goods and services in an economy and will directly affect economic growth. The discrepancy between what happened in Indonesia and previous research is a problem that will be discussed in this study.

Based on the endogenous theory related to economic growth in addition to investment and technological progress, there is another factor, namely labor. The workforce is an important part of shaping growth. According to Law No. 13 of 2003 Chapter I Article 1 paragraph 2 related to labor, that everyone who can work to produce goods or services both to meet their own needs and for the community is referred to as labor. The development of e-commerce also has an impact on increasing the number of workers working for e-commerce companies in Indonesia. Based on *Badan Pusat Statistik* (2020) the number of employees for e-commerce companies comes from 39 e-commerce companies classified based on the largest number of assets. Statistically, the growth in the number of the largest workforce of e-commerce companies was 2016 by 28% from 2015. This increase is in line with the opening of investment in Indonesia in the digital sector in particular (Dianari, 2019).

Research conducted by Qu and Chen (2014), Box, Sarah, And Gonzalez (2017), and Couture et al. (2018) found that the workforce in the e-commerce sector has a positive effect on economic growth. An increase in the number of workers will lead to production at a better level, the more goods and services produced in an economy. The increase in the number of workers accompanied by an increase in the ability of the workforce will result in maximum and efficient productivity. This will have an impact on increasing economic growth.

The main problem in this study focuses on a significant increase in the volume of e-commerce transactions in Indonesia but is not accompanied by a significant increase in economic growth, even tends to fluctuate. Based on research from Dianari (2019) and Qu & Chen (2014) found that an increase in the volume of e-commerce transactions will have a positive impact on economic growth.

2. Literature Review and Hypothesis Development

Economics Growth Theory

Classical Economic Growth Theory

This theory was pioneered by Adam Smith, David Ricardo, Malthus, and John Stuart Mill. According to this theory, economic growth is influenced by four factors, namely population, amount of capital goods, land area factor, natural wealth and technology used. Economic growth depends on many factors, classical economists mainly focus on the effect of population growth on the growth of economic growth. If there is a shortage of population and relatively excess natural wealth, the rate of return on investment from the investment will be higher and investors will experience more and more profits, giving rise to new investments and economic growth will be realized. If the population is too large, the increase will reduce the negative level, so the prosperity of the community will decrease (Sukirno, 2004).

Neo-Classical Economic Growth

The neoclassical growth theory developed by Robert M. Sollow and T. W. Swan is a refinement of the earlier classical theory. According to neo-classical theory, economic growth depends on the availability of production factors, labor, capital accumulation and the level of technological progress (Arsyad, 2010). The analysis of this theory is based on assumptions from classical theory, namely that the economy is at full employment and full utilization of its production factors. This model explains that the technology used determines the amount of output produced from a certain amount of capital and labor. The classical neon growth theory presented in the Cobb-Douglas function emphasizes the role of capital, labor and technology as factors of production. According to Sollow, population growth is based on technology, although technology is still considered an exogenous factor, the production function can be formulated as follows:

$$\mathbf{Y = F\ (K,L,\ X\ E)}$$

Where E is a variable called labor efficiency. L X E measures the number of effective workers taking into account the number of workers L and the efficiency of each worker. This production function states that the total output Y depends on the number of units of capital K and the number of effective workers L X E. This means that the increase in labor efficiency E is in line with the increase in labor force L (Mankiw, 2004). In this model, it will temporarily encourage economic growth, but the return on capital that will increasingly encourage the achievement of a stable economy will depend on technological advances.

New Economics Growth Theory

Based on the theory of endogenous growth, saving and investment can promote sustainable economic growth, with K (capital) being assumed to be broader, including science. Paul Romer explains three basic elements in endogenous growth, namely endogenous technological progress through a process of accumulation of knowledge, new ideas by companies as a result of science, and the production of consumer goods produced by the production factors of science will grow steadily. Comprehensive and without limits (Arsyad, 2016). So that the economic growth model built is as follows:

$$\mathbf{Y(t) = K(t)^{\alpha}\, H(t)^{\beta}\, \{A(t)\, L(t)\}^{1-\alpha-\beta}}$$

Information:

K = Capital
H = Accumulated human capital
A = Technological development
L = Labor

R&D Investment Theory

Based on Law Number 25 of 2007 concerning Investment, investment or investment is all forms of investment activities, whether carried out by domestic investors or foreign investors to carry out economic activities in the territory of Indonesia. Research and development (R&D) investment is the realization of investments made by top managers in research activities to acquire new knowledge, skills and technologies.

R&D investment can be in the form of investment in intangible assets, so it has consequences and risks that are quite high for the company. R&D investment is closely related to company risk (Sheikh & Wang, 2011). Research and development (R&D) activities have high risk and cost consequences, so financial capacity is needed to fund these investments. The success of R&D investment is also influenced by the size of the company, where the larger the company's assets are expected to be able to finance the R&D investment. Research and Development is the best investment decision related to the long-term value creation of the company and is a very important decision.

E-commerce Company Labor Theory

Based on the Manpower Act Number 13 of 2003 Article 1 Paragraph 2; Manpower is every person who is able to do work to produce goods and/or services both to meet their own needs and for the community. The working age set by the Indonesian government is the population aged 15 to 64 years. E-commerce company workforce is everyone who works for companies that have a main business in the retail sector and are connected online (Americo & Veronico, 2018).

E-commerce Theory

E-commerce (Electronic commerce) is a derivative product from the internet that is used as a means of business using computer networks and has been known since the early 1980s. The initial stage of e-commerce was carried out only between companies in the form of buying and selling transactions facilitated by Electronic Data Interchange (EDI). In general, e-commerce can be defined as all forms of

trade transactions in goods or services using electronic media, this electronic media is focused on the use of internet media (Pradana, 2016).

In early 2000, many websites provided the means to conduct buying and selling transactions with various multimedia data features such as images, videos, sounds, and animations. There are three types of business in e-commerce, namely B2B (business to business); transactions between suppliers and producing companies, B2C (business to consumer); transactions between producers and end users, and C2C (consumer to consumer); transactions between two or more end users. The buying and selling process in e-commerce that distinguishes it from the conventional buying and selling process is that all processes start from finding information about the goods or services needed, placing orders, to making payments electronically via the internet (Purohit & Purohit, 2005).

The Indonesian government itself has issued a law related to e-commerce and is represented by the Ministry of Communication and Information of the Republic of Indonesia (KOMINFO) through the Press Release of the Ministry of Communication and Information Technology No. 83/HM/KOMINFO/11/2016 submitted several revisions to Law no. 11 of 2008 concerning Information and Electronic Transactions. The result of the revision is a collection of aspirations submitted by Non-Governmental Organizations (NGOs), practitioners, academics, and the community. The revision is of the essence that there will be no criminalization of existing cases and asks that the accused person is not immediately detained.

Hypothesis Development

Technological progress has developed rapidly and comprehensively and knows no boundaries of time, region, and age. The development of technology has gone through several phases and stages, until the application of technology in all sectors and elements used by humans themselves. The application of technology in the economic field in particular, has a significant impact on the final productivity of the goods or services produced (Snowden, 2008).

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Research conducted by Qu & Chen (2014a), Sixun Liu (2013), and Dianari (2019) found that there is a positive influence between the volume of e-commerce transactions and economic growth. The more people who access, use, and transact on e-commerce platforms, the volume of transactions will also increase. This increase in transaction volume in e-commerce will be recorded as an increase in consumption on the macroeconomic side. This causes an increase in the value of final goods and services in an economy and will directly affect economic growth.

Research conducted by Qu and Chen (2014), Box, Sarah, And Gonzalez (2017), and Couture et al. (2018) found that the workforce in the e-commerce sector has a positive effect on economic growth. An increase in the number of workers will lead to production at a better level, the more goods and services produced in an economy. The increase in the number of workers accompanied by an increase in the ability of the workforce will result in maximum and efficient productivity. This will have an impact on increasing economic growth. The following is a picture of the framework of this research:

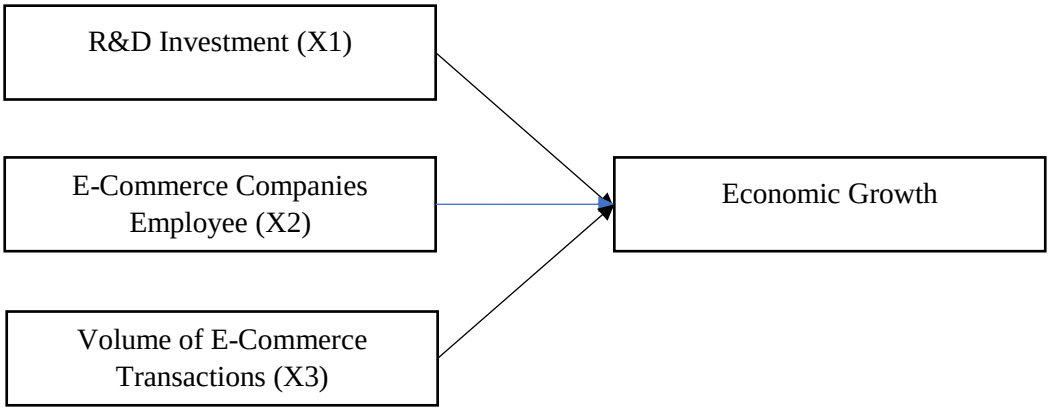

Figure 2. Research Framework

3. Research Methodology

The analytical method used is OLS (Ordinary Least Square). Previously, the Classical Assumption Test had to be carried out which consisted of the Normality Test, Autocorrelation, Heteroscedasticity, and Multicollinearity Test. After that, the Stationarity Test was carried out using the Unit Root Test method, followed by OLS regression. For the latter, the Partial Significance Test (T test), the joint test (F test), and the coefficient of determination test (R^2) were carried out.

4. Results and Discussions

Classic Assumption Test

Normality test

The results of the calculation of the Normality Test obtained a probability value of 0.071325 which means it is greater than the alpha value (0.05) so that it can be concluded that the research data is normally distributed.

Multicollinearity Test

Table 1. Multicollinearity Test Results

	I	TKE	VTE
I	1	0.019	0.051
TKE	0.019	1	0.016
VTE	0.051	0.016	1

The results of the multicollinearity test resulted in a correlation coefficient value of no more than R2 or 0.76. It can be concluded that there is no multicollinearity or close relationship between the independent variables used.

Heteroscedasticity Test

Table 2. Heteroscedasticity Test Results

F-statistic	4.8051	Prob. F(9,34)	0.000359
Obs*R-squared	24.6333	Prob. Chi-Square(9)	0.093404
Scaled explained SS	20.7653	Prob. Chi-Square(9)	0.013733

Table 2 shows that the results of the White Test show a p-value of 0.0934 or greater than (0.05). Thus it can be concluded that accepting Ho states that the variance is the same or there is no symptom of heteroscedasticity.

Autocorrelation Test

From the test results, the Durbin-Watson stat value is 1.981575, while for the value of DL = 1.3749 and DU = 1.6647 (n = 44, k = 3 with = 5%). So it can be written dU< d < 4 - dU or 1.6647 < 1.981575 < 4 - 1.6647 (2.3353) meaning that it failed to reject the null hypothesis; no autocorrelation.

Stationarity Test (Unit Root Test)

Table 3. Unit Root Test Results at Level (0)

Variable	t-statistic	alpha (5%)	Prob.	Information
Economic Growth	4.243641	-2.931404	0.0080	Stasioner (0)
R&D Investment	-3.698131	-2.931404	0.0050	Stasioner (0)
E-Commerce Companies Employee	-3.601865	-2.931404	0.0002	Stasioner (0)
Volume of E-Commerce Transactions	3.869844	-2.935001	0.0000	Stasioner (0)

Based on Table 3, the results of the stationarity test for all variables show that the t-statistic value is greater than the critical value (5%) and the probability value is smaller than the alpha value (5%) which means the data is stationary at the level (0). The results of the unit root test indicate that this research is appropriate to use Ordinary Least Square (OLS) regression estimation.

Ordinary Least Square (OLS)

Table 4. *Ordinary Least Square* Result

Variable	Coefisien	Std. Error	t-Statistic	Prob.
C	6.743798	0.374625	18.00144	0.0000
I	0.615323	1.379937	4.793933	0.0000
TKE	0.943430	0.218064	4.326392	0.0001
VTE	0.005386	0.004752	5.133321	0.0038
R-Squared	0. 760604	Prob (F-Statistic)		0.000000
Adjusted R-Squared	0. 742650	Durbin-Watson Stat		1.981575

$$\mathbf{PE_{it} = 6{,}743798 + 0{,}615323I_{it} + 0{,}943430TKE_{it} + 0{,}005386VTE_{it}}$$

Based on the regression equation above, it can be interpreted as follows:

1. The coefficient of the constant is 6.743798. This shows that if all the independent variables used in the study are equal to 0 (zero), then the economic growth in Indonesia from 2010 to 2020 is 6.74%.
2. R&D investment has a positive and significant effect on = 5% (0.05) with a coefficient of 0.615323. These results indicate that if there is an increase in the value of R&D investment by one percent and cateris paribus, then economic growth in Indonesia will increase by 0.615%.
3. The workforce of e-commerce companies has a positive and significant effect of = 5% (0.05) with a coefficient of 0.943430. These results indicate that if there is an increase in the number of employees of e-commerce companies by a thousand people and cateris paribus, then economic growth in Indonesia will increase by 0.94%.
4. The volume of e-commerce transactions has a positive and significant effect of = 5% (0.05) with a coefficient of 0.005386. These results indicate that if there is an increase in the volume of e-commerce transactions by one trillion rupiah and cateris paribus, then economic growth in Indonesia will increase by 0.005%.

T-test

Table 5. t-test Results

Variable	t-Statistic	t-table	Prob.	Information
I	4.793933	1,68385	0.0000	H_0ditolak
TK	4.326392	1,68385	0.0001	H_0ditolak
NTE	5.133321	1,68385	0.0038	H_0ditolak

Based on Table 5, all variables in the study reject Ho and accept Ha, meaning that each independent variable such as R&D investment, e-commerce company workforce, and volume of e-commerce transactions has a partial effect on economic growth in Indonesia from 2010 to 2020.

F-test

Table 6 F-Test Results

F-Statistik	F-Tabel	Prob.	Kesimpulan
42,36250	3,23	0,00000	H_0ditolak

In Table 6, F-statistic value of 42.36 is greater than the F-table value of 3.23, so Ho is rejected and Ha is accepted. This represents that R&D investment, the workforce of e-commerce companies, and the volume of e-commerce transactions together affect economic growth in Indonesia from 2010 to 2020.

Coefficient of Determination (R^2)

The value of the coefficient of determination is 0.760604 or 76.06%. This shows that variations in R&D investment, workforce of e-commerce companies, and volume of e-commerce transactions are able to explain variations in economic growth in Indonesia by 76.06% and the remaining 23.94% is explained by other factors outside the model.

Discussion

Effect of R&D Investment on Economic Growth in Indonesia from 2010 to 2020

Based on the regression results, the regression coefficient for the R&D investment variable shows a positive sign, which is 0.615323. Based on the partial significance test, the influence of the R&D investment variable has a significant effect on economic growth in Indonesia in 2010 to 2020. This is indicated by the t-count value of the investment variable, which is 4.793933, which is greater than the t-table value of 1.68385 with a significant level = 0.05. This indicates that if there is an increase in the value of R&D investment by one trillion, it will increase economic growth by 0.61 percent.

Investments that are being developed by several countries, especially in Indonesia, are R&D (Research and Development) investments. R&D investment is an activity or process carried out by a company in order to produce a product that is better than the previous product (new product) and can also improve the quality of the old product for the better. The resulting product does not have to be in the form of hardware, but can also be in the form of software (Yang & Chen, 2016). R&D investment is closely related to the development of technologies used to support production processes that are useful for increasing productivity and achieving economies of scale.

The results in this study are in line with research conducted by Ulku (2004) and Silvia (2015) which state that there is a significant influence between R&D investment and economic growth in each of the research countries. Increasing the value of R&D investment in the company will make the research and development process of company strategy through technology more developed. Developments through technology will have an impact on increasing efficiency and effectiveness in the production process. An increase in the number of productivities and a decrease in the company's operating costs arising from R&D investment will affect the final results of goods and services. This will have a positive impact on economic growth, especially in Indonesia.

One of the objectives of conducting R&D in a business is to test and minimize the adverse effects of new products so that the new products produced cannot be separated from environmental and social factors. The government in this case strongly supports the R&D carried out by the company with a policy regarding the provision of tax incentives for industries or investors who carry out the Research and Development (R&D) process in Indonesia, this further encourages research and development activities so that it is expected to spur industrial development in various sectors and increase company awareness of the importance of managing and disclosing research and development.

The Effect of E-commerce Company Workforce on Economic Growth in Indonesia from 2010 to 2020

Based on the regression results, the regression coefficient for the labor variable of e-commerce companies shows a positive sign, which is 0.943430. Based on the partial significance test, the effect

of the e-commerce company's workforce variable has a significant effect on economic growth in Indonesia from 2010 to 2020. This is indicated by the t-count value of the e-commerce company's workforce variable, which is 4.326392 which is greater than the t value. -table is 1.68385 with a significance level of = 0.05. This indicates that if there is an increase in the number of employees of e-commerce companies by a thousand people, it will increase economic growth by 0.94 percent.

Labor is one of the important production inputs and greatly affects the amount of production of goods and services produced. The maximum and efficient use of labor in an economy must pay attention to the quality and quantity of human resources. The ideal number of human resources along with the capabilities and skills possessed can produce production outputs that are expected to increase productivity and will also have an impact on economic capacity which is represented by increased economic growth. The workforce that is expected at this time is a workforce that is aware of technological advances because technology will help them in completing and contributing to their work. The workforce of e-commerce companies is a workforce that is closely related to technological developments. The digitalization of the economy that is being socialized by the Indonesian government is the beginning for workers to improve their ability to adapt to the use of technology.

Research conducted by Pertiwi & Sustikarini (2006), Chen & Kimura (2020) found that there is a positive and significant influence between the workforce of e-commerce companies and economic growth. An increase in the number of workers in e-commerce companies will have an impact on increasing the amount of output produced. A skilled workforce who has the ability in the field of technology will make productivity more quality and increase in quantity. This will have an effect on increasing economic growth.

The Effect of E-commerce Transaction Volume on Economic Growth in Indonesia from 2010 to 2020

Based on the regression results, the regression coefficient for the variable value of e-commerce transactions shows a positive sign, which is 0.005386. Based on the partial significance test, the effect of the variable volume of e-commerce transactions has a significant effect on economic growth in Indonesia from 2010 to 2020. This is indicated by the t-count value of the e-commerce transaction value variable, which is 5.133321 which is greater than the t-table value. of 1.68385 with a significance level of = 0.05. This indicates that if there is an increase in the volume of e-commerce transactions by one trillion rupiah, it will increase economic growth by 0.005 percent.

E-commerce is an online sales platform that can be accessed by anyone and at any time but must be with an internet network. E-commerce has become a means for SMEs and SMEs to advance in class as a place of marketing which has been an obstacle for SMEs. Expansion of sales access, ease of transaction, the discovery of new markets, and increasing economies of scale are some of the advantages of e-commerce. This will cause all transactions to be faster moving and can increase the number of sales.

Research conducted by Dianari (2019), Sixun Liu (2013), and Qu & Chen (2014) found that there is a positive and significant effect between the volume of e-commerce transactions and economic growth. Some of the advantages of e-commerce can realize the existence of economies of scale which will reduce production costs but at the same time there is an increase in economic growth. The use of e-commerce as a representation of technological progress is an idea that can help economic actors to maximize production processes and outputs. Problems related to the marketing process, costs that arise such as rental fees, and product diversification are all resolved with the presence of an e-commerce platform. All the advantages offered by the presence of e-commerce will indirectly affect economic growth.

5. Conclusion

Based on the results of data processing and discussions that have been carried out, it can be concluded as follows:

1. R&D investment variable has a positive and significant impact on economic growth in Indonesia from 2010 Q1 to 2020 Q4.
2. E-commerce companies' employees variable has a positive and significant influence on economic growth in Indonesia from 2010 Q1 to 2020 Q4.
3. Volume of e-commerce transactions variable has a positive and significant impact on economic growth in Indonesia from 2010 Q1 to 2020 Q4.
4. R&D investment, e-commerce companies' employees, and volume of e-commerce transactions variable have a joint effect on economic growth in Indonesia from 2010 Q1 to 2020 Q4.

Limitation and Study Forward

The research is limited to a few determinants, namely R&D investment, e-commerce companies' employees, and volume of e-commerce transactions variables. In addition, this research was only conducted in one country, namely Indonesia. It is hoped that further research can compare the state of e-commerce in several countries.

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