# THE INFLUENCE OF TECHNOLOGY ON ECONOMIC GROWTH IN INDONESIA IN 2010-2020

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**Abstract**

**Purpose:** The purpose of this study is to analyze the impact of R&D investment, e-commerce volume and employees of e-commerce companies on Indonesia's economic growth from Q1 2010 to Q4 2020.

**Research methodology:** The analysis method used this time is the OLS (Ordinary Least Square) method using time series data of quarterly data from 2010 to 2020. In conducting this study, the authors use the analysis tool E- views 9.

**Results:** The results of this study show that the variables R&D investment, number of employees in e-commerce firms, and e- commerce transaction volume contributed partially or jointly to Indonesia's economic growth from Q1-2010 to Q4-2010. It means making an impact. 2020.

**Limitations:** This study is limited by several factors, among others. R&D investment, e- commerce enterprise employees, e-commerce transaction volume.

**Contribution:** The results of this research are expected to serve as a reference when setting policy directions and adjusting appropriate policies based on the presented data, especially for the realization of economic digitalization in Indonesia.

**Keywords:** *Investment, E-Commerce, Economics Growth*

## 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 in the first quarter of 2010 to the fourth quarter of 2020:

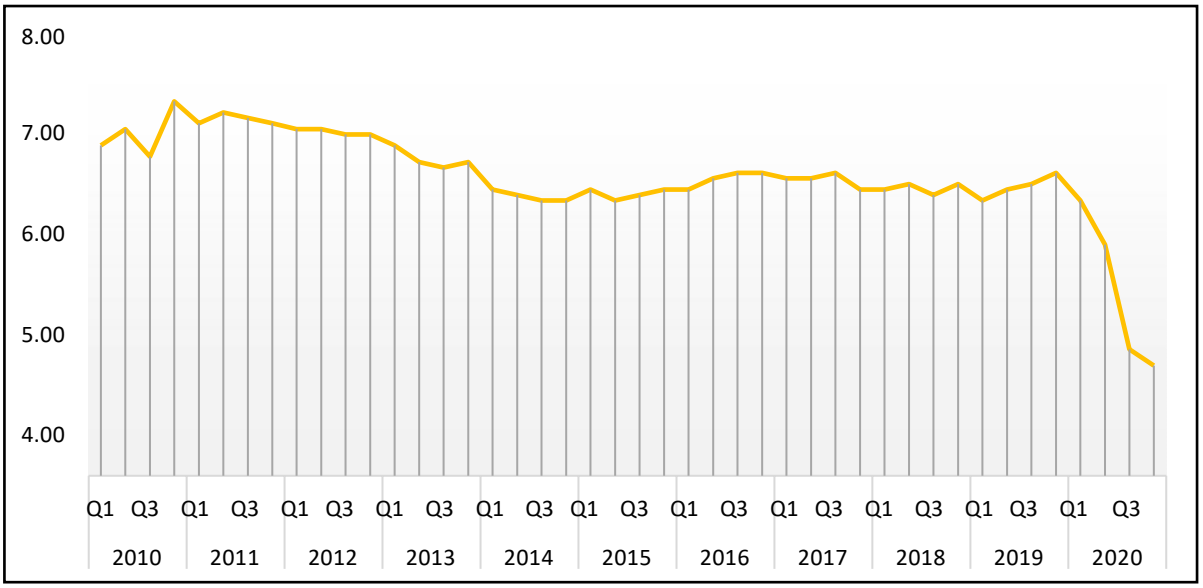


Figure 1. Economic Growth Statistics in Indonesia 2010Q1-2020Q4

The presence of technological advances such as the internet can bring convenience in 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 aims 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 from 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 as 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 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), the 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 the e-commerce platform is an alternative place for buying and selling, finding new markets, and expanding marketing networks amidst uncertain economic conditions.

The trend of e-commerce transaction volume is always increasing year by year, but it does not mean that the economic growth is increasing along with it. A study by Qu & Chen (2014), Sixun Liu (2013), and Dianari (2019) found a positive impact between e-commerce transaction volume and economic growth. The more people access, use and transact on e-commerce platforms, the more the trading volume will grow. This increase in e-commerce transaction volume is reflected across the economy as an increase in consumption. This leads to an increase in the value of final goods and services in the economy and has a direct impact on economic growth. Discrepancies between what happened in Indonesia and previous studies are the issues discussed in this study.

Based on the endogenous theory of economic growth, there is another factor besides investment and technological progress: labor. Employees play a key role in shaping growth. According to Law No. 13 of 2003, Labor, Chapter 1, Article 1, Paragraph 2, workers can work to produce goods or services both for their own needs and for the community. defined as a person. The development of e-commerce has also impacted the increasing number of workers working for e-commerce companies in Indonesia. Based on Badan Pusat Statistics (2020), the number of employees of e-commerce companies is taken from 39 e-commerce companies classified in descending order of assets. Statistically, e-commerce companies had a 28% increase in top employees in 2016 compared to 2015. This increase is consistent with the opening up of investment in Indonesia, especially in the digital sector (Dianari, 2019).

Studies conducted by Qu and Chen (2014), Box, Sarah, Gonzalez (2017), and Couture et al. (2018) found that the workforce in the e-commerce sector had a positive impact on economic growth. An increase in the number of workers produces more goods and services within the economy, thus increasing the level of production. An increase in the number of workers and an increase in the efficiency of the workforce will lead to maximum and efficient productivity gains. This will affect the promotion of 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. Economics Growth Theory Classical

### Economic Growth Theory

Adam Smith, David Ricardo, Malthus, and John Stuart Mill all contributed to the development of this theory. This theory holds that four factors population, capital goods quantity, land area factor, natural resources, and technology employed—have an impact on economic growth. Numerous things influence economic growth. Traditional economists typically concentrate on how population expansion affects economic growth. The return on investment is strong and investors can gain more and more profits due to the sparse population and comparatively huge natural resources, which encourages fresh investment and economic progress. Growth will lessen the negative level and lower the community's income if the population is too large (Sukirno, 2004).

### Neo-Classical Economic Growth

The neoclassical growth theory is a derivation of earlier classical theories created by Robert M. Solow and T.W. Swan. Neoclassical theory states that the amount of technological advancement, the labor force, capital accumulation, and the availability of production factors all affect economic growth (Arsyad, 2010). The examination of this theory is predicated on the classical theory's presumption that both the economy and the production factors are operating at maximum efficiency. According to this paradigm, the technology employed influences how much output can be created with a specific amount of labor and capital. The Cobb-Douglas function is used to express the classic neon growth theory, which emphasizes the importance of labor, capital, and technology as production inputs. Solow asserts that population expansion is:

$$Y = F (K, L, X E)$$

where E is a variable called labor efficiency. L X E measures the effective number of workers given 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 capital units K and the number of effective workers L (2004). While this model temporarily drives economic growth, the return on investment that increasingly drives the achievement of a stable economy depends on technological progress.

### 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**

According to Law Number 25 of 2007 concerning Investment, "investment" or "investment" refers to all types of investment operations, whether they are conducted by domestic investors or international investors to conduct economic activities on Indonesian territory. The realization of top managers' investments in research activities to gain new information, skills, and technology is known as research and development (R&D) investment.

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 Section 1(2) of Labor Law No. 13/2003. Labor force is anyone who can work to produce goods and services that meet the needs of both themselves and their communities. The working age set by the Indonesian government is the population between the ages of 15 and 64. An e-commerce company employee is anyone who works for a retail-based, online-connected company (Americo & Veronico, 2018).

**E-commerce Theory**

Since the early 1980s, e-commerce, also known as electronic commerce, has been utilized as a tool for conducting business over computer networks. Early on, electronic commerce was only used for sales transactions between businesses, which were made possible through electronic data exchange (EDI). Any economic exchange of products or services conducted through electronic means is generally referred to as electronic commerce. These digital media emphasize the use of the internet (Pradana, 2016).

Many websites offered the ability to complete buying and selling transactions with various multimedia data components, including images, videos, sounds, and animations, in the early 2000s. In e-commerce, there are three different business models: business-to-business (B2B), business-to-consumer (B2C), and consumer-to-consumer (C2C). B2B transactions are those between suppliers and producing companies, B2C transactions are those between producers and end users, and C2C transactions are those between two or more end users. The buying and selling process in e-commerce differs from the traditional method in that all steps begin with gathering information about the items or services required, followed by placing orders and making payments electronically through 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 extensively across eras, regions and eras. The development of technology went through several stages and phases until it was applied to all areas and elements that humans themselves use. In particular, the use of technology in the economic sector has a significant impact on the final productivity of the goods and services produced (Snowden, 2008).

Based on Romer's (1986) endogenous growth model, innovation occurs in the field of research and development (R&D). R&D is an investment activity or investment made to improve the quality of existing goods or services or to develop new products or services (Kutlača et al., 2020). A study by Yang and Chen (2016) found significant effects between R&D investment and economic growth in Indonesia. R&D investments are investments aimed at developing various systems, especially technology as a tool to achieve economies of scale. The effects of R&D investments can lead to increased production efficiency, resulting in increased output of finished goods and services, which can have an impact on promoting economic growth.

Studies by (Qu & Chen, 2014a), (Sixun Liu, 2013), and (Dianari, 2019) found a positive impact between e-commerce transaction volume and economic growth. The more people access, use and transact on e- commerce platforms, the more the trading volume will grow. This increase in e-commerce transaction volume is reflected across the economy as an increase in consumption. This leads to an increase in the value of final goods and services in the economy and has a direct impact on economic growth.

Studies conducted by Qu and Chen (2014), Box, Sarah, Gonzalez (2017), and Couture et al. (2018) found that the workforce in the e-commerce sector had a positive impact on economic growth. An increase in the number of workers produces more goods and services within the economy, thus increasing the level of production. Increasing the number of employees increases the efficiency of employees and increases productivity to the maximum and efficiency. This will affect the promotion of economic growth. The image of the framework of this research is as follows.

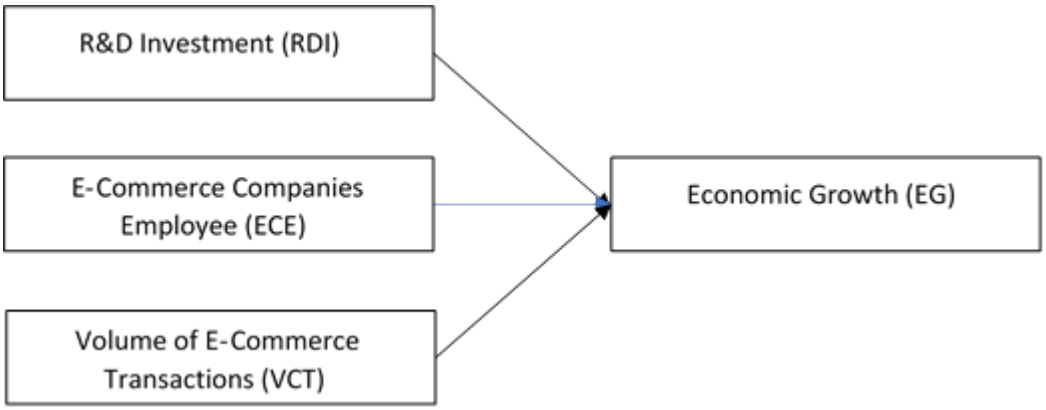


**Figure 2. Research Framework**

## 3. Research methodology

The analytical technique used is OLS (Ordinary Least Square). Previously, we had to perform classical acceptance tests consisting of normality test, autocorrelation test, heteroscedasticity test and multicollinearity test. Stationarity tests were then performed using the unit root test method followed by OLS regression. For the latter, partial significance test (T test), joint test (F test) and coefficient of determination test (R2) were performed.

## 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

| | RDI | ECE | VCT |
|---|---|---|---|
| RDI | 1 | 0.019 | 0.051 |
| ECE | 0.019 | 1 | 0.016 |
| VCT | 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 on the independent variables used.

### Heteroscedasticity Test

Table 2. Heteroscedasticity Test

| | | | |
|---|---|---|---|
| F-stat | 4.8051 | Probability F(9,34) | 0.000359 |
| Obs*$R^2$ | 24.6333 | Probability Chi-Square(9) | 0.093404 |
| Scaled explained SS | 20.7653 | Probability Chi-Square(9) | 0.013733 |

Table 2 shows that the p-value for the whiteness test results is greater than or equal to 0.0934 (0.05). From this we can conclude that Ho's assumption states that there is no symptom of equal variance or heteroscedasticity.

**Autocorrelation Test**

The test results show that the Durbin-Watson statistic is 1.981575, while DL = 1.3749 and DU = 1.6647 (n = 44, k = 3, = 5%). So you can write: d <; 4 - dU or 1.6647 < 1.981575 <; 4 - 1.6647 (2.3353), which means that the null hypothesis could not be rejected. No autocorrelation.

Stationarity Test (Unit Root Test)

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

| Variable | t-statistic | alpha (5%) | Prob. | Information |
|---|---|---|---|---|
| EG | 4.243641 | -2.931404 | 0.0080 | Stasioner (0) |
| RDI | -3.698131 | -2.931404 | 0.0050 | Stasioner (0) |
| ECE | -3.601865 | -2.931404 | 0.0002 | Stasioner (0) |
| VET | 3.869844 | -2.935001 | 0.0000 | Stasioner (0) |

Based on Table 3, the results of the stationarity test for each variable indicate that the data are stationary at level (0) when the t-statistic value is greater than the critical value (5%) and the probability value smaller than the alpha value (5%). The unit root test results show that using Ordinary Least Square (OLS) regression estimation in this study is reasonable.

***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 |
| RDI | 0.615323 | 1.379937 | 4.793933 | 0.0000 |
| ECE | 0.943430 | 0.218064 | 4.326392 | 0.0001 |
| VET | 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 |

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

1. The constant factor is 6.743798. This indicates that Indonesia's economic growth rate is 6.74% from 2010 to 2020 when all independent variables used in the study are equal to 0 (zero).
2. R&D investment has a positive significant impact = 5% (0.05) with a factor of 0.615323. These results suggest that a 1% increase in the value of R&D investment, at full par, would increase Indonesia's economic growth by 0.615%.
3. E-commerce firm workforce has a positive significant impact of = 5% (0.05) with a factor of 0.943430. These results suggest that if the number of employees in e-commerce companies were to increase by 1,000 and stay exactly the same, Indonesia's economic growth would increase by 0.94%.
4. E-commerce transaction volume has a positive significant impact of = 5% (0.05) with a factor of 0.005386. These results suggest that e-commerce volume will increase by IDR 1 trillion, increasing Indonesia's economic growth by 0.005%.

**T-test**

Table 5. t-test Results

| Variable | t-Statistic | t-table | Prob. | Information |
|---|---|---|---|---|
| I | 4.793933 | 1,68385 | 0.0000 | $H_0$ ditolak |
| TK | 4.326392 | 1,68385 | 0.0001 | $H_0$ ditolak |
| NTE | 5.133321 | 1,68385 | 0.0038 | $H_0$ ditolak |

Based on Table 5, all variables within the study reject Ho and accept Ha. This is Indonesia's economic growth by 2020, with independent variables such as R&D investment, labor force of e-commerce companies, and e-commerce volume as of 2010.

**F-test**

Table 6 F-Test Results

| F-Statistik | F-Tabel | Prob. | Kesimpulan |
|---|---|---|---|
| 42,36250 | 3,23 | 0,00000 | H0 ditolak |

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 indicates that fluctuations in R&D investment, e-commerce enterprise labor force, and e-commerce transaction volume can explain 76.06% of the fluctuations in Indonesia's economic growth, while the remaining 23.94% can be explained outside the model by other factors. is shown.

**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 has a positive sign, or 0.615323. Based on the partial significance test, the impact of the R&D investment variable had a significant impact on Indonesia's economic growth from 2010 to 2020, with a T count value of investment variable of 4.793933 and a t table value of is 1.68385, significance level = 0.05. This suggests that a 1 trillion increase in R&D investment would increase economic growth by 0.61 percent.

Investments by some countries, especially Indonesia, are R&D (research and development) investments. R&D investment is the activity or process a company undertakes to produce a better product than its predecessor (new product) and at the same time to better improve the quality of the old product. The resulting product does not necessarily have to be in the form of hardware, but can also be in the form of software (Yang & Chen, 2016). Investment in research and development goes hand in hand with the development of technologies that support production processes that help increase productivity and achieve economies of scale.

The results of this study are consistent with studies by (Ulku, 2004) and (Silvia, 2015), which find significant effects between R&D investment and economic growth in the countries studied. By increasing the value of R&D investments in companies, the R&D process of corporate strategy is further developed through technology. Technological developments influence the efficiency and effectiveness of production processes. Improving productivity through R&D investment and reducing a company's operating costs affect the profitability of goods and services. This will have a positive impact on economic growth, especially in Indonesia.

One of the purposes of research and development in companies is to test and minimize the negative impact of new products produced so that they are not isolated from environmental and social factors. In this case, the government will strongly support the R&D carried out by the company through policies that give tax incentives to industries and investors carrying out research and development (R&D) processes in Indonesia. This is expected to further promote research and development activities, promote industrial development in various fields, and raise awareness of the importance of corporate research and development management and information disclosure.

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

Based on the regression results, the regression coefficients for the work variables of e-commerce companies show a positive sign, ie 0.943430. Based on partial significance tests, the impact of e- commerce firms' workforce variables has a significant impact on Indonesia's economic growth from 2010 to 2020. This is supported by the t-count values for the e-commerce firm's workforce. The variable company is 4.326392, which is greater than the t-value. The table is 1.68385, significance level = 0.05. This means that an increase of 1,000 employees in e-commerce companies will increase economic growth by 0.94 percent. Labor is one of the most important factors of production and has a great influence on the quantity of goods and services produced. To make the most efficient use of labor in the economy, attention must be paid to the quality and quantity of human resources. The ideal number of human resources and existing skills and competencies lead to production outcomes that are expected to increase productivity and also affect economic capacity, which in turn leads to increased economic growth.

Today's expected workforce is one that recognizes technological advances, as technology helps and contributes to the way work is done. The workforce of e-commerce companies is closely related to technological development. The digitization of the economy, socialized by the Indonesian government, is the beginning of improving the ability of workers to adapt to the use of technology. Studies by Pertiwi & Sustikarini (2006) and Chen & Kimura (2020) found a positive and significant impact between e-commerce firms' workforce and economic growth. An increase in the number of workers in e-commerce companies will affect the increase in production. A qualified workforce with technical skills improves productivity qualitatively and increases quantity. This will affect the promotion of 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 e-commerce variable value shows a positive sign, that is 0.005386. Based on the partial significance test, the impact of e-commerce volatility will have a significant impact on Indonesia's economic growth from 2010 to 2020. This is indicated by the T count value of the variable "e-commerce transaction value". . This is 5.133321, which is larger than the value in the T table. 1.68385, significance level = 0.05. This suggests that an increase of 1 trillion rupiah in e-commerce transaction volume would boost economic growth by 0.005%. E- commerce is an online sales platform that can be accessed by anyone at any time, but it requires an internet network. E-commerce has become a means of career advancement for SMEs and micro businesses, and has become a barrier to marketing for SMEs. Expanding distribution access, simplifying transactions, discovering new markets, and increasing economies of scale are some of the benefits of e- commerce. As a result, all transactions are processed faster and you can increase the number of sales.

A study by Dianari (2019), Sixun Liu (2013), and Qu & Chen (2014) found significant positive effects between e-commerce transaction volume and economic growth. Part of the benefit of e-commerce is creating economies of scale that reduce production costs while driving economic growth. Using e- commerce as a symbol of technological progress is an idea that helps economic agents maximize their production processes and outcomes. Issues such as the marketing process, incidental costs such as rental fees, and product diversification are resolved by the presence of e-commerce platforms. Any benefit that the existence of e-commerce brings indirectly affects 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. 1R&D investment variables have a positive and significant impact on Indonesia's economic growth from Q1 2010 to Q4 2020.
2. E-commerce company employee variables will have a positive and significant impact on Indonesia's economic growth from Q1 2010 to Q4 2020.
3. Fluctuations in e-commerce volume will have a positive and significant impact on Indonesia's economic growth from Q1 2010 to Q4 2020.
4. R&D investment, number of employees in e-commerce companies, and e-commerce transaction volume will collectively affect Indonesia's economic growth from Q1 2010 to Q4 2020.

## Limitation and study forward

The research is limited to a few determinants, namely R&D investment, e-commerce companies employee, 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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