Dirham: Journal of Sharia Finance and Economics (JoSFE)
ISSN: 3123-6081, Vol 2, No 1, 2026, 17-28 https://doi.org/10.35912/josfe.v2i1.1665

Impact of R&D, E-Commerce Employees, and Transactions on Economic Growth in Indonesia

Gebrella Nadia Sumahir[1*], Heru Wahyudi[2], Tiara Nirmala[3]
University of Lampung, Bandar Lampung, Indonesia[1,2,3]
gabrellanadias9@gmail.com[1*], heru.wahyudi@feb.unila.ac.id[2], tiara.nirmala@feb.unila.ac.id[3]

Article History
Received on 22 October 2025
1st Revision on 18 November 2025
2nd Revision on 29 December 2025
Accepted on 19 January 2025

Abstract
Purpose: This study aims to examine the impact of Research and Development (R&D) investment, e-commerce company workforce, and e-commerce transaction volume on Indonesia's economic growth from 2010Q1 to 2020Q4.
Methods: The study employs Ordinary Least Squares (OLS) regression with time-series data, using quarterly data from 2010 to 2020. The analysis was performed using E-views 9 software, following normality, autocorrelation, heteroscedasticity, and multicollinearity tests to ensure the validity of the results.
Results: The study found that R&D investment, e-commerce workforce, and transaction volume significantly impact Indonesia's economic growth, both individually and collectively. R&D investment showed a positive effect, with an increase in R&D contributing 0.615% to economic growth, while e-commerce workforce and transaction volume also had positive effects on growth.
Conclusion: The results indicate that increasing R&D investment, e-commerce employment, and transaction volume can significantly boost Indonesia's economic growth, demonstrating the importance of these factors in driving digital economy growth.
Limitations: This research is limited by the scope of its focus on R&D investment, e-commerce workforce, and transaction volume, and it is confined to data from Indonesia alone. Further research could explore comparative studies across different countries.
Contribution: The findings provide valuable insights for policymakers and stakeholders aiming to enhance economic digitization in Indonesia, offering a data-driven approach to adjusting policies for sustainable economic growth.

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

How to Cite: Sumahir, G. N., Wahyudi, H., Nirmala, T. (2026). The Effect of Research and Development (R&D) Impact of R&D, E-Commerce Employees, and Transactions on Economic Growth in Indonesia. *Dirham: Journal of Sharia Finance and Economics,* 2(1), 17-28.

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. The application of technology in the economic field has a significant impact on the final productivity of goods and services (Tu, Wei, & Razik, 2025). In the era of globalization of the digital economy, the success of economic activity is largely determined by the transformation process that can add value to input goods to produce maximum output. Economic digitization was first introduced by Tapscott (1995). Tapscott argues that the digital economy is a system of economic, political, and social characteristics that has the characteristic of being an information space from various instruments such as access, capacity, and existing information processing (Sayekti, 2018).

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 to adapt 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 include the distribution process and finding new markets amidst competition for existing products.

The Internet is currently one of the sources of transformation in the economic field. 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 of 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 increasing the productivity of the goods and services produced. The resulting increase in output is closely related to the conditions of economic growth. Economic growth is an increase in the ability to manage the economy to produce goods and services within a certain period (Hindrayani, Rina, & Naufalin, 2024). The following is the development of economic growth in Indonesia from the first quarter of 2010 to the fourth quarter of 2020:

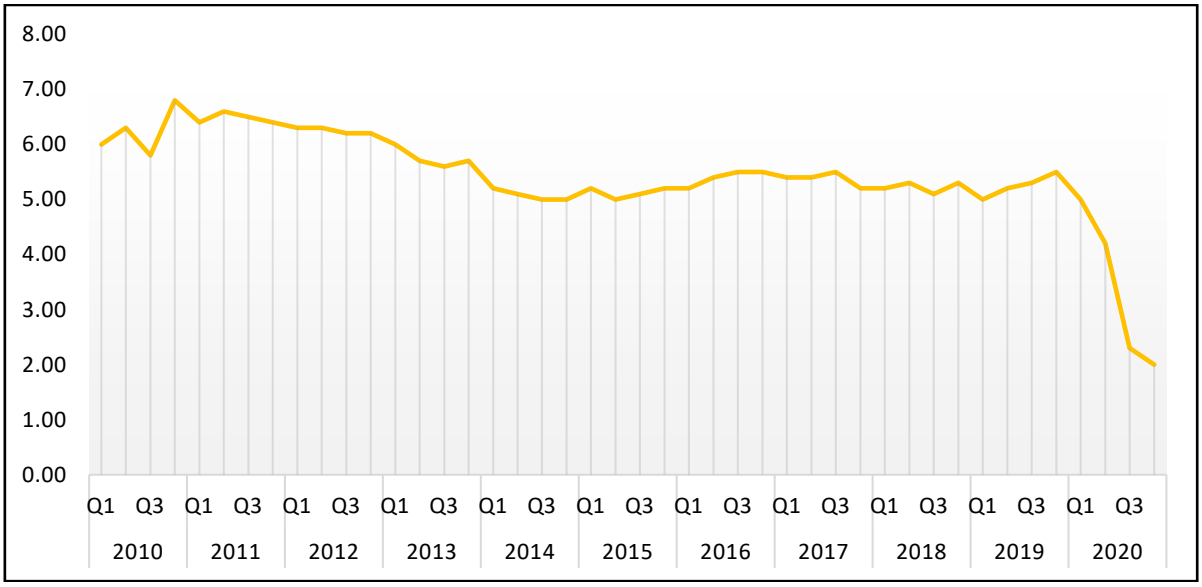

Figure 1. Economic Growth Statistics in Indonesia 2010Q1-2020Q4

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 produce derivative products that can adapt to current and future conditions. Based on the endogenous growth model pioneered by Šlander-Wostner, Križanič, and Vojinovic (2025), 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 (Kutlaca, Sestic, Jelic, & Popovic-Pantic, 2020).

R&D investment always goes hand-in-hand with the maximum use of Human Resources (HR) and knowledge resources. Innovations in the R&D sector lead to a sustainable increase in final goods and services to increase economic growth. R&D investment plays an important role and is an effective tool for determining a company's competitive advantage (Gutiérrez-Sánchez & Benéitez-Andrés, 2025). The expected output of 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. Insee

and Suttipun (2023) state that R&D can change small companies to develop and generate higher returns and can cause large companies to maintain their market share and competitive advantage.

The development of R&D investment in Indonesia has fluctuated. In 2015, there was a significant increase because the Indonesian government focused on R&D investment to help realize the digital economy (Dianari, 2018). The average R&D investment in Indonesia from 2010 to 2020 was 0.38%. This figure is still far adrift from countries around Indonesia, such as Malaysia (1.07 %) and Singapore (2.6 %). Indonesia's economic growth and R&D investment from to 2010-2020 shows a positive relationship. This is confirmed by research conducted by Yang and Chen (2012) finding that there is a significant influence between R&D investment and economic growth in Indonesia. R&D investment is an investment made to develop various systems, especially technology, as a tool to realize economies of scale. The impact of R&D investment can provide effectiveness in production to increase the output of final goods and services, which will increase economic growth.

The success of R&D investment is influenced by various factors, including the company's financial condition, funding sources, and government support. The research and development carried out by the company in R&D investment aims to increase the scale of sales volume so that the company's financial condition improves 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 of 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 (Sharma & Mishra, 2023).

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, which 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 destination for e-commerce companies because of its large population and high consumption tendency (Pradana, 2015). Various advantages of using e-commerce are considered suitable for various businesses in Indonesia because they can be an alternative to solving the main problems in Small and Medium Enterprises, namely marketing. Economic actors will face the dynamics of competition in the business world, both conventionally and digitally. The Indonesian people must prepare for digital competition to develop business strategies and increase added value. There are several large 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 (Melinda, Wiliasih, Irfany, & Haq, 2026).

The volume of e-commerce transactions in Indonesia has increased significantly since then. This reflects that e-commerce provides easy transactions, seller and buyer trust, and the right means to develop individual or company businesses. According to Indonesia (2021), the preference of Indonesian people for online shopping is increasing. Bank Indonesia (BI) estimates that the volume of transaction value in Indonesia's 14 largest e-commerce platforms will reach 456 trillion in 2020. The volume of this transaction value increased rapidly from the overall transaction value in 2019, which was 265 trillion rupiah. The pandemic conditions in 2020 increased the value of e-commerce transactions. This indicates that e-commerce platforms are an alternative place for buying and selling, finding new markets, and expanding marketing networks amidst uncertain economic conditions.

The volume of e-commerce transactions always increases annually but is not followed by an increase in economic growth. Research conducted by Maisaroh, Habibi, and Iqbal (2024) and Dianari (2018) found a positive influence between the volume of e-commerce transactions and economic growth. The more people access, use, and transact on e-commerce platforms, the higher the volume of transactions will also increase. This increase in the transaction volume of 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 directly affects economic growth. The discrepancy between what happened in Indonesia and previous research is a problem that this study discusses.

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 has also impacted the increase in the number of workers in e-commerce companies in Indonesia. Based on the *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 largest workforce growth in e-commerce companies occurred in 2016, with a 28% increase from 2015. This increase is in line with the opening of investments in Indonesia's digital sector (Dianari, 2018).

Anggraeni, Tan, Junaidi, and Achmad (2024) conducted research on this topic. Maisaroh et al. (2024), and Couture, Faber, Gu, and Liu (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, and the more goods and services produced in an economy. An 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 impact economic growth. The main problem in this study is the significant increase in the volume of e-commerce transactions in Indonesia, which is not accompanied by a significant increase in economic growth and tends to fluctuate. Based on research by Dianari (2018), Maisaroh et al. (2024) found that an increase in the volume of e-commerce transactions positively impacts economic growth.

2. Literature Review

2.1 Economics Growth Theory

2.1.1 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: population, amount of capital goods, land area, natural wealth, and technology used. Economic growth depends on several factors. Classical economists mainly focus on the effects of population growth on economic growth. If there is a shortage of population and relatively excess natural wealth, the rate of return on 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 that the prosperity of the community will decrease (Chu, Chen, & Yang, 2025).

2.1.2 Neo-Classical Economic Growth

The neoclassical growth theory developed by Robert M. Solow and T. W. Swan is a refinement of the earlier classical theory. According to the neoclassical theory, economic growth depends on the availability of production factors, labor, capital accumulation, and the level of technological progress (Wijayanti & Wahyudi, 2025). 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 input. 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 technology-based. Although technology is still considered an exogenous factor, the production function can be formulated as follows (Chukwuemeka Ogugua, 2024; Ferrara, 2025).

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

Where E is a variable called labor efficiency. 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 the labor force L (Trung & Doan, 2025). In this model, it temporarily encourages economic growth, but the return on capital that will increasingly encourage the achievement of a stable economy will depend on technological advances.

2.1.3 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 (Wijayanti & Wahyudi, 2025). Therefore, the economic growth model is as follows:

$$\mathbf{Y(t) = K(t)^{\alpha}\ H(t)^{\beta}\ (Americo\ \&\ Veronico)^{1-\alpha-\beta}}$$

Information:

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

2.1.4 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 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; therefore, it has consequences and risks that are quite high for the company. R&D investment is closely related to company risk (Asdemir, Cao, Coskun, & Tripathy, 2025). Research and development (R&D) activities have high-risk and cost consequences; therefore, 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 (Usnaka, 2025b).

2.1.5 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 to meet their own needs and for the community. The working age set by the Indonesian government is the population aged 15–64 years. The e-commerce company workforce includes everyone who works for companies that have a main business in the retail sector and are connected online (Americo & Veronico, 2018).

2.1.6 E-commerce Theory

E-commerce (electronic commerce) is a derivative product of 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, which is focused on the use of Internet media (Pradana, 2015).

In the early 2000, there were many websites that 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 e-commerce, namely B2B (business to business), where transactions occur between suppliers and producing companies, B2C (business to consumer), where transactions occur between producers and end users, and C2C (consumer to consumer), where transactions occur 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, and making payments electronically via the Internet (Mahfuzah & Chandriyanti, 2022).

The Indonesian government has issued a law related to e-commerce, 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 was a collection of aspirations submitted by Non-Governmental Organizations (NGOs), practitioners, academics, and the community. The revision is essential because there will be no criminalization of existing cases, and the accused person is not immediately detained.

2.2 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 its application in all sectors and elements used by humans. The application of technology in the economic field has a significant impact on the final productivity of the goods or services produced (Tu et al., 2025). Based on the endogenous growth model pioneered by Šlander-Wostner et al. (2025), 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 develop new products and services (Kutlaca et al., 2020).

Research conducted by Yang and Chen (2012) found a significant effect of R&D investment on economic growth in Indonesia. R&D investment is an investment made to develop various systems, especially technology, as a tool to realize economies of scale. The impact of R&D investment can provide effectiveness in production to increase the output of final goods and services, which will increase economic growth. Research conducted by Dianari (2018) and Maisaroh et al. (2024) found a positive influence between the volume of e-commerce transactions and economic growth. The more people access, use, and transact on e-commerce platforms, the higher the volume of transactions will also increase. This increase in the transaction volume of 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 directly affects economic growth.

Research conducted by Anggraeni et al. (2024), Maisaroh et al. (2024), and Couture et al. (2018) found that the workforce in the e-commerce sector positively affects economic growth. An increase in the number of workers will lead to production at a better level, and the more goods and services produced in an economy. An 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 impact economic growth. The following is a picture of the framework of this study:

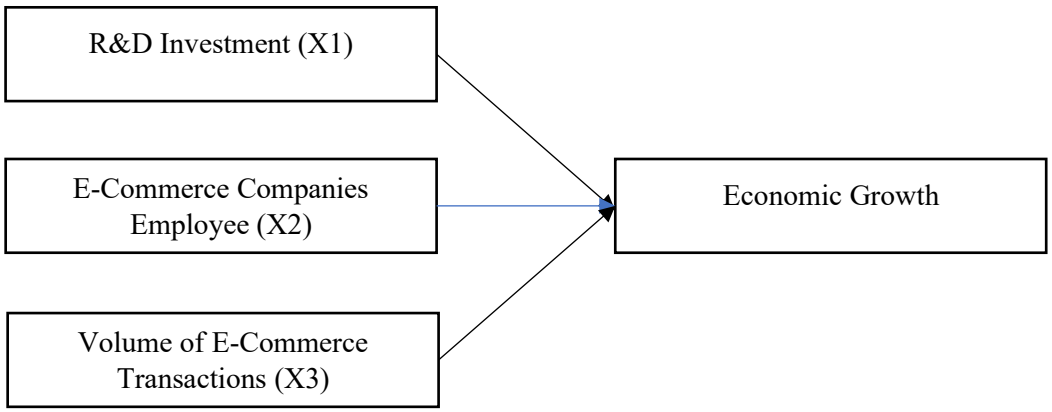

Figure 2. Research Framework

3. Research Methodology

The analytical method used is ordinary least squares (OLS). Previously, the Classical Assumption Test had to be carried out, which consisted of the normality test, autocorrelation, heteroscedasticity, and

multicollinearity tests. Subsequently, a Stationarity Test was conducted using the Unit Root Test method, followed by OLS regression. For the latter, the Partial Significance Test (T test), joint test (F test), and coefficient of determination test (R^2) were conducted.

4. Results and Discussions

4.1 Classic Assumption Test

4.1.1 Normality test

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

4.1.2 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 showed 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.

4.1.3 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 Ho is accepted, which states that the variance is the same or there is no symptom of heteroscedasticity.

4.1.4 Autocorrelation Test

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

4.1.5 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 are stationary at the level (0). The results of the unit root test indicate that it is appropriate to use ordinary least squares (OLS) regression estimation.

4.1.6 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, the following can be interpreted:

1. The coefficient of the constant was 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 ceteris paribus, then economic growth in Indonesia will increase by 0.615%.
3. The workforce of e-commerce companies has a positive and significant effect on = 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 on = 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 ceteris paribus, then economic growth in Indonesia will increase by 0.005%.

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

4.1.8 F-test

Table 6 F-Test Results

F-Statistik	F-Tabel	Prob.	Conclusion
42,36250	3,23	0,00000	H_0 Is Rejected

In Table 6, the F-statistic value of 42.36 is greater than the F-table value of 3.23; therefore, Ho is rejected and Ha is accepted. This indicates 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.

4.2 Coefficient of Determination (R^2)

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

4.3 Discussion

4.3.1 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 is positive (0.615323). Based on the partial significance test, the R&D investment variable has a significant effect on economic growth in Indonesia from 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 significance 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 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 to produce a product that is better than the previous product (new product) and can also improve the quality of the old product. The resulting product does not have to be in the form of hardware but can also be in the form of software (Yang & Chen, 2012). 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 (Yasin, 2023).

The results of this study are in line with those of Gutiérrez-Sánchez and Benéitez-Andrés (2025) and Raetskiy and Tereshchenko (2025), who state that R&D investment significantly influences economic growth in each of the countries studied. Increasing the value of R&D investment in the company will improve the research and development process of the company strategy through technology. Technological developments will increase the efficiency and effectiveness of the production process (Nursari, 2023). An increase in productivity 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, particularly in Indonesia (Yasin, 2023).

4.3.2 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 is positive (0.943430). Based on the partial significance test, the workforce variable of the e-commerce company 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 an important production input that greatly affects the amount 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, which will also have an impact on economic capacity, represented by increased economic growth. The workforce that is expected at this time is one that is aware of technological advances because technology will help them complete and contribute to their work. The workforce of e-commerce companies is closely related to technological developments. The digitalization of the economy, which is being socialized by the Indonesian government, is the beginning for workers to improve their ability to adapt to the use of technology (Usnaka, 2025a).

Research conducted by Hindrayani et al. (2024), Chen and 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 increase the amount of output produced. A skilled workforce with technological abilities will improve productivity in terms of quality and quantity. This will increase economic growth.

4.3.3 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 (0.005386). Based on the partial significance test, 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 at any time, provided there is an internet connection. E-commerce has become a means for SMEs to advance in class as a place of marketing, which has been an obstacle for SMEs. The expansion of sales access, ease of transaction, 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 (Fitriyani, Handayani, & Sari, 2025).

Research conducted by Dianari (2018) and Maisaroh et al. (2024) found a positive and significant effect between the volume of e-commerce transactions and economic growth. Some of the advantages of e-commerce include the existence of economies of scale, which 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 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 e-commerce indirectly affect economic growth.

5. Conclusion

Based on the results of data processing and discussions that have been carried out, the following conclusions can be drawn:

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

5.1 Limitation

The research is limited to a few determinants, namely R&D investment, e-commerce company employees, and the volume of e-commerce transactions. In addition, this study was conducted in only one country, Indonesia. Further research should compare the state of e-commerce in several countries.

Acknowledgment

The author would like to thank Mr. Dr. Heru Wahyudi, S.E., M.Si, and Mrs. Tiara Nirmala, S.E., M.Sc, who provided many inputs for the author in completing this research.

References

Americo, A., & Veronico, A. (2018). *The effect of e-commerce on employment in retail sector.* Paper presented at the Proceedings of the 2018 International Conference on Advances in Technology, Information and Communication-ATIT.

Anggraeni, L., Tan, S., Junaidi, & Achmad, E. (2024). E-commerce's impact on economic growth in Indonesia: A systematic literature review. *Nomico Journal, 1*(6), 64-76. doi:https://doi.org/10.62872/hqfac055

Asdemir, O., Cao, Z., Coskun, A., & Tripathy, A. (2025). Firm strategy and outcome uncertainty in R&D firms. *Journal of Risk and Financial Management, 18*(6), 292. doi:https://doi.org/10.3390/jrfm18060292
Chen, L., & Kimura, F. (2020). *E-commerce connectivity in ASEAN*. Jakarta: ERIA.
Chu, Z., Chen, X., & Yang, J. (2025). Impact of data factor and data integration on economic development: Empirical insights from China. *Telecommunications policy, 49*(8), 103004. doi:https://doi.org/10.1016/j.telpol.2025.103004
Chukwuemeka Ogugua, A. (2024). A theoritical and empirical literature on economic growth:. *Advanced Research in Economics and Business Strategy Journal, 5*(2), 07-16. doi:https://doi.org/10.29106/fesa.858707
Couture, V., Faber, B., Gu, Y., & Liu, L. (2018). *E-Commerce Integration and Economic Development: Evidence from China*.
Dianari, R. G. F. (2018). Pengaruh e-commerce terhadap pertumbuhan ekonomi indonesia. *Bina Ekonomi, 22*(1), 43-62. doi:https://doi.org/10.26593/be.v22i1.3619.45-64
Ferrara, M. (2025). Solow-Swan Model and Growth Dynamics: moving forward. *Decisions in Economics and Finance, 10*(2), 1-17. doi:https://doi.org/10.1007/s10203-025-00543-8
Fitriyani, L. N., Handayani, T., & Sari, L. P. (2025). Analysis of the marketing strategy of savings products at BMT Nasuha during the Covid-19 pandemic. *Dirham: Journal of Sharia Finance and Economics, 1*(1), 1-14. doi:https://doi.org/10.35912/dirham.v1i1.3329
Gutiérrez-Sánchez, G., & Benéitez-Andrés, E. (2025). The impact of R&D investment on economic growth and productivity: Evidence from emerging economies. *Economies, 13*(10), 293. doi:https://doi.org/10.3390/economies13100293
Hindrayani, A., Rina, L., & Naufalin, L. R. (2024). Impact of Indonesia's ICT development on economic growth. *Jurnal Pendidikan Ekonomi Dan Bisnis (JPEB), 12*(01), 01-10. doi:https://doi.org/10.62872/hqfac055
Indonesia, B. (2021). *Laporan kebijakan moneter 2021*. Retrieved from
Insee, K., & Suttipun, M. (2023). R&D spending, competitive advantage, and firm performance in Thailand. *Cogent Business & Management, 10*(2), 2225831. doi:https://doi.org/10.1080/23311975.2023.2225831
Kutlaca, D., Sestic, S., Jelic, S., & Popovic-Pantic, S. (2020). The impact of investment in research and development on the economic growth in Serbia. *Industrija, 48*(1), 23-46. doi:https://doi.org/10.5937/industrija48-24949
Mahfuzah, S., & Chandriyanti, I. (2022). Perkembangan transaksi e-commerce berdasarkan metode pembayaran, kategori produk, dan kelompok usia di Kalimantan Selatan. *JIEP: Jurnal Ilmu Ekonomi dan Pembangunan, 5*(1), 293-309. doi:https://doi.org/10.20527/jiep.v5i1.5529
Maisaroh, N., Habibi, A., & Iqbal, M. (2024). Growth trends of internet users and e-commerce in increasing economic growth in Indonesia. *Jurnal Ekonomi Pembangunan, 13*(3), 41-50. doi:https://doi.org/10.23960/jep.v13i3.3868
Melinda, V., Wiliasih, R., Irfany, M. I., & Haq, D. A. (2026). Capital structure and banking performance in dual banking system in Indonesia. *Dirham: Journal of Sharia Finance and Economics, 2*(1), 1-16. doi:https://doi.org/10.35912/josfe.v2i1.1665
Nursari, A. (2023). The influence of technological development through R&D on production efficiency and economic outcomes. *Jurnal JMM, 12*(1), 45-60. doi:https://doi.org/10.33024/jejama.v3i1.11259
Pradana, M. (2015). Klasifikasi bisnis e-commerce di Indonesia. *Modus, 27*(2), 163-174. doi:https://doi.org/10.24002/modus.v27i2.554
Raetskiy, A., & Tereshchenko, D. (2025). conomic growth and R&D investment: An empirical analysis of Russian regions. *Journal of the New Economic Association, 67*(2), 46-64. doi:https://doi.org/10.31737/22212264_2025_2_46-64
Sayekti, N. W. (2018). Tantangan perkembangan ekonomi digital di indonesia. *Info singkat, 10*(5), 19-24.
Sharma, D. A., & Mishra, D. S. K. (2023). The Evolution And Impact Of E-Commerce. *Journal of Namibian Studies, 33*(S1), 1838-1846. doi:https://doi.org/10.59670/jns.v33i.3260
Šlander-Wostner, S., Križanič, F., & Vojinovic, B. (2025). Endogenous growth factors and economic development: An in-depth analysis of the impact of investments in R&D and human capital on

total factor productivity and export dynamics. *Engineering Economics, 36*(2), 255-267. doi:https://doi.org/10.5755/j01.ee.36.2.35715

Trung, T. V., & Doan, L. H. (2025). Contribution of capital, labor, and total factor productivity to economic growth and enterprise value-added: A case study of Ha Tinh province, Vietnam. *International Journal of Innovative Research and Scientific Studies, 8*(3), 3899-3906. doi:https://doi.org/10.53894/ijirss.v8i3.7402

Tu, J., Wei, X., & Razik, M. A. B. (2025). The impact of digital technology on total factor productivity in manufacturing enterprises. *Scientific Reports, 15*(1), 23543. doi:https://doi.org/10.1038/s41598-025-05811-6

Usnaka, A. (2025a). Litigation and non-litigation approaches in Islamic Banking Syariah resolution. *Dirham: Journal of Sharia Finance and Economics, 1*(1), 49-59. doi:https://doi.org/10.35912/josfe.v1i1.3332

Usnaka, A. (2025b). Litigation and non-litigation approaches in Islamic Banking Syariah resolution. *Dirham: Journal of Sharia Finance and Economics, 1*(1), 45-59. doi:https://doi.org/10.35912/josfe.v1i1.3332

Wijayanti, S., & Wahyudi, M. S. (2025). Analysis of the Solow economic growth model in ASEAN-5 countries. *Jurnal Ilmu Ekonomi JIE, 9*(03), 286-294. doi:https://doi.org/10.22219/jie.v9i03.40568

Yang, C.-H., & Chen, Y.-H. (2012). R&D, productivity, and exports: Plant-level evidence from Indonesia. *Economic Modelling, 29*(2), 208-216. doi:https://doi.org/10.1016/j.econmod.2011.09.006

Yasin, M. Z. (2023). Does R&D Stimulate Firm's Efficiency in the Indonesian Manufacturing Sector? *Jurnal Ekonomi Indonesia, 12*(3), 203-219. doi:https://doi.org/10.52813/jei.v12i3.320