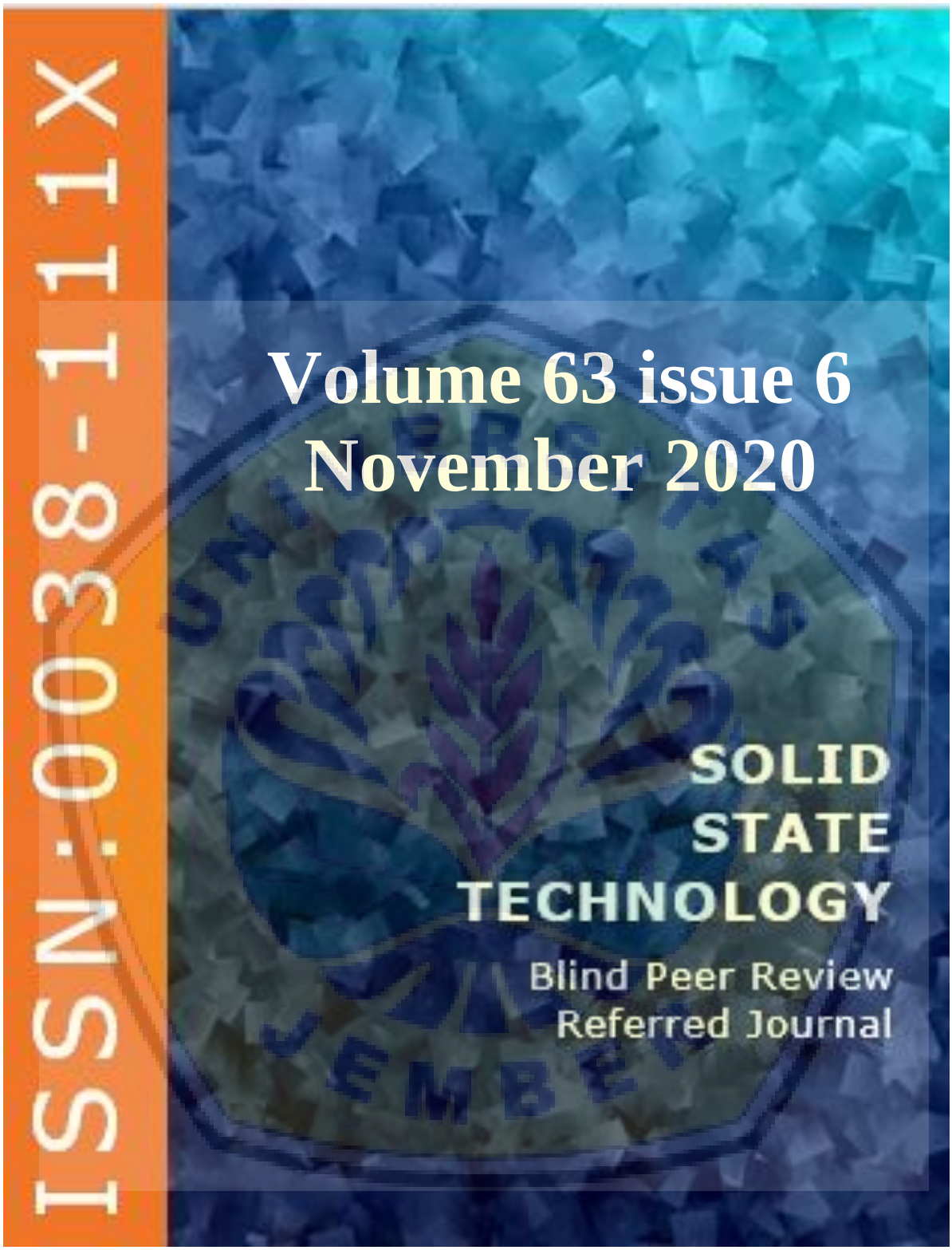

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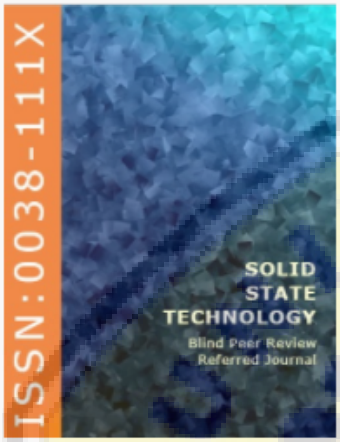

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Economic Growth Model In The Fourth Industrial Revolution: Case Study From East Java Province Of Indonesia

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Abstract: Solow's economic growth theory explains the relationship of capital, labor, and technology to the economic growth of a country. According to this theory, all of the factors have positive impacts on the economic growth. However, in the fourth industrial revolution, technology not only boosts business and economy, but also creates disruption in the economic, business, national and global relations, societal, and individual aspects. Thus, this research aimed to examine whether the traditional economic growth model still has relevance in the fourth industrial revolution. This case study was conducted in East Java Province of Indonesia on account that this province was considered to be representative of Indonesia. The data consisted of those on gross regional product, labor, investment, number of Internet users for purchase/sale of goods and services, as well as number of Internet users for accessing financial facility. The data were panel data from the Statistics Indonesia for the 2015–2017 period. The analysis method used was panel regression to examine the relationship between gross regional product as a response variable and labor, investment, number of Internet users for purchase/sale of goods and service, and number of Internet users for accessing financial facility as predictor variables. By the fixed effect model, it could be concluded: first, there was a positive and significant relationship of investment to the economic growth of East Java; second, there was a negative but not significant relationship between labor and the economic growth of East Java; third, number of internet users for purchase/sale of goods and services had a positive and significant effect on East Java's economic growth; and fourth, number of Internet users for accessing financial facility had negative and significant effect on East Java's economic growth.

Keywords: *investment, labor, internet users, economic growth, panel regression.*

I. INTRODUCTION

Every nation needs development strategies appropriate for its ability or factor endowment. Appropriate resources management strategies are key to development success. In the neo-classical theory, capital and labor are primary production factors in economic growth. The two production factors are determinant of the level of national income. In the ensuing development, not only the two factors determine economic growth, but also technology. As explained by Solow's economic growth theory, the economic growth of a country is influenced by not only the GRDP and investment values, but also other factors, including labor and technology. A number of assumptions related to the technological factor emerges after this theory gained recognition among society, where it is said that the

technological factor referred to is exogenous in nature. This means that this factor does not originate in the country in question, but from overseas. This later trigerred the emergence of the endogenous growth theory, which describes technological influence as an endogenous factor in the determination of the economic growth of a country, where the more advanced the technology owned by the country, the greater the economic growth rate is.

The importance of technology to economic growth becomes more significant in the Industrial Revolution 4.0 era, an extension of preceding industrial eras, and not only does it open wider interactions, it also disrupts a vast variety of human life aspects. Industrial Revolution 1.0, or the first industrial revolution, took place from 1760 through 1840, characterized by the advent of steam engine, which then pushed human labor aside. The second industrial revolution commenced by the end of the 19th century, marked with the introduction of electricity- and fuel-powered machinery. In 1969, the third revolution began, marked with technological innovations like computer making appearance and prompting automation. As for the Industrial Revolution 4.0, it is signed by the proliferation of such global phenomena as the Internet of Things (IoT), Artificial Intelligence (AI), Big Data, and 3D Printing Technology [1]. Further, there are five clusters of impacts of technology will arise, and those are from the economic, business, national and global relations, societal, and individual aspects. Economically speaking, optimal use of the existing technologies can promote the economic growth of a country, either in terms of unemployment reduction or job opportunity rate boost.

A great number of studies have been conducted to look at the influence technology exerts on economic growth, but the conclusions do not always reach an agreement. The research by Majeed and Ayub [2] showed that technology had a positive effect on economic growth. The study indicated that the existence of technology, capital, and labor positively affected economic growth. Such technological sub-sectors as online services, telecommunications infrastructure, and e-government systems had a significant, positive effect on economic growth. Other studies by Barini and Alaa [3] as well as Toader, Bogdan, Angela, and Sorin [4] offered analogous results, namely technology had a positive effect on economic growth. However, this is not always true in other cases. Separate other studies demonstrated results misaligned with both Solow's economic growth theory and the endogenous growth theory concerning the role of technology in economic growth. O'Mahony, Robinson and Vechhi [5], for example, explain that information and communications technology (ICT) negatively influenced output growth for industries in the United Kingdom (UK) out of lack of labor skills. Technology, previously described to have a positive influence on economic growth, demonstrated an opposite outcome, instead. Meanwhile, Yousefi [6] unveiled that ICT influenced the economic growth of upper middle-income countries but failed to contribute to the economic growth of lower middle-income nations. Zhao [7] give a good review how technology has been integrated into the study of economic growth using Paul Romer's endogenous growth theory.

This condition presents a question of whether the introduction of innovations in various technological fields like AI and IoT has developed in Indonesia and been able to influence the economic growth of the country, notably in the province of East Java. The Indonesia's ICT Development Index has also displayed a constant upward trend from 3.88 in 2015 to

4.34 in 2016 and 4.99 in 2017. The index is a measurement standard that represents the level of ICT development in a region, digital divide, and ICT development potential. The Special Capital Region of Jakarta is a province with the highest ICT development index in Indonesia and the highest domestic investment on Java Island. The two resources drive high economic growth rate in the province. Meanwhile, East Java tailed DKI Jakarta as the province with the second highest domestic investment but lagged behind at the 11th place in the ICT development index with a score of 4.88 as of 2017 (Statistics Indonesia, 2017).

Previously research shown that technology have important role in the fourth industrial revolution especially in economic growth. Thus, this paper aims to study economic growth model whether consistent with the classical theory. The study is limited in East Java Province of Indonesia using panel data from 2015-2017. The contribution of this study is to evaluate and to give suggestion to the policy maker how to boost regional economic growth.

II. LITERATURE REVIEW

Belonging to the traditional economic growth theories are Adam Smith's classical theory and Solow's neo-classical theory of development in economy. According to Adam Smith, growth of total output and population growth are two chief factors that influence output. The principal elements of the production system of a country consist of these three: natural resources, human resources, and capital stock. The natural resources at hand are the most fundamental medium of the production activity of a society wherein they have a maximum limit for the growth of the economy. Human resources (population) are a passive role in the growth of output, meaning that the population size will adjust to the need for labor. Meanwhile, capital stock is an indispensable production element to the growth of output.

Solow's growth model presents a different assumption from that of Adam Smith's model. In Solow's model, savings, labor growth, and technological advancement serve as factors that influence the level of economic output and growth in the long run. Solow's economic growth theory is one of the theories that show the influence of the three variables—labor, savings, and technological advancement—on the goods and services output of a country as a whole. This model was successfully developed through several stages. Firstly, it is assumed that labor and technology has a fixed value. Then, by reviewing the supply of and demand for goods that influence the accumulated capital, the existing assumptions are altered, starting with introducing the arising changes in the technological sector, with technological advancement being an exogenous variable. To gain a more holistic understanding of economic growth process, a different theory came forth to challenge the assumptions in Solow's model. The theory argues that in an economy, technological advancement is not exogenous in nature, but originating from within the economy. This theory is referred to as the endogenous growth theory.

With time, the definition of technology expands. Technology is not limited to only industrial machinery form. It has evolved into a more practical and, certainly, more effective and efficient form. One of the men who have discussed the concept of technology-induced new era emergence is Tapscott [8]. His thought is known as the economic digitization concept, as is explained in his book The Digital Economy: Promise and Peril of the Age of

Networked Intelligence. According to Don, the Age of Network Intelligence is a revolutionary phenomenon resulted from the convergence in the technological sector, be it from the communication, computing (computer, software, and services), or content (publishing, entertainment world, and information provider) aspect. This new era forced human being to quit seeing the definition of economy singly from the traditional side. The three keys to the discussion of economic digitization are the factors triggering a new era, internetworking and its implications for business and government, and leadership which will be responsible for the existence of transformation or even become part of agent of change in the said transformation. The technology referred to by Don encompasses not only network technology, but also the technology that has recently been able to mix knowledge and human creativity to create a new, better environment and social prosperity like the Internet. Digital economy possesses twelve essential characteristics, namely Knowledge, Digitization, Virtualization, Molecularization, Internetworking, Disintermediation, Convergence, Innovation, Prosumption, Immediacy, Globalization, and Disordance [8]

Majeed's work [2] demonstrated that the variable labor is positive and significant to economic growth, and so are human resources and physical capital. The study shows that the contribution from telecommunications infrastructure, e-government, and online services is beneficial to SAARC countries (Afganishtan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka). In the case of developing countries, enhancing telecommunications infrastructure and online services as well as human resources and labor can promote the economic growth. Similar results were obtained by Bahrini and Qaffas [3] through a study using the Panel GMM Growth Model over the 2007–2016 period. The study's results show that ICT, as represented by use of mobile phones and the Internet, left a positive impact on the economic growth of Middle East and North Africa (MENA) as well as Sub-Saharan Africa (SSA) countries.

Yousefi [6] used time-series data from 62 countries for the 2000–2006 period and adopted a traditional growth model as a framework to estimate the contribution of labor, ICT, and non-ICT capital to the economic growth of developed and developing countries. The results show that ICT's effect on economic growth differed by country group. ICT influenced the economic growth of upper middle-income countries but failed to contribute to the economic growth of lower middle-income countries.

O'Mahony, Robinson, and Vecchi [5] used industry panel data from 31 US industries and 27 UK industries from 1979 through 2000, 30 French industries from 1982 through 2000, and 25 German industries from 1979 through 1998 and found out that ICT negatively affected the growth of output for the industries in the UK out of lack of labor skills. Such findings explained that ICT exerted a negative effect on labor of low skills and education but positive on labor of high skills and education.

Guetat, Imene, and Imed [9] then revealed that ICT had a positive effect on growth for East and South Asian (ESA) countries but negative on Sub-Saharan Africa (SSA). The data employed were the panel data from six global regions, notably in 14 MENA countries (Algeria, Bahrain, Egypt, Iran, Israel, Jordan, Kuwait, Morocco, Qatar, Saudi Arabia, Syria, Tunisia, Turkey, and the United Arab Emirates) from 1992 through 2004. The data were processed by the GMM method. The research looked at the direct and indirect impacts of ICT

globally and regionally on growth in six world regions, especially in 14 MENA countries. The research investigated the ICT's indirect impact on growth through human resources and investment's on ICT profitability. The findings showed that in MENA countries, ICT had no specific impact on growth in comparison to OECD region. MENA region as a whole needed sustainable improvement in both the quality and quantity of human resources as well as in ICT equipment to improve the performance of the countries within in growth. MENA countries are segregated into two groups: oil and non-oil countries. To the former, ICT positively impacted economic growth.

III. METHODOLOGY

Type and Source of Data

This research employed secondary data from second party. The secondary data were panel data of each regency in East Java on labor size, amount of investment, rate of Internet use for purchase/sale of goods/services, rate of Internet use for accessing financial facility (e-banking), and GRDP. The research was conducted from 2015 through 2017. The secondary data were sourced from two websites. The data on investment realization were obtained from the website of the National Single Window of Investment (https://nswi.bkpm.go.id/), and the other data on labor, GRDP, rate of Internet use for accessing financial facility, and Internet use for purchase/sale of goods/services were from the website of the Statistics Indonesia (https://www.bps.go.id).

Research Variable

There were two types of variables used in this research, namely independent and dependent.

1. Independent variable is also referred to as stimulus variable, predictor variable, and antecedent variable. This variable will cause a change in dependent variable. The present research involved a number of independent variables.
    a) Investment realization per regency/city in East Java for the 2015–2017 period (in million rupiahs) – X_1
    b) Labor size per regency/city in East Java for the 2015–2017 period – X_2
    c) Number of Internet users for purchase/sale of goods/service per regency/city in East Java for the 2015–2017 period (in people) – X_3
    d) Number of Internet users for accessing financial facility per regency/city in East Java for the 2015–2017 period (in people) – X_4
2. Dependent variable is also referred to as output variable, criterion variable, or consequence variable. The dependent variable used in this research was gross regional domestic product (GRDP) per regency/city in East Java for the 2015–2017 period (based on Consumer Price in 2010) - Y

Data Analysis Methods

The data analysis method for this research is data panel regression. The general model for this data panel is as follows,

Yit = α + β1X1it + β2X2it + β3X3it + β4X4it + □it
where :

Yit = gross regional domestic product variable year t and district i
X1it = investment realization variable year t and district i
X2it = labor size per regency variable year t and district i
X3it = number of internet users for purchase/sale of goods/service year t and district i
X4it = number of Internet users for accessing financial facility year t and district i
A = constant
β1 ,…,β4 = model parameter
I = index for district, i = 1,2,3,…,38
T = index period-t, t =2015, 2016, 2017
Eit = error

The first step in data analysis is estimation the parameter model using common effect, fixed effect, and random effect assumption. The second one is selection the best model are the Chow Test, the Lagrange Multiplier Test (LM), and the Hausman Test. The third one is model evaluation and making statistical inference of the model parameter.

The Chow Test is a test for finding out which one between the common effect model and the fixed effect model should be used in a panel data analysis. The Hausman Test is a test for finding out which one is more suitable to use in further analysis between the random effect model and the fixed effect model. Lastly, the Lagrange Multiplier Test is a test for determining whether the random effect model is better than the common effect model.

If the results of the Chow Test and the Hausman Test indicate that the most suitable model is the fixed effect model, there will be no need in conducting the LM Test. However, if the Chow Test result shows that the model to use is the common effect model, while the Hausman Test result the random effect model, the LM test will become necessary to conduct as a concluding stage in which the most appropriate model between the common effect and the random effect can be determined.

IV. RESULTS AND DISCUSSION

The approaches to panel data regression employed in this research included the common effect model (CEM), the individual fixed effect model (FEM), and the random effect model (REM). The panel data regression model equations resulted from the three approaches are presented in Table 1.

Table.1: Regression Model Equations

	Regression Model	R-Sq
CEM	$Y = -0,6569 + 0,0438X_1 + 0,0583X_2 + 0,7142X_3 + 0,1373X_4$	65,56%
FEM	$Y = -9,5276 + 0,0043X_1 + 0,0005X_2 + 0,0695X_3 - 0,0362X_4$	99,86%
REM	$Y = 9,219 + 0,0045X_1 + 0,0035X_2 + 0,0899X_3 - 0,0325X_4$	24,53%

Table 1 shows that the CEM under intercept assumption and constant slope had an R-Sq value of 65.56%. The main FEM had the highest R-Sq value (99.86%), whereas the REM the lowest (24.53%).

The Best Model Selection

To select the most appropriate panel data model, the Chow Test, the Hausman Test, and the Lagrange Multiplier Test were conducted. The results are as follows.

a. Chow Test

The Chow Test was carried out to choose the best model between the common effect model (CEM) and the fixed effect model (FEM). At a significance level (α) of 5%, the p-value obtained was 0.00 (p-value < α). It could thus be concluded that the fixed effect model (FEM) was more appropriate.

b. Hausman Test

The Hausman Test was carried out to choose the best model between the random effect model (REM) and the fixed effect model (FEM). At a significance level (α) of 5%, the *p*-value obtained was 0.00 (*p*-value < α). It could thus be concluded that the fixed effect model (FEM) was more appropriate. The Lagrange Multiplier Test was no longer necessary to conduct because the fixed effect model (FEM) was selected.

Based on the results of the Chow Test and the Hausman Test, it was concluded that the fixed effect model (FEM) was the selected model for estimating the constant-price GRDP of the regencies/cities in the Province of East Java. The results of the estimation by the fixed effect model (FEM) between regencies/cities can be seen in Annex. Based on Annex, the best model for the constant-price GRDP in the regencies/cities in the Province of East Java with the fixed effect model (FEM) approach is as shown in the following equation.

$$y = -9,5276 + 0,0043x_1 + 0,0005x_2 + 0,0695x_3 - 0,0362x_4 + D_i$$

FEM regression model parameter testing was aimed to figure out about the effect the predictor variables had on the response variable. There were two regression model parameter tests used.

a. Simultaneous Test

A simultaneous test was carried out to find out about the simultaneous effect of all independent variables on the constant-price GRDP of the regencies/cities of the Province of East Java. At a significance level (α) of 5%, the *p*-value obtained was 0.00 (*p*-value < α). It could be concluded that there was at least one independent variable that affected the constant-price GRDP in the regencies/cities in the Province of East Java.

b. Partial Test

To figure out the effect of each independent variable, test of significance of the parameters was conducted partially. At a significance level (α) of 5%, the results of the partial test can be seen in Table 2.

Table.2; Partial Test

Variable	Coefficient	Std. Error	$\|t_{test}\|$	$t_{0,025;113}$	*p-value*
C	9,527619	0,243656	39,10281	2,271	0,0000
LOGX1	0,004334	0,001667	2,600730		0,0113
LOGX2	0,000595	0,007871	0,075654		0,9399
LOGX3	0,069551	0,018678	3,723764		0,0004
LOGX4	-0,036235	0,007809	-4,640388		0,0000

Table 2 presents the results of the partial t-test, and it was found that the $|t_{test}|$ values for the variables investment and Internet use for purchase/sale of goods and services were greater than $t_{0.025;113}$ (2.271) and that the *p*-values were smaller than the significance level (α) of 0.05. It could be concluded that the variables investment and Internet use for purchase/sale of goods and services had significant effects on GRDP.

The equation model above describes the following: 1) for every 1% increase in investment, the constant-price GRDP in the Province of East Java would increase by 0.005 billion rupiahs, other variables held constant; 2) for every increase of one person in labor, the constant-price GRDP in the Province of East Java would increase by 0.0043 billion rupiahs, other variables held constant; 3) for every increase of one Internet user for purchase/sale of goods and services, the constant-price GRDP of the Province of East Java would increase by 0.0695 billion rupiahs, other variables held constant; and 4) for every increase of one Internet user for accessing financial facility, the constant-price GRDP of the Province of East Java would decrease by 0.0362 billion rupiahs, other variables held constant.

From the results of the panel data regression analysis by the fixed effect model, it could be concluded that the model above could explain the variation in the economic growth of East Java at 99.86%. The F-test results also showed that investment, labor, Internet users for purchase/sale of goods and services, and Internet users for accessing financial facility collectively exerted a significant effect on the economic growth of East Java for the 2015–2017 period. Meanwhile, the t-test results showed that investment (IN), Internet users for purchase and sale activity (TEC_JB), and Internet users for accessing financial facility (TEC_KEU) significantly influenced the economic growth of East java, while labor (LAB) did not.

The regression analysis conducted yielded a coefficient for each regency or city in East Java. The coefficient showed how the region was associated to the free variables used. Greater or positive coefficient signalled that the effects of the three variables were not strong in encouraging the economic growth, while negative coefficient showed that the region's reliance on the three free variables was high. The regions with the highest positive coefficients were the City of Surabaya and the Regency of Sidoarjo, while the regions with the lowest negative coefficients were the City of Blitar and the City of Mojokerto. In the next paragraphs, the relationship of each of the free variable to the economic growth of the Province of East Java is to be described.

Investment was one of the propellers of economic growth. This variable had a significant, positive coefficient in its relationship with the economic growth of the province. This finding is in line with that of Bakari's study [10] that domestic investment had a significant, positive effect on the economic growth of Malaysia in the long term. The presence of investment now deserves attention from the regional government as its role can also influence how development is run in a region. East Java is the province with the second largest population size after West Java (39.29 million people). If East Java can increase investment in every city/regency, benefits can be felt in not only the development sector but also other sectors like education and health. The investment received may subsequently become preliminary capital for the community to start economic activities, which certainly will boost not only the regional income but also the community's consumption. In other words, the increase in the GDP will raise the community's prosperity.

Based on the analysis results, the effect of Internet use for purchase/sale of goods and services on the economic growth of East Java was positive and significant. This means that an increase in the number of Internet users for purchase/sale of goods and services would increase the economic growth of East Java. This is consistent with the findings of an earlier study by Jorgenson, Dale and Stiroh [11], which showed a positive effect from Information and Communications Technology (ICT) on the US's economy, as well as those of the studies by Saglam [12] and Edquist and Henrekson [13], which concluded that Internet, ICT investment, cellular phones, and research and development positively influenced economic growth.

Internet use for accessing financial facility showed a negative and significant result. This result is consistent with the results of the research by Al Smadi and Saad [14] that e-money use negatively affected the banking performance in Jordan, and banking performance subsequently influenced the economic growth. The research by Siddik et al. [15] indicated that e-banking use could reduce banking profits in the short term. The reason was that a significant amount of investment in banking technology was not offset by the number of users. Residents of developed countries favour traditional banking transactions as it took them some time to adopt new technology.

Lastly, labor had a positive, but insignificant, effect on economic growth. Majeed's study [2] showed that the presence of technology, capital, and labor exerted a positive effect on economic growth. However, such results were slightly different from the results obtained in this research. It was supported by a prior study, which stated that human capital per se could not guarantee economic stability [16].

One of the reasons that could shed light on the absence of effect from labor size on economic growth is the presence of job transition. The Industrial Revolution 4.0 is marked with the development of cutting edge, complex technology, and in this case, the labor in greater demand is one with expertise. This unquestionably will influence the jobs in Indonesia, particularly East Java. Machinery can offer better performance in terms of speed than human labor, and the product defect rate when machinery is used is well lower than when human labor is employed (National Development Planning Agency).

V. CONCLUSION

From the research conducted, it was found that investment had a significant positive effect on economic growth. It was figured out that an increase in investment would drive an increase in the economic growth. Number of Internet users for purchase/sale of goods and services also had a significant positive effect on the economic growth of East Java, but number of Internet users for accessing financial facility had a negative effect. This means that the increase in the number of Internet users for accessing financial facility would slower the economic growth of East Java down, instead. Meanwhile, labor size apparently had a positive, but insignificant, effect on the economic growth of the province, meaning that the rise in labor size had no impact on the economic growth. In the fourth industry revolution context, it should be noted that the relationship of technology and economic growth in this study is consistent with the previously study in another country especially the research of Jorgenson and Stiroh [11] , Oliner, Stephen and Sichel [17].The government is expected to maintain and increase existing investments in East Java. The government must also improve access and application of technology in each region. Then, the government also needs to improve the quality of education to provide an opportunity for them to be able to adapt to the phenomenon of the Industrial Revolution 4.0. As additional, the further research can be addressed on specific economic issues, i.e, productivity, skill labour, and income. Then, the time frame in data panel also can be extended to be longer.

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REFERENCES

[1] Schwab, K. (2016). The Fourth Industrial Revolution. Geneva: World Economic Forum.

[2] Majeed, M. T. & Ayub, T. (2018). Information and Communication Technology (ICT) and Economic Growth Nexus: A Comparative Global Analysis. Pakistan Journal of Commerce and Social Sciences Vol. 12 (2), 443-476.

[3] Bahrini, R. & Qaffas, A.A. (2019). Impact of Information and Communication Technology on Economic Growth: Evidence from Developing Countries, Economies, 7(21).

[4] Toader, E., Firtescu, B.N., Roman, A., Anton, S.G., (2018). Impact of Information and Communication Technology Infrastructure on Economic Growth: An Empirical Assessment for the EU Countries. *Sustainability*, *10*, 3750.

[5] O'Mahony, M., Robinson, C., and Vecchi, M. (2008). The Impact of ICT on the Demand for Skilled Labour: A cross-country comparison, Labour Economics, 15(6), pages 1435-1450

[6] Yousefi, A. (2011). The impact of information and communication technology on economic growth: Evidence from developed and developing countries. Economics of Innovation and New Technology, 20(6):581-596

[7] Zhao, R. (2019). Technology and economic growth: From Robert Solow to Paul Romer. Human Behavior and Emerging Technology,1(1), 62–65
[8] Tapscott, D. (1995). The Digital Economy: Promise and Peril In The Age of Networked Intelligence. McGraw-Hill.
[9] https://www.iai.it/sites/default/files/menara_wp_23.pdf
[10]Bakari,S. (2017). The Impact of Domestic Investment on EconomicGrowth: New Evidence from Malaysia, MPRA Paper No. 79436
[11] Jorgenson, Dale, W., & Stiroh, K.J. (2000). U.S. Economic Growth at the Industry Level. American Economic Review, 90 (2): 161-167.DOI: 10.1257/aer.90.2.161.
[12] Saglam, B. B. (2018). ICT diffusion, R&D Intensity, and Economic Growth: A Dynamic Panel Data Approach. Journal of the Knowledge Economy, 9(2), 636-648
[13] Edquist, H., & Henrekson, M. (2017). Swedish lessons: How important are ICT and R&D to Economic Growth?, Structural Change and Economic Dynamics, 42(1), 1-12.
[14] Al-Smadi, Mohammad O. & Al-Wabel, S. A. (2011). The Impact of E- Banking on The Performance of Jordanian Banks, Journal of Internet Banking and Commerce,16(2).
[15] Siddik, M. N. A., Sun, G., Kabiraj, S., Shanmugan, J., Yanjuan, C. (2016). Impacts Of E-Banking On Performance Of Banks In A Developing Economy: Empirical Evidence From Bangladesh. Journal of Business Economics and Management, 17(6): 1066–1080
[16] Čadil, J., Mazouch, P., Musil, P., Kramulová, J. (2014). True Regional Purchasing Power: Evidence from the Czech Republic. Post-Communist Economies, 26(2), pp. 241–256.
[17] Oliner, Stephen, D., and Sichel, D.E. (2000). The Resurgence of Growth in the Late 1990s: Is Information Technology the Story? Journal of Economic Perspectives, 14 (4): 3-22