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The Negative Relationship Between Intrnet Access and Economic Growth: Evidence from the Indonesian

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Abstract

The internet is closely linked to economic growth, including increased productivity, innovation and entrepreneurship, access to global markets, skills development and education, digital infrastructure and services, and increased connectivity and collaboration. The internet is growing rapidly in Indonesia, especially on the island of Java. Java as the largest economic contributor in Indonesia, followed by Sumatra Island as the second contributor. For this reason, this study aims to examine the influence of internet access, the number of mobile phone users, the number of BTS towers, and the Labor force participation rate on economic growth in Java and Sumatra for the 2018-2021 period partially and simultaneously. The analysis methods used are model suitability testing, classical assumption testing, panel data linear regression model, hypothesis test with t-test and f-test and determination coefficient interpretation. The results of the study show that internet access as a proxy for access to technological progress, has a negative effect on economic growth. Internet access, the number of mobile phone users, the number of BTS towers, and Labor force participation rate together have a significant effect on economic growth in Java and Sumatra Indonesia for the 2018-2021 period.

Keywords: *Internet Access, Number of Mobile Phone Users, Number of BTS Towers, Labor Force Participation Rate.*

Introduction

Economic growth is measured by changes in a country's Gross Domestic Product (GDP) which can be decomposed into its population and economic elements by writing it as population times per capita GDP (Peterson, 2017). In the Solow growth model, it is revealed that the relationship between capital accumulation, technological progress and labor can have an influence on the total output of goods and services in a country (Mankiw, 2014). These factors in a broad sense include human resource development, institutional framework, natural resource development, labor productivity, physical capital, and communication information technology (ICT) (Adeleye & Eboagu, 2019). The difference in these factors causes differences in economic growth in each region. Based on Sasana (2019), economic growth is used as an indicator to assess economic performance, particularly in increasing the production of goods and services, at regional level.

Indonesia is an archipelago country located in Southeast Asia with the fourth largest population in the world. As an archipelagic country, Indonesia has a lot of natural resources which of course affect economic growth. Natural resources have an influence on a country's economic growth, based on research from Wahyudi & Palupi (2023), finding that Indonesia's natural resources are a blessing for Indonesia's economic growth. Indonesia has 5 (five) large islands, including Sumatra, Java, Kalimantan, Sulawesi and Papua. The pattern of economic growth on each island in Indonesia is very diverse, this is because the factors that influence it are also different. Economic inequality in Indonesia is still very high. Java Island is the largest contributor to the economy in Indonesia, this is supported by the availability of adequate infrastructure and connectivity. The second largest contributor to the Indonesian economy is the island of Sumatra, the location of Sumatra Island which is not too far from the island of Java, making it a strategic position in economic development. The island of Sumatra can be an area that is developed as the initial pillar of Indonesia's economic equity.

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Table 1. Economic Growth of Java and Sumatra 2018-2021

Economic Growth	Year			
	2018	2019	2020	2021
Javanese	4.62	4.94	-1.56	2.94
Sumatra	3.04	3.38	-0.33	1.85

Source: Central Statistics Agency (2022), data processed

Table 1, showing the fluctuating level of economic growth on the islands of Java and Sumatra,it can be seen that from 2018 to 2019 economic growth increased, but in 2020 economic growthon the two islands contracted, but in 2021 there was a fairly good increase. Based on Table 1, it can be seen the economic growth rate on Java Island is better than the island of Sumatra. The decline in economic growth in 2020 occurred due to the Covid-19 pandemic. The mobility of people, goods, and services became very limited during the Covid-19 pandemic, thus reducing people's purchasing power, besides that government spending was also diverted to the health sector. Based on research from Fitriyah & Luqyana, (2018), it is stated that the decline in people's purchasing power and the turnover of business actors towards the decline in tax performance as a source of state revenue decreased, this led to a decline in economic growth.

To achieve stable economic growth requires the performance of factors that are able to support economic growth, renewable energy consumption has a positive impact on economic growth (Jia et al., 2023). Based on Sukirno (2019) one of the most important factors is advances in information communication technology (ICT). ICT is a symbol of today's technological revolution which is formed from a combination of computer systems, telecommunications, electronics, networks and information media which influence individuals, companies, the economy, and so on (Majeed & Ayub, 2018). Theoretically, most researchers argue that ICT should be the main stimulant of economic growth. According to neoclassical growth theory, growth is driven by exogenous technological changes, and conversely, endogenous growth theory emphasizes how growth naturally occurs from investments in human resources and technological developments. Endogenous growth theory views ICT as contributing to economic growth through the development of new products, processes and business models (Stanley et al., 2018). The results of the SUSENAS Survey data collection conducted by the Central StatisticsAgency in 2021 show that 62.10% of the population in Indonesia has accessed the internet in 2021. This indicates that the majority of Indonesian people have been open and accepted technological advances and developments. (BPS-Statistics Indonesia, 2022).

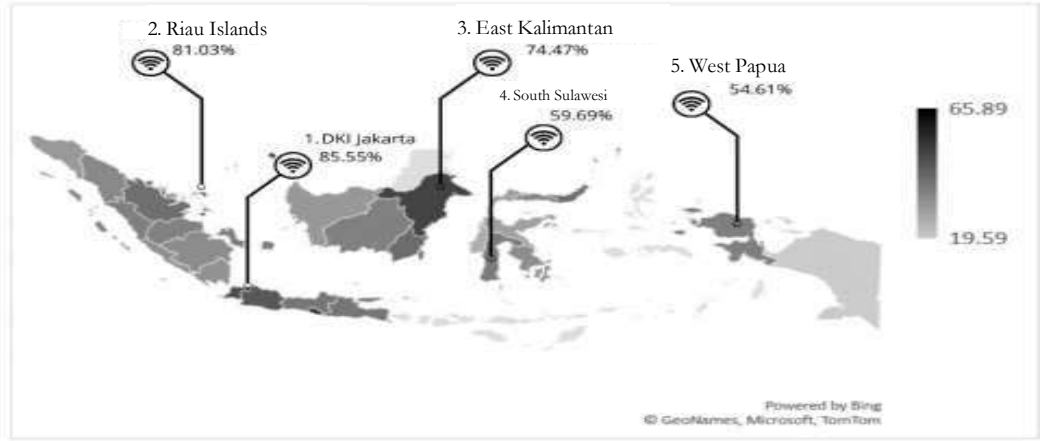

Figure1. Provinces with the Highest Internet Access on The Large Islands of Indonesia

Source: Central Statistics Agency (2022), data processed

Figure 1. Showing the map of Indonesia, with 5 (five) large islands including: Java, Sumatra, Kalimantan,

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Sulawesi, and Papua. The highest internet access on the 5 large islands is in Java, represented by DKI Jakarta at 85.55%, followed by the Riau Islands on the island of Sumatra at 81.03%. East Kalimantan occupies the third position, at 74.47%. South Sulawesi by 59.69%and occupies the fourth position. The fifth position is occupied by West Papua, at 54.61%. Based on BPS-Statistics Indonesia, (2022) The foremost fast advancement of ICT pointer was the utilize of the web in family units, which come to 86.54 percent in 2022; the development of internet use in families is additionally taken after by the development of populace who claim cellular phones, in 2022 coming to 67.88 percent.

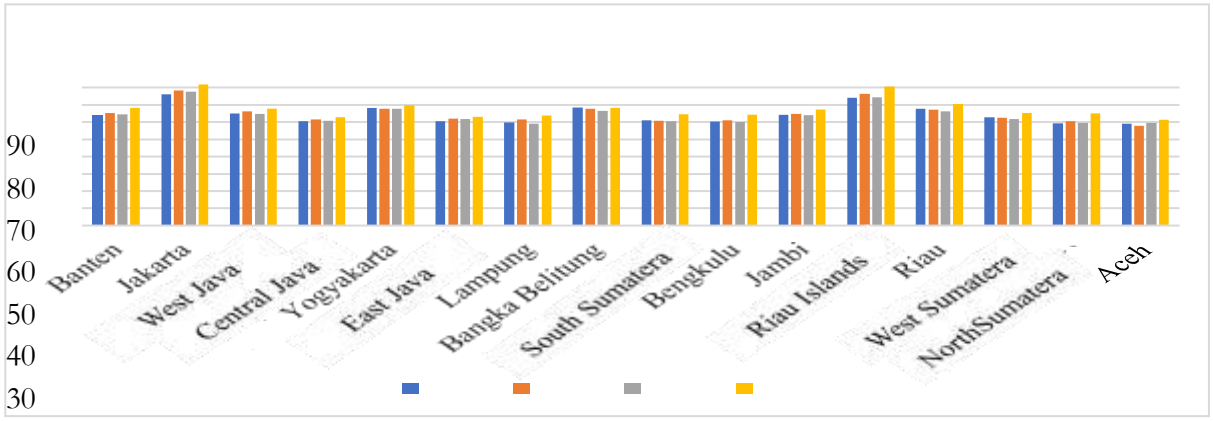

Figure 2. Number of Mobile Phone Users in Java and Sumatra 2018-2021

Source: Central Statistics Agency (2022), data processed

Figure 2 shows the number of mobile phone users in 2018-2021. In 2021, the highest number was in DKI Jakarta, which reached 81.83%, and the province with the second highest numberof users was the Riau Islands which reached 80.51%. When viewed from the average, the islandof Java has a higher number of mobile phone users than the island of Sumatra, which is 68.90%,while the island of Sumatra is 67.09%.

In accessing the internet through a mobile phone, a signal beam is needed to be able to connect.The Base Tranceiver Station (BTS) tower is the tower that emits the signal. BTS towers scattered in each area can affect the strength of the signal, which is one of the factors that affectsthe number of BTS towers in an area is the area of the area (BPS-Statistics Indonesia, 2022).

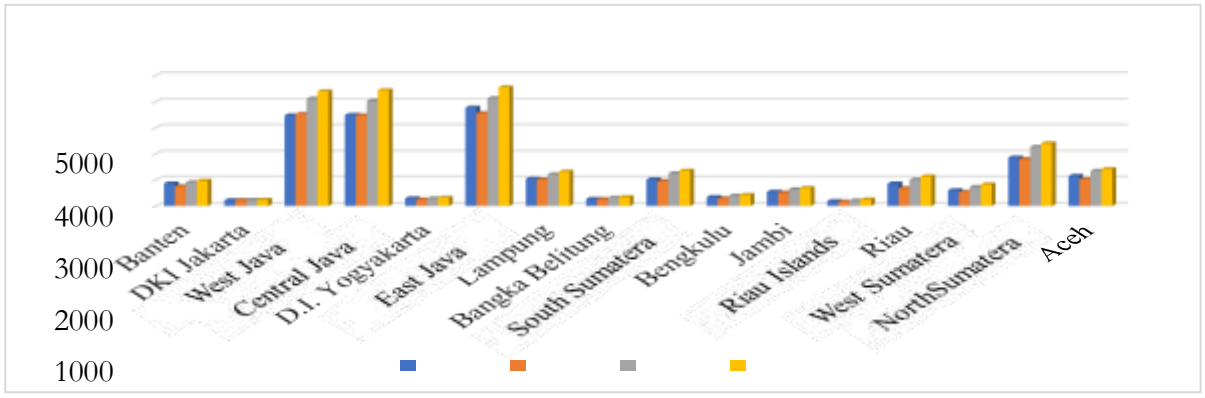

Figure3. Number of BTS Towers in Java and Sumatra 2018-2021

Source: Central Statistics Agency (2022), data processed

Figure 3 shows the number of BTS towers with 4G signal reception in Java and Sumatra from2018 to 2021. East Java in 2021 is the province with the most BTS towers, which is 4,539 units,while DKI Jakarta is the province with the least number of BTS towers in 2021 with only 242units. According to data from

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the area of West Java, Central Java, and also East Java, it is indeedwider than other provinces on the islands of Java and Sumatra, this is the factor in the numberof BTS towers in the three regions being the highest. In addition to technological advancements, labor is also a factor that affects economic growth. Labor force participation rate can describe the participation of thelabor force using a measure of the proportion of the labor force, namely the population who is ten years old and older and active in the job market.

Table 2. Labor Force Participation Rate in Java and Sumatra 2018-2021

Labor force participation rate	Year			
	2018	2019	2020	2021
Javanese	66.70	67.32	67.28	67.41
Sumatra	67.77	67.07	67.95	67.48

Source: Central Statistics Agency (2022), data processed

Table 2, Labor force participation rate on the islands of Java and Sumatra shows numbers that are not much different.On the island of Java, labor force participation rate is the highest at 67.41%, namely in 2021. 2020 was the year with the highest labor force participation rate on Sumatra Island which reached 67.95%, although the following year, namely 2021, labor force participation rate on the island of Sumatra decreased to 67.48%. Studies relatedto the development of ICT affecting economic growth have been carried out by several researchers, including (Harb, 2017) and (Kurniawati, 2022). In the study it is stated that the development of ICT and labor factors have a positive and significant effect on economic growth.

In this study, the researcher chose Java and Sumatra as the research object because based on data from BPS during 2018-2021 the islands of Java and Sumatra are the islands with the highest economic growth compared to other large islands, besides that internet access and the number of mobile phone users on these two islands are also the highest compared to the other3 (three) large islands (Kalimantan, Sulawesi, and Papua). However, with the high percentage of internet access and the number of mobilephone users on these two islands not followed by increased economic growth, economic growthis still contracting. This paper is divided into six structures, namely: the first is the introduction, the second is the literature review, the third is the methodology, the fourth is the results and discussion, the fifth is the conclusion, and the sixth is the limitations and recommendations.

Literature Review

Economic Growth Theories

Economic growth is one of the indicators used to measure the success of a country's development. Economic growth is represented by the increase of goods and services obtained within a time frame within the economy of a nation (Drăgoi, 2020). Neoclassical economic growth theories have evolved since the 1950s. This theory develops onthe basis of various analyses through classical economic views on economic growth. This theory reveals that economic growth depends on the increase in the supply of several factors of production. The production factors in question include population, labor, and capital. In addition, there are other factors that can affect it, namely technological advances. The assumption in this view is that the economy will grow depending on the capacity of its capitalequipment. According to this theory to create output, the capital used can be different from different workers. If the capital used is more, the labor used will be less, and vice versa. This shows that there is flexibility in an economy to determine the size of capital and labor that wants to be used in order to produce maximum output. In general, the neoclassical growth theory is based on the Cobb-Douglas production function which has the following functions.

$$Qt = TtaKtLtb$$

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Means:

A level of production Q_t is influenced by the rate of technological advancement T¸ the numberof stocks of capital goods K_t and the number of labor Lt t. The values of a and b are consideredto be equal to the production limit according to their respective production factors. It can be interpreted that the value of a and b can be seen through the output produced by the role of labor and capital.

Telecommunications

Telecommunications is a rapidly growing field interdisciplinary in nature, incorporating aspects of elect engineering, computer science, communications, economic, and business, political science, and sociology (Nelson, 1983). Telecommunications strongly supports all activities from various sectors, and certainly has a major impact on the economy. Currently, when talking about communication, it is inseparable from the internet, mobile phones, and BTS towers. The development of increasingly sophisticated technology has an impact on the use of telecommunications that are increasingly unlimited in distance and time. With the internet and mobile phones, everyone can communicate with anyone and anywhere. This is in accordance with purposes for which the internet is used may vary at different ages (Sironi & Kashyap, 2022).

Mobile phone devices have been used for various age levels in Indonesia, ranging from children, teenagers, and even the elderly and have spread throughout the region. The use of mobile phones makes it easier for people to access the internet, find information, news, and buy and sell goods compared to interacting directly. Research from Lee & Gardner (2011) found that mobile phones have a significant positive influence on economic growth. The use of mobile phones is related to the internet. The internet is a link and currently it has become one of the main needs for the people of Indonesia. The existence of the internet can facilitate economic activities, from the planning process to evaluation. Products and services can be promoted, marketed, ordered which can be accessed directly by internet channels. Banking, stock transactions, issuance, and advertising are also carried out through the Internet. Thus the internet has a positive influence on the economy, this is in accordance with research conducted by (Nurlela et al., 2021).

Base Transceiver Station (BTS) has an important role in sending and receiving radio signals to various devices (including mobile phones). The more BTS, the better the signal quality of the mobile operator. Thus, the availability of BTS has an influence on economic growth. Research from Afroz et al., (2020), found that BTS has a positive influence on economic growth. The amount of government information and Communication Technology (ICT) capital investment and Base Transceiver Station (BTS) construction in a certain location indicate the level of ICT infrastructure development in that area. The availability of BTS greatly affects community activities starting from basic services (education and health) and the economy. Currently, almost all government websites in the fields of education and health require internet access for various administrative purposes. In addition, people need signals from BTS to carry out economic activities (buying and selling products and/or services).

Labor Force Participation Rate

Development economists were primarily concerned with understanding the problems related to growth sources. The labor force and capital stock have always been key factors in determining economic progress, according to classical theorists (Ezenwobodo & Samuel, 2022). The labor force participation rate is an indicator to calculate the level of labor participation active in economic activities. Labor is a development actor who has a significant role in economic activities that can create output. The higher the labor level of a country, the more it can affect economic growth, this is in line with research conducted by (Eludire, 2023).

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Conceptual Framework

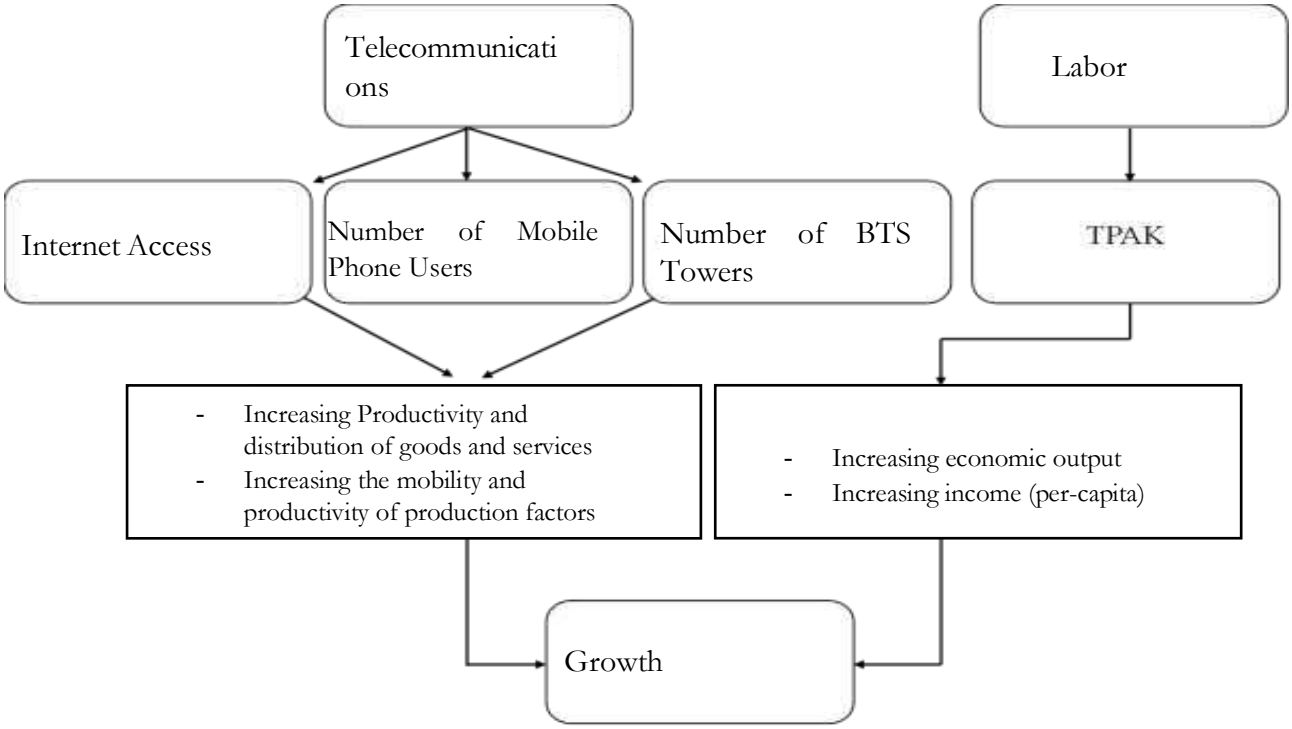

Figure 4. Conceptual Framework

Based on Figur 4, telecommunication components consisting of internet access, number of phone users, and number of BTS towers can increase productivity and distribution of goods and services and increase the mobility and productivity of production factors. It is suspected that telecommunications has a positive influence on economic growth. Furthermore, the variable labor force participation rate (TPAK) is able to increase economic output and increase per capita income. So it is suspected that the workforce has a positive effect on economic growth.

Methodology

This study aims to determine the influence of internet access, the number of mobile phone users, the number of BTS towers, and labor force participation rate on economic growth in Java and Sumatra 2018-2021. Based on the purpose of the research, it is hoped that this research can provide benefits to the government as a policy maker, to the community, and is expected to be a reference for the next research. This research uses a descriptive type with a quantitative approach. Using panel data estimates,with provincial cross-section data on the islands of Java and Sumatra as many as 16 provinces, and 4-year Time series data, namely 2018-2021. Using the OLS method or the smallest quorum method. The independent variables in this study include internet access, the number ofmobile phone users, the number of BTS towers, and labor force participation rate. The variables tied to this study useeconomic growth. Research equation:

$$\mathbf{Growthit = \beta 0 + \beta 1\ ACSit + \beta 2\ PTSit + \beta 3 \mathit{log}(BTSit) + \beta 4 LFPRit}$$

Means:

Growth = Economic Growth (%)

ACS = Internet access (%)

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PTS = Number of mobile phone users (%)

BTS = Number of BTS towers (units)

Labor Force Participation Rate (LFPR) = Number of Labor Force Participation Rate (%)

i = 16 Provinces in Java and Sumatra

t = Period 2018, 2019, 2020, 2021

Results and Discussion

Results

This study uses 3 method approaches, including Common Effect Model, Fixed Effect Model, Random Effect Model. To choose which model is the most appropriate to be used in this study,the Chow Test and also the Hausman Test were carried out.

Chow Test

This test was carried out to determine the most appropriate common effect model or fixed effect model to be used in this study. If the p-value of the test results shows a value of < α (0.05), then the most appropriate model for this study is fixed effect. If the p-value of the test results shows a value of >α (0.05), then the most appropriate model for this study is common effect. Here are the results.

Table 3. Chow Test Results

Effects Test	*Statistics*	D.F.	Prob.
Cross-section F	15.7003	(15,44)	0.0000

Source: Data Processing Results, 2024

The results of Table 3, the chow test show that p-value of 0.0000 < 0.05, so the most appropriate model to use in this study is the fixed effect model (FEM).

Hausman Test

This test was carried out to determine the most appropriate fixed effect model or random effect model to be used in this study. If the p-value of the test results shows a value of < α (0.05), then the most appropriate model for this study is fixed effect. If the p-value of the test results shows a value of > α (0.05), then the most appropriate model for this study is random effect. Here are the results.

Table 4. Hausman Test Results

Effects Test	Chi-Sq. Statistics	Chi-Sq. D.F.	Prob.
Cross-section random	14.113	4	0.0069

Source: Data Processing Results, 2024

The results of the test show a p-value of 0.0000 < 0.05, so the most appropriate model to usein this study is the fixed effect model (FEM). Here are the results of the FEM (fixed effect model) regression:

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Table 5. Fixed Effect Model Regression Results

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	Prob.
C	23.8186	10.40705	2.2887	0.0270
ACS	-0.1337	0.03089	-4.3307	0.0001
PTS	1.0553	0.09823	10.7432	0.0000
LOG(BTS)	-8.8835	1.78961	-4.9639	0.0000
LFPR	-0.35080	0.16132	-2.1749	0.0351

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.8844
Adjusted R-squared	0.8345
S.E. of regression	2.4971
F-statistic	17.7253
Prob(F-statistic)	0.00000

Source: Data Processing Results, 2024

Here are the similarities obtained.

Growth = 23.8186 – 0.1337 ACS + 1.0553 PTS – 8.8835 Log(BTS) – 0.3508 LFPR

T-Test

This test was carried out to determine the magnitude of the influence of the independentvariable on the partially bound variable.

Internet Access Variables

Table 6. Results of the t-Test of Internet Access Variables

Variable	t-stats	t-table(α=5%)	Probability	Conclusion
ACS	-4.3307	2.00	0.0001	Reject H0

Source: Data Processing Results, 2024

The results obtained are t-statistics of -4.3307 < t table 1.67, this means that internet access hasa negative influence on the economic growth of Java Sumatra. Internet access has a significant effect on economic growth on the islands of Java and Sumatra.

Variable Number of Mobile Phone Users

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Table 7. Results of the Variable t-Test of the Number of Mobile Phone Users

Variable	t-stats	t-table(α=5%)	Probability	Conclusion
PTS	10.7432	2.00	0.0000	Reject H0

Source: Data Processing Results, 2024

The results obtained are t-statistics of 10.7432 > t table 1.67, this means that the number of mobile phone users has a positive influence on the economic growth of Java Sumatra. The Number of mobile phone users has a significant effect on economic growth on the islands of Java and Sumatra.

Variable Number of BTS Towers

Table 8. Results of the Variable t-Test of the Number of BTS Towers

Variable	t-stats	t-table(α=5%)	Probability	Conclusion
BTS	-4.9639	2.00	0.0000	Reject H0

Source: Data Processing Results, 2024

The results obtained are t-statistics of -4.9639 < t table 1.67, this means that the number of BTStowers has a negative influence on the economic growth of Java Sumatra. the variable Number of BTS towers has a significant effect on economic growth onthe islands of Java and Sumatra.

Labor Force Participation Rate Variable

Table 9. Labor Force Participation Rate Variable t-Test Results

Variable	t-stats	t-table(α=5%)	Probability	Conclusion
LFPR	-0.3508	2.00	0.0351	Reject H0

Source: Data Processing Results, 2024

The results obtained are t-statistics of -0.3508 < t table 1.67, this means that labor force participation rate has a negative influence on the economic growth of Java Sumatra. The labor force participation rate variable has a significant effect on economic growth on the islands of Java and Sumatra.

F-Test

Table 10. F-Test Results

df(k-1 ; n-k)	F-Statistics	F-Table	Probability	Conclusion
3 ; 60	17.7253	2.76	0.0000	Reject H0

Source: Data Processing Results, 2024

The results of the F-test showed a F-statistic of 17.7253 > F-table 2.76. which means that the independent variables together affect the bound variables

Interpretation of R^2

The regression model is said to be good if the value of R2 is close to 1, with a range of $0 \leq R2 \leq 1$. The results of the FEM regression show that the R^2 value is 0.8844, and the Adjusted R^2 valueis 0.8345, this means that the free variable can explain the change in the bound variable by 88.44%, while the remaining

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11.56% is explained by other variables.

Discussion

The Influence of Internet Access on Economic Growth

FEM regression results show that internet access has a negative and significant effect on economic growth in Java and Sumatra. This research is not in line with research conducted by Nurlela et al., (2021), which shows that the internet has a positive impact on economic progress. This is in line with the way the internet works which allows people to carry out e-commerce transactions more easily by choosing the product quality, price, country of production and convenience of the goods or services they want. As a result, local or domestic goods are increasingly needed to compete in this digital age. However, this research is in line with research conducted by Tanjung et al., (2022) and Rochmahwati, (2023) where internet access can have a negative effect on economic growth due to the lack of public education regarding e-commerce and the uneven distribution of internet networks throughout Indonesia. This is what causes internet access to have a negative impact. Then, according to Yousefi, (2011) in his research, he explains that internet access for purposes other than transactions also has a negative impact, or in other words, the internet is used for random things, the lack of productivity when accessing the internet means that internet access can have a negative impact on economic growth. The average individual accessing the internet is limited to communicating via social media. According to Kurniawati (2022) internet access has a negative effect on economic growth in developing countries because the cost of accessing the internet tends to be expensive and requires a higher level of education and skills to operate it. In Abdullahi & Sieng (2023) research examining the effect of internet access on economic growth in sub-Saharan Africa, it also showed negative results.

The Effect of the Number of Mobile Phone Users on Economic Growth

FEM regression results show that the number of cell phone users has a positive and significant effect on economic growth in Java and Sumatra 2018-2021. This research is in line with research by Abdillah, (2023) which states that the increasing number of individuals using cell phones can support economic transactions to become easier and more efficient. The transaction in question is like using financial technology or a technology-based financial system, such as mobile banking or electronic wallets. The results of this research are also in line with research by Pradana, (2021) which states that increasing cell phone users can increase the added value of the telecommunications industry. This can ultimately have an effect on increasing economic growth. A study conducted by Deloitte et al., (2012) is in line with this research. The study states that cell phones have a positive effect on economic activity, social inclusion, communication and productivity in many sectors, namely education, finance, health and agriculture. The use of cellular telephones can streamline distances and prices between people and economic resources, especially financial services. Bahrini & Qaffas, (2019) stated that increasing cell phone users provide effectiveness in banking financial transactions, so that financial inclusion increases. Toader et al., (2018) stated that the switch from fixed telephones to cellular telephones with all its conveniences resulted in an increase in the number of subscribers, this being an important contribution in increasing people's per capita income.

The Effect of the Number of BTS Towers on Economic Growth

FEM regression results show that the number of BTS towers has a negative and significant effect on economic growth in Java and Sumatra. The results of this research are in line with research conducted by Kurniawan & Ihsan, (2021) where the number of BTS towers has a negative and significant effect due to diminishing marginal returns, which means that increasing the quantity of BTS towers has had a significant contribution because the quantity has been fulfilled, meaning that every construction the new network does not contribute more. However, this contribution will be maximized if it is improved in terms of network quality. Apart from that, this research is also in line with research conducted by Fahmi, (2022) this research states that areas that do not have BTS towers still receive a strong signal, and some areas that have BTS towers actually do not receive a strong signal. This has been explained by BPS (2022), which states that the strength and weakness of the signal is not described by the number of BTS towers, but there are several

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other indicators that influence it, namely coverage radius, area countour, and area. Inequality between these areas has created a gap. economic, due to limited quality, access and speed of telecommunications services which hampers economic growth and innovation in the relevant areas. In Tripathi & Inani, (2016) research which examined the influence of internet network infrastructure on economic growth in Sub-Saharan Africa, it found negative results, this is because building an internet network in Sub-Saharan Africa requires very high initial costs, this can provide big benefits in the long term. The results of building an internet network in the short term may have a negative impact on economic growth, because the costs incurred do not correspond to the resulting impact.

The Influence of Labor Force Participation Rate on Economic Growth

FEM regression results show that labor force participation rate has a negative and significant effect on economic growth in Java and Sumatra. The results of this research are in line with research conducted by Eludire, (2023) which states that increasing labor force participation rate will have a negative impact if it is not accompanied by increased employment opportunities, which instead of increasing economic growth is indicated as increasing unemployment. Apart from that, research by Safitri & Ariusni, (2019) is also in line with this research, which states that labor force participation rate has a negative influence on GRDP because the government does not create appropriate regulations and employment opportunities to handle the increase in labor force participation.

Conclusion

The results of the FEM regression that has been carried out, can be concluded that internet access as a proxy for access to technological progress, has a negative effect on economic growth because the internet for people on the islands of Java and Sumatra is a new item whose use still requires education. Limited knowledge in the use of ICT and limited internet access, there are still many areas that cannot access the internet and internet access is often used for fun. The number of cell phone users, as a proxy for the use of technological advances, has a positive impact on economic growth because with the presence of cell phones, it is easier for people to carry out financial transactions and other economic transactions. The number of BTS towers as a proxy for technological progress infrastructure has a negative effect on economic growth because large investments have not been optimized for use in transmitting signals and labor force participation rate as a proxy for labor has a significant influence on economic growth in Java and Sumatra with a confidence level of 95%.

Limitations and Recommendations

In this study, the researcher has maximized the results of the research in accordance with the provisions, but this study still has limitations, including the location of the study is only 2 islands among the many islands in Indonesia, besides that the period studied is only 4 years. The recommendation that the researcher can suggest to complement these limitations is that the next research can add the latest year and expand the research location, which can provide maximum results and a broader picture of related topics. For the government, it is recommended to be able to build better access and quality of infrastructure, to be used by the community so that the realization of an Indonesian society that does not stutter with technology, in addition to being advised to open a wider range of job opportunities, so that there are no more new unemployed people.

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