An Analysis The Influence Of Mobile Cellular Subscription, Fixed Telephone Subscription, Gross Fixed Capital Formation, And Labor Force Participation Rate On Gross Domestic Product In Indonesia

Dimas Bagus Wiranatakusuma[1],Yessi Fidiana Zakaria[2]

dimas_kusuma@umy.ac.id,yessifidianazakaria@gmail.com

Universitas Muhammadiyah Yogyakarta - Indonesia[1,2]

Abstract. This study examines the long- and short-term effects of gross fixed capital formation (GFCF), labor force participation rate (LFPR), mobile cellular subscriptions (MCS), and fixed telephone subscriptions (FTS) on Indonesian GDP. Indonesian GFCF, LFPR, FTS, and GDP time series data from 1990 to 2019 were used. The World Bank's website provided the sample data. This study used the Error Correction Model (ECM), t-test, F-test, and Coefficient of Determination. The study found that Fixed Telephone Subscriptions decreased GDP greatly. All independent factors have an 81.27% short- and long-term impact on GDP, while independent variables outside the model affect 18.73%. According to the findings, as more people work, capital is invested in the digital sector, more people use mobile phones, and telephone usage costs decline, the industry's contribution to national income gradually increases. These statistics also point to digital network access being the primary driver of increased national GDP.

Keywords: *Gross Domestic Product, Gross Fixed Capital Formation, Labor Force Participation Rate, Mobile Cellular Subscriptions, Fixed Telephone Subscriptions, Indonesia*

1. Introduction

The phrase "Industry 4.0" was coined in Germany in 2011 during the Hannover Fair [16]. The German government is very interested in Industry 4.0 as part of its High-Tech Strategy 2020 development plan policy. The purpose of the High-Tech Strategy 2020 is to keep Germany at the forefront of manufacturing [13]. Other countries have a similar ambition to achieve the concept of Industry 4.0, but they call it something different, such as Advanced Manufacturing, Smart Factories, Smart Industry, or Industrial Internet of Things. Even if they go by different names, they all attempt to boost the competitiveness of each nation's industry in the face of a very dynamic global market.

ICEB 2023, August 02-03, Padang, Indonesia

DOI 10.4108/eai.2-8-2023.2341521

This state is the result of the rapid development and application of digital technology in a variety of industries. Table 1 compares Industry 4.0 to projected benefits. The majority of perspectives on the possible benefits of Industry 4.0 revolve around boosting production speed, flexibility, customer service, and revenue. The achievement of these prospective benefits will benefit a country's economy.

Table 1. The Potential Benefit of Industry Revolution 4.0

Author	Potential Benefit
Lasi, Fettke, Kemper, Feld, and Hoffmann (2014)	Product creation becomes faster, individual demand is met (product customisation), production is flexible and quick in reaction to difficulties, and resource efficiency is achieved.
Russmann Lorenz, Gerbert, Waldner, Justus, Engel, and Harnisch (2015)	Improving productivity, fostering the spread of ideas, raising the need for talented labor, and increasing investment.
Schmidt, Möhring, Härting, Reichstein, Neumaier, and Jozinović (2015)	Realization of mass product customisation, usage of idle data, and reduction in production time.
[16] Wahlster, Helbig, Hellinger, Stumpf, Treugut, Blasco, Galloway, and Findek[20] (2013)	Engineering and business processes grow more dynamic, decision returns become more optimal, giving birth to new business models and new ways of delivering added value.
Neugebauer, Hippmann, Leis, and Landherr, (2016)	Realize a cost-effective, efficient, intelligent, and on-demand manufacturing process (that may be customized).

The digital economy, according to table 1, is an economy centered on electronic goods and services generated by electronic enterprises and traded via electronic commerce. That is, companies that use electronic manufacturing and process management, engage with partners and customers, and conduct transactions using Internet and Web technologies. In the final decade of the twentieth century, the concept of the digital economy evolved. Digital transactions are increasing in Indonesia.

Digital transformation strategies are implemented to transform every process, competence, and business model through the use of digital technology, in accordance with the recommendations of various global research institutions that confirm digital transformation as a requirement for organizations to compete globally today. Within the increasingly dynamic world of transportation, one of which spans digitalization, which is distinguished by characteristics such as vertical networks, networks that no longer have limits or hierarchies, has become fully evolved into all life lines. Vertical networks follow horizontal integration as a form of true collaboration by prioritizing output and the inherent innovation in digitization, giving birth to new phenomena with increasingly powerful concepts of the Internet, e-commerce, artificial intelligence, sharing economy, and financial technology in various areas of life, particularly economic competition. One of them is the potential to participate more actively in the global economy, particularly in the trade sector, which is today based on a digital platform, also known as e-commerce.

Indonesia has the world's greatest rate of e-commerce growth. Over the previous decade, the e-commerce industry in Indonesia has grown by approximately 17%, and more enterprises, both large and small, are shifting their operations to digital. The digital transition has increased economic growth to $150 billion by 2025. The widespread use and purchasing of mobile phones is one of the factors fueling Indonesia's e-commerce growth. With 73% of internet users in Indonesia accessing the internet via mobile phones, the trend is expected to continue. It's only that there are several variables that make it tough for the locals to use the internet. As a result, the government should provide internet access in remote areas so that villagers can participate in internet-based transactions or e-commerce.

Digital commercial transactions in Indonesia are fast increasing. According to E-Marketer, Indonesia's e-commerce transactions hit Rp 25.1 trillion in 2014 and are expected to reach Rp 69.8 trillion in 2016, at a rate of Rp 13,200 per US dollar. Similarly, the value of Indonesia's digital trade will climb to Rp 144.1 trillion in 2018. With a population of 250 million, Indonesia's potential for e-commerce development is enormous. It is backed by the increasing prevalence of internet users, the decreasing cost of internet connection, and the public's passion for using the internet to support daily life.

purchasing online has also become one of the more interesting pastimes because it gives consumers with a fresh purchasing experience. This is one of the reasons people began to shift from having to go to market to buy an item (offline) to now switching digitally by just browsing shopping sites. It's no surprise that e-commerce is projected to be a route for Medium, Small, and Micro Enterprises (MSMEs) to extend market access, both at home and abroad, as well as access to information with government records to expand broadband so that MSMEs in rural or distant locations can participate. Deloitte survey of 437 Indonesian MSMEs in 2015. MSMEs that participate in advanced online groups can increase earnings by up to 80% compared to before the deployment of technology. In Indonesia, digital progress is linked to economic growth. Where it has a favorable impact on Indonesian economic growth.

According to endogenous growth theory, physical and human capital investments play a role in determining long-term economic growth. The government's contribution to economic growth can be explained by its influence on changes in consumption, public investment spending, and tax receipts. Its inhabitants value economic benefits. The advancement or adjustment of technological, institutional, and ideological modifications to the varied demands of the actual situation results in a rise in capacity.

Certainly, technological advancement, particularly in the economic sector, has a significant impact on economic growth, as measured by GDP. By facilitating transactions as a result of technological variables, there is a process of growing output through time, which can be an essential sign of a country's development performance ([35] and Smith, 2008). According to [32] and [34] basic theory of Neoclassical economic growth, the presence of government in both expenditures and taxes has no effect on growth. Exogenous capital stocks, labor, and technology are the only factors that drive economic growth. The government can forecast population growth, which will alter labor availability but have no effect on economic growth. The GDP of a country is an indicator of its economic success. As a result, Indonesia's economy grew rapidly in 2000 compared to the previous year. Between 2000 and 2015, the value of GDP climbed and decreased before rising again in 2016 to its peak in 2018.

According to prior research, the expansion of the digital economy has a favorable and significant impact on economic growth , as evaluated by the Gross Fixed Capital Market, Labor Force Participation rate, mobile cellular subscription, and fixed broadband subscription variables. According to Ngatono (2016), every 1% rise in Information Communication Technology (ICT) teledensity leads to a 3% increase in economic growth. Furthermore, there is a one-way causality relationship between mobile phone users and economic growth in high-income countries [28] and a causality relationship between broadband users, internet users, and economic growth in G-20 countries [24].

According to the description, the purpose of this study is to investigate the relationship between economic growth (GDP) and gross fixed capital formation (GFCF), labor force participation rate (LFPR), mobile cellular subscriptions (MCS), and fixed telephone subscriptions (FTS). How does gross fixed capital formation affect Indonesian economic growth?

1. How does the labor force participation rate affect Indonesian economic growth?

2. How do mobile cellular subscriptions effect Indonesian economic growth?

3. How do fixed telephone subscribers effect Indonesian economic growth?

4. What effect does the long run or short run have on Indonesian economic growth?

2. Literature Review

A. Economic Growth

Economic growth, according to alşkan (2015), is a long-term increase in a country's ability to provide a wide range of goods and services. Several factors influence a country's capabilities, including institutional changes, technology, and ideology. There are various economic growth theories:

1. Classical Theory

Natural resources, human resources (number and quality of population), and capital stock are the essential aspects of the production system, according to Classical Economic Theory (Adam Smith) [6]. This theory holds that the maximum limit for economic expansion is the availability of natural resources. When natural resource elements are not fully utilized, the rise in output will be governed by human resources and capital stock. Natural resources will be depleted if output continues to rise. Natural resources impede an economy's expansion at this stage [6].

Population is the second component of productivity. This hypothesis holds that the population is passive and will adjust to the level of labor demand. Furthermore, population growth will lead to job specialization, which will enhance production. Smith emphasizes the importance of the third ingredient, namely capital stock expansion or capital accumulation, in the process of output growth.

Capital stock, according to Smith, has two effects on the level of total output: the direct effect of expanding capital and the indirect effect of boosting productivity through the possibility of increasing specialization and division of labor. The greater the capital stock, the greater the potential for specialization and division of labor, and the greater the productivity per worker [6]. The expansion of the market and the rate of profit over the minimum level of profit are two major aspects associated to capital accumulation. Smith emphasized the importance of market expansion and freedom in encouraging economic progress, which may be accomplished by removing rules and laws that impede free trade and economic activity ([6], 1982).

2. Neoclassical Growth Model (Solow-Swan)

[32] and [34] established neoclassical growth theory. Early neoclassical growth models emphasized the importance of capital accumulation. Capital and labor produce output in the Solow-Swan model. Economic expansion is compatible with labor augmenting technological progress, which operates as if it increases the amount of available labor. Over time, output per capita and labor productivity grow at an exogenously determined pace of technological progress. Technical advancement is fully exogenous to these theories, leaving economic growth unaccounted for. The Cobb-Douglas function presents Neoclassical Growth Theory, which highlights the significance of capital development as an essential element in growth. [32] (in [15] [22],) focuses on long-term growth and the roles of capital, labor, and technology as production factors. Furthermore, [32] believes that growth will occur if there is money, population increase, and technology, while technology is still regarded as an exogenous

component.

3. Harrod-Domar Growth Theory
[12] in England and Domar (1957) in the United States of America established this hypothesis. They could get the same answer but using different calculating methods, which led to both of them being thought to have come up with the same notion, which is known as the Harrod-Domar theory. This theory completes Keynes' theory. Harrod-Domar sees it in the long term (dynamic conditions), but Keynes sees it in the short term (static conditions).
This model's premise illustrates how the economy can attain substantial long-term growth. This model assumes that capital goods have reached maximum capacity, that saving has an ideal proportion to the amount of national income, and that the ratio between capital and production (Capital Output Ratio) remains constant. [35] argue that in order for an economy to grow, it must save and invest a portion of its GDP. Harrod-Domar analyzes and concludes, based on existing assumptions, that significant long-term growth (all output increases can be absorbed by the market) can only be achieved if the following equilibrium conditions are met:g=K=n (1)

g: Growth (output growth rate)
K: Capital (capital growth rate)
n: Labor force growth rate

B. Mobile Cellular Subscriptions

According to [14], mobilecellular telephone subscriptions are the number of subscriptions to public cellular telephone services that allow connectivity to the PSTN using cellular technology. The indicator comprises (and divides) the number of postpaid subscriptions and the number of active prepaid accounts (those utilized in the previous three months). This metric is applicable to all mobile subscriptions that include voice communication. Subscriptions through data card or USB modem, subscriptions to public cellular data services, private cellular radio, telepoint, radio paging, M2M, and telemetry services are not included. This metric refers to phone subscriptions to networks that use mobile cellular technology. This statistic represents network subscriptions for mobile phones. There are both postpaid and prepaid subscriptions available. It includes mobile-cellular phone plans that provide access to low- and medium-speed data communications, as well as mobile-cellular phone plans that provide access to broadband data communications. Subscriptions for trunked radio, radio paging machines, M2M mobile, and data-only are not included.

C. Fixed Telephone Subscriptions

The fixed telephone is a plane with electricity and wire that allows two people who are far apart to communicate. Most telephones work by sending electrical signals across the telephone network, allowing users to converse with one another. According to the [14], Fixed Telephone Subscriptions are the total number of active analog fixed telephone lines, voice-over-IP (VoIP) subscriptions, fixed wireless local loop (WLL) subscriptions, ISDN (Integrated Services Digital Network) voice-channel equivalents, and fixed public payphones.

D. Gross Fixed Capital Formation

Capital creation, also known as capital accumulation, is a rise in the stock of capital during a

specific time period ([1], 2011). Capital formation occurs when a portion of one's earnings are saved and reinvested in order to boost output and income in the future. Procurement of economic overhead boosts a country's physical capital stock, which clearly enables for future production growth. All new investments in land, fiscal equipment, and human resources are included in capital formation. The process of capital accumulation or capital creation is cumulative, and self-financing consists of three interconnected stages: the existence and growth of real savings, the mobilization of savings and their channeling into preferred economic domains, and the utilization of savings for investment.

The cornerstone to economic growth is capital formation. Investment in capital goods will result in technical advancement. Technological advancements will result in specialization and cost reductions in large-scale manufacturing. Capital formation, on the one hand, can generate effective demand; on the other hand, it is productive efficiency for future output. Capital formation, also known as capital accumulation, is an effort to increase capital in a short period of time by saving a portion of one's income and reinvesting it with the goal of increasing output and income in the future, with the ultimate goal of increasing national economic growth.

Gross Fixed Capital Formation (GFCF) consists of, as follows:

1. An increase in asset decline through asset reduction (treasure), including both new and used goods such as residential buildings, non-residential buildings, other buildings, machinery and equipment, transport equipment, asset cultivated assets, intellectual property products, and many more;
2. A shift in the ownership costs of non-produced financial assets such as land and patents.
3. Significant asset repairs to increase production capacity and extend asset life (for example, production engine refurbishment, reclamation, clearing, draining, and irrigation of forests, as well as flood and erosion prevention).

E. Labor Force Participation Rate

The labor force participation rate is the percentage of the working-age population that are employed. Labor force participation, on the other hand, denotes involvement in or possession of a job. Thus, the labor force participation rate denotes the proportion of the workforce that is employed [31]. The largest source of labor supply is the population. Outside the labor force refers to the proportion of the population who is neither unemployed nor looking for work. While the labor force is made up of people who have jobs, people who are actively seeking for work, and people who are thought to be looking for work. In polls, the latter are frequently identified as people who are now unemployed but are not looking for employment because they believe there are no job possibilities open to them. They are commonly referred to as "disenchanted workers" or "desperate unemployed."

According to the Central Bureau of Statistics (BPS), the labor force participation rate is the proportion of persons of working age who are actively engaged in the labor market, either by working or seeking for job. This statistic indicates the size of the labor pool available to engage in the production of products and services. The breakdown of the labor force by gender and age group provides a distribution profile of the economically involved people. In general, the GFCF is used to represent the proportion of a country's or region's working-age population (15 years and older) that is economically engaged, as well as the amount of labor (labor supply) that is readily available to generate goods and services in an economy.

F. Previous Research

Previous research indicates that the variables Gross Fixed Capital Formation (GFCF), Labor Force Participation Rate (LFPR), Mobile Cellular Subscription (MCS), and Fixed Telephone Subscription (FTS) have different effects on Gross Domestic Product (GDP). Because the conditions of each research object are undoubtedly distinct, variances in the research object and the period in which the research is conducted may result in varied outcomes. Furthermore, the variables Mobile Cellular Subscription (MCS) and Fixed Telephone Subscription (FTS) are related to technological developments, which will, of course, vary greatly depending on the time period in which research is conducted, because technology that is considered advanced at one time may be considered conventional at another.

The influence of GFCF on GDP based on past study references yields inconclusive results, since Shahid's (2014) research demonstrates a significant positive association between DFCF and GDP in the short run. According to [37], GFCF has a long-term favorable impact on economic growth in Nigeria. According to Ali's (2015) research, the GFCF has a long-term favorable impact on economic growth in Pakistan. However, according to the findings of Duasa and Ramadhan's (2019) research, GFCF has a long-term good effect but a short-term negative effect on Malaysian economic growth.

Previous studies that are used as references show contradictory conclusions about the influence of LFPR on GDP. According to the findings of [37] LFPR has a long-term favorable impact on Nigerian economic growth. Meanwhile, Majeed and Ayub (2018) and Duasa and Ramadhan (2019) found that LFPR has a good long-term effect but a negative short-term effect on Malaysian economic growth. However, Shahid's (2014) research demonstrates that the LFPR-GDP link is insignificantly negative.

Previous research has found that the variables Mobile Cellular Subscription (MCS) and Fixed Telephone Subscription (FTS) produce distinct results. The findings of Habibi and Zabardast (2020), Majeed and Ayub (2018), Sharma et al. (2021), Farhadi et al. (2012), and Adeleye and Eboagu (2019) studies all show considerable favorable results. However, according to Duasa and Ramadhan's (2019) research, MSC has a considerable beneficial influence on GDP in the long run but a negative effect in the near run. Whereas differences in research results were found in the FTS variable, namely in the research of Majeed and Ayub (2018), which stated that FTS had a significant positive effect on GDP, and in the research of Bahrini and Qaffas (2019), the results show a significant negative effect on economic growth. Meanwhile, Wiranatakusuma and Jami (2022) also found digital development has positif influence to economic development through banking financing.

The current study's novelty include the combination of variables observed, the object of investigation, and the time span of study. In this study, the variables examined are Gross Fixed Capital Formation (GFCF), Labor Force Participation Rate (LFPR), Mobile Cellular Subscription (MCS), and Fixed Telephone Subscription (FTS) as independent variables, and Gross Domestic Product (GDP) as dependent variable. Those variables may have been examined previously, but not all variables studied are observed as one research model at the same object of study over the same time period. Because the focus of study is data from the global economy rather than the economies of numerous countries, this research can provide a broader perspective than similar studies that just involve specific countries. Furthermore, the data observed from the analyzed variables are newer than previous studies. Data from 1990 to 2019 were used, resulting in new information.

G. Research Framework

The advent of information and communication technology (ICT) has resulted in many structural changes such as economic reorganization, trade expansion, and globalization, resulting in capital flows and increased information availability. ICT has a substantial impact on the development of every economic sector, particularly during the liberalization process, and growth economists predict that investments in ICT will drive economic growth. To establish the effect of the independent variable on the dependent variable in the short and long term, a Vector Error Correction Model (VECM) study was used.

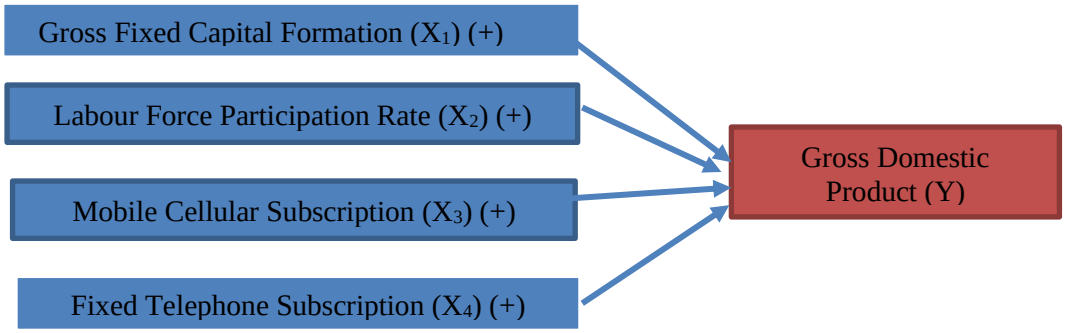

Figure 1. The Research Framework

3. Research Method

A. Type of Data

The data used in this investigation was secondary data. Secondary data is information gathered from sources other than the research item that has been confirmed. It can also come from books of literature or other credible sources. Following the collection of data, editing and tabulation must be performed. Data from the World Bank's official website (www.data.worldbank.com) include Indonesia's Real Domestic Product Per Capita (GDP), Gross Fixed Capital Formation (GFCF), Labor Force Participation Rate (LFPR), Mobile Cellular Subscriptions (MCS), and Fixed Telephone Subscriptions (FTS) from 1990 to 2019.

B. Operational Definition of Variables

This study employs two types of variables: independent variables and dependent variables. The

independent variables in this study are GFCF, LFPR, Mobile Cellular Subscriptions, and Fixed Telephone Subscriptions, while GDP is the dependent variable.

1. GDP (Gross Domestic Product)

GDP is the value of goods and services generated within a country utilizing production elements held by residents/companies from other countries. The GDP Real of Indonesia is used in this analysis.

2. GFCF (Gross Fixed Capital Formation)

Gross Fixed Capital Formation is a component of GDP that includes capital goods with a service life of more than one year, such as roads, airports, and manufacturing buildings, as well as machinery and equipment.

3. LFPR (Rate of Labor Force Participation)

The labor force participation rate is the percentage of the working-age population that are employed. Labor force participation, on the other hand, denotes involvement in or possession of a job. Thus, the labor force participation rate denotes the proportion of the workforce that is employed.

4. MCS (Mobile Cellular Subscription)

According to the International Telecommunication Union, "mobilecellular telephone subscriptions" refer to the number of subscribers to publicly available cellular telephone services that provide PSTN (Public Switched Telephone Network) access using cellular technology. It includes mobile-cellular phone plans that provide access to low- and medium-speed data communications, as well as mobile-cellular phone plans that provide access to broadband data communications. Subscriptions for trunked radio, radio paging machines, Machine to Machine (M2M) mobile, and data-only are not included.

5. FTS (Fixed Telephone Service)

The [14]defines Fixed Telephone Subscription as the sum of the active number of analog fixed telephone lines (telephone, modem, or fax machine connected to the telephone network), voice-over-IP (VoIP) subscriptions, fixed wireless local loop (WLL) subscriptions, Integrated Services Digital Network (ISDN) voice-channel equivalents, and fixed public payphones.

C. Data Analysis Method

The analytical methods used in this study are the Error Correction Model (ECM) with the condition that the data pass the Unit Root Test and Cointegration Test, then the Statistical t-test, Statistical F test, and Coefficient of Determination Test with the condition that the data pass the Classical Assumption Test. The Eviews 7 estimating tool is used for all data processing activities..

The linear econometrics model is as follows:

$$LogGDP_t = a_0 + a_1\ LogGFCF_t + a_2\ LogLFPR_t + a_3\ LogMCS_t + a_4\ LogFTS_t + e_t \quad (1)$$

GDP = Gross Domestic Product
GFCF = Gross Fixed Capital Formation
LFPR = Labour Force Participation Rate
MCS = Mobile Cellular Subscription
FTS = Mobile Cellular Subscription
Log = Logaritm

e = error term
t = time period
a_0, a_1, a_2, a_3, a_4 = parameter

4. Result And Discussion

A. Error Correction Model (ECM)

The ECM model is a model that is used to determine the long-term and short-term equilibrium regression equations, as well as whether or not a model is consistent. Furthermore, the ECM model seeks to address data issues related with misleading and non-stationary time series data. Long-run and short-run equations exist for the ECM approach.
A stationary test and data cointegration test must be performed prior to running the regression using the ECM test..

1. The Stationary Test

Before completing the regression with the ECM test, a stationarity test is performed to assess whether the variables employed are stationary or not. If the data is not stationary, a false regression will be obtained; if the data is stationary, a true regression will be obtained; if it is not stationary, the data must be examined for stationarity using the degree of integration test. A unit root test is performed at this level using the Augmented Dickey-Fuller (ADF).

Table 2. Stationary Test Result

Variable	Level Probability Value	1st Difference Probability Value
Gross Domestic Product	1.0000	0,0002
Gross Fixed Capital Formation (GFCF)	0.9985	0.0420
Labor Force Participation Rate (LFPR)	0.1577	0.0000
Mobile Celluler Subscriptions (MCS)	0.0913	0.0215
Fixed Telephone Subscriptions (FTS)	0.1830	0.0000

Source: Test Result Using Eviews 7 (2021)

According to table 2, all variables' level testing is known to be stationary, where the probability value of all variables is less than 0.05 in the first difference.

2. Data Cointegration Test

The cointegration test is used to provide an early indication if the model under consideration has a long-term link (cointegration relation). In this study, cointegration was tested using the Augmented Dicker-Fulley Unit Root Test on residual data, yielding the following results:

Table 3. Residual Data Unit Root Test Result

Variable	Probability	Description
Error Correction Term (ECT)	0.0293	Cointegration exist

Source: Test Result Using Eviews 7 (2021)

Table 3 shows that the probability value of the Error Correction Term (ECT) variable is less than 0.05. This indicates that the ECT variable is stationary at the first difference and means

that all variables employed are cointegrated, allowing the test to proceed to the equation of short-term estimation step.

B. Classical Assumption Test

1. Multicollinearity Test
Multicollinearity is defined as a linear relationship between independent variables in a regression model (Basuki and Prawoto 2016). The following are the findings of multicollinearity tests between independent variables:

Table 4. Multicollinearity Test Result

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
GFCF (X1)	0.001970	2.784494	2.289536
LFPR (X2)	3.24E-05	1.639158	1.556848
MCS (X3)	0.000180	3.605508	1.430475
FTS (X4)	0.000329	2.165048	1.965609

Table 4 demonstrates that the centered and uncentered VIF values of the dependent variable (Y) and other variables (X1, X2, X3, and X4) are less than 5, indicating that the data is not multicollinear.

2. Heteroscedasticity Test
Heteroscedasticity can cause a bias in dsdsds evaluation (Basuki, 2015; Basuki and Prawoto, 2016). The white heteroscedasticity test approach is used to determine heteroscedasticity:

Table 5. Heteroscedasticity Test Result

F-statistic	1.482607
Obs*R2	7.068616
Prob. F (5,23)	0.2340
Prob. Chi-Square (5)	0.2156

Source: Test Result Using Eviews 7 (2021

According to table 5, the output indicates that the probability value of Chi-Square from Obs* R2 is 0.2156, which is greater than 0.05. This demonstrates that there is no heteroscedasticity in this ECM model.

3. Autocorrelation Test
Autocorrelation demonstrates a relationship between the constituents in a series of observations (Basuki, 2015; Basuki and Prawoto, 2016). The Lagrange multiplier test approach is used to detect autocorrelation as follows:

Table 6. Autocorrelation Test Result

F-statistic	6.643524
Obs*R^2	11.23819
Prob. F(2,21)	0.0058
Prob. Chi-Square (2)	**0.0036**

Source: Test Result Using Eviews 7 (2021)

Based on table 6, it can be seen that the Chi-Square probability value of Obs*R^2 is 0.0036, which is smaller than 0.05.

4. Normality Test
The normality test carried out in this study was the Jarque-Berra test technique with the following results:

Table 7. Jarque-Bera Normality Test Result

Jarque-Berra	**Probability**	**Description**
3.781820	0.150934	Normal

Source: Test Result Using Eviews 7 (2021)

Table 7 shows that the probability value is 0.150934 which is greater than 0.05. This shows that the data used is normally distributed.

5. t-Test and F-Test
a. t-Test
t-Test is used to determine the significance of an independent variable towards another dependent variable. The results are as follow:

Table 8. t-Test Results

Variable	Coefficient	t-Statistic	Probability
GFCF	0.318063	7.165487	0.0000
LFPR	0.004951	0.869482	0.0436
MCS	0.009864	0.735537	0.0394
FTS	-0.013628	-0.751309	0.0189
ECT(-1)	-0.109174	0.592520	0.0293

From table 8, the ECM model equation can be arranged as follows:
$\mathbf{\Delta GDP_t = 0.028297 + 0.318063\Delta GFCF_t + 0.004951\Delta LFPR_t + 0.009864\Delta MCS_t - 0.013628\Delta FTS_t - 0.109174\ ECT_t}$
Based on the multiple ECM regression equation, it can be interpreted as follows:
a. At 0.318063, the regression coefficient of the Gross Fixed Capital Formation variable (b_1) is positive. This demonstrates an interconnected or unidirectional tendency because every 1% rise in Gross Fixed Capital Formation increases the value of Indonesia's Gross Domestic Product by 0.318063% between 1990 and 2019. As a result, H_1 is approved.

b. The Labor Force Participation Rate (b_2) variable has a positive regression coefficient value of 0.004951. This demonstrates the level of direction that is both in the same direction because increasing the Labor Force Participation Rate by 1% raises the Gross Domestic Product in Indonesia by 0.004951% between 1990 and 2019. As a result, H_2 is acceptable.

c. The regression coefficient for the variable Mobile Cellular Subscriptions (b_3) is positive, at 0.009864. This demonstrates that there is a similar pattern because increasing Mobile Cellular Subscriptions by 1% increases Indonesia's Gross Domestic Product by 0.009864% between 1990 and 2019. As a result, H_3 is approved.

d. The Fixed Telephone Subscriptions variable (b_4) has a negative regression coefficient value of 0.013628. This demonstrates that there is an inverse relationship because every 1% decrease in Fixed Telephone Subscriptions increases Indonesia's Gross Domestic Product by 0.013628% between 1990 and 2019. As a result, H_4 is acceptable.

e. The ECT(-) in the model has a negative coefficient value of -0.109174 and a significant probability of 0.0293, which is less than 0.05, showing that the ECM model has a short-term effect.

b. F-Test

The F test seeks to identify the effect of all independent variables (Gross Fixed Capital Formation, Labor Force Participation Rate, Mobile Cellular Subscriptions, Fixed Telephone Subscriptions) on the dependent variable, namely Gross Domestic Product, at the same time (together).

Table 9. F Test Result

F-statistic	Prob (F-statistic)
25.29690	0.000000

Source: Test Result Using Eviews 7 (2021)

The acquired F-statistic findings are 25.29690 with a probability value (F-statistic) of 0.000000, as shown in Table 9. Based on a significant probability of less than 0.005, it can be concluded that Gross Fixed Capital Formation, Labor Force Participation Rate, Mobile Cellular Subscriptions, and Fixed Telephone Subscriptions all have a significant influence on Gross Domestic Product.

6. Determination Test

In this study, the coefficient of determination of R^2 is to use the value of R^2 while evaluating the best regression model. Because there are multiple independent variables in this study.

Table 10. R-Squared Test Result

R-squared	0.846138

Source: Test Result Using Eviews 7 (2021)

According to table 10, the Adjusted R-squared value of 0.846138 indicates that the variation of the independent variables Gross Fixed Capital Formation, Labor Force Participation Rate, Mobile Cellular Subscriptions, and Fixed Telephone Subscriptions is 84,61%, with the remaining 15,39% explained by variables other than those studied.

7. Long Tem Regression Model

Table 11 depicts the model's long-term relationship between variables. In the long run, all variables are significant and can explain 81% of the variation in the dependent variable.

Table 11. Long Term Regression Model

Variable (X)	Coefficient	Probability
GFCF	0.318063	0.0000
LFPR	0.004951	0.0436
MCS	0.009864	0.0394
FTS	-0.013628	0.0189
R^2		0.846138
Adjusted R^2		0.812690
Prob. (F-statistic)		0.000000

Source: Test Result Using Eviews 7 (2021)
Table 11 reveals that the prob. (f-statistic) value of 0.000000 is less than 0.05 ().The adjusted determination test (R2) value of 0.812690 or 81.27% indicates that independent variables outside the model impact approximately 18.73% of the diversity of Gross Domestic Product variables (Basuki, 2015 in Basuki and Prawoto 2016).
The long-term equation estimate results reveal that the link between Gross Fixed Capital Formation (GFCF), Labor Force Participation Rate (LFPR), and Mobile Cellular Subscriptions (MCS) has a significant and beneficial effect on GDP. Meanwhile, Fixed Telephone Subscriptions (FTS) have a large and negative impact on the GDP.

D. Discussion

1. Gross Fixed Capital Formation (GFCF) affects Gross Domestic Product (GDP) in Indonesia between 1990-2019
Between 1990 and 2019, Gross Fixed Capital Formation has an impact on Indonesia's GDP. This is based on the t-test results of the Gross Fixed Capital Formation variable, which was 7.165487 with a significant level of 0.0000. The significant level is known to be less than 0.05. As a result, H1 with income projections has a favorable influence on Indonesia's GDP. Increases in Gross Fixed Capital Formation can boost Indonesia's GDP between 1990 and 2019.
Capital is very crucial in economic progress. This buildup of capital will determine whether a country's economic progress is rapid or gradual. The capital is obtained from community savings. Economic actors that accumulate capital from savings might invest it in the real sector to boost their income. People's ability to save is determined by their ability to control and process current resources, but capital accumulation and investment are strongly dependent on people's saving behavior. This suggests that those who can save belong to a class of people who control and exploit economic resources, particularly entrepreneurs and landlords. According to Adam Smith, the processes of economic progress will occur concurrently and in connection to one another. Improved performance in a sector will make capital accumulation more appealing, boost technological innovation, increase specialization, and expand markets. This will hasten economic progress ([18]). Furthermore, [33] published a research titled Review of economic growth and energy consumption: A panel cointegration analysis for EU countries. According to the findings of this study, the relationship between economic growth and energy consumption variables, gross fixed capital, which is cointegrated for the entire European Panel of Countries using the panel method and the Dols estimator, is positive. The panel and Dols estimator results show a positive and significant link between energy consumption, gross fixed capital, and economic growth.

2. Labor Force Participation Rate (LFPR) affect Gross Domestic Product (GDP) in Indonesia between 1990-2019
Between 1990 and 2019, the Labor Force Participation Rate had an impact on Indonesia's GDP. This is based on the results of a t-test on the Labor Force Participation Rate variable, which had

a t-count value of 0.869482 and a significant level of 0.0436. The significant level is known to be less than 0.05. So H2 with the assumption that the Labor Force Participation Rate has a positive effect on Indonesian GDP between 1990 and 2019 can be accepted since the Labor Force Participation Rate has a considerable positive effect on Indonesian GDP. An increase in the labor force participation rate can boost Indonesia's GDP between 1990 and 2019. This finding is consistent with the findings of a prior study titled "Labor Force Participation and Economic Growth in Nigeria" undertaken by [37].

Labor is one of the most important components of a country's economy. According to Adam Smith, a rising workforce will boost a country's economic prosperity. Indonesia is currently undergoing a demographic shift that is causing a rise in the working-age population; this growth has a direct impact on rising labor force participation. The greater the labor supply available to work in an economy, the higher the labor force participation rate. The higher the labor force participation rate and the lower the unemployment rate, the greater the value of the savings investment, which will enhance state income through taxes (such as income taxes). As a result, an increase in labor force participation will result in increased economic growth in Indonesia (Smith in [6]).

3. Mobile Cellular Subscriptions (MCS) affects Gross Domestic Product (GDP) in Indonesia between 1990-2019

Between 1990 and 2019, mobile cellular subscriptions had an impact on Indonesia's GDP. This is based on the results of the t-test of the variable Mobile Cellular Subscriptions, which had a t-count value of 0.735537 and a significant level of 0.0394. The significant level is known to be less than 0.05. So H3 with the assumption that Mobile Cellular Subscriptions has a positive influence on Indonesian GDP between 1990 and 2019 can be accepted, because Mobile Cellular Subscriptions has a considerable positive effect on Indonesian GDP..

One of the most common applications of mobile phones in developing countries has been to search for information. Farmers and small business owners are leveraging mobile phone data to eliminate or reduce the role of intermediaries in the value chain, reducing the risk that larger corporations or companies from developed countries may squeeze their profit margins. Small business owners in underdeveloped countries may now sell their products and engage with customers more effectively owing to mobile phones. For example, in the streets of Johannesburg, South Africa, one may see various homemade signs offering services such as house painting and gardening, as well as cell phone numbers ([17], 2011).

However, mobile communications have risen more than twice as fast in low-income nations as in high-income countries in recent years. As a result, low- and middle-income countries now account for more than 20% of the global mobile market, despite significant disparities in mobile phone prevalence and use across countries ([17], 2011).

The results of this study are in accordance with research conducted by [21]; [11]; [20]; [8]; [10];[4];[25]; [2] which shows the significant and positive influence of the telephone user variable. This demonstrates the importance of cell phone users in the economy, particularly in the digital economy. Cell phone users are one of the primary sources of production factors; their existence will boost the productivity of the digital economy, increasing GDP per capita. As a result, the government must continue to create and improve telecommunications infrastructure. The existence of cellular phones benefits both producers and consumers as telecommunications quality improves.

4. Fixed Telephone Subscriptions (FTS) affects Gross Domestic Product (GDP) in Indonesia between 1990-2019

Between 1990 and 2019, Fixed Telephone Subscriptions had an impact on Indonesia's GDP. This is based on the findings of the t-test of the Fixed Telephone Subscriptions variable, which had a t-count value of -0.751309 and a significant level of 0.0394. Because it is known that the significant level is less than 0.05 and the t-count value is negative, H4 with the assumption that Fixed Telephone Subscriptions have a substantial positive effect on GDP from 1990 to 2019 is rejected. These findings are consistent with the findings of a prior study, "Causality Analysis of Communication Information Technology (ICT) and Economic Growth in ASEAN," conducted by [27], which demonstrates the strong and negative influence of the telephone user variable. This demonstrates that telephone users have a detrimental impact on the economy, particularly the digital economy.

It is caused by the level of people's income, which may be assessed in Indonesia by per capita income. When the cost of telephone service rises, it is accompanied by a fall in other consumption items. People are forced to make a choice due to their limited consumption budget. As a result, individuals are less interested in the most recent cell phone releases, even if they have more advanced capabilities, and prefer to stick with an old cell phone that they already own [27]. In other words, consumers want to continue utilizing communications equipment due to their low cost.

The findings of this analysis are consistent with previous studies by [28] , [24] , and [27] that reveal a large and negative influence of the telephone user variable on GDP in Indonesia from 1990 to 2019.

5. Conclusion

1. The variable Gross Fixed Capital Formation (GFCF) has a considerable positive impact on GDP. Every 1% rise in Gross Fixed Capital Formation raises the value of Indonesia's GDP by 0.318063% between 1990 and 2019. The origin of this phenomena stems from the fact that the more opportunities available for economic actors to invest in productive economic activity, the higher the Gross Fixed Capital Formation, which leads to an increase in Gross Domestic Product.

2. The Labor Force Participation Rate (LFPR) has a strong positive effect on GDP. When the labor force participation rate rises by 1%, the Gross Domestic Product in Indonesia rises by 0.004951% between 1990 and 2019. This phenomenon can occur because, in addition to capital and natural resources, Labor Force Participation Rate (LFPR) or human resources operate as producers of products and services that contribute to the Gross Domestic Product (GDP).

3. Mobile cellular subscriptions have a strong positive impact on the GDP. When mobile cellular subscriptions rise by 1%, the Gross Domestic Product in Indonesia rises by 0.009864% between 1990 and 2019. This phenomenon can occur because technological advancements and access to information, such as what mobile cellular offered, can improve task completion and so increase the productivity of economic activity adding to GDP.

4. Fixed telephone subscriptions have a negative and large impact on GDP. Every 1% drop in Fixed Telephone Subscriptions raises Indonesia's GDP by 0.013628% between 1990 and 2019. This problem can occur because telephone subscriptions are becoming increasingly expensive for communication purposes, making them unaffordable to many individuals.

5. Gross Fixed Capital Formation (GFCF), Labor Force Participation Rate (LFPR), Mobile Cellular Subscriptions, and Fixed Telephone Subscriptions have a significant influence on Gross Domestic Product in the short and long term, with 81.27% influence, while independent variables outside the model influence around 18.73%.

References

[1] Adisasmita, R. (2011). Pengelolaan Pendapatan dan Anggaran Daerah (Edisi Pert). Graha Ilmu.

[2] Ariansyah, K. (2018). Pengaruh Difusi Layanan Telekomunikasi terhadap Pertumbuhan Ekonomi Negara-Negara ASEAN pada Periode 2005-2016 [Impact of Telecommunication Service Diffusion on Economic Growth of ASEAN Countries in the Period of 2005-2016]. Buletin Pos Dan Telekomunikasi, 16(1), 1. https://doi.org/10.17933/bpostel.2018.160101

[3] Basuki, A. T., & Prawoto, N. (2016). Analisis Regresi Dalam Penelitian Ekonomi dan Bisnis (Dilengkapi Aplikasi SPSS dan EViews). Raja Grafindo Persada.

[4] Bayraktar Sağlam, B. (2018). ICT Diffusion, R&D Intensity, and Economic Growth: a Dynamic Panel Data Approach. Journal of the Knowledge Economy, 9(2), 636–648. https://doi.org/10.1007/s13132-016-0353-0

[5] Budiono. (1981). Teori Pertumbuhan Ekonomi. Badan Penerbit Fakultas Ekonomi Yogyakarta.

[6] Budiono. (1982). Seri Sinopsis Pengantar Ilmu Ekonomi No.2 : Ekonomi Makro (Edisi 4). BPFE.

[7] Çalışkan, H.K., 2015. Technological change and economic growth. Procedia-Social and Behavioral Sciences, 195, pp.649-654.

[8] Das, A., Chowdhury, M., & Seaborn, S. (2018). ICT Diffusion, Financial Development and Economic Growth: New Evidence from Low and Lower Middle-Income Countries. Journal of the Knowledge Economy, 9. https://doi.org/10.1007/s13132-016-0383-7Difference between prepaid (PAYG) and postpaid phone plans – Commsbrief. (n.d.). Retrieved June 9, 2022, from https://commsbrief.com/difference-between-prepaid-payg-and-postpaid-phone-plans/

[9] Domar, E.D., 1957. Essays in the Theory of Growth. London: Oxford UniversityPress.

[10] Donou-Adonsou, F., Lim, S., & Mathey, S. A. (2016). Technological Progress and Economic Growth in Sub-Saharan Africa: Evidence from Telecommunications Infrastructure. International Advances in Economic Research, 22(1), 65–75. https://doi.org/10.1007/s11294-015-9559-3

[11] Fajar, E. C. (2012). Analisis Pengaruh Infrastruktur Ekonomi Terhadap Produk Domestik Bruto Di Indonesia. Jurnal Ekonomi Pembangunan, 10(2), 136–157. https://media.neliti.com/media/publications/71108-ID-none.pdf

[12] Harrod, Roy F. (1970). Dynamic Theory. In Growth Economics. Ed. by A. K. Sen. Harmondsworth: Penguin, 1970.

[13] Heng, S. (2014). Industry 4.0 - Upgading of Germany's industrial capabilities on the Horizon. Deutsche Bank, 16. http://www.dbresearch.com/servlet/reweb2.ReWEB?ColumnView=0&ColumnViewRwd=0&ColumnViewRwdFree=AT,DU2,TI,DA,T3,T1,T2,PE,NR,TE,DU1&ColumnViewRwdStyle=gmlist4&DocumentLanguage=EN&DocumentLayout=$%2BSTFI,-SHEO,MEKL,MPEK&ElementCount= 10&ElementKey=PROD00000000

[14] ITU. (2013) World Telecommunication/ICT Indicators Database 2013. (17th Edition). Geneva: International Telecommunication Union.

[15] Jhingan, M. L. (2017). Ekonomi Pembangunan dan Perencanaan (Cetakan ke-18). Raja Grafindo Persada.

[16] Kagermann, H., Wahlster, W., Helbig, J., Hellinger, A., Stumpf, M. A. V., Treugut, L., Blasco, J., Galloway, H., & Findeklee, U. (2013). Editorial staff Copy editing English

translation Layout and typesetting Graphics beim Stifterverband für die Deutsche Wissenschaft. April.
[17] Kefela, G. T. (2011). The impact of mobile phone and economic growth in developing countries. African Journal of Business Management, 5(2), 269–275. https://doi.org/10.5897/AJBM09.367
[18] Kuncoro, M. (2000). Ekonomi Pembangunan : Teori, Masalah, dan Kebijakan (Cetakan 2). UPP AMP YKPN.
[19] Lasi, H., Fettke, P., Kemper, H. G., Feld, T., & Hoffmann, M. (2014). Industry 4.0. Business and Information Systems Engineering, 6(4), 239–242. https://doi.org/10.1007/s12599-014-0334-4
[20] Lee, S. H., Levendis, J., & Gutierrez, L. (2012). Telecommunications and economic growth: An empirical analysis of sub-Saharan Africa. Applied Economics, 44(4), 461–469. https://doi.org/10.1080/00036846.2010.508730
[21] Lum, T. A. (2011). Mobile goes global: The effect of cell phones on economic growth and development. 62. https://digitalcommons.bucknell.edu/honors_theses/4
[22] Mankiw, N. G. (2007). Makroekonomi (Edisi 6). Erlangga.
[23] Neugebauer, R., Hippmann, S., Leis, M., & Landherr, M. (2016). Industrie 4.0 - From the Perspective of Applied Research. Procedia CIRP, 57, 2–7. https://doi.org/10.1016/j.procir.2016.11.002
[24] Pradhan, R. P., Arvin, M. B., Norman, N. R., & Bele, S. K. (2014). Economic growth and the development of telecommunications infrastructure in the G-20 countries: A panel-VAR approach. Telecommunications Policy, 38(7), 634–649. https://doi.org/10.1016/J.TELPOL.2014.03.001
[25] Qureshi, S., & Najjar, L. (2017). Information and communications technology use and income growth: evidence of the multiplier effect in very small island states. Information Technology for Development, 23(2), 212–234. https://doi.org/10.1080/02681102.2016.1173634
[26] Russmann, M., Lorenz, M., Gerbert, P., Waldner, M., Justus, J., Engel, P., & Harnisch, M. (2015). Industry 4.0: World Economic Forum. The Boston Consulting Group, 1–20.
[27] Sahrina, S., & Anis, A. (2019). Causality Analysis of Communication Information Technology (ICT) and Economic Growth in ASEAN. Jurnal Kajian Ekonomi Dan Pembangunan, 1(2), 421. https://doi.org/10.24036/jkep.v1i2.6209
[28] Saidi, K., & Mongi, C. (2018). The effect of education, R & D and ICT on economic growth in high income countries. Economics Bulletin, 38(2), 810–825.
[29] Schmidt, R., Möhring, M., Härting, R. C., Reichstein, C., Neumaier, P., & Jozinović, P. (2015). Industry 4.0 - Potentials for creating smart products: Empirical research results. Lecture Notes in Business Information Processing, 208(April), 16–27. https://doi.org/10.1007/978-3-319-19027-3_2
[30] Sukirno, S. (2003). Introduction to Macroeconomic Theory. Jakarta: PT. Raja Grafindo Persada
[31] Suroto, D. (1993). Strategi Pembangunan dan Perencanaan tenaga Kerja (Edisi Kedu). Gajahmada University Press.
[32] Solow, R.M. (1970). Growth Theory: An Exposition. Clarendon Press, Oxford.
[33] Streimikiene, D., & Kasperowicz, R. (2016). Review of economic growth and energy consumption: A panel cointegration analysis for EU countries. Renewable and Sustainable Energy Reviews, 59, 1545–1549. https://doi.org/10.1016/J.RSER.2016.01.041
[34] Swan, T. M. (1956). Economic Growth and Capital Accumulation. Economic Record, 32(2), 334-361.

[35] Todaro, M. P., & Smith, S. C. (2008). Pembangunan Ekonomi Jilid 1 Edisi Kesembilan. Erlangga.
[36] World Bank Open Data | Data. (n.d.). Retrieved June 12, 2022, from https://data.worldbank.org/
[37] Yakubu, M. M., Akanegbu, B. N., & Jelilov, G. (2018). Female Labor Participation And Economic Growth In Nigeria. Ilorin Journal of Economic Policy, 5(5), 1–11.
[38] Wiranatakusuma, D., & Jami, D. (2022). *Fintech Development and Banking Performance in Indonesia*. https://doi.org/10.4108/eai.10-8-2022.2320831