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Effect of Uneven Distribution of Broadband Internet Services in Developing Countries during Economic Recession

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Abstract

Purpose: This study examines the economic and technical reasons for the uneven distribution of broadband internet services in Indonesia before and during the recession due to the C19 pandemic, and examines its effect on the country's economy. **Research design, data and methodology:** The research was designed by conducting an economic feasibility, which was verified through area observations and interviews with providers and their association, as well as the Regulator. **Results:** The results show that during the C19 pandemic, there has been an increase in the distribution of broadband internet services in Indonesia since there has been an increase in demand for cellular services and fixed services together. However, the increase in broadband internet service coverage is still not evenly distributed in the country and unable to boost the decline in Gross Domestic Product during the C19 pandemic. **Conclusions:** The increase in fixed broadband coverage by seventy percent is an indication for the state to make policies to encourage bundling techniques between operators with the aim of internet services being more evenly distributed throughout the country. Where, the influence of a more even distribution of broadband internet services in all countries is believed to be able to support the country's economy.

Keywords : Broadband Internet Distribution, Economic Policy, Broadband Deployment, Economic Development

JEL Classification Code : A12, A13, C65

1. Introduction

The impact of information and communication technology (ICT) on economic growth in developing countries can encourage economic progress (Bilan et al., 2019). Then Appiah-Otoo and Song (2021) stated that building an ICT index from mobile internet and fixed broadband proved boosts the economic growth in all countries, especially the poor countries tend to get more from the ICT revolution. Then, mobile payments have a significant effect in the increasing economic impact of developing countries to improve the quality of public life (Zhang et al., 2022).

On the other hand, Indonesia, which is part of the Group of Twenty or G20, which is a group consisting of 19 countries with the largest economies in the world, plus the European Union, was ranked 108th IDI (ICT Development Index) of the International Telecommunication Union in 2012. And, the main factors that caused Indonesia's IDI rating to be very bad in 2012 was due to the low area coverage by fixed broadband services at the sub-district

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level, where conditions did not improve until early 2020. In detail, the coverage area of fixed broadband services in Indonesia, which has been deployed since the 2000, was only thirty-five percent until early 2020, which then, shot up to sixty percent in the middle of 2021.

In order to answer the reasons for the low coverage area before the pandemic, and the rapid increase during the pandemic, the research was designed by conducting a feasibility study of fixed broadband in Indonesia and verified through the field observation to find gaps in the problems. In detail, the preparation of a feasibility study for deploying fixed broadband networks in Indonesia uses a model that is limited to context specificity with its characteristics and limitations related to fixed broadband networks, especially in sub-districts in Indonesia.

In general, when prices have been set, it would be strange when the demand fell there was an increase in supply, but this is happening in the fixed broadband business in Indonesia during the pandemic, then the topic is very interesting to study. The research was designed by conducting an economic feasibility study of fixed broadband in Indonesia and verified through the field observation to find gaps in the problems and to get the answers of the research purpose to examine the constraints in area coverage of the fixed broadband industry in Indonesia during the "normal" period and the reasons why there was a sudden rapid increase during the C19 pandemic.

The results of economic feasibility which show that the coverage and distribution of internet services in Indonesia can be increased if the bundling technique is carried out between broadband internet providers is a guide for the government to make policies that make it easier for providers to cooperate with each other. Thus, it is hoped that in the future the distribution of broadband internet services can be more evenly distributed throughout the country so that it will be able to support the country's economy. This expectation is supported by the results of this study which shows that the communication sector in Indonesia continues to increase when the country is experiencing a recession due to the monetary crisis in 1998 and during the C19 pandemic in 2020-2021.

2. Literature Review

This chapter will describe the literature review. First, it is necessary to summarize and quote the main contents of the previous studies or theoretical background in a table (see table 1).

2.1. ICT and Economic Development

The impact of information and communication technology (ICT) on economic growth in developing countries can encourage economic progress, which can be seen from government policy-making actions aimed at economic development that can be determined and disseminated using Internet access and web technology, especially in the field of e-commerce (Bilan et al., 2019). Then Appiah-Otoo and Song (2021) which examined 123 countries consisting of 45 high-income countries, 58 middle-income countries, and 20 low-income countries from 2002 to 2017, by building an ICT index from mobile internet and fixed broadband proved that in general the ICT boosts economic growth in all countries, especially poor countries tend to get more from the ICT revolution. Then, mobile payments have a significant effect of facilitating household consumption in rural China and increasing financial inclusion and convenience of consumption activities for people, this proves the increasing economic impact of telecommunications technology for developing countries to improve the quality of public life (Zhang et al., 2022).

Table 1: The Main Contents of The Previous Studies

Author's name and year of the journal article	Relevant Main Content as the theoretical background
Bilan, Mishchuk, Samoliuk, & Grishnova (2019)	An economic growth in developing countries encourages the economic progress.
Zhang, Zhang, & Gong (2022)	Telecommunications technology improve the quality of public life
Klein (2022)	There is a strong and significant effect of the spread of broadband
Briglauer & Cambini (2018)	Rising access prices have reduced acceptance rates
Rajabiun (2020).	The essence of broadband as an enabler of socio-economic activities
Whitacre & Gallardo (2020).	There the positive and negative effect of the state policies on broadband availability
Briglauer, Stocker, & Whalley (2020)	There are significant socio-economic benefits of broadband internet networks
Burleigh, Cola, Morosi, Jayousi, Cianca, & Fuchs (2019).	A smaller satellite design has been successfully designed to support telecommunications services
Oteri, Kibet, & Edward (2015).	There are the problems with broadband penetration and coverage
David & Grobler (2020).	A large investment is needed to develop the broadband network for increasing the distribution

The International Telecommunication Union (ITU), in 2012 report that Indonesia, which is a member of the Group of Twenty or G20, which is a group consisting of 19 countries with the largest economies in the world plus the European Union, is only ranked 108th in the world of the IDI (ICT Development Index). In detail, the IDI was compiled by ITU to monitor the development of information

and communication technology (ICT) from 176 countries in the world from 2009 to 2017, which combines 11 indicators into a composite score, where Indonesia scored very low on the indicator of deploying the fixed broadband networks.

2.2. Broadband Internet Technology

There is a strong and significant effect of the spread of fixed broadband, which demonstrates relevant benefits to customers in Germany (Klein, 2022). There is evidence of consumer decisions in Europe to switch from copper-based to fiber-based broadband technologies, due to the impact of regulatory interventions where rising access prices have reduced acceptance rates and suggest that fiber coverage is stronger than fiber adoption (Briglauer & Cambini, 2018). Then, the emergence of broadband Internet connectivity as an important utility in Canada, proves the essence of broadband as an enabler of social and economic activities, but the government must address the digital uneven between rural-urban (Rajabiun, 2020).

The three papers above prove that fixed broadband networks are important in the era of high-speed internet services, which have succeeded in shifting copper cable technology, and from time to time always compete to be used together with mobile communication networks.

2.3. Broadband Deployment and Economic Policy

Research on various state policies on broadband availability in the United States has found a positive and significant impact of state-level funding programs on rural fixed broadband availability, but there is a negative impact of restrictions by some city/cooperative policies (Whitacre & Gallardo, 2020). The European Commission, reflecting on the widely held view that there are significant socio-economic benefits of broadband internet networks, has substantially revised telecommunications regulations, but has sought to encourage increased investment and choose which technologies should be adopted in the context of technology neutrality (Briglauer et al., 2020).

The two papers above have prompted us to examine the constraints and the facts that occur in the deployment of fixed broadband networks in Indonesia and to what extent the role of state economic policy can be used to overcome the obstacles.

2.4. Effect of Distribution of Internet Service

Recently, a smaller satellite design has been successfully designed to support telecommunications services with a particular focus on telecommunications aspects such as the use of higher frequency bands, optical communications, new protocols, and advanced architecture (Burleigh et al., 2019). However, for use in Indonesia, which has a population of more than 270 million and spread over 2.55 million kilometers, this technology has not been able to overcome the problem of broadband internet service coverage which has not been evenly distributed throughout the country. So, so far, they still have to rely on optical technology and cellular communication.

Cellular operators in another developing country, Kenya, are also experiencing problems with subscriptions, penetration and coverage, even though these services have been around since 1999 (Oteri et al., 2015).

A study examining economic growth and development in Africa using ICT penetration and distribution parameters concluded that mobile telecommunications is growing faster than other types of telecommunications services, and in general ICT penetration has had a positive impact on economic growth and development in Africa. Furthermore, this study recommends that a large investment is needed to develop fixed-line telecommunications services and Internet access with the aim of increasing distribution penetration throughout Africa (David & Grobler, 2020).

3. Research Methodology

3.1. Data Collection

Primary data comes from observations and interviews with providers and their associations, while secondary data comes from the Central Bureau of Statistics and Regulators. In detail, the primary data include: Barriers and obstacles related to licensing, levies, funding, Right of Way, and non-monopoly opportunities; and the opportunities solutions from the government include funding models, licensing coordination, ease of access, tax incentives and Right of Way coordination. And, secondary data include: Area and Number of Islands by Province 2019-2021; Fixed broadband subscriptions in Indonesia; Fixed Broadband Target & Achievement of Government 2014-2019; Fixed Broadband Target & Achievement of Government 2019-2024; Gross Regional Domestic Product of Provinces in Indonesia by Expenditure 2019-2021; Gross Regional Domestic Product of Provinces in Indonesia by Expenditure 1997-2003 (Indonesia during the monetary crisis); ICT Development Index; Indonesian Internet Profile 2019-2022; Number of Districts by Province in Indonesia 2019-2021; Number of Villages by Province in 2019-2021; Number of Villages by Province and Cellular Phone Internet Signal Reception in 2019-2021; Population, Population Growth Rate, Distribution of Population Percentage, Population Density, and Population Sex Ratio by Province in 2019-2021; Internet services demand; Palapa Ring data (national fiber optic network); and the regulations of the central

government and local governments related to fixed broadband network, access, and services.

3.2. Research Design and Methodology

The research was designed by conducting a feasibility study of fixed broadband in Indonesia before and during the C19 pandemic and verified through the field observation to find gaps in the problems and to get the answers of the research purpose. And, the research purpose is to examine the constraints in the fixed broadband industry in Indonesia in terms of increasing area coverage during the "normal" period and the reasons why there was a sudden rapid increase during the C19 pandemic. While, the "normal" period, meaning that in the period before the C19 pandemic and after the C19 pandemic began to subside, and the "pandemic" period is from early 2020 to mid-2022. In detail, the research combines descriptive and verification approaches, in which the verification and explanatory processes on what factors cause the difficulty level of deploying the fixed broadband network in Indonesia is very high, as well as how the pattern of relationships between aspects and the extent of the relationship. Furthermore, the hypothesis that causes the low coverage rate of fixed broadband networks in Indonesia is a combination of geography, demography, policy, and economy.

4. Results

4.1. Indonesian Profile

Referring to Central Bureau of Statistics of the Republic of Indonesia, the Republic of Indonesia is the largest archipelago country in the world, which in 2021 has 16,766 islands, with an area of 7.81 million square kilometers, consisting of 1,916,907 million square kilometers of land and 3.25 million square kilometers of sea, of which there are 2.55 million kilometers in the form of the Exclusive Economic Zone.

The number of sub-districts in 2021, which is the starting point of the research regarding the deployment of fixed broadband services 7,274. The total population of Indonesia in 2021 is 272,682,500 people, the annual population growth rate is 1.22%, the national population density is 142 people per square kilometer, of which the highest is in the province of Jakarta is 15,978 people per square kilometer, and the lowest is nine people per square kilometer in the province of North Kalimantan. The communication system with the widest reach in Indonesia is mobile communication, where of 83,843 villages in Indonesia, 61,926 villages (73.86%) have been served by mobile broadband (4G/LTE), of which, 13,967 villages (16.66%) there is low speed mobile communication (2G/3G), and only 3,045 villages (3.63%) have no mobile communication. In contrast, out of 7,230 sub-districts in Indonesia, 2,831 sub-districts (39.16 %), that is the reason the research focuses on the problem of fixed broadband. National per capita income from 2019 to 2021 is as follows: (1) Per capita income based on current prices in units of thousands of rupiah is 59,317.91 (2019), 57,269.8 (2020), and 62,236.44 (2021); and (2) Per capita income based on constant prices in 2010 was 41,021.61 (2019), 39,778.89 (2020), 40,775.88 (2021).

4.2. Government Targets and Achievements

In general, before the C19 pandemic, the Indonesian government could only reach around 50% of the target, especially in terms of area coverage of fixed broadband.

Fixed broadband subscribers in Indonesia experienced significant growth continuously from 2007 to 2019 (see figure 1), but area coverage is still far below the government's target.

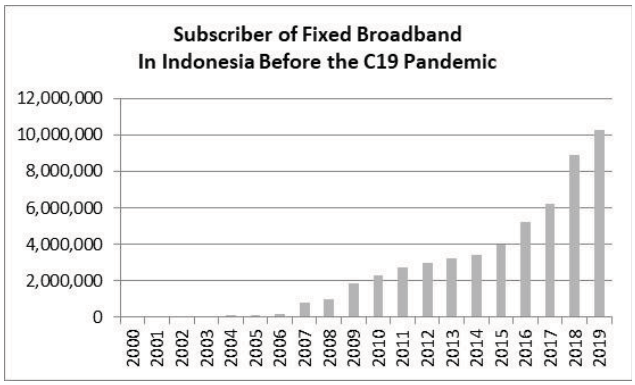

Figure 1: Fixed Broadband Subscriber's Before the C19 Pandemic

The figure is processed from the source of the Central Bureau of Statistics 2000 – 2020

The target of the central government for 2014-2019 stated in Presidential Regulation number 96 of 2014 concerning Regulation of the President of the Republic of Indonesia, concerning the 2014-2019 Plan of the Broadband of the Republic of Indonesia, was not achieved. In detail, the target of Indonesia's broadband development until the end of 2019 is to increase the reach and speed of access to infrastructure: (a) In urban areas, broadband fixed access infrastructure reaches a penetration rate of seventy-one percent of total households with an average speed of 20 Megabits per second, and (b) In rural areas, broadband fixed access infrastructure reaches a penetration rate of forty nine percent of total households with a speed of 10 Megabits per second. However, in reality only 9,333,183 households subscribed to fixed access broadband in December 2019, or

13.59% of 68,700,700 households in 2019.

In 2020, the level of policy makers is lowered, from a Presidential Regulation to a Ministerial Regulation, where the target in the fixed broadband sector is the percentage (%) of sub-districts that are covered by fiber broadband network infrastructure, which is 36.42% (2020), 37.15% (2021), 42.85% (2022), 50% (2023), and 60% (2024). While the target of ratio of households served to the total household is 14.46% (2020), 16.25% (2021), 20.83% (2022), 25.42% (2023), and 30% (2024).

Contrary to the failure of the government target for the period of 2014-2019, it turns out that during this C19 pandemic, suddenly the government's target achievement related to fixed broadband, namely 60% sub-district coverage in 2024, achieved in 2021 (See table 2).

Table 2: Area-coverage of sub-district by Fixed Broadband Network in Indonesia Before and During Pandemic

Year	Targets of # District Covered by Fixed Broadband Network	Achievements
2019	50.00 % *	35.71% (December)
2020	36.42% **	36.42% (December)
2021	37.15%	60.84% (December)
2022	42.85%	61.01% (April)
2023	50.00%	-
2024	60.00%	-
Note: * Government targets 2014 – 2019 ** Government targets 2020 – 2024		

The data is processed from the source of the Central Bureau of Statistics (2019 – 2022) and the Regulatory Body (2021)

4.3. The Effect of the Recession

During the C19 pandemic, the communication sector in Indonesia continued to grow positively, by 10.61% in 2020 and 6.81% in 2021, the opposite condition occurred in the national GDP which fell 2.07% in 2020 and only increased 3.69% in 2021 (See figure 2). This shows that the communication sector is highly resilient in facing the economic crisis, which is supported by economic data when Indonesia experienced the monetary crisis in 1998, where the communication sector grew 4.83% compared to the national GDP which fell 13.23% in 1998. Furthermore, in the following years when the national GDP began to stabilize in 2000, the communication sector continued to grow about 3,4 times compared to the growth of the national economy: 12.24% vs. 4.85% in 2000; 12.56% Vs. 3.28% in 2001; 15.73% vs. 4.38% in 2002; and 17.69% vs. 4.72% in 2003 (See figure 3).

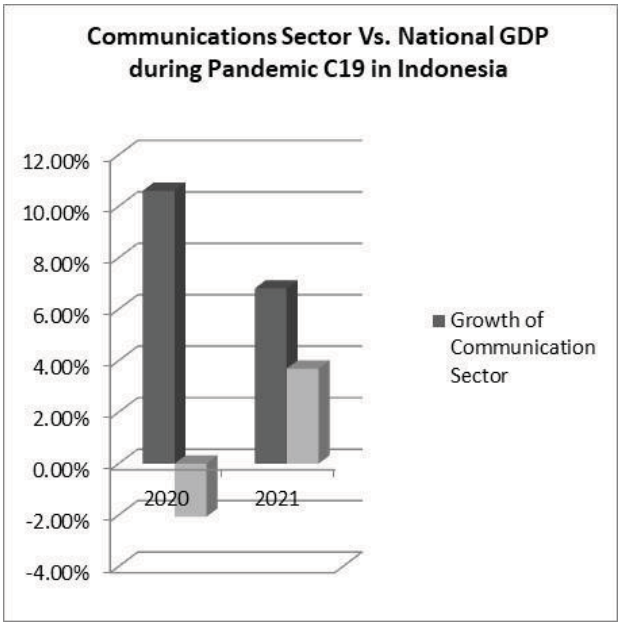

Figure 2: Growth of Communication vs. National GDP during the C19 Pandemic in Indonesia

The figure is processed from the Central Bureau of Statistics (2020 – 2022)

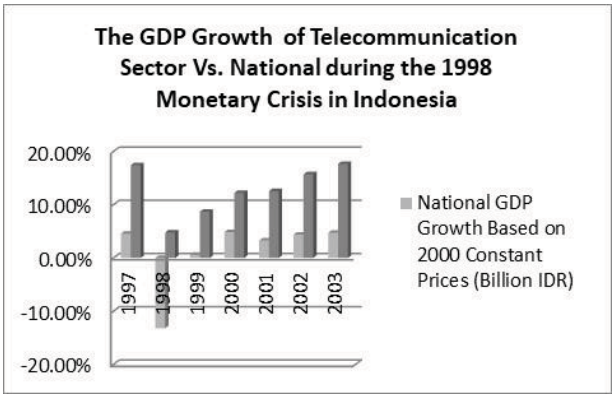

Figure 3: The GDP Growth during the 1998 Monetary Crisis in Indonesia

The figure is processed from the source of the Central Bureau of Statistics (1997 – 2004)

4.4. The Effect of the C19 Pandemic

Subscribing to fixed broadband services by most customers (60.84%) is between 100 thousand rupiahs to 300 thousand rupiahs per month, which on average is IDR 267,760 per month or IDR 3,213,120 per year, which is 3.66 times compared to mobile service subscriptions IDR 877,356 per year. The cheapness of mobile service subscriptions compared to fixed broadband in Indonesia occurs because the government has only begun to make a

policy in mid-2022 to gradually phase out low-speed mobile networks, where until the end of 2021, only 55% of mobile networks are 4G/LTE broadband networks and the rest are 2G and 3G networks. See Table 3.

The picture of internet traffic demand during the pandemic, see at figure 4 about the increase in internet user penetration in Indonesia during the pandemic, figure 5 about the level of internet use in each age group and table 4 regarding internet use by the Indonesian people. While, during the C19 pandemic, there has been a significant increase in internet subscribers from 64.80% at the end of 2018 to 73.70% in April 2021 and 77.02% in April 2022. It is noted that the largest increase occurred in mobile services which correlated with the most age group of internet users, aged 13-18 years (76.63%) where most of them used it to be able to access social media (Top 2 Boxes Rating Scale = 98 %).

Table 3: Calculation of Internet Subscription Fees in Indonesia

MOBILE (IDR/Monthly)		FIXED (IDR/Monthly)	
Don't know	0.31%	Don't know	0.75%
< 10,000,-	1.20%	< 100.000, -	3.71%
10,000 - 50.000,-	38.31%	100,000 - 300,000, -	60.84%
50,001 - 100.000, -	46.80%	300,001 - 500.000, -	33.15%
100,001, - 250,000, -	11.66%	> 500.000, -	1.55%
> 250,000, -	1.73%		
Average per month	73,113	Average	267,760
Average per year	877,356	Average / year	3,213,120

The data is processed from the source of Indonesian Internet Service Provider Association (2022)

Data source: Indonesian Internet Service Provider Association (2022)

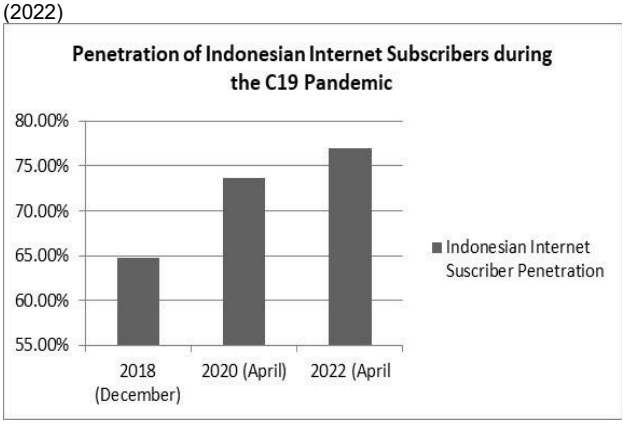

Figure 4: Penetration of Indonesian Internet Subscribers Before and During the C19 Pandemic

Data source: Indonesian Internet Service Provider Association (2022)

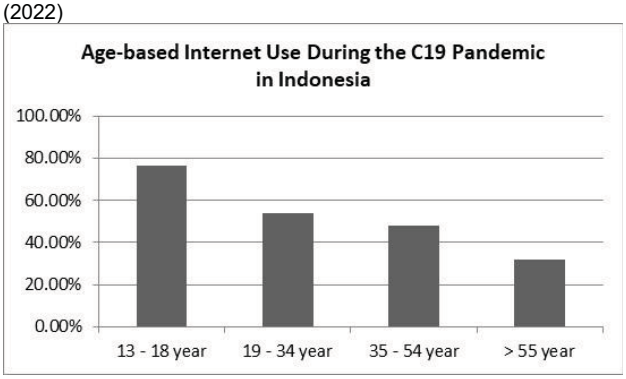

Figure 5: Age-based Internet Use during the C19 Pandemic in Indonesia

In detail, the high school age children were the most numerous, 76.63% of respondents claimed to have experienced an increase in internet use during the C19 pandemic in Indonesia. Meanwhile, the increase in internet use is also recognized by around half of people aged 19-34 years (53.99%) and at the age of 35-54 years (47.91%). See figure 5. And, regarding the function of the internet during the C19 pandemic in Indonesia, most of it was for to be able to access social media and to do work or school from home. See table 4.

Table 4: Social Impact of Internet Use during the C-19 Pandemic in Indonesia

Reasons for Using the Internet	Mean Score Rating Scale	Top 2 Boxes Rating Scale (%)
To access social media	3.35	98.02
To do work or school from home	3.19	90.2
To access information/news	3.12	92.21
To access public services	2.99	84.90
To access can use email	2.93	80.74
To do online transactions	2.9	79.00
To access entertainment content (Online games/TV/Radio/Online Video)	2.87	77.25
To access online transportation	2.86	76.47
To access financial services	2.8	72.32

Data source: Indonesian Internet Service Provider Association (2022)

4.5. Feasibility Calculation

4.5.1. If Provider Only Serves the Customers

Currently, more than 95% of fixed broadband services in Indonesia are served using fiber optic cable networks, so in the discussion in this research, fixed broadband is intended as fiber to the user. Furthermore, the feasibility of the research is intended as an economic feasibility in a sub-

district in Indonesia before the C19 pandemic, in early 2020, when a fixed broadband network has not yet been deployed in that area.

The fixed broadband network architecture in a sub-district generally consists of: (1) a junction network from the nearest point of the national optical network to the central point of the fixed broadband network in the sub-district, and (2) Local optical access network.

Feasibility calculation of FIXED BROADBAND networks and services here is compiled based on the resumes of observations and interviews with providers and their associations, where there are variations in parameters and unit price units, and the research re-checks with the vendors and contractors. In detail, economic feasibility includes: calculation of CAPEX (Capital Expenditure); OPEX (operational Expenditure) calculation; revenue estimation; and finally the determination of the feasibility of deployment of fixed broadband Services in the new location.

4.5.2. CAPEX of the Fixed Broadband Services

From the results of field observations and interviews with providers as well as their associations, the fiber optic network that will be deployed in a new sub-district, which is the most economical when carried out by the same provider and has an optical network in the near sub-district. Even then, with a note, the closest distance from the existing sub-district to the new sub-district is one of the ODP points of the existing sub-district. In addition, the remaining capacity or bandwidth in the existing ODP is sufficient to serve traffic in the new sub-district, in which case the CAPEX calculation will be much more expensive. The last thing happened because it required the deployment of an additional optical network in the existing sub-district specifically to serve the new sub-district. Based on secondary data, the distance from the existing sub-district to the new sub-district is 2 km to 40 km. An additional assumption is that the most economical installation of a junction network from the existing sub-district to the new sub-district is to use connecting the poles, not ducts.

Then, the investment of the fixed broadband network in the new sub-districts refers to prices in mid-2021, consists of: (1) CAPEX of a junction network to connect the nearest sub-district to the central point in the new sub-district, which consists of two possibilities: (a) Using the fiber optics, the variable cost of procurement and installation cost of cable and the poles is IDR 59,605 per meter distance between the existing sub-district and the new sub-district, or Using the radio transmission, with investment value per system of IDR 1,050,000,000 (for new sub-district where it is not possible to connect using optical fiber to the nearest existing sub-district); and (2) CAPEX of the local network in the new sub-district, which consists of Procurement and installation cost: (a) the variable cost of procurement and installation cost of cable and the poles is IDR 57,425 per meter average distance between OLT and ODPs in the new sub-district and, (b) Fixed Cost of IDR 145,167,115. Note: these prices are obtained based on a survey at the end of 2021.

4.5.3. OPEX of Fixed Broadband Services

The cost of fixed broadband services consists of: (1) Technical, administrative, and human resources cost; (2) Resources and supporting facilities cost; (3) The procurement of spare parts cost; (4) Marketing cost[(5) Tax and non-tax expenditure; and (6) Using Rights Fee of frequency spectrum, if necessary of construction of radio communication network.

OPEX (operational expenditure) of fixed broadband services in Indonesia per year ranges from 15%~30% of CAPEX.

4.5.4. Revenue Estimation

The calculation of the revenue prediction for fixed Broadband Services in Indonesia is done by choosing the smallest value as follow: (1) Prediction of fixed broadband service revenue which refers to the calculation of estimated demand, which is equal to the estimated number of subscriber multiplied by the average subscription price per subscriber. Where, the demand estimation is the same as the number of households multiplied by the subscriber-penetration of fixed broadband service subscribers in the sub-district area. However, due to the low ability to pay and competing providers in the same sub-district, then penetration per provider is assumed between 1%~3% of the number of households; and (2) The second prediction is made simpler, where the population's expenditure on broadband internet services is only about 7% of GDP per capita, then each provider only dares to set a target of around 1%~3% of GDP per capita.

4.5.5. Feasibility of Deployment

Sub-districts that do not have the fixed broadband services are estimated to be feasible, if they meet two conditions as follows: (1) Taking into account changes in technology and public policies from the government, the estimated payback period cannot be more than five years, where the calculation is carried out using techniques commonly used in standard theory of economics, which by taking into account the average CAPEX, OPEX, and Revenue estimation; and (2) The calculation of the Rate of Return refers to the technical approach, according to the reference from ITU-D (the International Telecommunication Union - Development), in general using the formula to calculate the rate of return as follows: The rate of Return = {(Average service price * service quantity) - Operating Expenses - Depreciation - Tax)} divided by Net

Book Value.

The results of the feasibility calculation show that in the "normal" period (in December 2019): out of 4,613 sub-districts that do not yet have a fixed broadband network, there are 276 sub-districts are economically feasible. Thus, at the end of 2019, there is a difference of about four percent between the number of sub-districts that have already deployed a fixed broadband network (35.71%) compared to what is feasible according to this research (39.96%).

4.6. Calculation in Bundling with Mobile Provider

In Indonesia, what is meant by mobile internet services are those provided by cellular communication providers, where customers are served by waves from a BTS (Base Transceiver Station) belonging to a provider in a coverage area called a cell. In order for BTS to operate to serve broadband internet, the BTS must be connected using an optical communication network to the provider's Core Network, which generally only exists in one in the district or city center. And, one alternative is that the cellular operator leases an optical network owned by a fixed broadband provider, and prefers it if the cellular provider and the fixed provider are in the same holding company. Technically, a cellular operator rents an optical channel belonging to a fixed provider in an OLT in a rural sub-district that connects to the BTS, while the core network is connected to the OLT of the same fixed provider located in the city center or district.

With a business concept like this, the calculation of the feasibility of deploying fixed broadband in a new location has changed drastically in such a way: (1) CAPEX will change to the following: CAPEX of a junction network to connect the nearest sub-district using the fiber optics = the variable cost of procurement and installation cost of cable and the poles is 77,710 rupiah per meter distance between the existing sub-district district and the new sub-district, or up 30.37 percent; (2) CAPEX will change to the following: CAPEX of a junction network to connect the nearest sub-district using the fiber optics = the variable cost of procurement and installation cost of cable and the poles is 77,710 rupiah per meter distance between the existing sub-district district and the new sub-district, or up 30.37 percent; (3) OPEX is relatively fixed; and (4) Estimated revenue to increase by 100%, because there is certainty of network rental by cellular providers

Then, the results of the feasibility calculation: in the "pandemic" period in mid-2021: out of 2,831 sub-districts that do not yet have a fixed broadband network, there are 94 sub-districts are economically feasible. Thus, at the mid of 2021, there is a difference of 1.3 percent between the number of sub-districts that have already deployed a fixed broadband network (60.84%) compared to what is feasible according to this research (62.14%).

5. Discussion of Result

From the results of this research, it is evident in Indonesia that the telecommunications sector is resistant to recession, where the telecommunications sector increases 10.61% % compared to the national GDP fell 2.07% during the C19 pandemic, the telecommunications sector increases 4.83% compared to the national GDP which fell 13.23% in the 1998 monetary crisis. And, this fact confirms the notion that the pandemic has had a devastating effect on the macroeconomic in the US, China and the rest of the world, but there has been an increase in several areas, such as increasing demand for health care, increasing demand for communication services; and an increase in pent-up demand (Walmsley et al., 2021).

Not as far as those found by Addo and Avgerou (2021), who investigated Government Corruption in Developing Countries, especially in Ghana who found petty corruption practices as a socially embedded and institutionally conditioned phenomenon in government organizations that are influenced by the vested interests of government officials, politicians, and businesses. Not in relation to corruption, in this research we find the same phenomenon, which the organization of government in Indonesia is influenced by the personal interests of government officials, politicians, and businesses that affect the increase in time and cost of deploying the fixed broadband network.

5.1. The Constraint before the Pandemic

The results show that the area-coverage of fixed broadband services in Indonesia before the C19 pandemic, or around the end of 2019, was feasible at around 39.56%, but the fact at that time the area-coverage only reached around 35.71%. And, it is the explanation regarding the difficulties: (1) During the "normal" period, local government policies causing the permit to deploy a fiber broadband network is about 6 months to 12 months; and (2) Fixed broadband providers are unable to compete with mobile broadband service providers which have wider coverage, are cheaper and relatively sufficient to meet the communication and entertainment needs of households and small-scale businesses.

5.2. The Acceleration during the Pandemic

The results show that the area-coverage of fixed broadband services in Indonesia during the C19 pandemic, or around mid-2021, was feasible at around 62.14%, and in fact at that time the area-coverage was reached around

60.84%. Then the feasibility calculation and the existing reality are almost the same, or only 1.3% different. While the computation of the number of sub-districts that have a FIXED BROADBAND network at the end of 2019 (2562 sub-districts) compared to the mid-2021 (4399 sub-districts), it means that in only 1.5 years there was an increase in coverage area as much as 71.68%.

From the results of observations and interviews with regulators, central governments, local government, providers, as well as the associations, the following facts are obtained: (1) During the C19 pandemic, due to pressure from the central government, the licensing process only takes much shorter time, which is less than 3 months; and (2) Without a fixed broadband network in a sub-district, mobile internet providers cannot provide their services. Where, the deployment of a fixed broadband network in a new location has the opportunity to build a large capacity of optical network to serve the customers as well as to be rented out to other mobile providers.

6. Conclusions

6.1. Summary

Economic policy, at least in Indonesia, has proven to play an important role, both positive and negative, related to the achievement or failure of the country's targets for internet services in general, and fixed broadband services in particular. However, in a developing country, generally the policies of the central and local governments that are not well established are the main obstacles to the deployment of telecommunication networks, and the best solution can suddenly appear as the blessing in disguise from a major disaster.

6.2. Regulation Implications

From the results of the discussion there are two regulation implications.

[1]. First, the central government and the House of Representatives must simplify local government regulations so that the process of obtaining network deployment permits can be much faster.

[2]. The second, the Regulator with the support of the House of Representatives should make the regulations easier for the fixed and the mobile providers to cooperate with bundling techniques.

6.3. Limitations and Future Research

This research is limited to observing broadband internet networks that have been deployed at this time, which the fixed networks that use fiber optic technology and cellular networks that use 4G/LTE radio communication technology, therefore they still have the weaknesses. For this reason, further research needs to be carried out, namely by incorporating more advanced technology, which the 5G/6G cellular communication, as well as the low-orbit satellite communication technology.

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