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Internet As Public Utility: A Case Study of Public-Private Partnership in Malaysia to Build Digital Infrastructure in Rural Areas

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Executive Summary

Internet access has been deemed as a basic human right and a necessity to survive in this modern world. Covid-19 pandemic has highlighted the disparity that exists in the telecommunication industry and deters digital participation for marginalized communities. Oftentimes, it is due to the lack of broadband infrastructure and inadequate digital technology adoption because of the absence of digital literacy and deprivation of access to communication devices. This study highlights the Malaysian government and private companies' effort to bring digital infrastructure across Malaysia especially in rural areas. The research questions focus on the coordination of the JENDELA project, the government's authority in the project (policy, funding, fair pricing, and digital participation encouragement), and initiatives done to bridge the digital divide. Structuration Theory by Anthony Giddens was used along with interpretive case study methodology as the framework to answer research questions. Based on the findings, the Malaysian government managed to coordinate with private companies and come up with a sound national broadband plan to improve digital infrastructure in Malaysia with an impressive strategy to tackle existing problems. Sunsetting of the 3G spectrum and the involvement of power companies in providing fiber-optic broadband are good examples of better managing resources to expedite the digital infrastructure expansion. Besides, the government's authority as a leader of the country was demonstrated with the introduction of four policies to support national broadband rollout including recognizing telecommunication as a public utility after water and electricity. Besides, the government also has initiated *Pusat Internet Komunikasi* PIK (Internet Communication Center) in rural areas to bridge the digital gap among rural and urban areas.

Keywords: digital divide, telecommunication, broadband, public-private partnership, infrastructure, internet, public utility, rural areas

Introduction

The internet has become an inevitable part of our everyday lives and the appropriate internet use makes our lives easier, faster, and simpler. The basic necessity of internet connection and universal access has become even more evident as we shift into an era of managing and living with Covid-19 (Bamford & Hutchinson, 2020). According to a Pew Research Center poll done in April 2020, almost half of the American citizens (53%) believe the internet was "essential" for them during the pandemic, while another 34% think it was "important, but not essential" (Anderson et al., 2020).

At the same time, the COVID-19 pandemic brought to light a long-standing issue: billions of people still lack access to the internet, which is a universal human right (Roese, 2021). The infrastructure gap may be seen in a variety of ways, including the disparity in internet speeds between areas. People who live in city centres frequently have access to substantially quicker internet than those who live in less developed locations (Jalli, 2020). Because most classes are online and rely on high-speed internet for synchronous distant learning, varying access to broadband internet has harmed the quality of education for students (Kim, 2020). Besides access to broadband infrastructure, access to digital devices is also lacking. In Malaysia, there were about 36.9% of students did not have access to devices that could be used to follow online lectures (Chan et al., 2020). Furthermore, access to the internet alone cannot bridge the digital gap as digital literacy skills are as important as access (Brisson-Boivin et al., 2021).

Governments' around the world have been called to react to these problems. To narrow the digital divide can be achieved through policy solutions and massive investment from the government (Tate, 2021). Major upgrades are needed in telecommunication infrastructure and the internet should be recognized as a public utility, after water and electricity (Andriole, 2020). Thus this study has been done to investigate the Malaysian government's effort in narrowing the digital gap by ramping up their national broadband infrastructure roll-out and recognize telecommunication as the third national public utility.

Research Question

Main Research Question:

How is the structure of public-private partnership coordinated in achieving the status of the internet as a public utility?

Sub-Research Question 1:

What are the roles of government as someone with authority to bring change in the system?

Sub Research Question 2:

What has been done by the government to ensure digital inclusivity especially in rural areas?

Limitations

Practical limitations: The findings of this research are only based on a Malaysian case study. In no way it can be a model for other countries as institutions are set up differently around the world.

Theoretical limitations: The study is solely based on the Structuration Theory of Anthony Giddens and its analytical dimensions of 'Duality of Structure'. It was designed in such a way as the operationalization of a theoretical framework bounded by the three pillars, that is, Structuration, Domination, and Legitimation.

Methodological limitations: The interpretation and the findings from this research are only based on a limited amount of documents related to the project and one(1) interview with Malaysian Communication and Multimedia Commission (MCMC) representatives. There is also a lack of research has been done specifically related to this project and the topic for 'internet as public utility'

Background

Internet As Public Utility

What is public utility?

By definition, according to Cambridge English Dictionary, public /ˈpʌb.lɪk/ : relating to or involving people in general, rather than being limited to a particular group of people, and utility /juːˈtɪl.ə.ti/ : the usefulness of something, especially in a practical way. By combining those terms, public utilities are recognized as a group of specific services provided by public, private organizations, and institutions to perform essential services (Glaeser, 1957). It encompasses a wide realm of industries in the market including transportation, electricity, oil and natural gas, airlines, telecommunication, cable television, water, and waste collection (Geddes 2000, as cited in McNabb, 2016). Two key factors that differentiate the industry of public utilities and others are: (1) operate under socially sanctioned conditions of monopoly competition, and (2) the operations or supply chain are regulated by the government (McNabb, 2016).

In the 20th century, public utility development was heavily associated with natural monopoly organizations. In economic terms, natural monopoly happens when high sunk costs and increasing returns to scale suggest that private market competition will underperform in supplying the goods thus public control over infrastructure is warranted (Rahman, 2018). According to Geddes (2000), typically utilities were generated at a single location and distributed to the end-user over a ‘network’. This ‘network’ could span all over the nation and it exhibits economies of scale and involves substantial sunk costs, thus traditionally natural monopoly is the go-to strategy for governments (Geddes, 2000). Economists believe the public will be better served if the monopoly organizations were exempt from antitrust laws and on tight regulatory restrictions (McNabb, 2016). There are definite cost savings in having only one provider of services for any utilities concerning the public (Crew & Kleindorfer, 1979).

There are multiple ways of ownership that public utilities can operate on. According to McNabb (2016), the establishment of utility services consists of three major forms of ownership: public (municipal), private (also known as investor-owned), and cooperative. Public ownership is also known as state-owned enterprise involves publicly traded shares and public corporate governance with dispersed ownership and control, while private ownership involves private contracting and usually concentrated ownership and control (Boot et al., 2006).

There has been an exhaustive debate on the benefits and barriers of public and private ownership. Sappington and Stiglitz (1987) argue that public ownership is beneficial when market failure must be corrected and it reduces the cost of government involvement in the market. As Wilner (1996) suggests, income inequality can be diminished and product quality can be increased through public ownership at an acceptable loss of economic efficiency. However, Shirley et al. (2001) believe that the interference of political figures and poor governance in the public sector will cripple the industry and perform poorly in highly competitive markets. There are also concerns that public ownership especially concerning utilities are usually lacking innovative edge and competition (Downes, 2016).

Private ownership is seen as more effective than public ownership in some cases. Megginson, Nash, and Randenborgh (1994), investigated the performance of pre and post-privatization industries and found that it increases efficiency in all situations, especially in competitive markets. This study was backed by Ros (1999) that there are significant effects on efficiency concerning ownership and market structure. However, Caves (1990) argues that private ownership can be as inefficient as public ownership if there is no competition in the market as he sees monopoly, natural or otherwise as widespread market failure.

While public and private ownership has their pros and cons towards specific markets, cooperative arrangements between the two entities are seen as an initiative to tackle issues relating to the market. Public-private partnership (PPP) requires actors from each sector to adopt characteristics of their counterpart, private companies would need to embrace public interest considerations and expect greater public accountability and the government would need to behave like entrepreneurs (Linder, 1999). A partnership between the two entities can come in all sizes and shapes, tax concessions in return for job creation or a private contractor managing public facilities can be considered as PPP (Akintoye et al., 2008). OECD (2008) defined PPP as

> an agreement between government and one or more private partners (which may include the operators and the financiers) according to which the private partners deliver the service in such a manner that the service delivery objectiveness of the alignment depends on a sufficient transfer of risk to the private partner (OECD, 2008, p. 17)

In the past, PPP was adopted as a way for governments' to reduce financial strains (Cheung et al., 2009) thus private companies were allowed to participate in the provision of public services and facilities (Grimsey & Lewis, 2007). It is apparent now that PPP policy goes beyond just

appeasing governments' financial constraints. Generally, the private sector is more systematic than the public sector (Walker and Smith, 1995) and they utilize resources efficiently and effectively (Skiertrys et al., 2008). Hambros (1999), backed this up in his research explaining that private sectors' number one goal in dealing with business is minimizing project cost while maximizing the revenue of the project. Besides that, governments' can fully appreciate the knowledge and technology that the private sector possesses as an expert in the field (Chan et al. 2006). When it comes to delivering infrastructure of public utilities especially in rural areas, there are risks involved and by sharing it with the private sector, the partnership can control those risks in an efficient manner (Jeffries & McGeorge, 2009).

However, there are drawbacks in PPP to achieving success such as corruption, a lack of clear government aim and evaluation standards for the project, and unclear risk allocation between public and private entities (Ball et al., 2007). Besides, due to the nature of PPP contracts which are more complex to evaluate, it was discovered that the PPP negotiating process is a very long process (Ball et al., 2000). Li et al., (2005) in their research listed 'high participation costs', 'lengthy delays in negotiation' and 'extensive management time in contract transaction' are the top three negative factors for adopting PPP. In addition, Liu and Wilkinson (2011) state that PPP is political, less attractive, social and legal risks, problems associated with the contracting partners are part of the constraints that hinder PPP from becoming more successful.

Over the last few decades, market-oriented management systems marked by privatization, public-private partnership, increased user fees for government services substituted the traditional authoritative and bureaucratic system of state and government regulation (McNabb, 2016). The paradigm shift of governments' market-oriented management systems over time has affected public utility policies and regulations. Clifton et al. (2011) in their studies of public utilities agreed that utility regulation has evolved in various forms in different geopolitical, economic, and sectoral contexts. Several policies affect the operation and management of public utilities, examples include the country's welfare policy, public safety, environment, and tax policies (McNabb, 2016). In the case of utilities, policies included subsidization and cross-subsidization by extracting from a more profitable part of the service to facilitate the lower performing one (Clifton et al., 2003). Key problems in public utilities regulation in the past have been reformed in phases to ensure the industry flourished and attained better performance results (Kessides, 2004).

Broadband as a public utility

The importance of broadband towards society and the economy is becoming extremely clear for the past few decades. Access to network infrastructure and high-speed Internet, as well as the next generation of information services, is seen as a prerequisite for economic growth and competitiveness (Picot & Wernick, 2007). OECD predicted in 2002, that the productivity of countries like France, Germany, and the UK will increase from 2001 to 2011 due to broadband technologies (OECD, 2002). However, the productivity level within the nation can create differences, for example giving urban dwellers more opportunity than rural areas, or higher income and better-educated households an additional edge (Bandias and Ram Vemuri, 2005; Savage and Waldman, 2005). Has the history of telecommunication in the past created this predicament?

In the past, many countries around the world largely organized their telecommunication industry into national networks operated by the government on a monopoly basis (Clifton et al., 2011). It was believed that private companies only built sophisticated network infrastructure in densely populated areas (Casson, 1971 as cited in Pennings et al., 2005). This has called for governments to take ownership and control the telecommunication industry. The monopolization of the telecommunication industry has become a trend worldwide and they are responsible for the technological and economic environment by adapting the technologies with changing markets (Guan, 2003). By taking control and ownership, the priority has been to provide national telecommunication services to users on a universal service basis (Clifton & Díaz-Fuentes, 2010). On the other hand, governments' ownership was believed to be able to solve the internal conflict of interests involving the right of way, investment, and geographical challenges (Clifton et al., 2011). The nature of the technology at the time also exhibited natural monopoly characteristics - voice transmission to a single handset (Clifton et al., 2011).

As globalization sets the stage, the telecommunication industry gradually changes to cater to a market-driven society. New technological advancements and digitalization have had a major influence on industry restructuring (Pennings et al., 2005). Multiple purpose networks such as integrated services digital networks (ISDN) made the incumbent technology that is more specialized no longer necessary (Davids, 2005). Privatization, liberalization, and deregulation across the telecommunication industry were introduced, however, they differed between regions (Pennings et al., 2005). Privatization of telecommunication was proposed as a sector reform to promote competition as the main benefit and deregulation entails freedom from

government intervention (Rubsamen et al., 1989; Makhaya & Roberts, 2003). The liberalization of the telecommunication industry has given a natural monopoly advantage as first-mover, vertically integrated, and market power (Joskow, 1998; Parker & Kirkpatrick, 2005). These monopolies usually were vertically integrated and retained their structure even after reform, thus abusing their power to discriminate against competitors by limiting access to their infrastructure (Makhaya & Roberts, 2003). Wallsten (1999) argues, the privatization of the telecommunication industry is negatively related to network penetration and capacity but the presence of a strong regulator positively increases network infrastructure and control of prices (Makhaya & Roberts, 2003).

The telecommunication industry is regarded as a dynamic industry because of innovation in new services and alternative network infrastructures, therefore regulation can impact the future of telecommunication infrastructure (Bourreau, 2001). Deregulation was believed to be not conducive enough to simulate competition thus called for governing bodies to regulate and enforce them (Bitran & Serra, 1998). Due to imperfect competition and market failures, regulation is an integral part of the reform and the complexity can change with the increase of liberalization (Helm & Jenkinson, 1998; Newberry, 2002; Makhaya & Roberts, 2003). Furthermore, regulators play a big role in understanding the industry to avoid any information asymmetry that can exist between firms, regulators, and the consumers (Sappington & Weisman, 1996).

In the 21st century, there are challenges in the regulatory and policy to ensure equal access, fairness, and prevention of exploitative behavior by private providers (Rahman, 2017). Broadband services were not subject to universal service provision after the liberalization, consequently leaving companies concentrating their investment in more rentable and populated areas (Matteucci, 2020). There is also a paradox: despite the availability of broadband in rural areas, the number of subscribers and users is still lagging in comparison with that in urban areas due to many reasons (LaRose et al., 2007).

Hence, those who live in rural areas are at a disadvantage since they don’t have or have limited access to the internet (Toh, 2020).

Internet Beyond Broadband

To achieve the status of the internet as a public utility extends beyond the need for digital infrastructure improvement. West (2015) highlighted poverty, digital literacy, high device, data, and telecommunication charges are some of the challenges in bringing internet access to the public.

According to a study by Delloite (2014), internet penetration is often the lowest in countries with the lowest GDP per capita largely due to income levels and poverty limiting internet access. This barrier is not limited to poorer countries only, even countries like the United States have the same issue between high and low income relative to smartphone ownership (Tsetsi & Rains, 2017). Which explains the cost to participate in digital culture since device, data, and telecommunication charges can be expensive. van Deursen & van Dijk, (2019) described this phenomenon as a second-level digital divide relating to having access to the material of the internet as the user must consider the supplementary expenses connected to the internet such as devices and peripherals, repair costs, and software licensing costs.

The lack of digital literacy among the people especially those in the rural area further contributed to the existing digital divide. According to Real et al. (2014), the skills and abilities required for access once the technology is accessible, including knowing the language and component hardware and software required to properly traverse the technology, are referred to as digital literacy. Goldstuck, (2010) found that there is a 5-year gap for the general population to become proficient in using digital tools. For the general public to participate in the social, educational, economic, and political scene, the skills for digital literacy is highly essential to realize its potential (Cohron, 2015)

There are no easy fixed solutions to the growing problems of the digital divide, either within or between nations. The telecom giants and multinational companies are more interested in the profits made from higher bandwidth and new technologies rather than investing in poor regions (Cullen, 2001). However, there is a range of solutions proposed by the United Nations (UN), government, and commercial reports concerning the digital divide specifically in the lack of access and skill to ICT. These initiatives are important for the general public and will be the main driver to achieving the internet as a public utility.

Initiative in National and State level

Broadband Commission for Sustainable Development by International Telecommunication Union (ITU) and United Nations Educational, Scientific, and Cultural Organizations (UNESCO) has introduced seven 2025 Advocacy Targets for national and international to reflect aspirational objectives and serve as a policy and programmatic framework. The 2025 Advocacy Targets are as follows (*The State of Broadband 2020*, 2020):

> Advocacy Target 1: Making broadband policy universal: By 2025, all countries should have a funded national broadband plan or strategy or include broadband in their universal access and service (UAS) definition (p. 11)
>
> Advocacy Target 2: Making broadband affordable: By 2025, entry-level broadband services should be made affordable in developing countries at less than 2% of monthly Gross National Income (GNI) per capita (p. 15)
>
> Advocacy Target 3: Getting people online: By 2025, Broadband-Internet user penetration should reach: i) 75% worldwide, ii) 65% in developing countries, and iii) 35% in the least Developed Countries (p. 20)
>
> Advocacy Target 4: Digital skills and literacy: By 2025, 60% of youth and adults should have achieved at least a minimum level of proficiency in sustainable digital skills (p. 23)
>
> Advocacy Target 5: Digital financial services: By 2025, 40% of the world's population should be using digital financial services (p. 28)
>
> Advocacy Target 6: Getting business online: By 2025, improve the connectedness of Micro-, Small-, and Medium-sized Enterprises (MSMEs) by 50% by sector (p. 33)
>
> Advocacy Target 7: Achieving gender equality in access to broadband by 2025: by 2025, gender equality should be achieved across all targets (p. 36)

United States (U.S.)

According to Pewtrusts research, 24 million Americans are still not connected to the internet due to the lack of broadband infrastructure (Whitacre et al., 2017). Consequently, at the federal level, the government has come up with the ReConnect Program through the U.S Department of Agriculture to provide loans and grants to fund the cost of building and maintaining broadband infrastructure, and acquisition of facilities to provide broadband service in rural areas (Stauffer & Wit, 2019). From 2018 to 2021, the US government has allocated a budget

of around $1.8 billion to be used on an expedited basis from The 2018 Appropriations Act, Consolidated Appropriations Act 2019 and 2020, and the Coronavirus Aid, Relief and Economic Security Act. (*Program Overview*, n.d.).

The U.S is however facing a big challenge in identifying and pinpointing the exact location of existing broadband services (Stauffer & Wit, 2019). For a nation that has over 330 million population spread over 9.834 million km^2 it is a very important tool to make decisions about where service is needed. The Federal Communications Commission (FCC) has come up with a Broadband Data Collection (BDC) program to give FCC, industry, state, local, and Tribal government entities, and consumers the tools they require to enhance the accuracy of existing broadband maps (*Broadband Data Collection*, 2021). On the other hand, the FCC also has introduced Emergency Broadband Benefit to address the broadband affordability issue that will provide a discount of up to $50 per month for eligible households (*Emergency Broadband Benefit*, 2021). Additionally, the Homework Gap and Connectivity Divide were introduced in preparation for students, school staff, and library patrons to survive during the Covid-19 pandemic by funding the costs of the laptop, tablet, computers, Wi-Fi hotspots, modems, routers, and broadband plans (*Homework Gap and Connectivity Divide*, 2021).

At the state level, only recently Virginia has allowed its power utility companies to add fiber which will enable ISPs to lease to provide broadband to homes and businesses (Wagner, 2018). Meanwhile, Nevada performed a “dig-once” program in 2017 by allowing the state to install fiber along its rights-of-way and give access to ISPs to utilize it (Stauffer & Wit, 2019).

United Kingdom

The United Kingdom (UK) has established an ambitious national broadband strategy and is one of the first countries to do so in the world. The UK government planned 100% coverage of gigabit fiber broadband by 2025 through its Project Gigabit program (*Building Digital UK*, n.d.). The project will boost the funding of the current broadband rollout with an additional £5 billion to expand the fiber coverage in the hardest reach an area that will benefit 20% of homes and businesses (*Building Digital UK*, n.d.). It was a laudable goal pre-pandemic, but the surge in demand for stable broadband connection during the Covid-19 times has urged the government to rapidly achieve connectivity targets (Staff, 2020). On the other hand, the UK government has also introduced the Shared Rural Network (SRN) to increase 4G mobile coverage throughout the UK to 95% and partnered with mobile operators to jointly invest over

£1 billion in infrastructure development (*Building Digital UK*, n.d.). Besides that, they have just completed a 700Mhz spectrum clearance program back in August 2020 to meet the growing demand for 5G mobile data (*Building Digital UK*, n.d.).

To encourage people in rural areas to get gigabit-capable speeds, the UK government is prepared to give £1,500 for homes and £3,500 for businesses through its Gigabit Broadband Voucher Scheme (*Building Digital UK*, n.d.). Since the start of the pandemic, the world's poorer communities are at risk of widening the digital divide and the UK is not an exception. Thus, the Department for Education (DfE) is providing 1.3 million laptops and tablets to support disadvantaged children learning during the Covid-19 pandemic (*Get Help with Technology during Coronavirus (COVID-19)*, n.d.).

South Korea

South Korea has been recognized as one of the world leaders in broadband development. These are the result of a unique combination of highly competitive private-led marketplaces and government leadership, use, support, and regulation (Kim et al., 2010). According to Our World in Data, South Korea with about 51 million population has one of the highest fixed broadband subscriptions per 100 people with 41.58% (*Broadband Subscriptions per 100 People*, 2017). The government has been emphasizing universal access and the requirement to provide broadband access to rural areas since the start of the privatization of the telecommunication industry (Ma & Jia, 2017). The participation of Korea Electric Power Company (KEPCO) in the broadband market to build its fiber-optic infrastructure has further increased South Korea's broadband outreach (Khayyat, 2017).

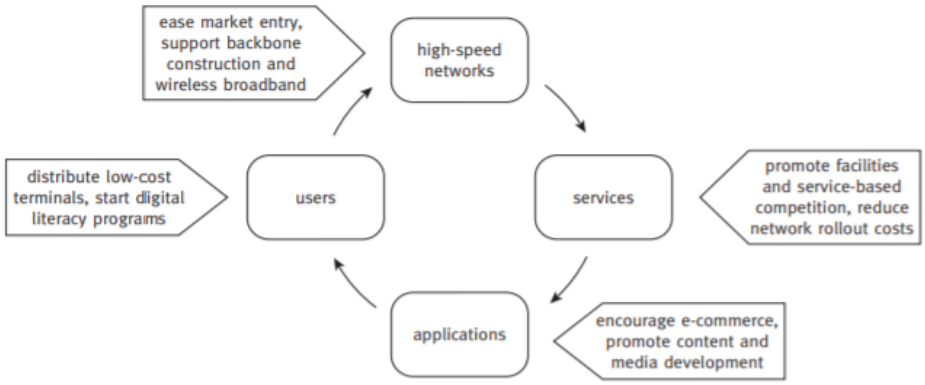

Figure 1.1: South Korea's approach to developing the broadband ecosystem (Kim et al., 2010)

Part of South Korea’s success came from its broadband ecosystem that consists of supply- and demand-side policies by diminishing market entry barriers and increasing needs for broadband. Kim et. al. (2010) explained competition policies helped expand network infrastructure while public and private sectors' development of applications adds relevance towards broadband thus spurs demand. Additionally, the government has an extensive range of free public Wi-Fi availability amounting to up to 41, 000 access in total at public areas such as community service centers and transportation stations worldwide (Mu-Hyun, 2020). The effort is vital to bring affordable broadband access to further bridge the digital divide among the people.

Sweden

Sweden is a great example of a coherent national broadband strategy, a brilliant partnership between public and private firms, and wide coverage of fixed broadband infrastructure for its large sparsely populated rural areas. Sweden's government has updated their national broadband plan to cover 98% of households and businesses to have access of 1Gbps, 1.9% of households and businesses to have access to 100 Mbps, and 0.1% of households and businesses to have at least 30Mbps by 2025 (*A Completely Connected Sweden by 2025 - a Broadband Strategy,* n.d.). The government has prepared a strategic plan to achieve these goals; increase collaboration with Broadband Coordinators, increase in demand and will for payment among users, expansion of wireless broadband, faster processes of infrastructure deployment, specification of mission to facilitate broadband expansion by providing support, guidance and education for municipalities, assessment of frequency utilization to cater for future demand, and analysis of new technology around the world (*A Completely Connected Sweden by 2025 - a Broadband Strategy,* n.d.).

Besides that, the involvement of municipalities in broadband infrastructure consists of multiple levels of government, national and local. The local government has recognized broadband infrastructure as a public utility along with electricity and water, thus to a great degree involved in the provisioning of new projects (*Development of High-Speed Networks and the Role of Municipal Networks*, 2015). 290 municipalities of Sweden can undergo the public procurement process to build the infrastructure themselves as they have more knowledge of the needs and demands of their municipalities (Khayyat, 2017; Lucchi et. al., 2017). The municipalities have the option to either operate for-profit broadband companies, municipally owned utility companies, or broadband networks as divisions of local government (Zager, 2019). As a result,

more rural and remote villages can be connected through fixed broadband as long as it is a sustainable and feasible business model (Zager, 2019).

Sweden has done a good job to increase the digital participation and competence of its citizens. For years, Sweden promoted the use of digital technologies through school, but OECD recommended more inclusive policies targeted to different groups with lower usage levels such as low-income earners and the elderly (OECD, 2018). However, there are multiple initiatives done at the municipal level, for example, eRUM Lyckele that was started by three municipalities in the region of Västerbotten to increase digital literacy among senior citizens and immigrants (Valentini, 2020).

Notable Projects

Guifi.net Gurb, Spain. It is a citizen-driven, bottom-up initiative with the goal of establishing a free, open, and neutral telecommunications network based on the commons concept (Magnatti, n.d.). It started back in 2003 to provide WiFi and radio links services and has since evolved to fiber-based broadband (Tieman, 2017). Grub City Council agreed to use a small flexible high-density polyethylene duct within the existing water infrastructure to lay optical fiber throughout the town (Magnatti, n.d.). Thus, ensuring the status of broadband as a public utility on par with water and electricity.

Net Pracharat, Thailand. The project was initiated to support Thailand's national broadband plan in providing high-speed internet access and free public Wi-Fi access in rural areas (*The Village Broadband Internet Project (Net Pracharat)*, n.d.). It is a holistic approach in delivering internet access that focuses on economic, education, social and public health. Local businesses, SMEs, farmers, and students are the main beneficiaries of this project as it unlocks the digital potential for villagers to access information online, e-consultation with health professionals, and e-commerce to generate income through the use of the internet (*The Village Broadband Internet Project (Net Pracharat)*, n.d.).

Komen, Slovenia. The project was largely funded by the EU to bridge the digital divide in the municipality of Komen with the focus being long-term sustainability and low operational costs (Magnatti, n.d.). Due to its challenging terrain and solid rock, a combination of optical backbone and optical overhead cable for local drop using existing power utility poles was

utilized (Magnatti, n.d.). Tight deadlines and intense collaboration between the municipality and private partners are key to its success.

Malaysian Telecommunication In Context

Privatization and liberalization of the telecommunication industry in Malaysia began in the 1980s. The government believed that privatizing its incumbent public-owned telecommunication company then known as Jabatan Telekom Malaysia (JTM) will relieve administrative and financial burdens, improve efficiency and promote competition (Lee et al., 2002). JTM held a natural monopoly position in Malaysia and was in charge of the introduction and expansion of International Direct Dial (IDD) facilities, submarine cable link, packet switch technology, INTELSAT Business Service, ISDN services, and 1800 MHz digital cellular services ("Telekom Malaysia (TM)," 2013). Since the liberalization and introduction of new technologies, new players entered the market offering ranges of telecommunication solutions Celcom Sdn Bhd (cellular) in 1989, Maxis Communication Berhad (cellular) in 1993, Digi.Com Berhad (cellular) in 1995, Binariang Satellite Systems Sdn. Bhd. (satellite) in 1996, Time Dotcom Berhad (fixed-line) in 1996 (Mahdaliza & Zainol, n.d.).

To ensure the growth of telecommunications services and its use of technology to support national development, the Malaysian government introduced the National Telecommunication Policy 1994 - 2020 of Malaysia in 1994 (Ong, 2015). The policy includes the following (Kazmi, 2006):

- Expansion of services in a systematic and comprehensive manner
- Development of strategic and export-oriented manufacturing industry
- Encouraging competitiveness
- Research and development to enhance the application of technology
- Development of a dynamic and innovative human resource
- Upgrading of rural telecommunication facilities
- Encouraging active *Bumiputera* (native) participation
- International strategic interaction

This approach has established new legislation, the Communication and Multimedia Act 1998 (CMA), to regulate the converging communications and multimedia industries. Additionally, an independent regulatory body was created, namely, the Malaysian Communications and

Multimedia Commission (MCMC) to oversee the communication industry activities including regulatory and licensing of service providers (Ong, 2015).

Even after liberalization, Telekom Malaysia (TM) still holds a 99% share of the fixed-line market due to their position as incumbent natural monopoly company and the penetration rate for both fixed and cellular technologies reflect a more competitive market (cellular) rose higher from 1996 to 2001 (*The Evolution of Malaysia's Telecom*, 2020).

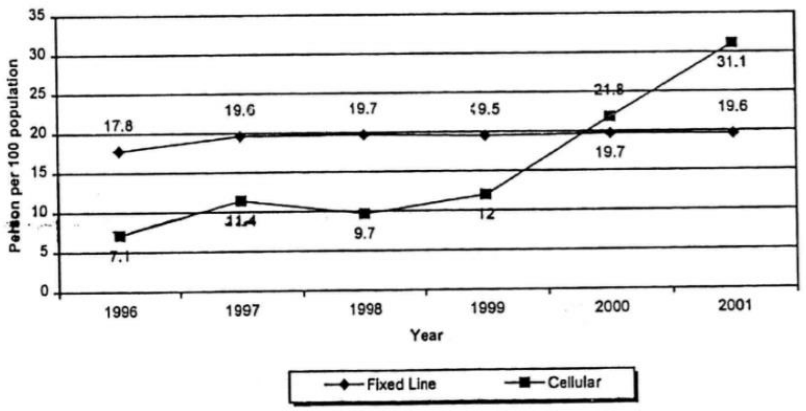

Figure 1.2: Penetration rate for fixed and cellular (*The Evolution of Malaysia's Telecom Industry*, 2020)

According to OECD, nothing much has changed now as Telekom Malaysia still controls 92% of fixed broadband subscriptions (OECD, 2018). Although TM was essential in attaining universal basic connection, its upstream market dominance, ownership of the national backbone, and a high degree of vertical integration have given it a structural advantage that is currently impeding development (*Malaysia's Digital Economy: A New Driver of Development*, 2018).

Malaysia surpasses the worldwide average when it comes to internet users and mobile broadband penetration, but lags in terms of fixed broadband penetration. According to the 2018 figures given to the ITU, fixed broadband penetration is 8.6%, compared to a global average of 15.5 percent across 178 reporting countries, while mobile broadband penetration is 134.5 percent, compared to a global average of 111.2 percent across 179 reporting countries (Gong, 2020).

Country	Internet users (%, 2017)	Internet users (%, 2018)	Fixed broadband (%, 2018)	Mobile broadband (%, 2018)
MALAYSIA	**80.1**	**81.2**	**8.6**	**134.5**
Selected benchmarks				
South Korea	95.1	96.0	41.6	129.7
U.K.	94.6	94.9	39.6	118.4
U.S.	87.3	-	33.8	129.0
Australia	86.5	-	30.7	113.6
China	54.3	-	28.5	115.5
India	34.5	-	1.3	86.9
Comparable GDP per capita				
Kazakhstan	76.4	78.9	13.4	142.3
Poland	76.0	77.5	16.1	134.8
Mexico	63.9	65.8	14.6	95.2
Comparable population				
Canada	91.0	-	39.0	89.6
Saudi Arabia	82.1	93.3	20.2	122.6
Ghana	39.0	-	0.2	137.5
Selected ASEAN				
Singapore	84.4	88.2	28.0	148.8
Philippines	60.0	-	3.7	126.2
Vietnam	58.1	70.3	13.6	147.2
Thailand	52.9	56.8	13.2	180.2
Indonesia	32.3	39.9	3.3	119.3

Figure 1.3: Malaysia's internet penetration rates (Gong, 2020)

The digital gap in Malaysia is not an issue with a single cause and effect. Within Malaysia, factors contributing to the digital divide may be found in a variety of categories and/or demographics. These can include, among other things, age, education, income level, and geographical location (Tengku, 2005). When it comes to the widespread absence of ICT (and capable users of such technology) in Malaysia, age and gender are minor influences. Most older generations in much of the globe have less experience with technology in general, which further confirms that young age vs. old age may be a role in the digital divide but not significant enough, while Malaysia has a gender-responsive broadband policy (Anderson & Perrin, 2017; Gong, 2020).

However, location within the nation, as well as the wealth surrounding particular places, have a bigger influence in either bridging or widening Malaysia's digital divide. As of 2019, high-income states of Malaysia, namely Kuala Lumpur, Selangor, Pulau Pinang, and Putrajaya show higher penetration rates of fixed and mobile broadband in comparison with lower-income states (Gong, 2020). Due to the lack of access and digital skills, people in rural areas are often neglected. Because of these differences, Malaysians will have a distinct digital experience based on where they are, and therefore various possibilities to profit from digital technology (*Malaysiaôs Digital Economy*, 2018). Schools among rural and *Number of*

urban areas show a great disparity in the digital divide and that impacts education. Schools in urban areas are generally fully equipped with ICT and broadband services that will ease learning, thus higher educated people are more likely to adopt digital devices and skills needed to operate them (Ahmad et al., 2019).

Theoretical Framework

In any aspect of social life or organization, there is a well-built structure that has been produced over time through practices and past experiences. The telecommunication industry has undergone massive reform for the past few decades concerning policies, technologies, and challenges it entails. Thus, the structure of organization between countries might differ in terms of how it was shaped or whether it is publicly or privately owned, and a combination of the two. Public-private partnership projects would oftentimes involve different sets of an organization to form a bigger structure with the same shared goal. To understand the complex interplay between government, private entities, and community/citizens, Structuration Theory by Anthony Giddens was employed.

Structuration theory is a general social theory developed by Anthony Giddens in the 1970s. The core concept of the theory highlights that social structure is continuously being formed through the flow of everyday social practice (Jones & Karsten, 2008) and the pattern of activity that is meaningful to those involved in them (May & Mumby, 2004). Walsham & Han (1990), regarded structure as rules and resources that exist as memory traces in the mind of the people that manifest which they are drawn on in action and interaction.

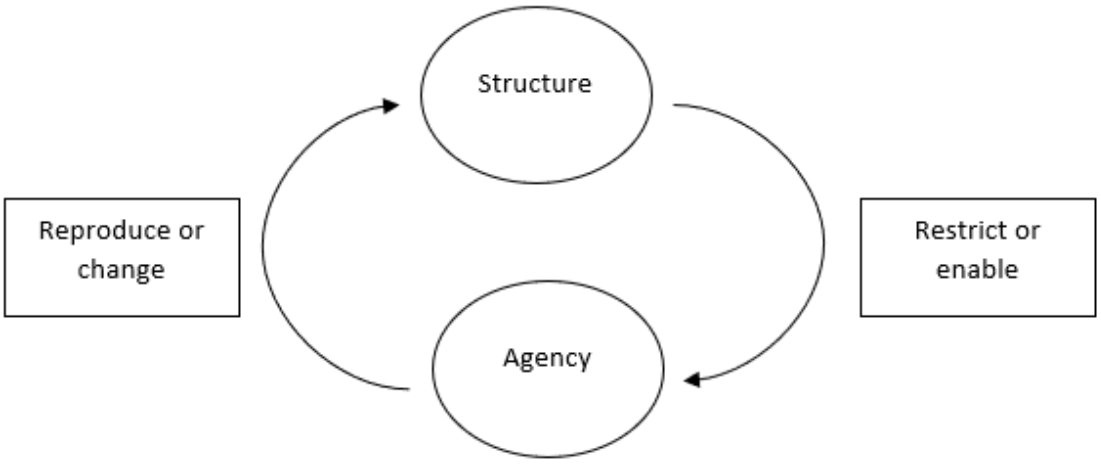

Figure 2.1: Duality of Structure

Structuration Theory was further explained to be recursive in nature between agents and structure. Social structures are produced and reproduced by agents and structures and don't act

independently whereby a structure is drawn on in human interactions, and this phenomenon is called the duality of structure (Walsham & Han, 1990). The idea of the duality of structure also implies that organizations are shaped through continuous practices where an agent has the power to change the structure and vice versa (May & Mumby, 2004). The pattern of the action is both constraining and enabling by rules and resources that establish social structures (Jensen et al., 2016). Rules, in the context of Structuration Theory, comprise normative social elements and codes of meaning while resources are those empowering or constraining agents' authority to direct others' activity and those controlling the allocation of material objects as power bases (Jensen et al., 2016).

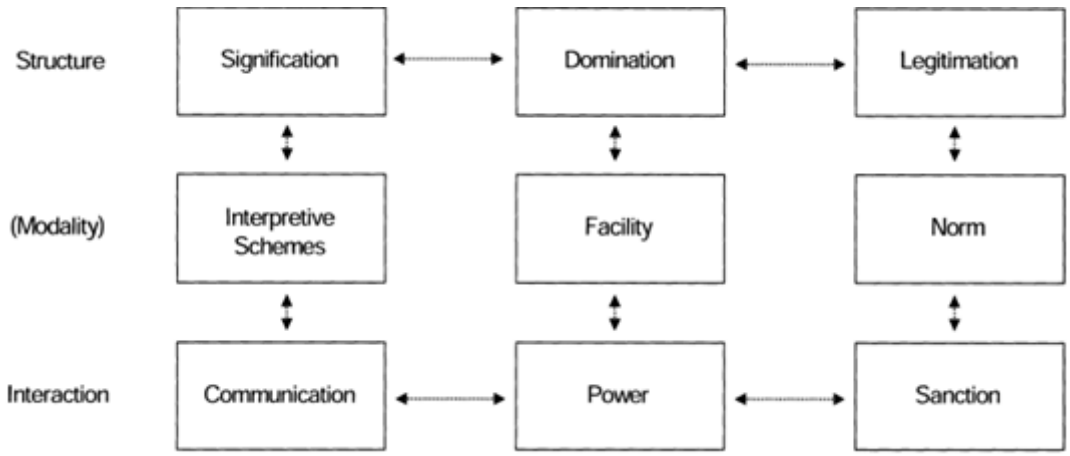

Figure 2.2: Analytical Dimension of Duality of Structure (Giddens, 1984)

For analytical purposes, Giddens classifies three dimensions of the duality of structure (signification, domination, and legitimation). In figure 2.2 above, three modalities are interlinked between social structure and human interaction as shown (Walsham & Han, 1990). The three aspects of any social system consist of meaning, power, and norms (May & Mumby, 2004). Giddens emphasizes that these dimensions can be distinguished but are inseparable and interwoven, with the element of the structure having more or less force of all three sorts in any single situation (Jensen et al., 2016; May & Mumby, 2004).

Walsham & Han (1990), breaks down the dimension as the first realm (signification) involving the human communication and interpretive schemes that act as stocks of knowledge that a human agent draws upon to make sense of their own and other's action. Secondly, by portraying domination, human agents use power in interaction by drawing facilities such as the ability to allocate material and human resources. Lastly, human agents sanction their actions

by drawing on norms or standards of morality to form the structures of legitimation (Walsham & Han, 1990).

Another vital aspect of the theory is that human agents are knowledgeable, and they depend on it for their everyday routines (May & Mumby, 2004). Since power is the central tenet of Structuration Theory, the focus is on how power can be used to govern a social system by understanding how resources are utilized to control aspects of a structure and system (May & Mumby, 2004).

PPP projects imply a social and structural change throughout the projects. The complex interaction between government, private entities, and society are continuous and like any structure, it is recursive in nature. Multiple phases of the project from pre-implementation to post-implementation require a deep involvement from various parties to give ideas and feedback to the direction of the projects. In this case, there are multiple human agents from each party that bring their niche and specialty (knowledgeability) to the table working together on a common goal.

By using the analytical dimensions of the duality of structure, JENDELA projects can be interpreted within this context. Signification means producing meaning and it will be used to determine the significance of these projects to society and investigate their true motivation. Domination on the other hand shows the power that human agents hold in the JENDELA projects to control resources. Since the projects are a unique combination of multiple entities, authority and control are divided in managing different resources. Legitimation is the legal endorsement of the JENDELA projects and the publics' view and approval towards the project that can change the course of society-altering norms.

Table 1: Analysis of Duality of Structure

Realm	Type	Analysis
Structure	Signification	Significance of the project
	Domination	Authority and Control
	Legitimation	Legal endorsement
Modality	Interpretive Schemes	Shared knowledge
	Facility	Financing and Technology
	Norms	Needs and requirements of the projects
Interactions	Communication	Communications among the community, public and private entities
	Power	Policy maker's willingness
	Sanction	Public approval

Methodology

Interpretive Case Study

An interpretative framework is a theoretical approach that entails a systematic examination of socially significant activity in order to gain a better understanding and interpretation of how individuals construct and sustain their social worlds (Bernard, 2000). Researchers risk losing a better knowledge of the phenomena if they stick to a positivist paradigm that focuses on generalizability (Patton, 2002). Interpretivism promotes the researcher to be the primary data collector, as this improves data consistency and increases the researcher's involvement in the study (Walsham, 1995).

There are a number of advantages in using interpretive case studies as the methodology. Firstly, The most common context in which data is examined is in the context of its usage and the environment in which the activity takes place (Yin, 1994). Case studies typically generate comprehensive qualitative descriptions that not only assist to examine or describe data in a real-world setting, but they also serve to explain the complexity of the phenomena that may not be captured by experimental study (McDonough, 1997). Secondly, Multiple sources of data gathering are possible due to differences in intrinsic, instrumental, and collaborative approaches to case studies to improve the validity of study findings (Yin, 1994).

The interpretative case study method used in this work provides a platform for extracting insights from data analysis and facilitating the examination of system-related challenges (Yin, 1994). It enables the researcher to investigate complicated, dynamic processes in a case's natural environment. This strategy also allows for the selection of numerous data sets and the use of diverse interpretative strategies (Yin, 1994).

The Operationalization of Theoretical Framework

In an interpretative case study, a theory may be used in three ways: as an initial guide to design and data collecting, as part of an iterative data gathering and analysis process, and as the research's ultimate output (Walsham, 1995). Using interpretivism entails adhering to its theoretical principles and using them to improve the utility of the results (Thorne et al., 1997).

The empirical focus for this paper is the implementation of the JENDELA project by the Malaysian government to bring digital infrastructure across the nation including rural areas. An interpretive case study is a perfect methodology to use as the complex interplay between the government, private industries, and the citizens with the history of telecommunications in privatization played a big role in the direction of achieving the internet status as a public utility. Structuration Theory by Anthony Giddens is employed as a theoretical framework, explicitly utilizing the analytical dimensions of 'Duality of Structure' to operationalize research discussion.

Table 3.1: Operationalization of theoretical framework

Analytical Dimensions of Structuration Theory	Explanation
Signification - Interpretive Scheme - Communication	Signification is to find the meaning of the JENDELA project and clearly define how it impacts society. Since the project involves human agents in multiple parties, knowledge sharing and communication medium of the project are of important values to be extracted.
Domination - Facility - Power	Domination heavily relates to the authority of single or multiple agents involved in the JENDELA structure that possesses facility and exercise power. In this case, the government holds the authority as a national leader, thus an analysis of the use of resources and capacity is the main action to be investigated.

Legitimation - Norms - Sanctions	JENDELA project is an enabler for digital participation within society. The improvement of digital infrastructure can change the norms and the course of society. Society is the main focus for the project, thus their sanctions towards the project are vital.

Data Collection

The case study technique often entails the collecting of numerous sources of evidence to build a complete knowledge of the situation. The data acquired in case study research is often qualitative (words, meanings, and perspectives), but it can also be quantitative (descriptive numbers, tables) (Shanks & Bekmamedova, 2018). In this study, purely qualitative studies were employed by conducting an interview with industry experts and assessing documents of related articles, news clippings, published research, quarterly report, regulatory act, and press releases.

There are several types of qualitative interviews, ranging from open-ended, exploratory talks to highly organized interviews (Magaldi & Berler, 2020). Interviews normally being a form of discourse, can be arranged in a variety of ways. Structured interviews, which are rarely utilized in qualitative research, have the identical phrasing and arrangement of questions from one interview to the next. Unstructured interviews, on the other hand, employ a free-flowing conversational approach in which respondents are encouraged to raise problems that are not addressed in structured interviews (Wright, 2015). This research is using semi-structured interviews to have a rigid structure of the topics discussed and also the flexibility of exploring further on said topics. The capacity of the interviewer to explore and pursue multiple paths as information emerges, including flexibility in the order of questions, while keeping the organization structure chosen beforehand, is a feature of the semi-structured interview (Hill et al., 2005).

An interview with an independent regulator Malaysian Communication and Multimedia Commission (MCMC) was picked because the JENDELA initiative is largely under MCMC's supervision thus information that can be extracted from an expert in the topics will be valuable.

MCMC's role as a regulator since the start of privatization has been heavily involved in the interest of private companies, citizens, and government (state and federal).

Table 3.2: Interview Topic with MCMC

Coordination of JENDELA Project	Can you tell me what the JENDELA project is about? What is the significance of the JENDELA project? What are the goals of the JENDELA project? Are the goals of the government aligned with other parties involved in the project? How is the JENDELA project coordinated since other private companies are part of the initiatives? How does knowledge of each party are being communicated throughout? MCMC wanted to use CIMS as a platform for companies to share infrastructure, government, and residential data? Is that the case now and are there any hiccups? As we know, public utilities are for the public, so does public opinion regarding the course of the project are being considered?
Government's role in the project?	Can you explain MCMC's role in the project? Installing digital infrastructure in a rural area can be expensive, what are the funding mechanisms that are being used currently? MCMC has identified four (4) key policy support which is; - Blanket approval from States to approve the digital infrastructure development

	- Access to federal-owned lands and buildings - Digital infrastructure is treated as a public utility - Standardization of electricity tariff Can you briefly explain each of the policies mentioned? What has MCMC done to solve the 'right-of-way' issue between the state governments? To treat telecommunications as a public utility, the government has amended UBBL 1984 and introduced the GPP-I. Can you explain more on this and how it helps treat telecommunications as a public utility? According to the latest report, there are states that won't adopt UBBL 1984 Amendment and GPP-I. Why is that the case and what will MCMC do to encourage that? What has MCMC done to increase the number of internet subscribers in rural areas especially in the poorer community?
Internet As Public Utility	The project is to serve the public, thus what are their acceptance and approval of the project? How has the public benefited from the project? Can the project bridge the digital gap between rural and urban dwellers? What has been done to educate the poorer community in areas regarding the usage of the internet and ICT?

Results and Discussion

JENDELA: National Digital Infrastructure Plan Case in Context

As the world progresses in becoming the front-runner of the digital nation, countries worldwide have been proactively planning to improve their existing digital infrastructure. As a result, the Broadband Commission known internationally as an organization overseeing the advancement of digital inclusivity established by the International Telecommunication Union (ITU) and United Nations Educational, Scientific and Cultural Organization (UNESCO) has urged countries around the world to develop digital infrastructure based on three pillars. Specifically, 1) resilient and reliable connectivity; 2) Affordable access to the internet; 3) Safe environment for online services for well informed and educated societies aligned with Sustainable Development Goals (*The State of Broadband 2020*, 2020.). As seen, the pandemics have exposed the lack of inclusivity in the development of digital infrastructure, especially in rural areas. It has highlighted disparities in coverage and adoption and the creation of additional burdensome for those who can't afford it (Wallsten, 2020). To demonstrate, as most students have the comfort of working and studying from home during these trying times, there's a university student in Malaysia who went viral as she had to climb a tree to ensure she had good internet coverage to sit her exams online ("Malaysian Student Sits Exams in a Tree to Ensure Good Wi-Fi," 2020).

There is no secret digital infrastructure in Malaysia that needs improvement to be on par with other developing nations. In 2018, the World Bank released a report on Malaysia's digital economy and found that even though over 80 percent of the population is online through mobile connectivity, only 36 percent of households have fixed broadband access. In comparison with other countries, China (79 percent), Vietnam (42 percent), and Australia (77 percent) and other regional peers have better coverage and adoption of fixed broadband access (*Malaysia ô s Digital Economy*, 2018). This situation has called for the Malaysian government to ramp up its effort to give better internet access especially for the people in the rural area.

Figure 4.1: JENDELA: National Digital Infrastructure Plan

JENDELA: National Digital Infrastructure Plan or formerly known as National Fiberisation and Connectivity Plan (NFCP) was introduced by the Malaysian government to tackle current internet issues and broaden the coverage of internet connectivity. To achieve said goals, the initiatives include better digital infrastructure and an improvement plan for coverage by optimizing the use of resources. In addition, JENDELA aspirations are as followed (*National Digital Infrastructure Lab (NDIL) Report*, 2020);

- 96.9% Nationwide Coverage of 4G coverage
- Average wireless broadband speed of 35Mbps
- 83% of fiber connectivity in premises/homes

Table 4.1: JENDELA aspirations (*National Digital Infrastructure Lab (NDIL) Report*, 2020)

	2016 - 2020 Plan	**Current State (2020)**	**JENDELA National Aspirations**
Wireless Broadband	Nationwide 3G coverage Rapid 4G expansion	96.7%* of 2G coverage 95.3%* of 3G coverage 91.8%* of 4G coverage *In populated areas	100% of 4G coverage in populated areas 100Mbps speed by adopting 5G
Fixed Broadband	Expand from High-Speed Broadband (HSBB) to HSBB 2	4.95 million premises passed	9 million premises passed

and Sub-urban
Broadband (SUBB)

JENDELA comes in two phases, phase one is to improve the foundation of national digital infrastructure involving mobile and fixed broadband, and phase two is to bridge the additional digital gaps that exist by implementing fit-for-purpose technology. The two phases are (*2nd Quarterly Report of Jendela*, 2021):

Phase 1 (current to 2022):

- 4G mobile coverage: from 91.8% to 96.9% in a populated area
- Mobile broadband speed: from 25 Mbps to 35 Mbps
- 9 million premises connected to fixed broadband
- Gradual retirement of 3G networks by end 2021
- 5G planning and implementation for commercialization

Phase 2 (2023 and beyond):

- Utilizing Fixed Wireless Access and other fit-for-purpose technologies

The government has introduced an Action Plan (2020 - 2022) as a strategy to materialize JENDELA aspirations and it entails constructing new mobile sites, an upgrade to existing 2G/3G base stations to 4G, sunset of a 3G network, and migrate the spectrum for 4G technology and, fiberize additional 2,527,184 premisses from 2020 to 2022 (*2nd Quarterly Report of Jendela*, 2021). Details of the Action Plan (2020 - 2022) can be found in the figure 4.2 below;

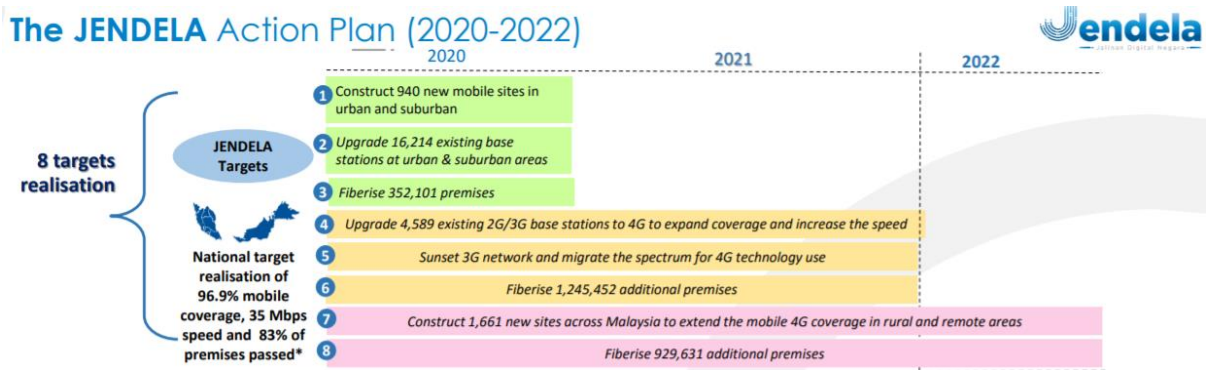

Figure 4.2: Action Plan (2020 - 2022) (*2nd Quarterly Report of Jendela*, 2021)

Transitioning from 3G to 4G

Each new technology generation (G) demands the repurposing of the spectrum or airwaves to allow for faster and more reliable mobile broadband (Forchheimer, 2019). Changes in technology throughout time necessitate changes in infrastructure (tower upgrades), requiring any type of cellular transmitter to be changed in order to broadcast and receive signals. As mentioned previously, mobile broadband in Malaysia is the main driver for internet connectivity, thus the sunsetting of 3G networks is a very important strategy by the Malaysian government. Consequently, internet connectivity and the quality of service can be enhanced to the public for a better experience in the digital world. Moving forward, this approach is part of the government's effort to better use existing resources of the 3G network by repurposing the spectrum to optimize 4G network and deliver higher data speeds, lower latency, improved network reliability, and stability, enhancing the quality of experience (*FAQ 3G Network Sunset*, 2021). Network operators are decommissioning 3G networks to focus on faster and more reliable networks, such as 4G LTE, to pave the way for new technologies and 5G deployments.

Since spectrum is a limited resource, it is critical to optimize to meet our future connection demands. In 2019, Malaysia has completed the transition from analog to digital television, and that has free up 700MHz airwaves for 5G connections (Wong, 2019). Most 3G networks operate in the 800 MHz, 850 MHz, 900 MHz, 1,700 MHz, 1,900 MHz and 2,100 MHz bands (GSMA, 2017). In Malaysia, 3G networks frequency allocation is between 900 MHz and 2100 MHz, Several telecoms have reused the lower 900MHz spectrum for 3G and 4G use after it was initially offered for early 2G GSM networks. The 900MHz spectrum, while having less capacity than higher frequency bands, is nevertheless sought after because it gives more coverage and penetrates walls better. The figure 4.3 below shows the allocation of frequency spectrum between telco companies, and currently, Celcom, Digi, Maxis, and Umobile hold the 3G spectrum.

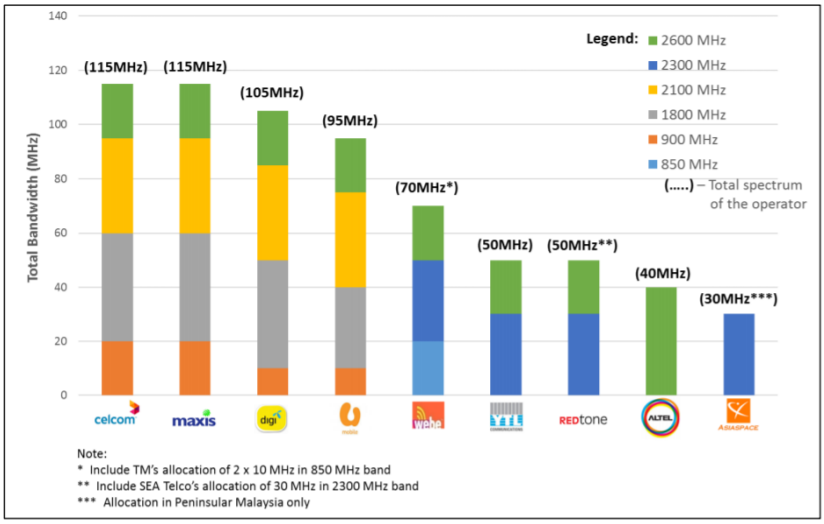

Figure 4.3: Frequency spectrum holding by the operator (MCMC, 2019)

The government hopes to enhance 4G coverage in populous regions from 91.8 percent to 96.9 percent in Phase 1 of the JENDELA plan. 400 new towers will be built in East Malaysia during the second phase, as well as upgrade almost 2,000 transmitters on existing towers. This would increase 4G coverage and better cellular service in rural areas. Besides, to avoid unnecessary infrastructure duplication and frequency spectrum use, Malaysia has practiced infrastructure and spectrum sharing since 2007 (GSMA, 2015). To facilitate and ensure smooth implementation of 3G sunset, MCMC won't provide certification and forbid the importation of 3G and 4G equipment without VoLTE from 1st January 2021 (MCMC, 2021). However, one barrier to this plan is smartphone adoption and the lack of awareness to switch to 4G capable devices. Telco players have updated their FAQs on 3G sunsetting to educate people on the matter. Other than preparing the consumer for the future of network technology, the government should ban the sales of non-compatible devices.

Power Company Involvement in JENDELA

Over the past few decades, power companies installed and used fiber optics cable to assist with the communication of Supervisory Control and Data Acquisition System (SCADA) technology. Malaysian power company Tenaga Nasional Berhad (TNB), weren't left behind to implement this technology all over peninsular Malaysia to their substation. SCADA was used in the substation to collect and send information, monitor, and control it remotely without having to deploy an engineer (Thomas & McDonald, 2017). Fiber optics are usually the technology of choice to connect the substation and control center as it provides higher bandwidth and better speed thus further enhancing the data delivery (Lefebvre, 2016). TNB realized their extensive fiber network across Malaysia was underutilized as it was solely used for the SCADA system. For this reason, the Malaysian government and TNB decided to leverage these existing infrastructures for the national plan to fiberize the nation.

Historically, TNB was a state-owned enterprise providing the nation with electricity access and underwent privatization in 1992. Until now, due to infrastructure development across Malaysia, TNB has stayed as a natural monopoly to provide universal electricity access at a lower price and that has deterred competitors to join the market. Fortunately, in the case of telecommunication, the extensive coverage of electricity across Malaysia also means the existence of fiber cable connections or also known as Optical Ground Wire (OPGW) that were installed on TNB's electricity pylon.

OPGW is largely utilized by the electric utility sector, and it is installed in the safest portion of the transmission line, where it "shields" the critical conductors from lightning while also providing a telecommunications channel for internal and third-party communications (Blackwell, 2017). The optical fibers in the cable can be used for high-speed data transmission, either for the electrical utility's purposes of transmission line protection and control, or voice and data communication, or they can be leased or sold to third parties to serve as a high-speed fiber interconnection between cities (Moore & BICC Cables Ltd, 1997).

TNB is using its existing fiber infrastructure to provide fiber-to-the-home (FTTH) with Passive Optical Network (PON). A PON is a fiber-optic network with a point-to-multipoint architecture with optical splitters that transports data from a single transmission point to numerous user endpoints (Bulgin, 2019). The PON system, which is the primary choice in many FTTH

implementation scenarios, provides several notable advantages: lower power consumption, less required space, higher bandwidth, better security, easier to implement and expand, and reduced cost (Sheldon, 2015). As shown in the figure 4.4 below, the optical line terminal (OLT) serves as the hub for the passive optical network, converting, framing, and transmitting signals for the PON network, as well as coordinating the multiplexing of the optical network terminals for shared upstream transmission. The optical signals delivered via fibers are then converted to electrical signals by ONU which are then sent to individual subscribers. This connection is being done with the help of a distribution point installed on the pole. The distribution point is an important part of the system that provides the physical connection between OLT and ONU that consists of fiber optic cables, connectors, passive optical splitter, and auxiliary components (Sheldon, 2015).

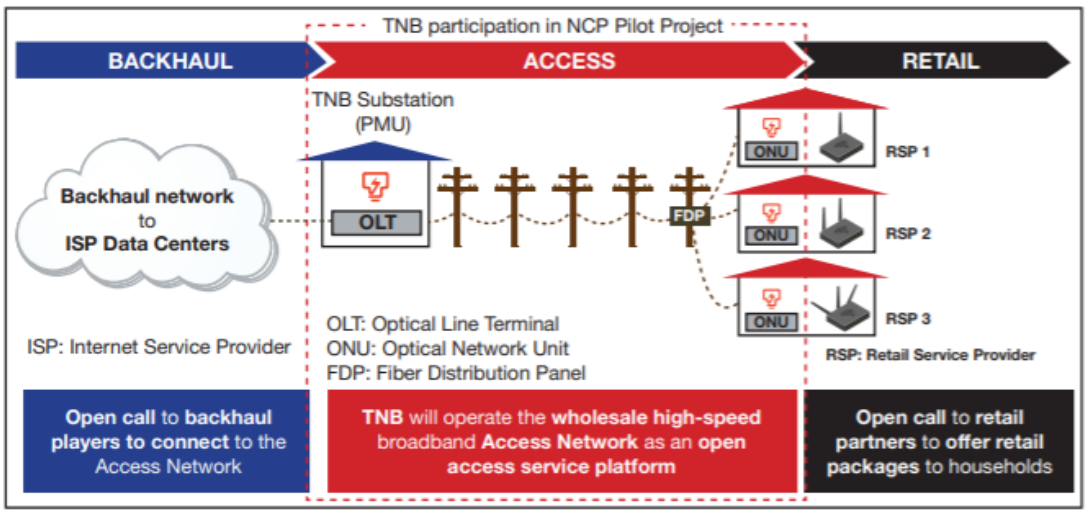

Figure 4.4: Open access model of TNB in JENDELA initiatives (*MCMC MyConvergence Issue*, 2018)

Figure 4.5: Installation of fiber optic cables and distribution point (MCMC, 2018)

To better use and manage existing resources is one of the key pillars in JENDELA's plan to provide internet connectivity across the nation. The involvement of TNB in this initiative is a great example of making use of existing resources as it saves a lot of time, effort, and money. For instance, to lay new fiber optic cables underground requires extensive investment in terms of technology and bureaucratic process to obtain permits and paperwork before the project can be started, and it may take months if not years. Besides that, the location of TNB's substation spread all over peninsular Malaysia even in the rural area, and will give them an extra advantage to reap the benefit of economies of scale in the industry. Thus, it provides a great opportunity for the government to exploit these untapped resources to penetrate high-speed broadband in rural areas.

Malaysian Communications and Multimedia Commission (MCMC) and TNB have agreed to implement an open-access model for the project. Accordingly, this has allowed other telecommunications providers to be involved and supply their services by sharing the same infrastructure. Customers have the freedom to pick their preferred retail service providers (RSP) which are up to three RSP, hence it can promote rivalry among the last-mile providers to provide competitive packages. By using existing infrastructure, TNB estimated a reduced cost of around 80%, shortened implementation timeline, and also minimal traffic disruption (MCMC, 2018). The figure 4.6 below shows the combination of existing and new equipment installed to bring high-speed broadband to the home of the rural area.

Figure 4.6: Combination of existing and new infrastructure during the pilot project (MCMC, 2018)

However, En. Izhar from MCMC has mentioned that due to its status as a new player in the industry, it's facing stiff competition from the incumbent fixed-line broadband provider, Telekom Malaysia (TM). TM has been supplying fixed-line broadband to people even in rural areas with copper-based technology and slowly migrating their infrastructure to fiber. They have managed to secure existing customers from jumping ship to other competitors with a lock-in strategy. Even if the area is using fixed-line broadband often of low quality, the take-up rate for TNB's fiber network is quite slow. Retail service providers (RSP) using TNB's fiber have to come up with plans to increase demand in fiber technology especially with the increasing need for extra bandwidth during the pandemic. Allo Technology, one of the RSP, is partnering with Astro Malaysia Holdings the content and entertainment company by providing bundled services of broadband and entertainment either through internet protocol television (IPTV) or satellite communication.

Coordination of JENDELA Project (Signification - Interpretive Schemes - Communication)

Malaysia realizes the key to unlocking its digital economy is by providing an infrastructure that is reliable, ubiquitous, and ultrafast broadband service. In 2018, the World Bank reported that Malaysia needs a change in infrastructure, regulations, skills, and public finance to create a dynamic ecosystem for its digital economy (*Malaysia's Digital Economy*, 2018). JENDELA was established to address issues related to Malaysia's digital infrastructure and it includes the high cost and low return of investments, and inadequate broadband coverage especially in rural areas. However, the government alone is incompetent and lacks the know-how to tackle this problem, thus they rely on consultation from the industry to propose changes, laid out market barriers, and technology suggestions by the experts in the field.

In October 2018, the Malaysian government held a conference "Malaysia: A New Dawn" as a platform for private firms to speak their mind on the matter. Companies involved include representatives from telco companies, Tenaga Nasional Berhad, Facebook Inc., and other organizations (*NFCP Industry Consultation Report*, 2018). The exchanges between different parties to share knowledge and strive forward as a cohesive unit shows a promising start for the project (*interpretive schemes*). Feedbacks is given by the industry concerning authorities, infrastructure planning and deployment, spectrum-related issues, access/competition, fundings, consumer-related matters, technology, and others (*NFCP Industry Consultation Report*, 2018). A brief explanation of the feedbacks can be seen in the table below;

Table 4.1: Feedbacks from the industry (*NFCP Industry Consultation Report*, 2018)

Feedbacks	
Authorities	● Overlapping powers between Federal and State Governments ● Exclusivity of State-Backed Companies ● Difficult and burdensome Right-of-Way (ROW) requirements
Infrastructure planning	● More effective database for better infrastructure planning and coordinated data collection ● Regulation to promote infrastructure sharing ● Mandating fiber for building ● Affordable satellite broadband for remote areas

Spectrum	● Spectrum pricing/fee structure ● The demand to review Spectrum Regulations and Spectrum Plan ● Fair and adequate allocation ● Different technologies of 5G, 4G, Wi-Fi, and unlicensed LTE need to work together
Access/competition	● Mandatory Standard on Access Pricing (MSAP) costing using LRIC (Long-run Incremental Cost) ● Neutral infrastructure provider ● Active supervision from the commission on the enforcement of the access framework is required
Fundings	● For uneconomical areas - to look for potential funding sources ● Funding models such as Ring Fencing revenue, Public-Private Partnership to address funding issues, pooling government funding ● The need to review USP processes to meet the timelines and NFCP targets
Consumer related	● Parameters for Quality of Services ('QoS') measurements to be agreed amongst the industry ● An alternative approach to measuring affordability (5% below the average monthly income, Affordability Drivers Index (ADI), special incentive to poor families)
Technology	● Mixed technologies to meet targets ● Leverage from TNB's infrastructure - to roll-out FTTH, fiberising telco towers

The feedback given by the industry players are problems that need to be rectified for Malaysia to improve its digital infrastructure. It comprises challenges and barriers that companies have to face in the Malaysian market that curb the widespread of digital coverage. Malaysian government identified four key issues that need to be prioritized; funding, Right-of-Way, spectrum, competition/access (*NFCP Industry Consultation Report*, 2018).

As continuous technology improvement is needed to achieve better results, funding is seen as one of the major barriers for telco companies to expand their services, especially in rural areas. There has been discussion on whether aerial or underground networks are needed for technology deployment in rural areas, but neither approach won't even achieve a break-even point (MCMC, 2018). This has deterred telco companies to invest in the development of rural

area digital infrastructure and not to mention the numbers of potential customers are much less than those in urban areas. Aside from that, Right-of-Way (RoW) was one of the problems stated by the industry as burdensome processes that they have to undergo for new projects. RoW in the telecommunication world are the permits that telecom operators need to obtain for any installation and maintenance work related to network infrastructure and equipment for a specific location. The processes of RoW at the state and local levels are uncoordinated, costly, bureaucratic, and a wide range of requirements are needed thus delaying broadband development (*NFCP Industry Consultation Report*, 2018).

Spectrum allocation and its regulatory framework need an upgrade. Mobile broadband is still an important development in Malaysia as it easily covers populated areas. Hence, the improvement of its spectrum is important to enabling the provisioning of higher quality services and the policy to support the growth of other technology.

As a result, the government outlined four action plans to be achieved in JENDELA (*NFCP Industry Consultation Report*, 2018);

1. Ensure optimum deployment of digital infrastructure
2. Provision of affordable services and improve quality to drive the digital economy
3. Promote competition
4. Participation in the digital economy

To ensure optimum deployment of digital infrastructure, the government laid out a plan to improve its existing infrastructure and increase the coverage of high-speed broadband throughout the nation. Some of the key targets are, wider coverage of fiber networks in public buildings (schools and government offices) and rural areas, increased average speed of mobile broadband, phasing out of copper network, and reallocation of the frequency spectrum (*NFCP Industry Consultation Report*, 2018). On the other hand, while the infrastructure is the main highlight, the government wants to ensure services provided are of great quality and affordable to the masses by introducing 'Double the speed at half the price' and cheaper entry-level fixed broadband packages. Besides that, another action plan on the agenda is to promote fair competition for all by encouraging infrastructure sharing among all telco players. Lastly, e-commerce fulfillment centers will be built in rural areas to educate society and bridge the digital gap between people in the rural and urban areas.

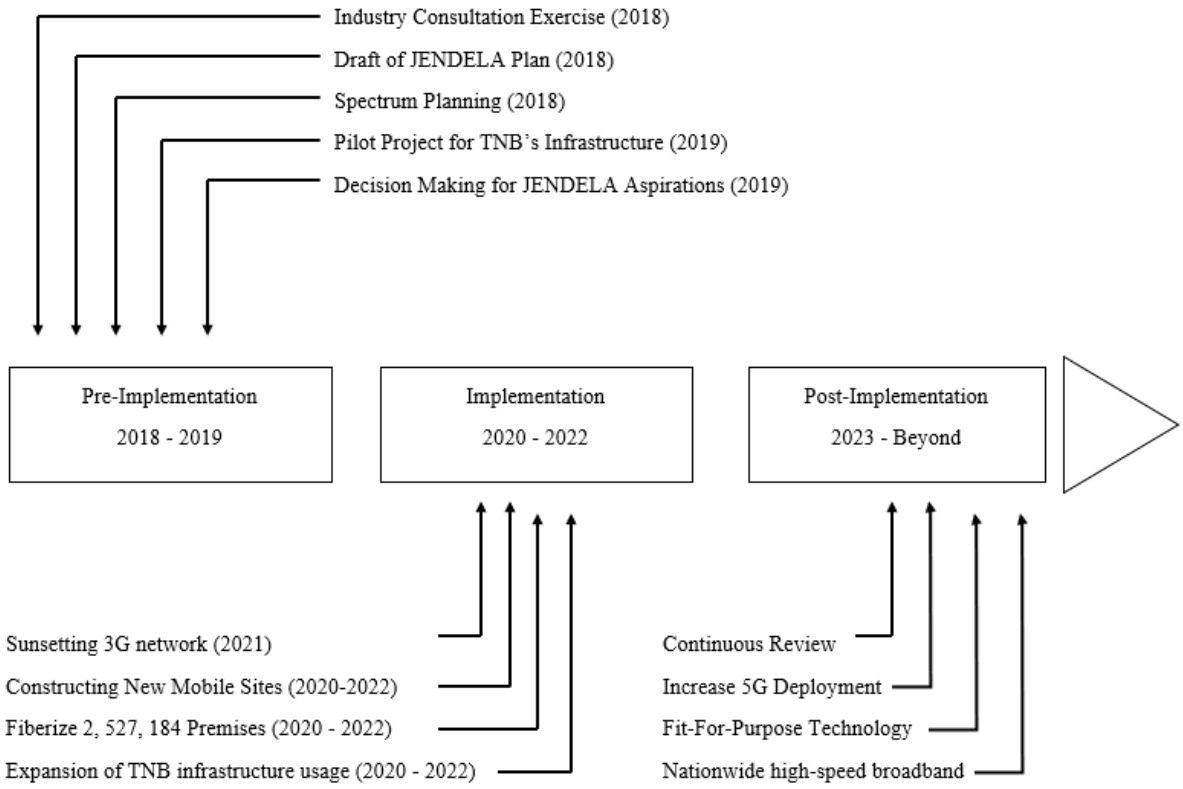

Figure 4.7: Pre-implementation to post-implementation of JENDELA

JENDELA Coordination with CIMS (*Communication*)

Communication Infrastructure Management (CIMS) is a data mapping service that was created to correctly plan, analyze, and coordinate numerous implementations as well as Malaysia's overall communications and multimedia infrastructure and services. As reported in the United States, uncoordinated implementations of mobile base stations will cost the development of national broadband infrastructure greatly (Stauffer & Wit, 2019). Malaysia has been using the platform to ease infrastructure sharing and broadband planning among telco players for years. JENDELA project will further elevate the use of the CIMS platform as a one-stop platform for industry players and the government to track updates of the current status of broadband infrastructure. Government and residential data including buildings and addresses will be included in CIMS to assess demand in specific areas. Details of CIMS use in Jendela are provided in the table below.

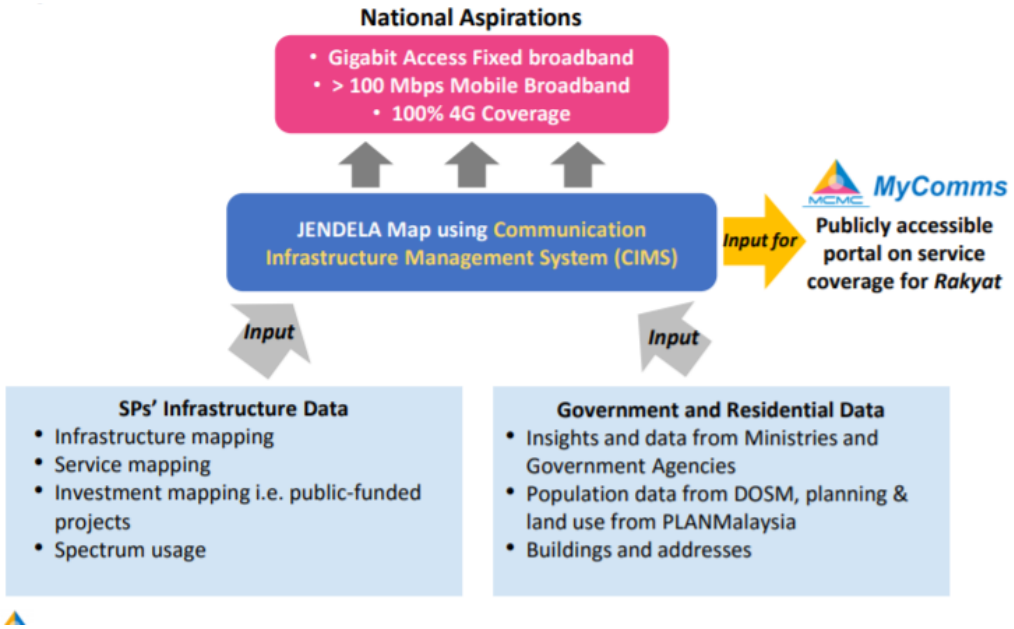

Figure 4.8: CIMS Integration WIth Jendela (MCMC, 2020)

Table 4.2: CIMS detailed explanation (MCMC, 2020)

Initiatives	Explanation
Enhancement of the CIMS and Human Capital requirements	The current CIMS will be updated to become a one-stop digital infrastructure databank that will include the whole dataset from SPs and MDAs, as well as improved user experience (internal and external)
Improvements in Data Integrity (including accuracy and completeness)	Data auditing of other SP infrastructure submissions – rooftop tower, pole, dual functions (mobile) – cabinet building, duct and manhole (fixed)
Streamlined Data Reporting Process Across Supply and Demand Stakeholders	• Clear process flow of reporting data needs by MCMC divisions, SPs, and MDAs • Creation of an Executive tab on CIMS to view submission status
Integration of e-Spectra and CIMS	• MCMC's data requirement process has been improved to reduce the number of duplicate queries. • Future spectrum utilization mapping in the National Digital Infrastructure Mapping
Rakyat-centric Portal on Service Coverage Availability by SPs	SPs raising service awareness with public data on coverage areas (through jendela.my)
Policy Development on Infrastructure Asset Management Framework	SPs follow best practices when it comes to maintaining digital infrastructure assets, which will ensure data integrity.

However, the platform is not available for the general public to use. Fortunately, MCMC has come up with another platform named Jendela. my (then known as myComms) that is available on the web and mobile application. The platform will help the public navigate and check coverage for certain areas, report on shortcomings of network performance, and get the latest news regarding the JENDELA project. Despite that, the platform is only limited to mobile communication. It would be best for MCMC to update the progress for fiber installation as well, hence it would help the public to be well informed with the availability of high-speed fiber broadband in their area especially for people in rural areas.

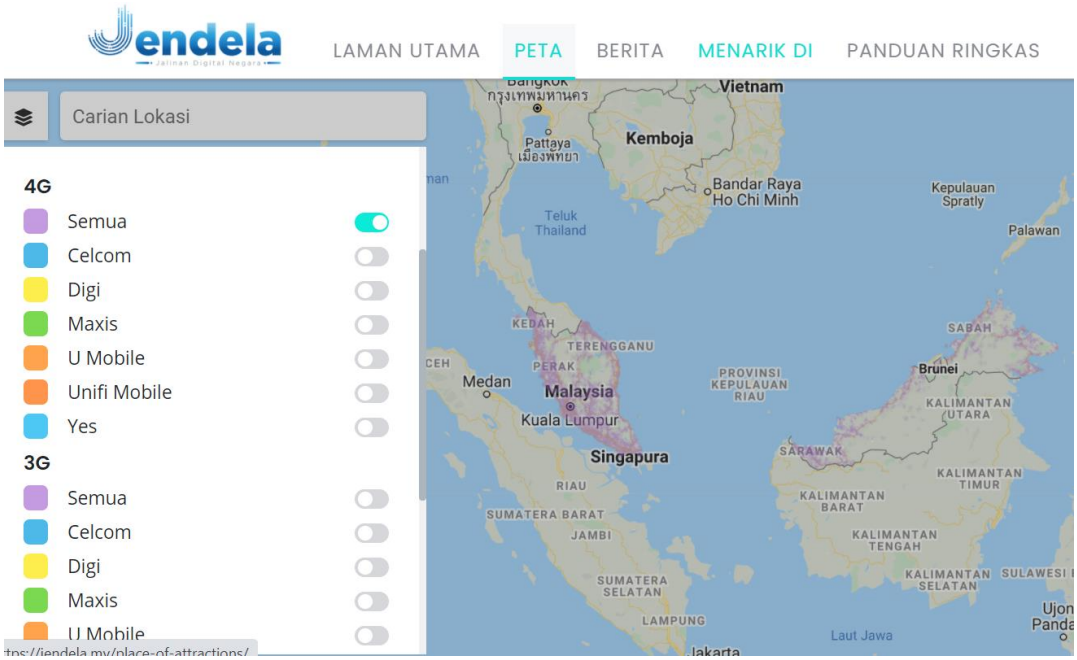

Figure 4.9: Check coverage on Jendela.my

Government's Authority In JENDELA *(Domination - Facility - Power)*

Policy Support for JENDELA

Malaysian government through its independent regulator Malaysian Communications and Multimedia Commission (MCMC) has been extensively involved in the construction of national broadband infrastructure since the privatization of the telecommunication industry. The government realizes the importance of having universal access to telecommunication and the impact it will bring to the national GDP. Thus, MCMC has identified four critical policy supports that are required to expedite the project's delivery to meet national goals. According to Mr. Izhar from MCMC, these four policies were introduced because in the past this has been part of the issue in national network rollout and delay deployment. Mr. Izhar has explained it as below.

Policy 1: Blanket approval from states and local authorities to approve the digital infrastructure deployment to meet the national aspirations

Previously, in the provisioning of a new digital infrastructure project, the process from planning to implementation took a very long time due to standard processes that applicants have to undergo. For example, the provisioning of a new base station will include site acquisition, application to state government, local councils, and other agencies, permit to build, telco integration, and testing, only then the service will be provided to the public and the process is linear meaning happens from one stage to another. The duration from the beginning to the end of a project will take approximately 12 months. This is because, for a specific land, the state government has to check its status and the local council has to determine future setbacks that can exist for example if it touches a reserved area for planned road infrastructure and nearby buildings. The whole process is slow; thus, it is not aligned with the government's aspirations to expedite network rollout.

Hence, the first policy is to shorten the time taken for a project to be finished by giving blanket approval for any network or telecommunications-related project. Instead of waiting for approval to be given from multiple stages, the applicants can apply for approval from multiple parties concurrently and the base station to be built as soon as possible even without approval from the state government and local council yet. This is to ensure the public will be able to enjoy telecommunication service as soon as possible once approval is given. A further

illustration of the processes is shown in the figure 4.10 below.

Before Implementing blanket approval:

Standard of Procedure / Month	1	2	3	4	5	6	7	8	9	10	11	12
Site acquisition application & approval *												
Local council application & approval												
Tower building												
Telco integration and testing												

After Implementing blanket approval:

Standard of Procedure / Month	1	2	3	4	5	6	7	8	9	10	11	12
Site acquisition application & approval *												
Local council application & approval												
Tower building												
Telco integration and testing												

* 6 months is the maximum

Figure 4.10: Illustration of blanket approval implementation

However, there is one drawback to this methodology. It's possible in some cases if the base station has been built, but the approval for either site acquisition or local council was not given due to certain circumstances. Therefore, the base station has to be dismantled or moved somewhere else. Mr. Izhar acknowledged the risk involved but corroborated that the benefit is greater than the risk. As he stipulated, in the case of a mobile base station, the nature of the infrastructure itself is temporary and it can be removed when needed although more cost has to be incurred if it is a free-standing masts base station in comparison with rooftop or building mount.

Policy 2: Access to Federal-owned lands and buildings to develop digital infrastructure and expand coverage and quality

The government has prioritized telco companies to build digital infrastructure in federal or state-owned land instead of private land. This is because it will be cheaper to rent and the process to acquire will be much faster. Usually, these lands are pocket lands that exist by the roadside, besides traffic lights, and parks. The size of the land also varied according to

technology, fiber installation would use more depending on the distance covered, followed by mobile technology.

On the other hand, the development of JENDELA also focuses on digital infrastructure involving government-owned buildings such as public schools, police stations, public libraries, and others. To embrace the digital culture, the Malaysian government believes through expansion of broadband coverage in these places it will encourage public servants to adopt digital services that facilitate processes. A good example is the fiber coverage availability of school in rural areas would accelerate learning and bridge the digital divide of people in rural and urban areas.

Policy 3: Digital infrastructure to be planned, deployed and treated as public utility

To treat digital infrastructure as a public utility, the infrastructure development and planning have to be done at the root of any city development. The lack of proper planning will delay the broadband service provided to the public and adds difficulty for telco providers to prepare the service (MCMC. 2021). The government, through MCMC, has included two measures in treating digital infrastructure as public utility, the amendment of Uniform Building By Laws 1984 and *Garis Panduan Perancangan Infrastruktur Komunikasi* GPP- I (Guidelines For Communication Infrastructure Development).

Mr. Izhar informed that, most states have recognized telecommunication as the third utility along with electricity and water, but there are lacking in the implementation and execution part as no guidelines and standardised way of doing things were introduced. GPP-I serves as the guidelines for the states to follow and will change the course of city development processes.

Amendment of Uniform Building By Laws 1984

The amendment of Uniform Building By Laws (UBBL) 1984 is the first step to achieve the status of telecommunication as a public utility. UBBL 1984 acts as a standardized building regulation for the whole of Malaysia that defines the line of legal responsibilities for buildings development. The amendment will change the course of housing development in Malaysia but subject to state and local authority approval. At this point of time, it is not required by law for housing and city developers to install telecommunication devices as part of the planning, they are only obligated to reserve areas for mobile base stations or fiber pathways that will be completed by telco providers. Communication and Multimedia Minister of Malaysia mention that this method not only delay broadband service delivery, the reserved areas will be used by

other projects thus leave telco providers with no option to install their equipments in a best suited place for the location, in consequence will create more problems in the future with the lack of coverage and dead spots (Radhi, 2021)

With the amendment, developers will need to take charge of telecommunication device installation including mobile base stations and fixed line infrastructure. Consequently, it will save time and ease telco's burden to reassess and plan for network rollout in the area. The buildings or house will be internet ready when tenants decide to move in and telco providers only need to be involved in the last mile connection.

Garis Panduan Perancangan Infrastruktur Komunikasi (GPP-I)

Proper city development that is filled with basic necessities like internet connectivity are an added value to the development. Improper planning for mobile and fiber optic installation will impede progress for any city development. Besides, it costs extra time and money to have a telecommunication infrastructure installed in a retrofitted approach. To avoid these problems, a proper telecommunication infrastructure guideline that is systematic and integrated has to be constructed.

GPP-I functions as a guideline for local authority, developers, and other agencies connected with the planning of telecommunication infrastructure development in Malaysia. It can also be used for existing city development and acts as a standard of best practice for telecommunication infrastructure development. The telecommunication infrastructure development operate on a number of principle;

Table 4.3: GPP-I Principle (MCMC, 2021)

Principle	Explanation
Safe and Comfortable	The design of the infrastructure has to have a stable and safe structure, while taking into consideration the public's opinion in the area.
Fair and Open	The access to the infrastructure has to be open for all industry players and the same rights are given throughout.
Tidy and Systematic	The design of the infrastructure has to be integrated and systematic, and included with the initial proposal for city development.

Sustainable and Economical	The location of telecommunication infrastructure has to bring a cost saving component in comparison with the retrofit approach.
Accessibility	It has to be strategically located to ensure wide coverage and easily accessible for maintenance.
Cleanliness and 'Beauty' factor	The infrastructure and its surrounding area has to have landscaping element that are suitable and interesting to avoid public's discomfort

GPP-I guidelines only emphasized on the placement, size, function, and location of the reserve area for telecommunication infrastructure. It falls under developers' authority in the planning phase to include telecommunication infrastructure as part of the proposal. Technical specification of the equipment still follows the Malaysian Technical Standards Forum (MTSF) registered under MCMC.

To date, only three states have accepted both UBBL 1984 Amendment and GPP-I to be implemented at local and state level. The other states have agreed in principle to review the plan and discuss further among state members (MCMCb, 2021). The following states are:

No.	State / Region	Gazette UBBL 1984 Amendment	GPP-I	Telecommunications as Public Utility - Gazette and Implementation at PBT Level
1	Perlis	✓	✓	✓
2	Kedah	✓	✗	✗
3	Pulau Pinang	✓	✓	✓
4	Perak	✓	✗	✗
5	Selangor	✓	✗	✗
6	N. Sembilan	✓	✗	✗
7	Melaka	✓	✓	✗
8	Johor	✓	✗	✗
9	Pahang	✓	✓	✗
10	Terengganu	✓	✓	✗
11	Kelantan	✓	✗	✗
12	W. Persekutuan	✗	✓	✗
13	Sabah	✗	Not Applicable	✗
14	Sarawak	Not Applicable - TPPG*	Not Applicable	✓

Figure 4.11: State approval and implementation for UBBL 1984 and GPP-I (MCMCb, 2021)

According to Mr. Izhar, there are many factors that played into this. Most of the states have agreed with the gazette of UBBL 1984 but are unable to adopt GPP-I because they have their own guidelines. They are planning to take some components of GPP-I to be included in their guidelines that are more accurate with the current setting of telecommunication infrastructure in the state. Besides, there is also a disparity in state government's effort and initiative between each state. There are states that are more proactive in achieving the status of telecommunication as a public utility and have to be set as an example for every other state to follow. For instance, Penang state is applauded for its effort to attract private companies by giving support and innovative ideas like fiber-to-the 'drain' that will minimize traffic disruption for installation and cost-effective solution. MCMC plays a big role in educating other states for current best practices to ensure lower income and less performing states to execute the planning up to the standard.

Policy 4: Standardisation of electricity tariff for communication service based on industrial rates

As reported by MCMC, the cost of doing business for each mobile tower can cost between RM12065 ($2846) to RM64500 ($15217) for 6 years depending on the state (MCMCb, 2021). Since base stations have to run for 24 hours, the electricity for operating them can be expensive. This is an added burden to telco providers as pressure from the government and the public are mounting to reduce broadband package prices. Other than decreasing the price for permit and licenses application, the government is planning to give better tariff rates for the operation of telecommunication devices.

Universal Service Provision (USP) Funding

Massive fundings is needed to fuel nationwide broadband network rollout in Malaysia. Due to privatization of the telecommunication industry in the late 20th century, private companies are not subject to equal access to broadband services and more interested in the profits made in highly populated areas rather than rural areas (Cullen, 2001; Matteucci, 2020). For JENDELA, a combination of private investment and USP funding are employed to ensure smooth provision of digital infrastructure. In a commercially viable area, telecommunication providers have the responsibility to improve their existing service or install new telecommunication devices using their own fundings and investment. On the other hand, for rural areas that aren't as profitable USP fundings will be provided.

The Universal Service Provision (USP) programme was initiated to offer nationwide and individual access to essential telecommunication and internet services for people in underserved areas or underserved groups within served areas under the remit of the USP Regulations 2002 (MCMC, 2020). The contribution to the USP Fund is based on three factors (MCMC, n.d.):

- The list of designated services
- Weightage factors; and
- 6% of weighted net revenue

Telecommunications services businesses that have a net profit of more than RM2 million in the year of assessment must contribute 6% of their weighted revenue to the USP Fund, according to USP regulations. Since its establishment, it has funded projects related to rural broadband, mini community broadband centres, smart devices with internet packages, netbook supply, and community broadband libraries (MCMC, 2020). The Communication and Multimedia Minister of Malaysia announced an allocation of RM 3.2 billion from the USP Fund will be provided for JENDELA to upgrade broadband coverage with mobile and fiber technology nationwide.

Mandatory Standard on Access Pricing (MSAP)

Mandatory Standard on Access Pricing (MSAP) is an initiative done by Malaysian government through MCMC to make sure pricing for telecommunication services are affordable for the general public. Worldbank stipulates that Malaysia's Internet delay was largely due to a lack of competition in the fixed broadband sector, which was characterised by a 90% market share held by one provider as of December 2017 (Record & Raja, 2019). The dominance of this company has given them power to set high prices for fixed broadband packages. Since no other company can contest their position in the market, the government's intervention is long overdue.

All licensees bound by Communications and Multimedia Act 1998 that owns and provides network facilities and services should not exceed the maximum prices prescribed by MCMC according to technology used (MCMC, 2017). It was established in 2017 but only implemented in 2018 and effective until 2020, thus lays a great foundation for the JENDELA project. Since its implementation, pricing of entry-level high speed broadband packages has recorded a 30% reduction which increases the

number of subscribers as well (MCMC, 2019). This would not only attract new subscribers to the service, but allow existing subscribers to upgrade their package as well and bring national average internet speed up. Parallel with price elasticity of demand, Gong (2020) in his study, agreed that the number of subscribers increases as price for mobile broadband packages decreases.

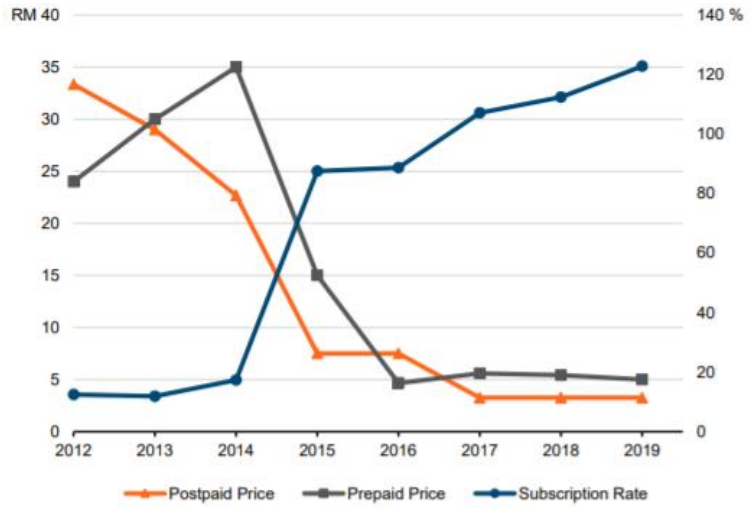

Figure 4.12: Mobile broadband price and number of subscribers (Gong, 2020)

MyDigital: Malaysian Economic Digital Blueprint

To complement JENDELA as an enabler to digital society, Malaysian government has introduced MyDigital: Malaysian Economic Digital Blueprint to step up their efforts in bringing digital culture to the nation. While the four critical policies of JENDELA acts as the supply-side market based policy, MyDigital complements JENDELA by preparing a demand-side and user-centric policy. The blueprint will encourage industry players to become both producers and consumers of new business models, to develop human capital that is competitive, and stimulate the development of an integrated ecosystem that allows communities to engage in the digital economy (Yusof & Povera, 2021). The implementation of MyDigital will be done in three phase:

- 2021 - 2022: Strengthening the basis of digital usage
- 2023 - 2025: Driving inclusive digital transformation
- 2026 - 2030: The country as regional leader in the field of digital content and cybersecurity

From 2021 to 2025, Malaysia envisioned it will enhance digital literacy, get more high-paying employment, and improve social well-being of the citizens. Businesses, including micro, small, and medium enterprises (MSMEs) will have more chances to grow and expand locally, regionally, and even internationally through digital income streams, as well as more potential to connect economic sectors and be more cost effective through a shared economy. While the government will deliver end-to-end online government services that will be more efficient, effective, and transparent (*MALAYSIA DIGITAL ECONOMY BLUEPRINT*, n.d.). Details of MyDigital targets as in figure 4.13 below.

Malaysia has laid out comprehensive plans and strategies to achieve MyDigital targets. It comprises six strategic thrusts, 22 strategies, 48 national initiatives and 28 sectoral initiatives (*MALAYSIA DIGITAL ECONOMY BLUEPRINT*, n.d.). The initiatives will increase the adoption of digital technologies in the government, businesses, and society. Some of the initiatives includes, introducing Digital Accelerator as in-house experts to increase digital technology usage among the ministry, review regulatory requirements to accelerate innovation for businesses, and upskilling teachers and equip students with digital technologies to nurture competitiveness in the digital world (*MALAYSIA DIGITAL ECONOMY BLUEPRINT*, n.d.). Figure 4.14 below shows the six thrusts and 22 strategies for MyDigital.

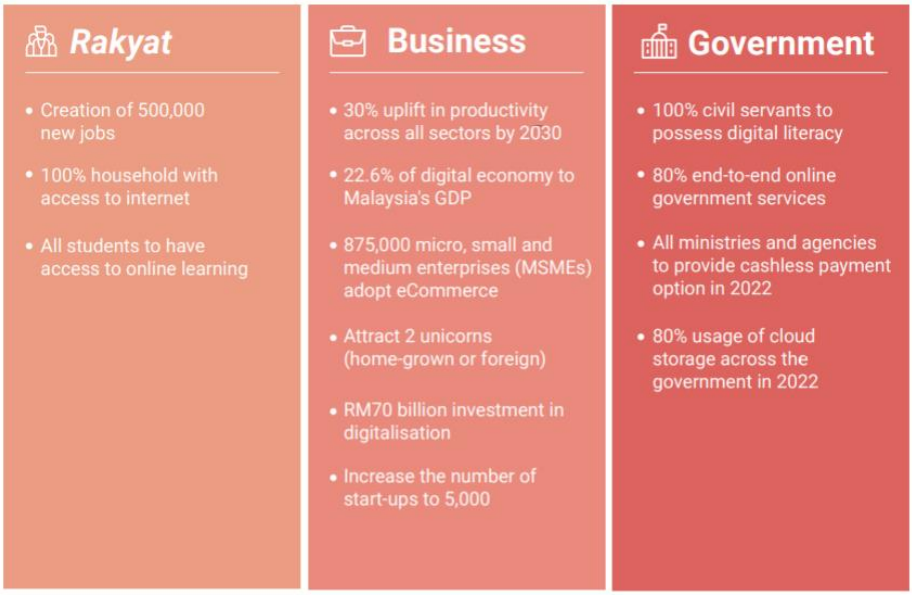

Figure 4.13: MyDigital Targets for 2021 to 2025 (*MALAYSIA DIGITAL ECONOMY BLUEPRINT*, n.d.)

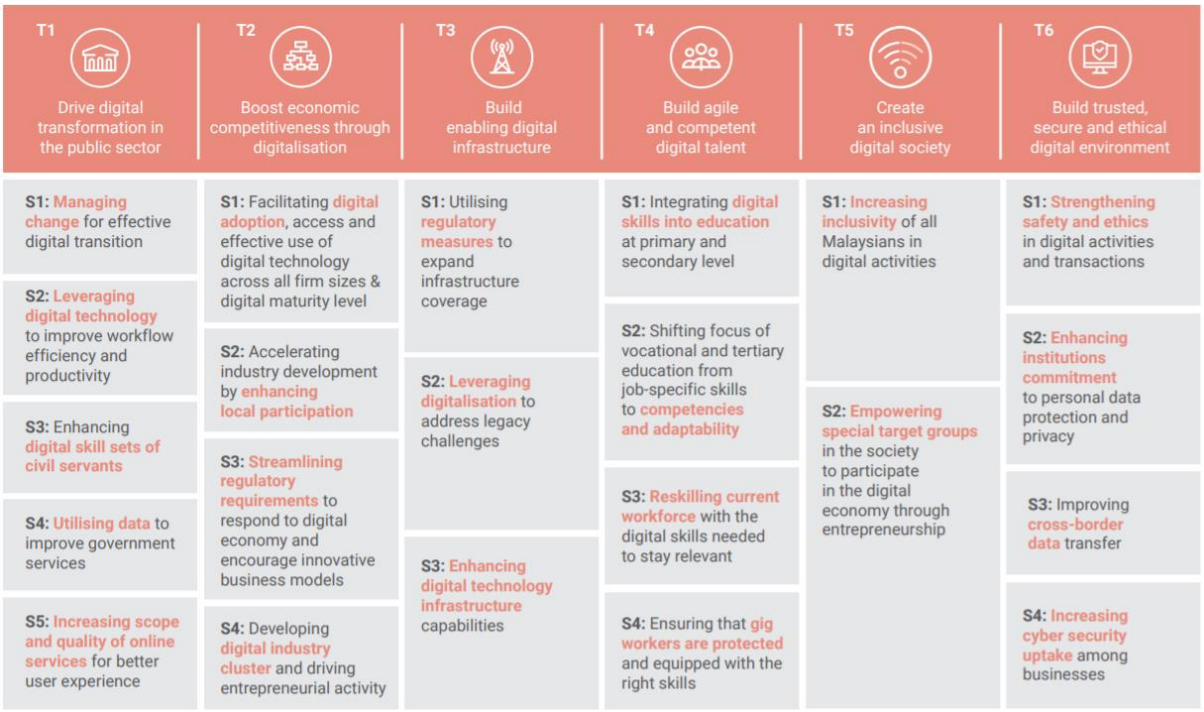

Figure 4.14: Six thrusts and 22 strategies of MyDigital (*MALAYSIA DIGITAL ECONOMY BLUEPRINT*, n.d.)

Internet as Public Utility (Legitimation - Norms - Sanction)

Covid-19 pandemic worldwide has shown the importance of broadband services to the lives of the society for work, entertainment, and school. Information is being shared through social media, meetings through Zoom or Webex are the new normal, and online learning for students proves society is heavily dependent on internet connectivity. Enhancing broadband coverage is the first step to achieve the status of the internet as public utility.

With the execution of the JENDELA project, the digital divide between the rural and urban populations can be bridged. TNB's involvement in sharing national grid infrastructure to provide high-speed broadband service has allowed people in rural areas to enjoy download speeds of up to 1Gbps (MCMC, 2018). The increase usage in mobile data also has called for an aggressive upgrade in mobile telecommunication services to avoid complaints of quality of experience (QoE) and quality of service (QoS). Consequently, the improved services and higher connection speeds can bring a plethora of benefits and opportunities to local communities. The result for fiberising the nation with TNB and TM infrastructure has managed to not only connect people in rural areas but connect public schools, post office, and local government offices (MCMC, 2018), This will allow processes and online learning to be done digitally in a smooth and efficient manner.

But, access to digital infrastructure is just one component of treating the internet as public utility. Broadband Commission highlighted basic communication is the first stage for ICT adoptions, while access to devices and adequate skills are just as vital as broadband connectivity (*The State of Broadband 2020*, 2020). Low take up rate and lack of awareness are some of the challenges in delivering broadband services to rural areas.

To foster digital inclusions especially for people in rural areas, the government has devised multiple initiatives to promote the use of broadband services. The pandemic further highlights the digital gaps that exist between rural and urban areas. Thus, Malaysian government has allocated RM3.5 billion for telco providers to provide discounts for mobile broadband packages and smartphone devices for eligible individuals. The Bottom 40% (B40) of the Malaysian household income get to enjoy this benefit to equip themselves for the digital society. Besides that, the government promised to provide 150000 laptops to poor students in rural areas to prepare themselves for online learning. However, as of June 10 2021, there are delays in the delivery of the laptops and only 8.6% of eligible students have obtained them (*Only 8.6pc of*

Promised 150,000 Laptops Distributed to Students, Says Former Deputy Education Minister | Malay Mail, 2021).

To improve individual's skills and digital literacy MCMC have initiated *Pusat Internet Komunikasi* PIK (Internet Communication Center) to offer internet access to disadvantaged communities while also instilling computer skills and knowledge (MCMC. 2019). According to Mr. Izhar, PIK have been around for quite some time, at first MCMC's focus was to educate the rural community on how to use computers, mouse, and keyboard, then it shifted to the use of internet, Google, and social media. Students and elderly are among the target community for PIK as they want to nurture the digital literacy needed for people to survive in the digital world. For now, the focus is to utilize the skills they had in the first two phases and generate income out of it.

E-commerce is the way forward and with the right skills even rural businesses can be included in the digital roadmap. There are about 1064 PIK across Malaysia, and local businesses are benefiting from the training given and acquiring critical skills like creating a facebook page, adding business contact details and products in Google Maps and e-commerce websites like Shopee and Lazada. On average, local businesses have enjoyed a 60% increase in their income through this program (MCMC, 2019). The availability of internet access coupled with digital business skills have opened up a bunch of opportunities for businesses in rural areas as they are riding the positive network effects and connecting to more potential customers locally or internationally.

Conclusion

To achieve the status of the internet as a public utility, government and private companies together played a big role in ensuring access to broadband infrastructure is universal to every citizen no matter their social status. Disparity in infrastructure development, broadband speed, and digital divide were highlighted in the study as the main problems for the government to tackle.

The partnership of government bodies and private companies were emphasized in 'Coordination of JENDELA Project' to demonstrate the level of collaboration between the two entities. Malaysian government created a platform and invited all industry players to voice out their opinion on the current shortcomings of the telecommunication industry. From the discussion, the government outlined four key plans to be achieved in JENDELA, that is optimum deployment of the project, affordable services, increased competition, and participation in the digital economy which were being used for JENDELA aspirations. CIMS were used for the whole duration JENDELA provision to align government and residential data with telco providers data to avoid duplication of infrastructure and promote infra-sharing. This has clearly shown the commitment from both the government and private entities in achieving the internet status as a public utility, thus answering the main research question.

The role of the government as someone with authority is clearly shown in this study. To support the provision of JENDELA project, the government has introduced four key policies to expedite network rollout across Malaysia, which is, blanket approval from states and local authority, access to federal-owned lands and buildings, digital infrastructure to be treated as public utility, and standardization of electricity tariff. Along with that, USP Fund and MSAP were utilized to fund the project and decrease the general price of broadband packages to stimulate adoption among citizens. To complement JENDELA policies that are mostly market-based supply demand policy, Malaysian government has introduced MyDigital that acts as a demand-side and user-centric policy to increase digital participation of the society in the next few years.

On the other hand, in the light of the pandemic the government realizes the inadequacy of digital infrastructure has created a digital divide among the poor and the rich in having access to the internet. The government has provided multiple initiatives like smartphone and mobile data rebates for bottom 40% households and free laptops for eligible students. However, it

shows there are some flaws in the execution. To increase digital literacy, MCMC created PIK for rural areas across Malaysia to bridge the digital divide among rural and urban areas. PIK has successfully educated people on the usage of the computer and the internet while training them to capitalize on it. In return, there are a number of successful businesses that are based in rural areas thanks to e-commerce.

As a conclusion, governments' effort to achieve universal service access to the internet can only be possible with proactive cooperation from other parties. Private companies should increase effort in the network rollout, the state governments should adhere to standards provided, and citizens should continue look for opportunity to participate digitally no matter the application.

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APPENDIX A

Interview Guide

Interview Guide for Malaysian Communications and Multimedia Commission (MCMC)

Thesis Title: Internet as Public Utility: A case study of public-private partnership in Malaysia to build digital infrastructure in rural areas.

Date: July 16, 2021
Interviewer: Muhammad Hariz Bin Husni
Interviewee: Izhar Abdul Rahman
Interview Structure: Semi-structure
Interview Language: Bahasa Malaysia / English
Location: Online (Skype - Meet Now) - https://join.skype.com/yWyaeCPvhAmh

Interview Topics:

Coordination of JENDELA Project	Can you tell me what JENDELA project is about? What is the significance of JENDELA project? What are the goals of JENDELA project? Are the goals of the government aligned with other parties involved in the project? How is the JENDELA project coordinated since other private companies are part of the initiatives? How does knowledge of each party are being communicated throughout? MCMC wanted to use CIMS as a platform for companies to share infrastructure, government, and residential data? Is that the case now and are there any hiccups? As we know, public utilities are for the public, so does public opinion regarding the course of the project are being considered?
Government's role in the project?	Can you explain MCMC's role in the project? Installing digital infrastructure in a rural area can be expensive, what are the funding mechanisms that are being used currently? MCMC has identified four (4) key policy support which is;

	- Blanket approval from States to approve the digital infrastructure development - Access to federal-owned lands and buildings - Digital infrastructure treated as a public utility - Standardization of electricity tariff Can you briefly explain each of the policies mentioned? What MCMC have done to solve the 'right-of-way' issue between the state government? To treat telecommunications as a public utility, the government has amended UBBL 1984 and introduce the GPP-I. Can you explain more on this and how it helps treat telecommunications as a public utility? According to the latest report, there are states that won't adopt UBBL 1984 Amendment and GPP-I. Why is that the case and what will MCMC do to encourage that? What has MCMC done to increase the number of internet subscribers in rural areas especially in the poorer community?
Internet As Public Utility	The project is to serve the public, thus what are their acceptance and approval of the project? How has the public benefit from the project? Can the project bridge the digital gap between rural and urban dwellers? What has been done to educate the poorer community in areas regarding the usage of the internet and ICT?

APPENDIX B

Interview Transcription *available upon request