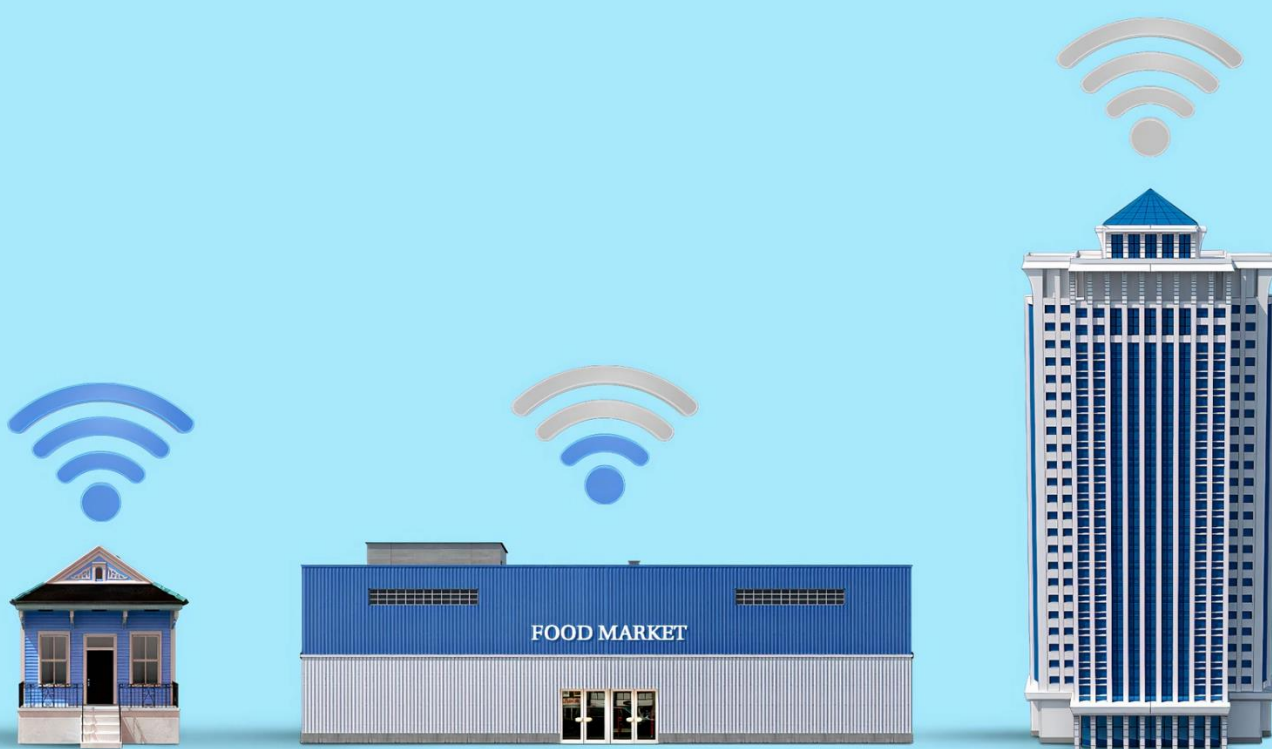


DISCUSSION PAPER 11/20 | 07 SEPTEMBER 2020

Digital Inclusion: Assessing Meaningful Internet Connectivity in Malaysia

Rachel Gong



Khazanah Research Institute

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This discussion paper was prepared by Rachel Gong from the Khazanah Research Institute (KRI) with research assistance from Shariman Arif Mohamad Yusof, Ahmad Ashraf Ahmad Shaharudin, Amos Tong Huai En, Anne Sharmila Selvam, Claire Lim Yu Li, Emir Izat Abdul Rashid, and Shenyi Chua. The author would like to thank the #NetworkedNation research team, Hady Hud, Nungsari Ahmad Radhi, Rinalia Abdul Rahim, and reviewers from Bank Negara Malaysia for their valuable comments. The author would also like to gratefully acknowledge the use of data shared by Bank Negara Malaysia, Pos Malaysia Berhad, and Telekom Malaysia Berhad. All errors remain the author's own.

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Digital Inclusion: Assessing Meaningful Internet Connectivity in Malaysia

Rachel Gong

Summary

- This paper explores the digital divide in Malaysia by examining three aspects of digital inequalities from a demand-side perspective: first, internet penetration rates (access); second, data pricing (affordability); and third, several ways in which Malaysians use the internet (application). The paper also discusses why closing the digital divide requires more than just technical solutions and offers some policy considerations regarding meaningful connectivity and digital inclusion.
- Generally speaking, as at 2019, Malaysia is a highly digitally networked nation, with 90% of households using the internet, mostly through mobile broadband plans on smartphones. Internet usage trends show the digital generation gap closing, but the digital gender gap widening. Despite data affordability, there remains a positive relationship between median household income and both fixed and mobile broadband subscription rates.
- The most popular online activities among internet users in Malaysia are still oriented around communication, socialising, and media consumption, but economic activities rank highly as well, with approximately one in two internet users engaging in work-related activities, banking, and shopping online.
- Providing affordable digital access is just the first step in the digital transformation of a society. Policymakers would do well to consider the societal implications of an increasingly digital population before jumping ahead to automation, artificial intelligence, and 5G. Digital literacy, data privacy, cybersafety, and surveillance are just some of the issues that need to be addressed as part of the nation's digital inclusion efforts.
- Six areas for future research and policy considerations are discussed: (1) Internet access as a public utility, (2) measurement of meaningful metrics, (3) the benefits of fixed broadband, (4) subsidies for devices, not just data, (5) reformatting of legal codes, and (6) focusing on fundamentals first.

Introduction

Sabahan student Veveonah Mosibin made international headlines¹ in June 2020 when her video of spending 24 hours in a tree to take her online examinations went viral. The Malaysian Communications and Multimedia Commission (MCMC) responded by releasing a statement indicating that plans had been made to build a new telecommunications tower² where she lived, which would improve the 3G coverage and service in the area, and to upgrade coverage in the area to 4G under the Universal Service Provision (USP) fund.

Considering that Malaysia's internet penetration rates are well over 100%, indicating that the average Malaysian has at least one way of accessing the internet, and that internet penetration in Sabah in 2019 was 80.7%³, is Veveonah's story an outlier, or is it indicative of a deeper structural inequality masked by macro-statistics?

This paper explores the digital divide in Malaysia by examining three aspects of digital inequalities from a demand-side perspective: first, internet penetration rates (access); second, data pricing (affordability); and third, several ways in which Malaysians use the internet (application). The paper also discusses why closing the digital divide requires more than just technical solutions and offers some policy considerations regarding meaningful connectivity and digital inclusion.

Even before the new normal wrought by the Covid-19 pandemic, Malaysia was well on its path of digital transformation. The National Fiberisation and Connectivity Plan (NFCP) had been established, aiming to “put in place robust, pervasive, high quality and affordable digital connectivity throughout the country”⁴, efforts to improve digital financial services and go cashless saw the average Malaysian making 150 e-payment transactions in 2019, compared to just 83 in 2015⁵, and schools and universities were trying out online classes in line with the National e-Learning Policy 2.0⁶. The pandemic has accelerated this process, and it is imperative that efforts to develop a digital economy do not neglect the fundamentals of a digital society, namely meaningful connectivity and digital inclusion.

¹ BBC (2020)

² Malaysian Communications and Multimedia Commission (2020b)

³ Malaysian Communications and Multimedia Commission (2020a)

⁴ Malaysian Communications and Multimedia Commission (n.d.)

⁵ Author's correspondence with Bank Negara Malaysia (BNM)

⁶ Ministry of Higher Education (n.d.)

Box 1. Definitions of digitization, digitalization, and digital transformation

Digitization: the process of making a digital (i.e. electronic) version of something analog, e.g. scanning a document or converting a paper ledger into an electronic spreadsheet.

Digitalization: the process “in which many domains of social life are restructured around digital communication and media infrastructures”⁷. This process changes the world of work, making “the acquisition of digital skills...a prerequisite for individual, industry, and regional success”⁸ e.g. automated filtering of resumes and first-round interviews taking place via video-conferencing.

Digital transformation: the process of technological adoption and cultural change that have broader socio-technological implications, e.g. influencers on social media becoming primary news sources as paid print journalism declines.

What is the digital divide?

Research on digital inequalities in the late 1990s and early 2000s described a “digital divide” that was primarily focused on digital inequalities in terms of internet access⁹. As internet connectivity spread quickly in developed nations and the digital divide closed, at least in terms of access, researchers turned their attention to other areas of digital inequalities, such as affordability, quality of service, and digital literacy¹⁰.

Most of this early research used socio-economic factors such as income and educational attainment to predict internet use¹¹, but as access became more ubiquitous, researchers flipped their models and began to use internet access as a predictor of socio-economic and socio-political outcomes. Initially, research indicated that people who were better off were more likely to use the internet. Later research indicated that people who used the internet were likely to improve their life outcomes, leading to a reinforcing cycle that could worsen existing inequalities.

Studies have shown, broadly speaking, that increases in internet accessibility are positively associated with improvements in socio-economic outcomes, such as educational attainment, job opportunities¹², political engagement¹³, and health literacy¹⁴. These positive relationships have been found not just in countries with developed infrastructure but in developing countries as well.

⁷ Brennen and Kreiss (2016)

⁸ Muro et al. (2017)

⁹ DiMaggio, Hargittai, Celeste, et al. (2001), Robinson et al. (2015)

¹⁰ Hargittai, Piper, and Morris (2018)

¹¹ Howard, Busch, and Sheets (2010), Willis and Tranter (2006)

¹² DiMaggio and Bonikowski (2008), Hjort and Poulsen (2019), Kuhn and Mansour (2014)

¹³ Samsudin A. Rahim (2018)

¹⁴ Neter and Brainin (2012)

As more and more of society's functions become dependent on internet connectivity and computer processing power, the debate continues as to whether digital inequalities are the result of existing socio-economic inequalities or the cause of continued and worsened social inequalities. These are not mutually exclusive explanations, but both point towards the same policy implication – that one of the priorities of digital policy should be universal, affordable high-speed internet access.

In 2016, the United Nations (UN) affirmed “the importance of applying a comprehensive human rights-based approach in providing and in expanding access to Internet and request[ed] all States to make efforts to bridge the many forms of digital divide”¹⁵. The UN declared internet access a human right and several countries such as Costa Rica, Finland, Greece, and India have made it a legal requirement that all their citizens have access to the internet. This does not mean that service is provided at no cost; rather it means that government policy values internet access as a public utility, like water and electricity.

What is meaningful connectivity?

An important shift in the conversation on the digital divide is a move away from a binary view of internet access and towards a spectrum measuring multidimensional aspects of meaningful connectivity. The UN's Broadband Commission for Sustainable Development defines meaningful universal connectivity as “broadband adoption that is not just available, accessible, relevant and affordable, but that is also safe, trusted, empowering users and leading to positive impact”¹⁶.

The Alliance for Affordable Internet (A4AI) has proposed a meaningful connectivity standard that takes into account four dimensions, as shown in Table 1:

Table 1. Four dimensions of meaningful connectivity

Dimension of internet access	Minimum threshold
Regular internet use	Daily use
An appropriate device	Access to a smartphone
Enough data	An unlimited broadband connection at home or a place of work or study
A fast connection	4G mobile connectivity

Source: A4AI 2020

Usage of this standard would mean that instead of evaluating the digital divide in terms of a single binary measure of internet penetration, policymakers would assess progress to reduce the divide along these four dimensions. At the time of writing, this standard has been tested in Colombia, Ghana, and Indonesia¹⁷.

¹⁵ United Nations Human Rights Council (2016)

¹⁶ International Telecommunication Union (2019)

¹⁷ Alliance for Affordable Internet (2020)

How is broadband defined?

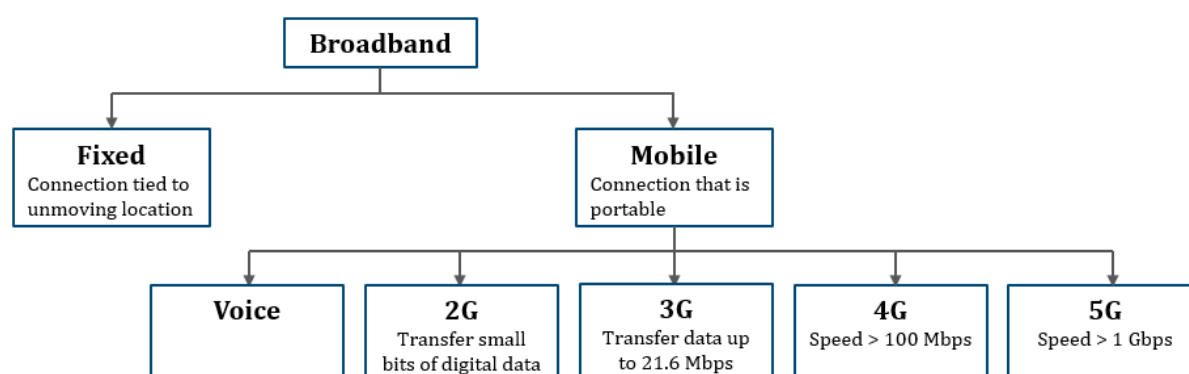
One of the difficulties in assessing the extent of the digital divide lies in the ways that terms are defined and measured. For starters, the definition of broadband internet, which is commonly understood to mean a high-speed connection that is always available (as compared to the early days of the internet when users had to manually dial in each time they wanted to connect), is inconsistently specified.

The International Telecommunication Union (ITU), a UN agency, in 2003 defined broadband as a combination of connection capacity and speed, “at 1.5 or 2.0 Mbps”¹⁸. In 2018, this definition was revised to “access in which the connection(s) capabilities support data rates greater than 2 Mbps”¹⁹. The United States of America’s Federal Communications Commission (FCC), in its 2018 Broadband Deployment Report, defined broadband connections as having a minimum 25 Mbps download speeds and 3 Mbps upload speeds²⁰.

The Malaysian government, in its National Broadband Initiative (NBI) in 2010, defined broadband along two categories: broadband to high impact economic areas and businesses with a minimum speed of 10 Mbps and broadband to the general population with average speeds of 2 Mbps²¹. The NFCP has set a target for internet service providers to deliver average speeds of 30 Mbps for download and 10 Mbps for upload²². The definitions used in this paper follow the 2019 MCMC specifications of fixed broadband with speeds starting at 1 Mbps, and mobile broadband with speed starting at 650 kbps²³.

Broadband can be further divided into fixed broadband and mobile broadband. Fixed broadband refers to a connection tied to an unmoving location, for example, at home, school, or the office. Mobile broadband refers to a connection that is portable, usually associated with a SIM card and accessed via a smartphone.

Figure 1. Broadband classification



Source: Author's visualization

¹⁸ International Telecommunication Union (2003)

¹⁹ International Telecommunication Union (2018)

²⁰ Federal Communications Commission (2018)

²¹ Malaysian Communications and Multimedia Commission (2010)

²² Malaysian Communications and Multimedia Commission (n.d.)

²³ Malaysian Communications and Multimedia Commission (2020a)

Mobile broadband can be classified according to what generation of development it belongs to. For simplicity, the following classifications are based on only the data transfer capabilities of each generation. The first generation of mobile technology was analog, that is, voice only. The second generation (2G) allowed mobile users to transfer small bits of digital data, typically via text messages; 3G allowed mobile users to transfer data at up to speeds of 21.6 Mbps although in practice speeds of 2 Mbps were the norm. 4G was a big jump up from 3G, with speeds theoretically able to reach over 100 Mbps, and 5G is expected to jump an even bigger order of magnitude, with data transfer speeds reaching over 1 Gbps.

Until 5G infrastructure is widely installed and compatible devices reach the consumer market at affordable prices, the average mobile broadband user will have to be content with 3G or 4G service, which is generally enough for typical consumer use such as checking email and social media, streaming audio or video, or playing games. Table 2 summarises the development of internet service provision in Malaysia.

Table 2. A brief history of internet service provision in Malaysia

1985	The Malaysian Institute of Microelectronics System (MIMOS) is established as Malaysia's first internet service provider (ISP) ^a
1986	Rangkaian Komputer Malaysia (RangKom) is set up between academic institutions ^a
1991	JARING (Joint Advanced Integrated Networking) is launched as a separate entity which absorbed RangKom and commercialized Internet access ^b
1992	A satellite link is established between Malaysia and the United States with speeds of 64kbps ^b
1994	JARING upgraded the average connection speed in Malaysia to 1.5Mbps, accessible via fixed telephone lines in 16 major cities ^b
1996	Telekom Malaysia Berhad (TM) is awarded second ISP license, established TMNet ^b
1998	TIME, Maxis, Mutiara (later known as Digi), Celcom and Prismanet received ISP licenses ^c The government passed the Communications and Multimedia Act 1998 (CMA) and Malaysian Communications and Multimedia Commission Act (1998), which established the Malaysian Communications and Multimedia Commission (MCMC) ^d The Universal Service Provision (USP) fund is established to fund infrastructure costs of the Rural Broadband Initiative (RBB). ISPs contribute 6% of weighted net revenue to the USP fund ^e
2001	TM launched Streamyx that provided national coverage and at a minimum speed of 384kbps ^f
2008	The Government formed the Broadband Implementation Strategy in 2008 which consisted of two key strands: High Speed Broadband (HSBB) and Broadband to the General Population (BBGP) ^h Public-private partnership (PPP) is established with TM for HSBB Phase 1 to provide speeds of 10Mbps to 100Mbps in strategic areas ^h
2010	The government launched the National Broadband Initiative (NBI) ^g TM launched its HSBB service, Unifi, providing 48 exchange coverage areas across Malaysia ^g
2015	Further PPPs are developed for Phase 2 of HSBB and Sub-Urban Broadband Project (SUBB) to upgrade copper lines and improve speeds in suburban areas ⁱ
2018	Mandatory Standard on Access Pricing (MSAP) is implemented to regulate wholesale prices of broadband ^j The Ministry of Communications and Multimedia launched the National Fiberisation and Connectivity Plan (NFCP) to further improve high-speed broadband coverage nationwide ^j

Sources: ^aMohamed b. Awang-Lah (1987), ^bNorfaezah binti Abd Halim (2010), ^cMCMC (2015b), ^dMCMC (2016b), ^eMCMC (2006), ^fTelekom Malaysia (2002), ^gMCMC (2010a), ^hNor Akmar Shah Minan (2009), ⁱTelekom Malaysia (2015), ^j(Raju 2019)

Assessing Access

The first of the three aspects of the digital divide explored in this paper is access, measured in terms of internet penetration, user demographics, and broadband subscription rates.

Global comparison: internet penetration statistics

According to the Department of Statistics Malaysia (DOSM), household internet use in Malaysia has increased from 21% in 2009 to 90% in 2019²⁴. However, it is unclear from this statistic whether that refers to a fixed connection or a mobile connection.

The Malaysian Communications and Multimedia Commission (MCMC) reports slightly different statistics, indicating that broadband penetration rates per 100 inhabitants have increased from 17% in 2010 to 131% in 2019²⁵. In other words, for every 100 people in Malaysia, there are approximately 131 registered broadband subscriptions, most of them in the form of SIM cards. It should be noted that this number is the sum of both fixed and mobile subscriptions, which are not perfect substitutes. While it is highly likely that an individual with a fixed broadband subscription also has a mobile broadband subscription, the reverse is not as likely.

The DOSM and MCMC numbers differ because of the distinct ways these agencies calculate internet penetration. The DOSM method employs a household survey in which respondents are asked whether they used the internet in their household in the last three months. The MCMC method takes the number of registered broadband accounts and divides it by the population of the country, as estimated by DOSM. Statistics from both agencies are reported to the International Telecommunications Union (ITU) to evaluate different measures of internet penetration. Table 3 compares Malaysia's internet penetration rates to selected countries in 2017 and 2018.

Malaysia outperforms the global average in terms of internet users and mobile broadband penetration but falls behind in terms of fixed broadband penetration. Based on DOSM's 2018 figures provided to the ITU, 81.2% of individuals in Malaysia use the internet, compared to a global average of 73.6% across 82 reporting countries. The 2018 numbers MCMC provided to the ITU supply further detail, indicating a fixed broadband penetration rate of 8.6%, compared to a global average of 15.5% across 178 reporting countries, and a mobile broadband penetration rate of 134.5%, compared to a global average of 111.2% across 179 reporting countries. The statistics indicate that mobile broadband is preferred over fixed broadband globally, even in countries with developed fixed line infrastructure.

²⁴ Department of Statistics Malaysia (2012, 2020a)

²⁵ Malaysian Communications and Multimedia Commission (2010a, 2020a)

Table 3. Malaysia's internet penetration rates compared to selected countries, 2017, 2018

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

Source: International Telecommunication Union 2019

Note: Dash “-” indicates no data available.

National demographics: internet penetration by gender and age

Figure 2 shows the proportion of women in the Malaysian population and the proportion of internet users who are women from 2012 to 2018. The proportion of women in the population remains steady around 48.0%, but the proportion of internet users who are women declines over time from 43.6% to 41.0%. This is a worrying trend as it indicates a possible increase in the digital gender divide.

The digital gender divide is not limited to Malaysia. Across the 100 countries, including Malaysia, assessed in the Inclusive Internet Index 2020²⁶, men are 12.9% more likely than women to have internet access. The index indicates that this digital gender gap becomes wider as income levels and women's participation in the labour force decrease. The good news is that an expert survey conducted by the A4AI and the World Wide Web Foundation in 2018 found that Malaysia had a gender-responsive broadband policy in place, which included “gender-specific targets for internet access and digital skills training, with adequate budget set aside to implement the

²⁶ The Economist Intelligence Unit (2020)

policy”²⁷. Evidence of this policy’s implementation and outcomes will need to be collected and evaluated to determine its effectiveness.

Figure 2. Percentage of women in Malaysia vs internet users

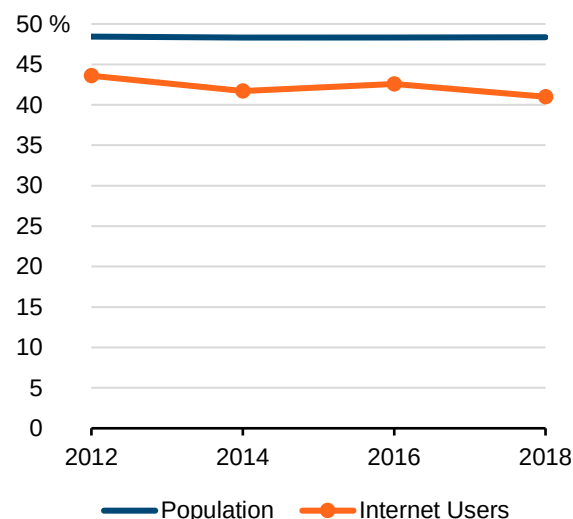
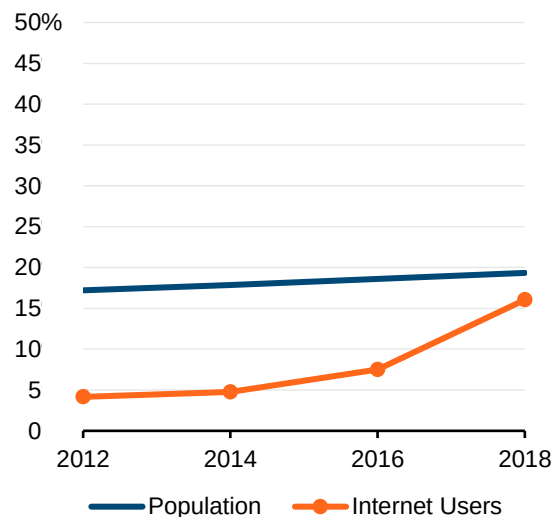


Figure 3. Percentage of population aged >50 in Malaysia vs internet users



Sources: DOSM population estimates, MCMC Internet Users Survey 2012, 2014, 2016; 2018

Figure 3 shows the proportion of the Malaysian population aged 50 and above and the proportion of internet users in this age group from 2012 to 2018. This proportion of this age group in the general population increases slightly from 17.2% to 19.3% during this time period, but the proportion of internet users in this age group increases much more rapidly from 4.2% to 16.0% as internet usage increases overall.

While 20-something year-olds continue to form the biggest age group among internet users, data suggest that the digital age gap is closing. The age of the average internet user in Malaysia increased from 29.7 years in 2012 to 36.2 years in 2018²⁸. As the time period under analysis is just 2012-2018, this effect is likely not only due to internet users moving up into the next age group, but also likely indicates that more seniors are coming online.

On the one hand, this is an encouraging finding, indicating that Malaysians of all ages are adopting digital technologies. On the other hand, older internet users who have limited technological exposure and experience may find themselves at greater risk of becoming victims of cybercrime, especially fraud and scams, or distributors of misinformation on social media. Reports indicate that there are seniors unfamiliar with terminology, including cashless and online payments who are struggling to find appropriate education, guidance, and support²⁹. Seniors also report less experience with computers, the internet, and technology in general³⁰. As such they are

²⁷ World Wide Web Foundation (2018)

²⁸ Malaysian Communications and Multimedia Commission (2014, 2019b)

²⁹ Wong et al. (2018), Yaakob, Wan Hassan, and Daud (2016), Yeoh (2019)

³⁰ Hui (2016)

uncomfortable with the pace at which digital technology evolves and may be reluctant to try relatively more complicated tools such as cashless online payment apps even as they embrace social media and messaging apps³¹.

State subscription rates: trends in fixed and mobile broadband

The following figures show trends in broadband subscription rates at state-level from 2011-2019. Figure 4 shows state trends in broadband subscription rates while Figure 5 shows state trends in mobile broadband subscription rates. Both figures are sorted in descending order of fixed broadband subscription rates for ease of comparison.

Kuala Lumpur has the highest subscription rates among the states for both fixed and mobile broadband. The fixed broadband subscription rate peaked in Kuala Lumpur in 2014 at 23.1% but then declined as mobile broadband gained popularity. As at 2019, Kuala Lumpur, Selangor, Pulau Pinang, and Putrajaya outperform the national average in terms of fixed broadband subscription rates.

Mobile broadband penetration in Kuala Lumpur is significantly higher than all the other states; the mobile broadband subscription rate in Kuala Lumpur in 2019 is 249.6%, implying that, on average, every resident has at least two SIM cards. There are at least two possible explanations for this high number. First, Kuala Lumpur has a larger number of large firms that are likely to register SIM cards for their employees' work use. Second, there is a large number of migrant workers in Kuala Lumpur who are likely to have registered SIM cards but are themselves not counted in population estimates.

Overall trends show fixed broadband subscription rates remaining relatively flat over the years, with a national rate of 9.0% in 2019 versus 7.6% in 2011. These statistics indicate that there are approximately 9 registered fixed broadband subscriptions for every 100 inhabitants. However, since the average household size in Malaysia is 3.9 people³², it would be reasonable to assume that approximately 35% of the population has access to a fixed broadband connection.

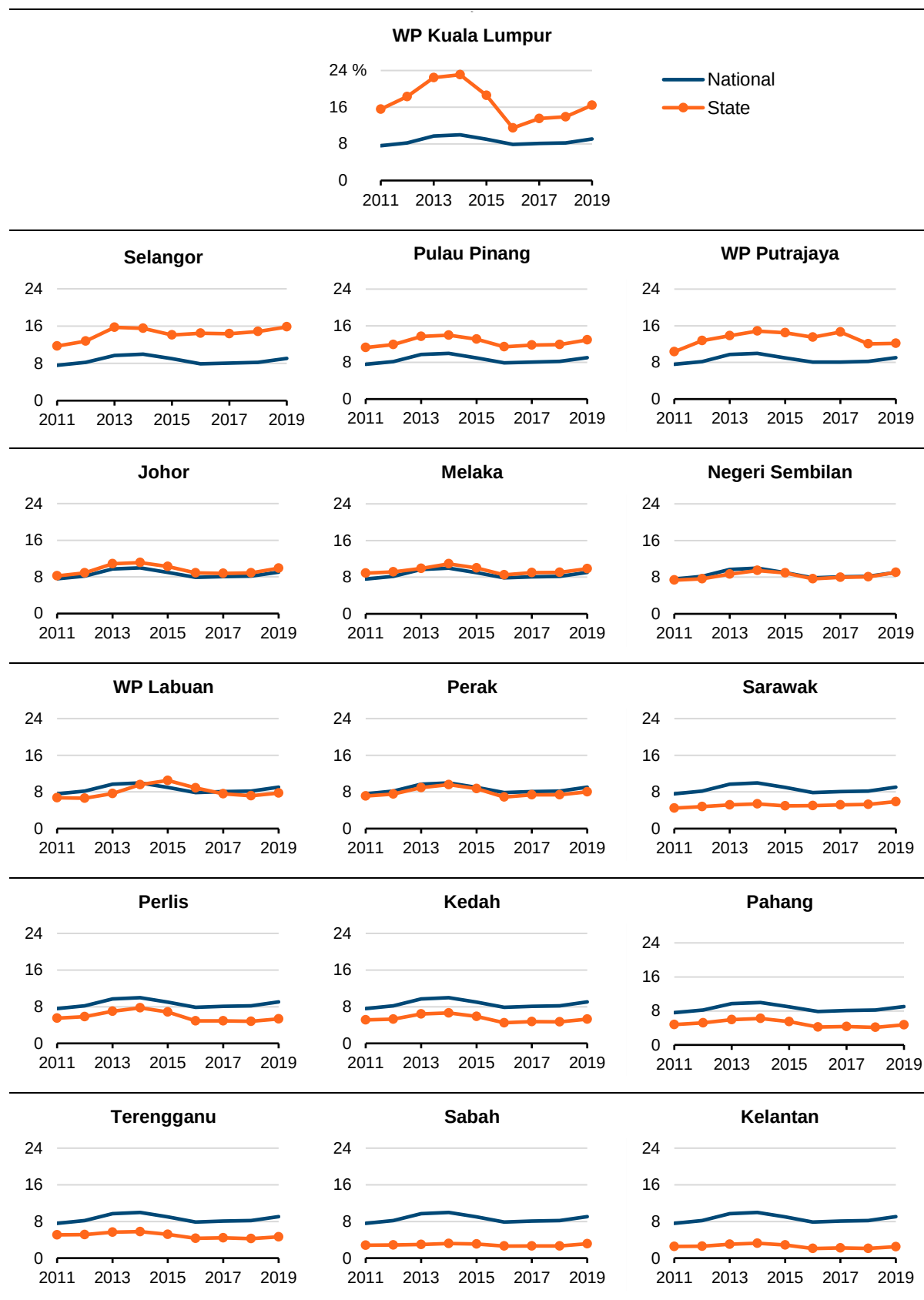
Mobile broadband subscription rates, on the other hand, show substantial growth beginning in 2015, which accounts for the dramatic growth from a national rate of 11.6% in 2011 to 122.7% in 2019. This growth can be attributed to at least three developments circa 2015. First, there was the roll out of 4G beginning in 2013 that supplemented the migration from 2G to 3G, all of which improved mobile broadband quality of service. Second, smartphones prices dropped, which made them more widely affordable. Third, telephone companies (telcos) responded by heavily promoting mobile data packages³³.

³¹ Andalib and Hashim (2018), Wong et al. (2018)

³² Department of Statistics Malaysia (2020b)

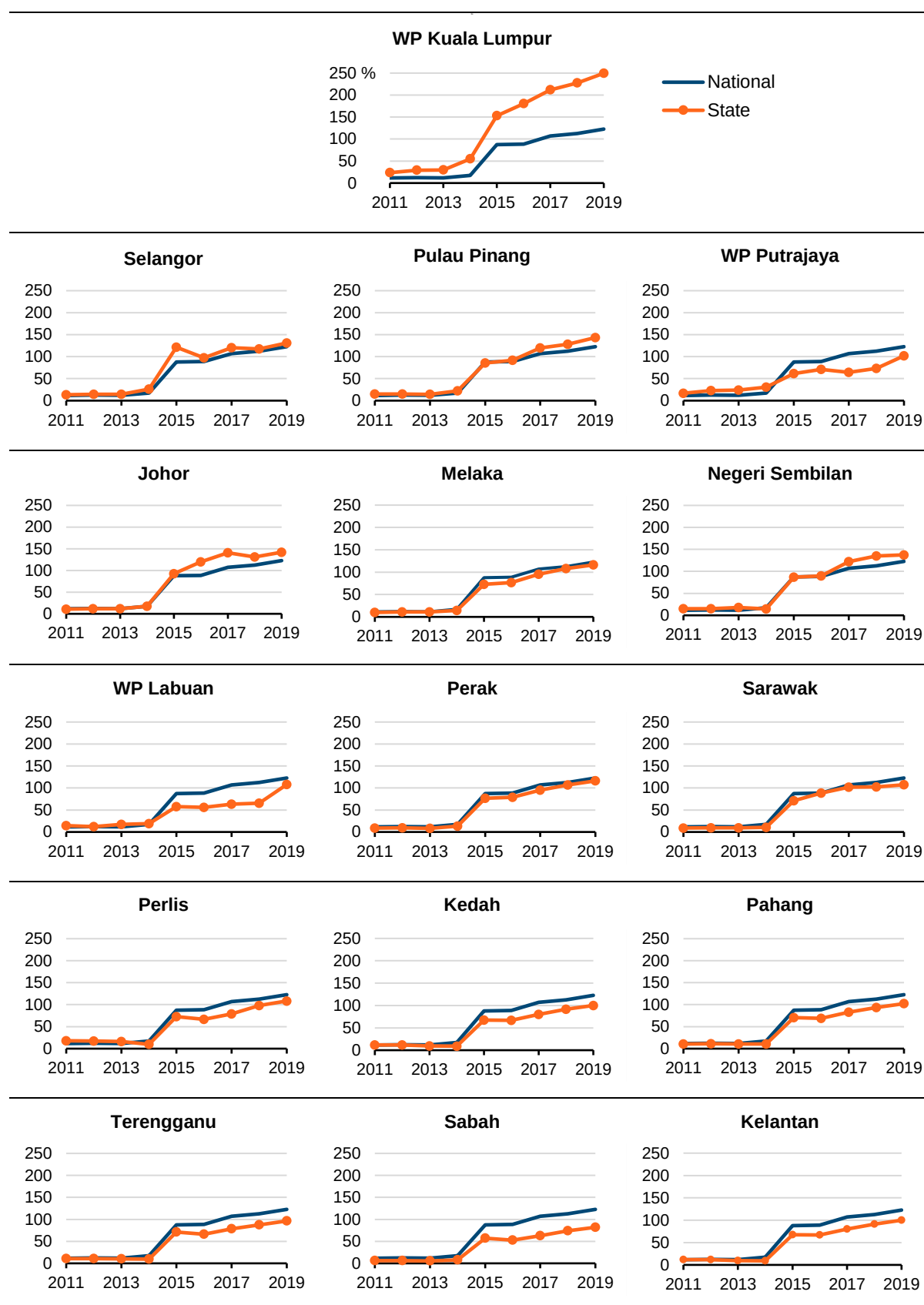
³³ Malaysian Communications and Multimedia Commission (2016)

Figure 4. Fixed broadband subscription rates by state, 2011-2019



Source: Author's calculations based on MCMC data

Figure 5: Mobile broadband subscription rates by state, 2011-2019



Source: Author's calculations based on MCMC data

Table 4 shows the states' median household income and fixed and mobile broadband subscription rates as at 2019, sorted by state median household incomes. States whose median household income is above the national average are likely to have fixed and mobile broadband subscription rates that also outperform the national average, although the direction of causality cannot be conclusively determined. The data suggest that there is a significant positive relationship between fixed broadband subscription rates and median household income, and that this relationship is weaker between mobile broadband subscription rates and median household income.

Table 4. Broadband subscription rates and median household incomes, by state, 2019

State	Fixed broadband (%)	Mobile broadband (%)	Median household income (RM)
MALAYSIA	9.0	122.7	5873
Kuala Lumpur	16.4	249.6	10549
Putrajaya	12.5	102.1	9983
Selangor	15.8	130.5	8210
Labuan	8.1	107.8	6726
Johor	9.9	142.0	6427
Pulau Pinang	12.9	143.3	6169
Melaka	9.9	116.3	6054
Terengganu	4.7	96.4	5545
Negeri Sembilan	9.0	137.4	5005
Perlis	5.5	108.5	4594
Sarawak	5.9	107.4	4544
Pahang	4.7	102.3	4440
Kedah	5.3	100.0	4325
Perak	8.0	116.2	4273
Sabah	3.1	82.0	4235
Kelantan	2.5	93.0	3563

Source: Household Income Survey (HIS) 2019, author's calculations based on MCMC 2020

Note: Figures diverge slightly from MCMC statistics due to rounding.

Using Household Income Survey (HIS) data from 2012, 2014, and 2016, state median household incomes and fixed broadband subscription rates, the latter lagged by a year, were found to be positively correlated ($r(46) = .72, p < 0.001$) while state median household incomes and mobile broadband subscription rates, also lagged by a year, were found to have a weaker positive correlation, ($r(46) = .59, p < 0.001$).

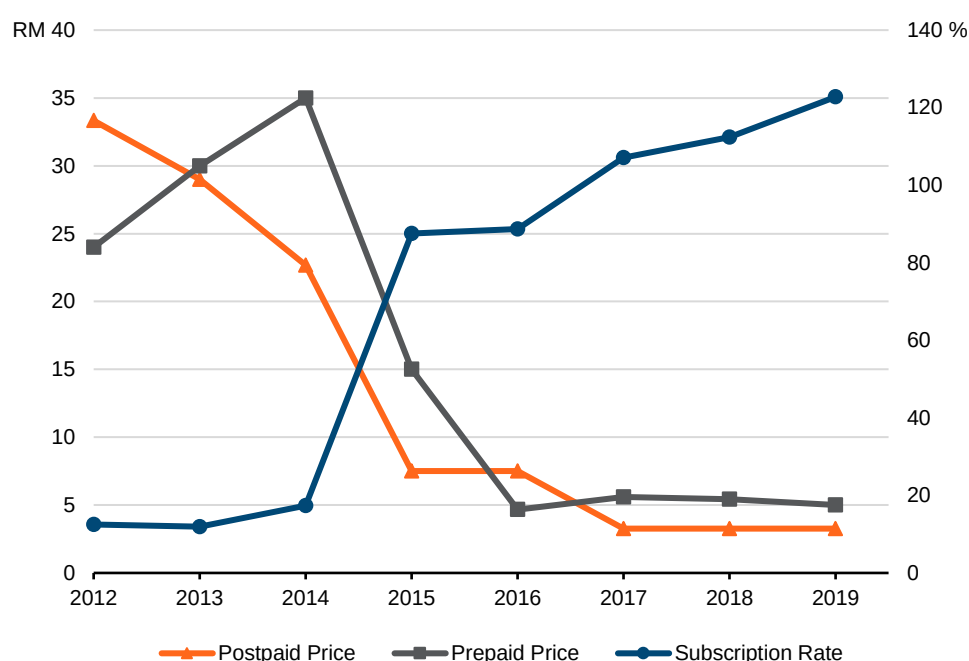
Assessing Affordability

The second of the three aspects of the digital divide explored in this paper is data affordability, measured using data pricing for both fixed and mobile broadband and considered in absolute and relative terms.

Absolute pricing: how much does internet access cost in Malaysia?

Mobile broadband plans are typically priced according to how much data is allocated over a fixed period, e.g. 20 GB per month. Fixed broadband plans are typically priced according to the speed at which data are transferred, e.g. 100 Mbps, and do not limit the amount of data transferred.

Figure 6. Mobile broadband prices per GB and subscription rates, 2012-2019



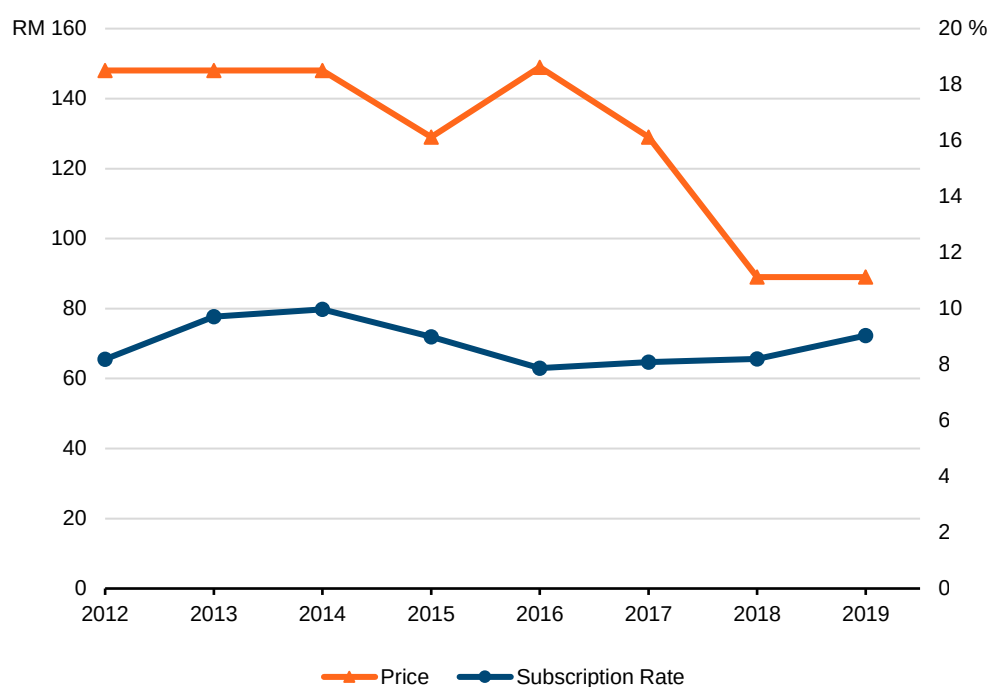
Source: Author's calculations based on web and MCMC data

Figure 6 shows the absolute price per GB of mobile data from 2012 to 2019. As might be expected, as the price of mobile data drops, the total number of mobile broadband subscriptions increase. From 2012 to 2018³⁴, prepaid subscriptions comprised, on average, 79.4% of all mobile broadband subscriptions. Prepaid subscriptions are slowly declining, making up 72.7% of all mobile broadband subscriptions in 2018³⁵. Postpaid plans are generally better value than prepaid plans, but usually require a payment commitment and come at higher prices.

³⁴ 2019 data were not available at the time of writing.

³⁵ Malaysian Communications and Multimedia Commission (2016, 2019)

Figure 7. Fixed broadband prices and subscription rates, 2012-2019



Source: Author's calculations based on web archive and MCMC data

Figure 7 shows the monthly price of a fixed broadband subscription with unlimited data from 2012 to 2019. Fixed broadband prices do not appear to have affected subscription rates very much, even when the price of the cheapest unlimited data subscription dropped by about 40% from 2016 to 2019. This decrease in price was partly attributable to the implementation of the Minimum Standard on Access Prices (MSAP). The MSAP regulates the price of wholesale broadband prices, effectively driving down the price of retail broadband.

Reports indicate that, as a result of the MSAP's implementation, "demand for fixed residential and commercial broadband services rose by 18 to 22 percent"³⁶ from August 2018 to August 2019 and that "the number of fixed broadband subscription[s] with the uploading speed of more than 100 Mbps rose eight-fold to 1.2 million subscribers in 2018"³⁷. However, the upgrade in quality of service at lower prices does not necessarily correspond to an increase in the number of new fixed broadband subscribers. As seen in Figure 7, the total number of fixed broadband subscribers increased by approximately 10.2% from 2018 to 2019.

Relative pricing: is internet access affordable in Malaysia?

In order to close the affordability gap, it is necessary but not sufficient for absolute data pricing to decrease over time. Internet access could remain at a relatively higher cost for low income groups, hence the need to assess not just price, but price relative to income.

³⁶ Bernama (2019)

³⁷ Ibid.

In addition to its proposed standards for meaningful connectivity, the A4AI also uses a “1 for 2” measure to access affordability: “Affordable internet is where 1GB of mobile broadband data is priced at 2% or less of average monthly income”³⁸. This measure was adopted by the UN’s Broadband Commission for Sustainable Development in 2018 as part of its goal to close the global digital divide.

To assess whether broadband prices in Malaysia meet this affordability threshold, a variation of the “1 for 2” measure was applied to the cheapest mobile data plans and to the cheapest unlimited data fixed broadband plans available from 2012 to 2019. Median individual monthly income was estimated and used for the calculation instead of gross national income per capita.

Using this benchmark, Malaysia performs well in terms of mobile broadband affordability. In 2019, the price per GB of data for both prepaid and postpaid mobile broadband is less than 0.3% of every state’s median individual monthly income with prepaid data being slightly more expensive than postpaid data, as shown in table 5. In Kelantan, where a mobile data plan is the most expensive, relative to the rest of the country, 1GB of prepaid mobile data costs 0.25% of the state’s median individual monthly income. This is well below the A4AI’s 2% affordability threshold and indicates that mobile data in Malaysia is generally very affordable.

Fixed broadband data does not appear to be as affordable as mobile broadband data. Table 5 shows data pricing as a percentage of each state’s median individual monthly income in 2019.

Table 5. Data pricing as a percentage of median monthly individual income, 2019

State	Prepaid mobile (per GB)	Postpaid mobile (per GB)	Fixed broadband (per GB)	Fixed broadband (unlimited data)
WP Kuala Lumpur	0.09 %	0.06 %	0.08 %	1.52 %
WP Putrajaya	0.09	0.06	0.09	1.60
Selangor	0.11	0.07	0.10	1.95
WP Labuan	0.13	0.09	0.13	2.38
Johor	0.14	0.09	0.13	2.49
Pulau Pinang	0.15	0.10	0.14	2.60
Melaka	0.15	0.11	0.14	2.65
Terengganu	0.16	0.12	0.15	2.89
Negeri Sembilan	0.18	0.13	0.17	3.20
Perlis	0.20	0.13	0.19	3.49
Sarawak	0.20	0.13	0.19	3.53
Pahang	0.20	0.13	0.19	3.61
Kedah	0.21	0.14	0.20	3.70
Perak	0.21	0.14	0.20	3.75
Sabah	0.21	0.14	0.20	3.78
Kelantan	0.25	0.17	0.24	4.50

Source: Author’s calculations based on web archive data and HIS 2019

³⁸ Alliance for Affordable Internet (2019)

At first glance, it seems that fixed broadband is only ‘affordable’ at the 2% threshold in Kuala Lumpur, Putrajaya, and Selangor. This analysis suggests a plausible explanation for why an individual might not want to subscribe to fixed broadband especially if they are already paying for a mobile broadband subscription.

However, this interpretation of the data for fixed broadband pricing is not strictly comparable to mobile data pricing for two reasons. First, this is a variation of the affordability measure that does not consider the price per GB of data, instead calculating the price of access to unlimited data. Second, fixed broadband access is accessible in the household by more than one person, but the price is calculated for an individual subscriber. Thus, if multiple household members use large quantities of data, it is likely that the price per GB of fixed broadband data would be lower than the price per GB of mobile broadband data.

Assuming that the average internet user uses approximately 9 GB of data per month at home, and the average Malaysian household comprises four people, at least two of whom use that much data, the estimated price per GB of fixed broadband data does become comparable to the price of prepaid mobile data, as shown in Table 5³⁹. Nonetheless, as mobile services are the preferred means of internet access in Malaysia, take-up of fixed broadband for supplementary internet access remains low.

This analysis implies that data affordability is not the barrier to getting people connected, as mobile data plans are extremely affordable. However, internet users solely on mobile plans may not be able to take advantage of the benefits of fixed broadband connectivity unless they are able to pay for two broadband subscriptions.

³⁹ See Appendix: data pricing calculations for further details on this estimate.

Assessing Application

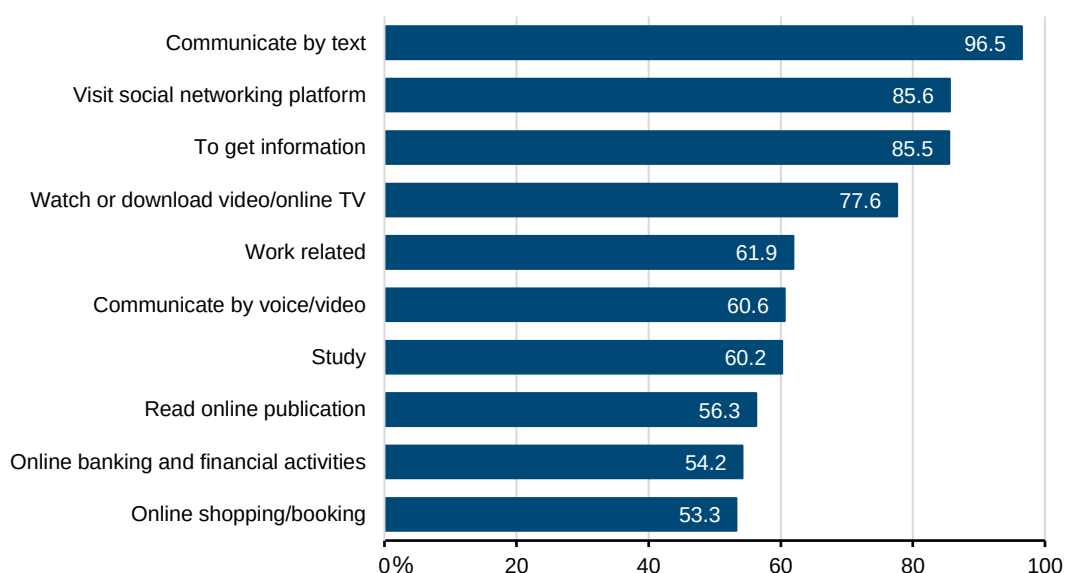
The third of the three aspects of the digital divide explored in this paper is application, measured using indicators of five of the top ten online activities in Malaysia – communicating by text, visiting social networking platforms, video streaming, online banking, and online shopping.

The following analyses use selected data to gain insight into how Malaysians use the internet. Unless specifically stated, these data are not nationally representative, and should not be used to generalize across the Malaysian population. They simply indicate trends and the distribution of online activities for subsets of internet users in Malaysia.

What are Malaysians doing online?

Figure 8 shows the ten most popular online activities among internet users in Malaysia in 2018, sorted by the proportion of internet users who report engaging in such activities. Communicating by text ranked first, followed by visiting social networking platforms. Streaming videos online was the fourth most popular online activity, with online banking and online shopping in ninth and tenth place respectively.

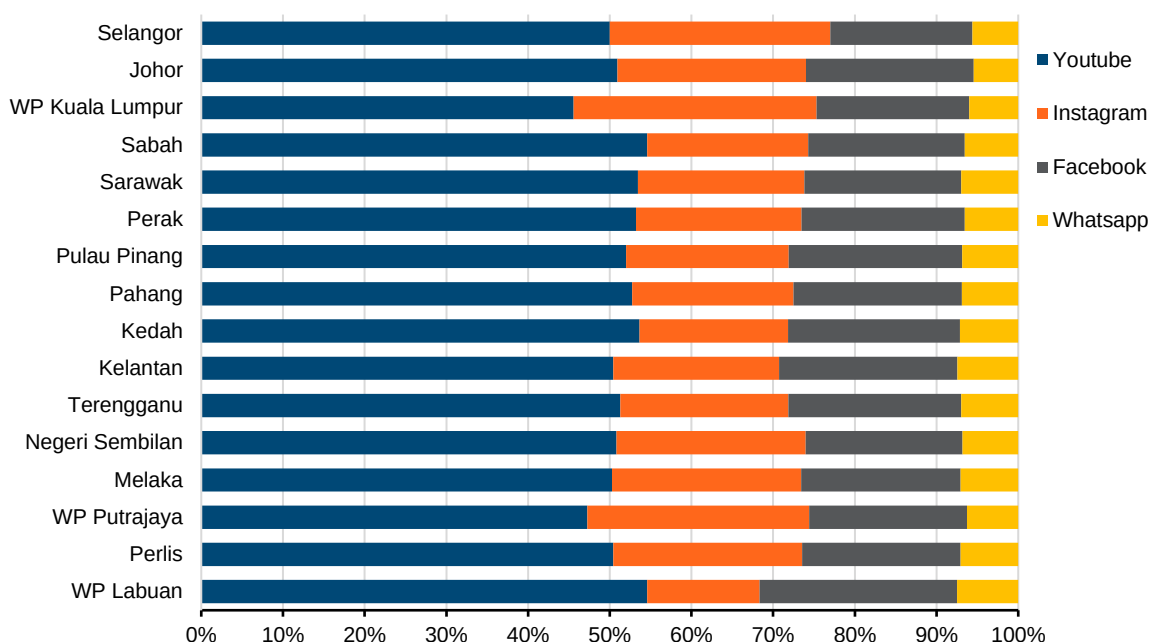
Figure 8. Online activities, 2018



Source: MCMC Internet Users Survey 2018

Communication, social networks, and video streaming

Figure 9. Unifi Mobile data usage for top four apps, by state, 2019



Source: Author's calculations based on TM Berhad data

Note: Share of data usage is limited to these four apps and does not represent total mobile data usage.

In 2019, mobile internet users in Malaysia used approximately 14 GB of data each month⁴⁰. Figure 9 shows the share of internet data used by four of the most popular data-intensive mobile apps in 2019. These four apps – YouTube, Facebook, Instagram, and Whatsapp – rank among the top ten mobile apps, in terms of data volume, used by unifi Mobile users in 2019.

These data are in line with the 2018 MCMC survey findings as three of these four apps are the preferred apps used for the two most popular online activities of 2018. Whatsapp was the most popular text communication app, being used by 98.1% of internet users who used such apps. Facebook and Instagram were the two most popular social networking apps, used by, respectively, 97.3% and 57.0% of social network users.

The fourth most popular online activity, video streaming, generated the most amount of data, which is expected as videos are data-intensive. Across all states, YouTube generated the biggest share of data volume, averaging 50% of data used by these four apps. While there are other apps and platforms used for video streaming, such as Astro Go, iFlix, and Netflix, YouTube was the most data-intensive app among unifi Mobile users.

Facebook was the most popular social networking platform among internet users in 2018, but in 2019 Instagram generated more data volume than Facebook among unifi Mobile users. This may not indicate Instagram's increased popularity among users, but simply be due to the Instagram's content being more data-intensive than Facebook's content.

Although it is the most commonly used app for the most common online activity (communication by text), Whatsapp data made up the smallest proportion of data traffic among the four apps. This

⁴⁰ This approximation is based on numbers in the Axiata, Digi, and Maxis 2019 annual reports.

is to be expected because, photo and video sharing notwithstanding, the majority of Whatsapp exchanges occur through text and voice, which have a smaller data footprint than videos.

While the data sample used in this analysis is not nationally representative, there is no reason to expect internet use behaviour to differ significantly across service providers. It is reasonable to assume that the data volume would be proportionally similar across service providers. This implies that the lion's share of internet data – and digital content – in Malaysia is being driven by Google and Facebook, which owns Instagram and Whatsapp, and all together make up four of the most data-intensive apps in the country.

Online banking

Online banking and financial activities comprised the ninth most popular online activity in 2018. Figure 10 shows the indexed growth trends of bank accounts, active online accounts⁴¹, and online financial transactions from 2011 to 2019. Figure 11 shows active online accounts as a percentage of total number of bank accounts from 2011 to 2019. The growth rate of online accounts, which increased starting in 2015, can be expected to continue or increase given the efforts made by Bank Negara Malaysia (BNM) to move Malaysia towards adopting electronic payments and becoming a cashless society.

Figure 10. Growth trends of bank accounts, online accounts, and online transactions, 2011–2019 (2011 = 1)

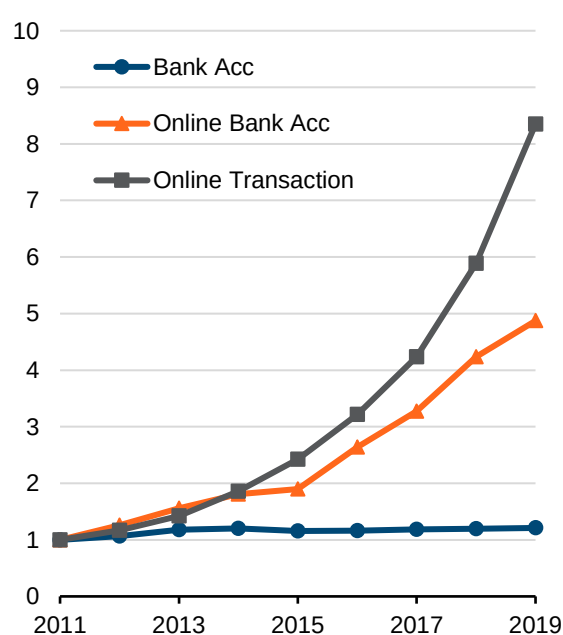
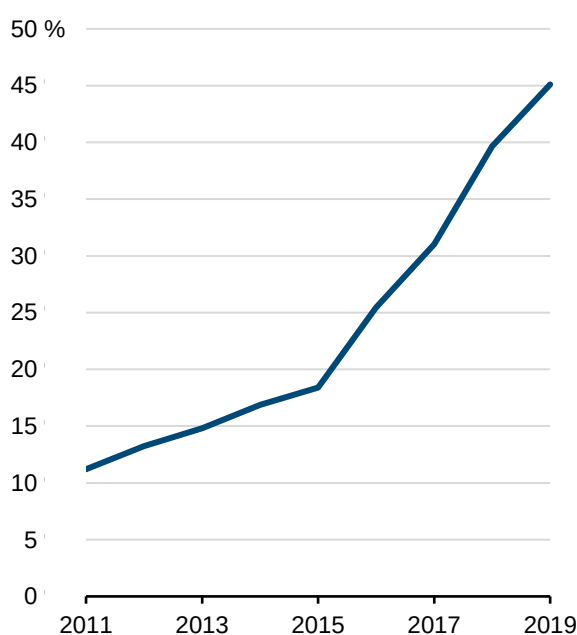


Figure 11. Online accounts as a percentage of total bank accounts, 2011–2019



Source: Author's calculations based on Bank Negara Malaysia data

The number of online transactions per month has increased almost nine-fold over the last nine years while the number of online accounts have increased five-fold. Online accounts remain less than half the total number of bank accounts in 2019, indicating that there is still room for growth

⁴¹ Active online accounts are defined as Internet/mobile banking subscriptions with at least one online transaction per month.

in digital financial services. The Covid-19 pandemic is likely accelerating the transition to cashless systems.

Not only do electronic payment systems provide cost savings and improve efficiency, but they are also a means of extending financial services to unbanked communities. In addition to digital banking services provided by traditional banks, BNM has issued licenses to 47 non-bank e-money issuers to provide electronic payment systems, including e-wallets such as Boost, GrabPay, and TouchNGo.⁴² Widespread take-up of digital financial services at all levels of society is important in facilitating the transition to a cashless society.

Implementing BNM's Interoperable Credit Transfer Framework (ICTF) would allow cross-platform transactions from bank accounts to non-bank e-wallet accounts. In a market with multiple e-wallets, such interoperability would improve efficiency and convenience by allowing an e-wallet user to seamlessly pay and receive funds from users of other participating e-wallets. Not only would this facilitate personal and commercial transactions, it could also facilitate the disbursement of social assistance and social protections, including the PRIHATIN economic stimulus package (PRIHATIN) funds, to financially under-served populations in rural and remote areas.

Online shopping

Online shopping was the tenth most popular online activity in 2018 and is likely to rise in the rankings as a result of the pandemic. Figure 12 shows the distribution by state of the number of Pos Laju e-commerce deliveries per thousand people in 2018 and the median monthly household income in 2016 relative to their respective national averages, which are scaled to zero. This means that Selangor's median household income in 2016 was approximately RM2000 more than the national average median household income and the number of e-commerce deliveries per thousand people in Selangor in 2018 was approximately 600 packages more than the national average of deliveries per thousand people.

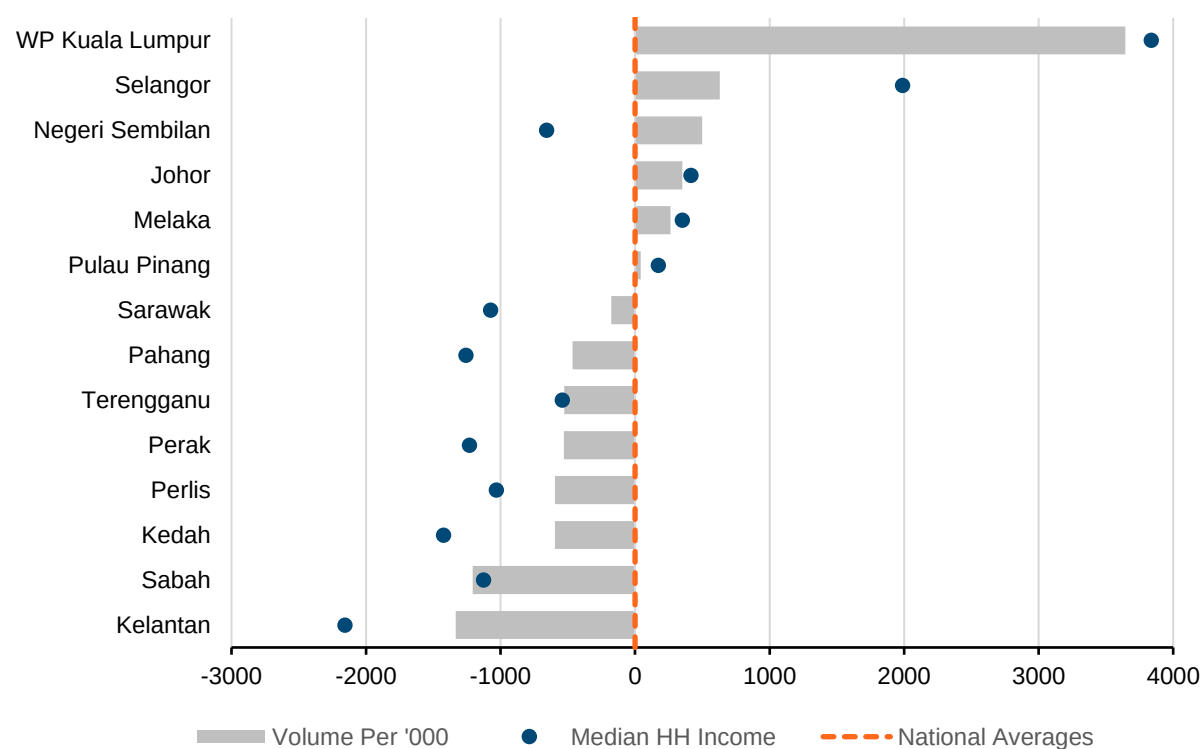
A pattern emerges between household income and online shopping, where states with higher median household incomes receive more e-commerce deliveries per thousand people, Negeri Sembilan being an exception to the rule. It should be noted that this chart represents e-commerce deliveries fulfilled by one specific courier whose market share may not be consistent across states. Nonetheless the data reveal how income inequalities and digital inequalities are linked.

These economic and digital inequalities can have public health consequences. Digital inequality scholars point out that those on the privileged side of the digital divide can work from home, stay in touch with friends and family online, and have their groceries, meals, and household supplies ordered online and delivered. They are better equipped to remain sheltered and connected, thus lowering their exposure and risk to the coronavirus⁴³. Nor are health concerns related solely to the coronavirus. Socially isolated individuals with limited or no internet connectivity during quarantines or movement control orders may face mental health challenges such as anxiety or loneliness and may not be able to get the regular healthcare they need without access to telemedicine.

⁴² Data on the take-up rates and geographic distribution of these electronic payment systems were not available at the time of writing.

⁴³ Robinson et al. (2020)

Figure 12. Pos Laju e-commerce deliveries per thousand people, by state, 2018



Source: Author's calculations based on Pos Malaysia data and HIS 2016

Further research and policy considerations

Three aspects of the digital divide in Malaysia have been examined in this paper: internet penetration rates (access), data pricing (affordability), and internet use (application).

Generally speaking, as at 2019, Malaysia is a highly digitally networked nation, with 90% of households using the internet, mostly through mobile broadband plans on smartphones. Internet usage trends show the digital generation gap closing, but the digital gender gap widening.

Mobile data plans are affordable and popular, with national mobile broadband subscription rates exceeding 130% while national fixed broadband subscription rates lag behind at 9.0%. However, internet users solely on mobile plans may not be able to take advantage of the benefits of fixed broadband connectivity unless they are able to pay for two broadband subscriptions. Despite data affordability, there remains a positive relationship between median household income and both fixed and mobile broadband subscription rates.

The most popular online activities among internet users in Malaysia are still oriented around communication, socialising, and media consumption, but economic activities rank highly as well, with approximately one in two internet users engaging in work-related activities, banking, and shopping online.

What then of the story of Veveonah Mosibin that opened this paper? First and foremost, her story demonstrates that there remains a need for improved network coverage and quality of service, important supply-side considerations that are outside the scope of this paper.

Her story also underlines why the digital divide is a pressing policy issue that needs to be considered from a demand-side perspective. As discussed earlier, improving digital access, affordability, and literacy could lead to gains in educational attainment, economic opportunity, and health literacy, all of which are important as Malaysia recovers from the Covid-19 pandemic and continues its development and growth, including its efforts towards digital inclusion.

What is digital inclusion?

Digital inclusion is a broad policy-driven approach towards ensuring that “all individuals and communities, including the most disadvantaged, have access to and use of Information and Communication Technologies (ICTs). This includes 5 elements:

- 1) affordable, robust broadband internet service;
- 2) internet-enabled devices that meet the needs of the user;
- 3) access to digital literacy training;
- 4) quality technical support; and
- 5) applications and online content designed to enable and encourage self-sufficiency, participation and collaboration.

Digital inclusion must evolve as technology advances. Digital inclusion requires intentional strategies and investments to reduce and eliminate historical, institutional and structural barriers to access and use technology”⁴⁴.

⁴⁴ National Digital Inclusion Alliance (n.d.)

Digital inclusion is about more than closing the digital divide. Building more infrastructure, improving network performance, and developing devices and apps that are easier to use and more secure are important technical solutions to the problem of the digital divide. But digital inclusion also requires social solutions, including addressing social inequality, rethinking social norms and behaviours, and thinking proactively about the societal implications of digitalization, including education, healthcare, and social cohesion.

Providing affordable digital access is just the first step in the digital transformation of a society. Researchers and policymakers would do well to consider the societal implications of an increasingly digital population before jumping ahead to automation, artificial intelligence, and 5G. Digital literacy, data privacy, cybersafety, and surveillance are just some of the issues that need to be addressed as part of the nation's digital inclusion efforts.

The findings of this discussion paper invite further investigation on the uses, benefits, and risks of digital technologies in a networked, data-driven society. The following topics are presented for both research and policy consideration:

1. Internet access as a public utility

Internet access is important for more than just economic outcomes, and is key to social development. As described earlier, the UN has declared internet access a human right and several countries have made it a legal requirement that all their citizens have access to the internet. This policy implies that governments should take the lead on the funding and provision of infrastructure in non-profitable areas, especially rural areas deemed unprofitable to private service providers.

In Malaysia, this is managed using the Universal Service Provision (USP) fund under Section 204 of the Communications and Multimedia Act (CMA) 1998. Telecommunications licensees whose annual revenue exceeds RM2 million contribute 6% of their weighted net revenue to the USP fund. This fund is currently the central source of funding for the NFCP but, should this prove insufficient to ensure universal coverage of populated areas, additional funds should be allocated for the provision of internet infrastructure.

The public sector should be cautious of entering into public-private partnerships where private companies take the lead on both funding and service provision. Facebook's Free Basics programme was intended to bring free internet access to rural areas in India by allowing users to access a limited set of websites and apps. India's telecommunications regulators rejected this plan because it violated net neutrality, meaning that it privileged some services (including Facebook) instead of allowing equal access to all online content⁴⁵.

2. Measurement of meaningful metrics

As described earlier, the A4AI has proposed a new standard on meaningful connectivity, which includes four dimensions: enough speed, an appropriate device, enough data, and daily access. The organisation has proposed a method of applying this standard and has tested it in Colombia, Ghana, and Indonesia⁴⁶. The adoption of these metrics to complement internet penetration rates

⁴⁵ Bhatia (2016)

⁴⁶ Alliance for Affordable Internet (2020)

would allow policymakers to identify specific dimensions where a digital divide might exist and to address those gaps accordingly.

The A4AI standard also calls for a gender-disaggregated measure along these dimensions to examine where gender inequalities might exist. Because national identification numbers used to register broadband subscriptions include information on gender, Malaysia is well-placed to gather this data as a means of evaluating the efficacy of its gender-responsive broadband policies.

Existing surveys included data on gender, but data analysis was not always done with gender-disaggregation in mind. Allowing researchers access to existing microdata that includes gender information would permit historical analysis of digital gender inequalities to better assess if the gaps are closing.

3. The benefits of fixed broadband

Several studies have found that mobile broadband is a substitute for fixed broadband while fixed broadband is a complement to mobile broadband⁴⁷. This corroborates the finding that mobile connectivity is becoming far and away the preferred means of internet access, driven by the advance and falling prices of mobile devices and mobile services globally⁴⁸.

Nonetheless, fixed broadband has several advantages over mobile broadband, typically offering higher data transfer speeds, better network stability, and unlimited data. For a household that generates high amounts of media streaming traffic, whether streaming movies for entertainment, attending video conferences for work, or attending university or school classes, a fixed broadband subscription would be a useful supplement to individual mobile subscriptions. This is particularly important in Malaysia where the most popular online activities are all data-intensive.

Furthermore, fixed broadband access, whether at home, work, or school, is associated with a non-mobile access device, such as a desktop or laptop computer, on which, arguably, users are more likely to be engaging in educational and/or productive work, compared to mobile access devices such as tablets and smartphones. The next generation of workers are likely to develop and hone their digital skills such as data analysis, coding, and design on non-mobile devices that have greater processing power and better network performance. As such, the provision of internet infrastructure should not be entirely focused on mobile service provision while fixed broadband service provision is neglected.

4. Subsidies for devices, not just data

Analysis for the Inclusive Internet Index corroborates the finding that Malaysia's data pricing plans are generally affordable. However, it also finds that Malaysia does not perform as well with respect to the affordability of access devices, e.g. entry-level smartphones⁴⁹. Malaysian schools wrestled with online education in response to the Covid-19 pandemic as 37% of students did not have appropriate learning devices at home⁵⁰.

As with considerations of the value of fixed broadband connectivity, so with considerations of non-mobile access devices such as personal computers. Research indicates that having access to

⁴⁷ Bae, Choi, and Hahn (2014), Prieger (2013), Srinuan, Srinuan, and Bohlin (2012)

⁴⁸ Roessler (2018)

⁴⁹ The Economist Intelligence Unit (2020)

⁵⁰ Hawati Abdul Hamid and Jarud Romadan Khalidi (2020)

an internet-enabled device is more effective than reducing mobile prices in increasing broadband penetration⁵¹. Programmes subsidising or providing devices to under-served groups could be developed alongside programmes subsidising broadband subscriptions. Once network infrastructure has been established, the USP fund could be redirected for this purpose, which is still in line with its objective to provide access to internet access throughout the country.

5. Reformatting of legal codes

The UN Broadband Commission for Sustainable Development notes that there are potential downsides to digital connectivity, especially for vulnerable groups such as women, children, and seniors. These downsides include online harassment, stalking, bullying, hate speech, exploitation, fraud, and scams. Legal frameworks and digital laws that take into account digital technologies have to be developed or amended from existing laws to better protect internet users from these risks. This entails a review of existing laws written in and for an analog world to ensure they can be appropriately applied in a digitalized society.

Also needed are regulations around data governance that protect individual privacy and national data sovereignty. The existing Personal Data Protection Act (PDPA) restricts how personally identifying data may be distributed but is rarely enforced⁵². The European Union's General Data Protection Regulation (GDPR) provides a model that limits personal data collection to only what is necessary, does not allow data to be used for purposes other than what was originally intended, and limits how long data can be stored.

6. Focusing on fundamentals first

There is much to be said about (and for) technological developments and innovative applications such as 5G and artificial intelligence leading to the development of smart cities that respond to citizen actions and needs in real-time. However, before they can benefit from those technologies, Malaysians should first have meaningful universal connectivity.

For example, much has been made of the improved performance of 5G connectivity that will enable things like remote surgery and sensor-controlled factories. But in order to provide 5G service, additional infrastructure must be built, and 5G poles must be even more closely placed to each other than current telecommunications towers providing 3G and 4G service.

Furthermore, internet users will need newer and more expensive devices that are 5G-compatible. This implies that urban and industrial areas are more likely to benefit from 5G compared to rural and agricultural areas, further increasing socio-economic inequality.

A more digitally inclusive policy should prioritise improving digital education and the suite of digital services available to internet users at all strata of society. This includes (1) improving digital literacy, e.g. avoiding scams and verifying information on social media; (2) improving digital skills, e.g. software, coding, and data analysis; and (3) improving digital services provision, e.g. government and financial services websites and apps.

⁵¹ Hawthorne and Grzybowski (2019)

⁵² Gong and Chiam (2019)

Conclusion

This paper presents an overview of state of broadband connectivity and internet use in Malaysia as at 2019, but as with much in the field of digital technology the statistics cited within will soon be obsolete, if they are not already. However, the problem of digital inequalities and the challenges to meaningful connectivity and digital inclusion are prevailing and pressing policy issues. Research must keep up with rapidly changing trends in order to understand how technological advances affect social and economic outcomes. Policy must be flexible enough to adjust to new and unintended consequences of digital transformation. Technology, especially digital technology, evolves quickly, and the appropriate policy response should be to move fast without breaking things.

Appendix: data pricing calculations

The data pricing analysis in this paper is based on a dataset compiled from archives of technology and/or news websites that listed or compared broadband pricing plans in Malaysia from 2012 to 2019. The data were retrieved from multiple sources by a researcher, and the details were verified by a second researcher.

Next, researchers estimated the cheapest available mobile data plans in Malaysia using a modification of the ITU's method⁵³ of determining the cheapest handset-based mobile prepaid broadband plan per country. The ITU's method identifies the cheapest plan(s) providing at least 1GB of broadband data over a 30-day period from the largest mobile network operator in each country. The modified version used here does not restrict data pricing plans to the single largest mobile provider in the country or to a 1GB minimum. However, only the three major service providers (Celcom, Digi, and Maxis) were considered and the cheapest among the three was selected for analysis. Price per GB of mobile data was then calculated based on the cheapest plan.

This process was repeated for the cheapest available fixed broadband plan with unlimited data and a fibre connection, thus eliminating asymmetric digital subscriber line (ADSL) plans that use copper wires from consideration. The cheapest fibre plans came at the lowest speeds, with the lowest speed being a 5 Mbps plan in 2014. Since these plans came with unlimited data, price per GB was not calculated.

The team then calculated 2019 affordability based on the A4AI's 1 for 2 standard, using median monthly income instead of gross national income per capita. Median monthly income was sourced from DOSM's 2019 HIS and adjusted from the household to the individual level by dividing the median household monthly income by the average number of income recipients per household in 2019 i.e. 1.8.

An estimate of price per GB of fixed broadband data was derived based on the following assumptions. First, average mobile broadband data usage in terms of total data volume is representative of the average internet user, regardless of whether they also have a fixed broadband subscription. Second, approximately two thirds of usage occurs at home. Third, if internet users have a fixed broadband subscription at home, they will use that while at home instead of their mobile broadband subscription. Fourth, the average household includes two internet users. Thus, estimating the average monthly mobile data use to be 14 GB in 2019 based on annual reports from Axiata, Digi, and Maxis, this means that the average fixed broadband home subscriber uses $\frac{2}{3} * 14 * 2 = 18.67$ GB per month.

⁵³ International Telecommunication Union (n.d.)

Table A1 shows the cheapest price of prepaid mobile, postpaid mobile, and fixed mobile data as well as the median monthly household income by state in 2019.

Table A1. Data prices and median household income, by state, 2019

State	Prepaid mobile (per GB)	Postpaid mobile (per GB)	Fixed broadband (unlimited data)	Median monthly household income
WP Kuala Lumpur	5.00	3.27	89.00	10549
WP Putrajaya	5.00	3.27	89.00	9983
Selangor	5.00	3.27	89.00	8210
WP Labuan	5.00	3.27	89.00	6726
Johor	5.00	3.27	89.00	6427
Pulau Pinang	5.00	3.27	89.00	6169
Melaka	5.00	3.27	89.00	6054
Terengganu	5.00	3.27	89.00	5545
Negeri Sembilan	5.00	3.27	89.00	5005
Perlis	5.00	3.27	89.00	4594
Sarawak	5.00	3.27	89.00	4544
Pahang	5.00	3.27	89.00	4440
Kedah	5.00	3.27	89.00	4325
Perak	5.00	3.27	89.00	4273
Sabah	5.00	3.27	89.00	4235
Kelantan	5.00	3.27	89.00	3563

Sources: Author's calculations based on web archive data and HIS 2019

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