

DISCUSSION PAPER SERIES NO. 2022-47

The Philippine Digital Sector and Internet Connectivity: An Overview of the Value Chain and Barriers to Competition

Ramonette B. Serafica and Queen Cel A. Oren



The PIDS Discussion Paper Series constitutes studies that are preliminary and subject to further revisions. They are being circulated in a limited number of copies only for purposes of soliciting comments and suggestions for further refinements. The studies under the Series are unedited and unreviewed. The views and opinions expressed are those of the author(s) and do not necessarily reflect those of the Institute. Not for quotation without permission from the author(s) and the Institute.

CONTACT US:

RESEARCH INFORMATION DEPARTMENT
Philippine Institute for Development Studies

18th Floor, Three Cyberpod Centris - North Tower
EDSA corner Quezon Avenue, Quezon City, Philippines

publications@pids.gov.ph
(+632) 8877-4000

<https://www.pids.gov.ph>

The Philippine Digital Sector and Internet Connectivity:
An Overview of the Value Chain and Barriers to Competition

Ramonette B. Serafica
Queen Cel A. Oren

PHILIPPINE INSTITUTE FOR DEVELOPMENT STUDIES

December 2022

Abstract

The size of the digital sector is significant and comprises various activities, processes and industries. The interdependence of different markets within and across segments of the digital value chain implies that barriers to entry and expansion in one industry can have far reaching effects on the growth of the rest of the digital sector and the economy, more widely. Ensuring robust competition across the digital value chain is therefore of paramount importance.

Internet connectivity is the most critical element of the value chain as it links the various participants in the digital sector to the final users or consumers. It is also the segment that has highest barriers to entry. Although natural barriers exist, regulatory and strategic barriers further constrain competition. Thus, access regulations will need to be strengthened and enforced. An open access framework and increased transparency will facilitate the growth of broadband. Adapting M&A guidelines, effective cross-sectoral regulatory cooperation, and investment in training will also reduce barriers to entry and expansion. Partnerships between the private and public sectors will be necessary as well to significantly reduce the digital divide in the country.

The telecommunications industry has been dominated by two vertically integrated firms, which are also expanding their service portfolios to other segments. While vertical integration along the digital value chain could create efficiencies, significant market power could also enable anti-competitive conduct and limit innovation. In the digital age, competitive pressures must be built into the entire value chain by lowering barriers to entry and expansion, removing bottlenecks to innovation, and reducing switching costs. Further analysis of particular segments or specific bottlenecks and anti-competitive practices will be useful in crafting appropriate regulatory approaches.

Keywords: ICT, telecommunications, digital, internet, value chain, competition

Table of Contents

1. Introduction	1
1.1 Objectives	1
1.2 Methodology	2
1.3 Organization and scope	2
2. Sector overview	2
2.1 The internet value chain	2
2.2 Competition bottlenecks in the digital sector	5
2.2.1 Types of barriers	5
2.2.2 Issues and challenges with digitalization	7
3. Participants in the internet value chain	11
3.1 Content rights	11
3.2 Online services	12
3.2.1 E-retail	12
3.2.2 E-travel	13
3.2.3 Video and audio	14
3.2.4 Gaming and Gambling	14
3.2.5 Search and information and reference	14
3.2.6 Social	14
3.2.7 Other online services	14
3.3 Enabling technology and services	15
3.3.1 Payment platforms	16
3.3.2 Content delivery services	16
3.3.3 Online advertising services	17
3.3.4 Design and hosting	17
3.4 Internet access connectivity	17
3.5 User interface	18
3.5.1 Hardware devices	18
3.5.2 Systems and software	19
4. Internet connectivity value chain	19
4.1 International link	20
4.2 Domestic backbone	23
4.3 Middle mile	25
4.3.1 Internet exchange points (IXPs)	26
4.3.2 Data centers and cloud services	26
4.3.3 Telecommunications tower	28
4.4 Last mile	30
4.4.1 Telco operators	31

4.4.2	Cable TV operators	42
4.4.3	Other Internet Service Providers	45
5.	Regulatory framework	46
5.1	Sector laws and regulations	46
5.2	Competition law	51
6.	Competition issues in the internet access connectivity segment	52
6.1	Barriers to entry and expansion.....	52
6.2	Examples of complaints or cases	53
7.	Key findings and implications	54
8.	Reference	59
9.	Appendix A. Members of selected IXPs	69

List of Tables

Table 1.	Types of barriers to entry	5
Table 2.	Examples of recent competition cases or concerns.....	10
Table 3.	Online services segment: Top websites by traffic share in the Philippines from August to October 2022	15
Table 4.	Enabling technology and services segment: Top websites by traffic share in the Philippines from August to October 2022	16
Table 5.	Web hosting and domain names websites in the Philippines by traffic share, August to October 2022	17
Table 6.	International Submarine Cable Systems with Landing Stations in the Philippines .	21
Table 7.	Domestic Submarine Cable Systems	24
Table 8.	How data can travel between content provider and internet service provider	25
Table 9.	Internet exchange points in the Philippines	26
Table 10.	Datacenters in the Philippines	27
Table 11.	List of Independent Tower Companies (ITCs), August 2022	28
Table 12.	Internet Service Provider with valid certificate from the NTC (as of 31 August 2022).....	31
Table 13.	PLDT Subsidiaries, ownership, and principal business activities	35
Table 14.	Globe Subsidiaries, ownership, and principal business activities	38
Table 15.	Market concentration of mobile services in selected ASEAN countries.....	41
Table 16.	Estimated number of member cable TV operators of PCTA by region, September 30, 2022	43
Table 17.	Satellite/VSAT providers with coverage including Philippines	46
Table 18.	Level of competition allowed in each service	47

List of Figures

Figure 1. The internet value chain	3
Figure 2. Illustrative service portfolios of Facebook and Google	4
Figure 3. Most popular YouTube channels in the Philippines by number of subscribers, September 2022	12
Figure 4. Percentage of internet users ages 16 to 64 who have purchased the following products online, Q2 to Q3 2021	13
Figure 5. Annual spend in each consumer goods e-commerce category (in USD billion), 2021	13
Figure 6. Philippines: Device ownership of internet users aged 16 to 64, February 2022	18
Figure 7. Philippines: Market share for mobile vendor, October 2021 to October 2022	19
Figure 8. Philippines: Market share for mobile and desktop operating system, October 2021 to October 2022	19
Figure 9. Internet connectivity value chain.....	20
Figure 10. Cable landing stations in the Philippines and connected international submarine cable systems	21
Figure 11. Gross revenue of telcos/ISP (in millions), 2019.....	32
Figure 12. PLDT service revenues, 2018-2021	33
Figure 13. Globe service revenues, 2019-2021	33
Figure 14. Converge ICT revenues, 2019-2021	34
Figure 15. PLDT service portfolio	37
Figure 16. Globe service portfolio	39
Figure 17. Market share based on number of subscriptions	40
Figure 18. CATV Stations by region, 2019	42
Figure 19. Cities and municipalities with PCTA cable TV operators by region, September 2022	44
Figure 20. Income classification by region for cities/municipalities with at least one PCTA cable TV operators, September 2022	45

List of Boxes

Box 1. Barriers identified in the telecommunications sector	6
Box 2. Bottlenecks in the provision of internet connectivity	7
Box 3. Examples of barriers to entry in the digital age.....	9

The Philippine Digital Sector and Internet Connectivity: An Overview of the Value Chain and Barriers to Competition

Ramonette B. Serafica and Queen Cel A. Oren*

1. Introduction

The economic contribution of the digital economy is significant and growing. In 2021, digital transactions covering digital-enabling infrastructure, e-commerce, and digital media/content accounted for 9.6 percent of GDP. From PHP1.73 trillion in 2020, the gross value added increased by PHP1.87 trillion in 2021, or an increase of 7.8 percent (PSA 2022a).

Digital businesses have become core drivers of digitalization to supply digital solutions to firms and consumers, contributing to overall economic growth. However, the number of digital businesses in the Philippines is only 0.5 per USD1 billion of GDP, which is lower than its regional counterparts, such as Cambodia (1.43) and Vietnam (.92). Median investment in the country (USD0.5 million) is also low compared to peer countries, such as Vietnam with USD0.6 million, Cambodia with USD1.2 million, and Indonesia USD1.6 million.

Underpinning the digital economy is broadband, which is high-speed access to the Internet DICT (2017). In 2017, firms across sectors used the internet to send or receive emails, exchange information within and outside their organizations, and conduct finance accounting and auditing. The IT-BPM industry in particular, has employed it for recruitment. While 92 percent of employees in the IT-BPM industry use computers with internet access, only 57 percent and 38 percent of employees in the Information Economy and Non-core ICT industries, respectively, use computers with internet access routinely at work (SICT 2017). However, the internet adoption in the Philippines has increased, especially attributed to the COVID-19 pandemic.

The availability of quality, affordable broadband services in the Philippines, both for business operations and service provision, is essential to facilitate innovation, support economic productivity and growth, improve government services, and reinforce social inclusion as well as preserve cultural norms (DICT 2017, p.2). Enhancing competition in services, particularly backbone or infrastructure services such as telecommunications, is a priority since broadband services are not only critical elements of digital value chains but are essential to all industries.

With the growing size of the digital economy and the drive for digital inclusion, understanding the components of the digital economy, relevant regulations, and current competition issues, particularly in the internet connectivity segment, will help policymakers and implementing agencies formulate policies and regulations to promote further entry and expansion.

1.1 Objectives

Continuing on from Serafica and Oren (2022) which looked the overall ICT regulatory regime, this paper seeks to gain a better understanding of the market participants and the regulations that govern the competition in the market.

* Senior Research Fellow and Research Specialist, respectively, at the Philippine Institute for Development Studies. The authors are grateful to the Philippine Cable and Telecommunication Association, Inc and Dr. Kris A. Francisco of PIDS for sharing invaluable information and insights. The administrative and research assistance of Ms. Junalyn Bayona is likewise acknowledged. The views expressed in this paper are those of the authors and do not necessarily reflect the position or official policy of any company or any agency of the Philippine government. The authors are solely responsible for the analysis and conclusions in this paper including any errors

General Objective

In general, the study will provide a first look at the digital value chain in the Philippines and evaluate competition issues in the sector.

Specific Objectives

Specifically, the study will:

1. Describe the current digital value chain in the Philippines including key players, bottlenecks and barriers to competition focusing on a specific component of the value chain.
2. Identify potentially anti-competitive laws and regulations that may affect firm entry and expansion.
3. Propose regulations or policies to address the identified competition issues. Areas/sectors that need further study/investigation will also be identified.

1.2 Methodology

A review of the literature is first conducted to understand the digital value chain and related competition issues. To describe the characteristics of the Philippine market, the study looked at industry and trade statistics from the PSA, company annual reports, and market studies. Administrative data from relevant government agencies were also used. Based on industry analysis and the review of the regulatory framework, interviews were conducted to identify policy-induced barriers to firm entry and expansion.

1.3 Organization and scope

The next chapter describes the digital value chain and discusses the competition issues that may arise. It identifies the different types of barriers to entry and expansion as well as the impacts of digitalization on competition. An overview of the market participants and trends in the Philippine digital value chain is presented in Chapter 3, which provides examples of the various companies and activities. The following three chapters focus on a key segment of the digital value chain - internet access connectivity. Chapter 4 looks at the components of connectivity in greater detail and highlights the services provided by key players while Chapter 5 presents the relevant laws and regulations. The specific barriers to entry and expansion are presented in Chapter 6 while the final chapter summarizes the key findings and provides recommendations for policy and further research.

2. Sector overview

2.1 The internet value chain

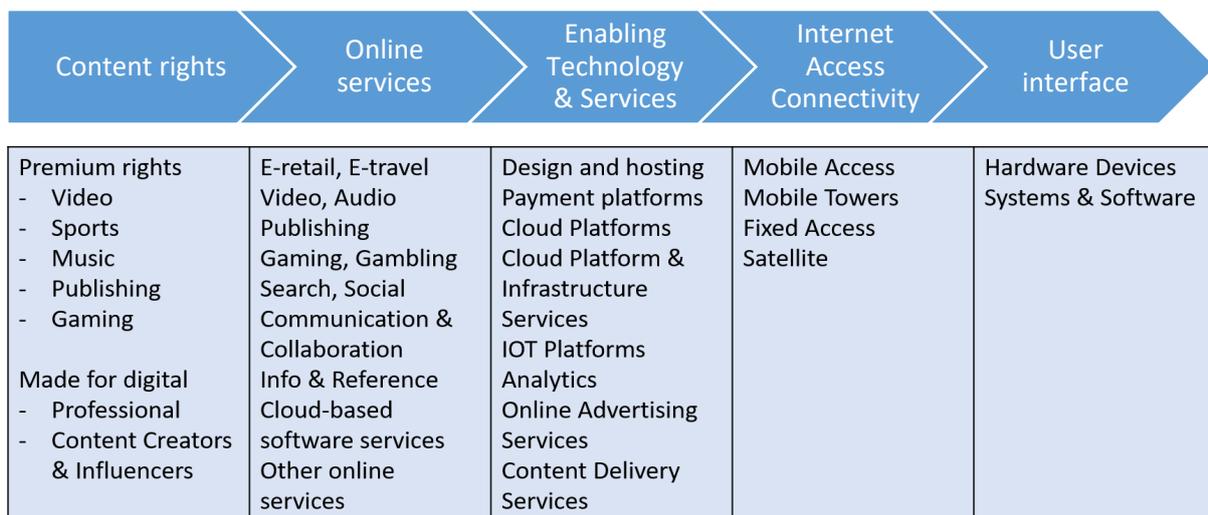
From the acquisition or production of digital content to its delivery and final consumption, Figure 1 shows the internet value chain developed by A.T. Kearney for GSMA (2022):

- Content rights – involve the acquisition of commercial property rights to distribute content via the internet. These rights are monetized by selling the content in various platforms and services (e.g., subscription, on-demand services, YouTube, social media, and other platforms).
- Online services – This includes services apparent to internet users, such as e-commerce, where products or services are transacted online and consumed either online or offline; entertainment (e.g., video or music streaming); search, information, and reference services which are funded by advertising or subscription; and social media and

communications. It also involves B2B services for companies, such as cloud-based software services and other e-services.

- Enabling technology and services - These services are usually hidden to internet users but are a very important part of the value chain since it supports online services. It comprises of Design and hosting of websites, Online payment gateways and e-wallets, Cloud-based infrastructure and platform services, platforms that manage and process data from the Internet of Things (IoT) devices, Online advertising services, and Content delivery services.
- Internet access connectivity – These services are paid for by users to connect to the internet. Internet connectivity can be a form of mobile or fixed connection. This segment also covers mobile towers, which provide service to various operators and satellite services.
- Use interface – This refers to the most tangible part of the value chain, such as hardware devices, operating systems, and internet-related software. In addition to smartphones or web browsers on a PC, other devices such as smart TVs, household appliances and vehicles are used to access internet-based services.

Figure 1. The internet value chain



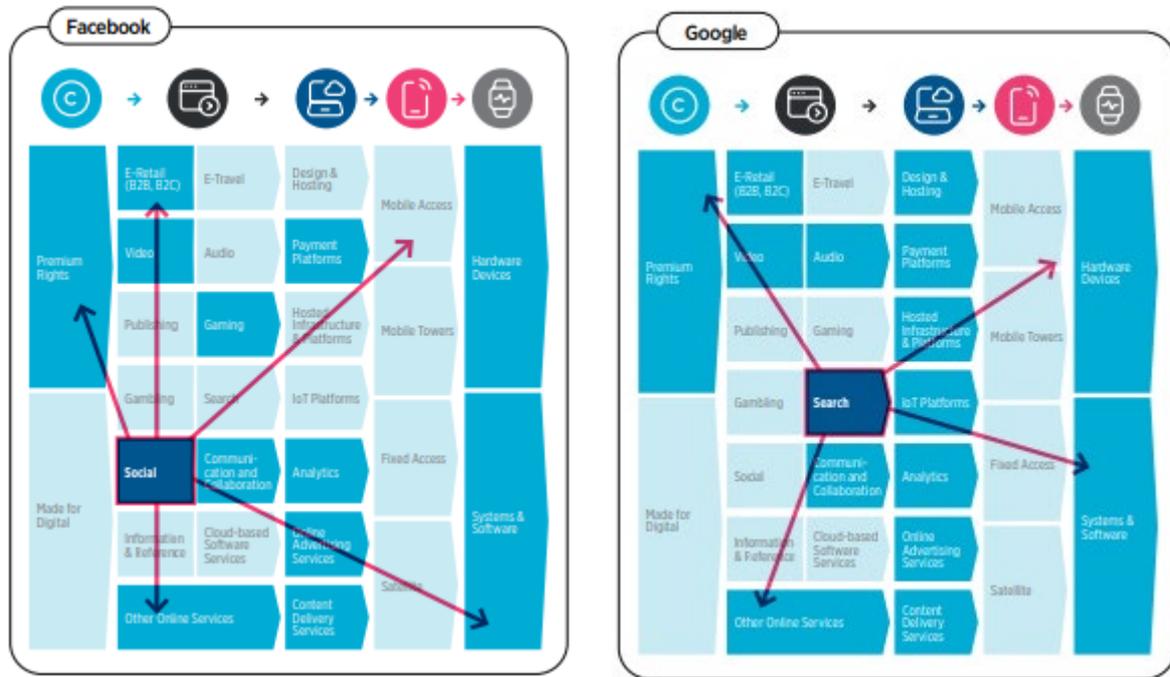
Source: GSMA (2022)

The total revenue of the internet value chain in 2020 was estimated at \$6.7 trillion globally, reflecting an annual growth of 15 to 16 percent from 2008. Moreover, more than half or 57 percent of the revenues generated in 2020 came from the online services segment, followed by internet access connectivity (15 percent), user interface (14 percent), enabling technology (12 percent), and finally content rights (3 percent) (GSMA 2022).

Key trends in the digital value chain are also emerging globally (GSMA 2022). The shift to online activities is expected to accelerate with the increase in digitalization in both private and public enterprises. Consumers will likewise spend more online as the majority of services are going to be paid-for rather than supported through advertising. Gaming, subscription entertainment services, and enterprise cloud-based services will be the key drivers of revenue growth. Advertising will continue to focus on search engines, social media platforms, and ad-supported video services. Another development is the expansion of the large technology players across the value chain. New online services are being launched as companies use their scale and existing customer bases to move to new segments, leading to integration along the value chain. Strategies include buying up content rights players and enabling technologies as

well as investing in end-user devices (See Figure 2 for examples). The rise of super-apps in Asia also reflects this trend toward integrated platforms and ecosystems that connect users to online services.

Figure 2. Illustrative service portfolios of Facebook and Google



Note: Darker shading indicates the original or core service segment
 Source: GSMA (2022, p.25)

Given the complexity of the digital value chain with numerous layers and players, the term **value web** is deemed more suitable to reflect the convergence of previously separate value chains (GSMA 2015; European Parliament 2015). Within the broad scope of the digital value chain described above are multiple other clusters of activities, processes, and industries. Internet access connectivity for example, is made up of different segments. The international link, composed of international submarine cable systems, cable landing stations, or satellite facilities, carries data traffic between network facilities from one country to another. The national backbone network connects the major regions. The middle mile carries data from the domestic backbone to the nearest aggregation point, such as core networks of internet service providers (ISPs) in the provinces, cities, or municipalities. Lastly, the last mile is the final segment of the network that connects to the end-users (Mirandilla-Santos 2021; See also Salac and Kim 2016). In the case of an online service such as e-retail, apart from platform itself, the distribution channel that facilitates the sale and delivery of a good from the seller to the final buyer involves specialized intermediaries such as market research and consulting firms, e-marketing firms, payment systems, and logistics providers (Seráfica, et al. 2020). Ultimately however, the various participants of the internet value chain from the content producers to the online service providers as well as device manufacturers are dependent on the broadband access network to reach the final users or consumers (GSMA 2015).

2.2 Competition bottlenecks in the digital sector

2.2.1 Types of barriers

There are various ways to define barriers to entry. They may be classified into three categories: natural, strategic, and regulatory, as shown in Table 1. There might also be gender barriers in some situations involving culture or religion (DFID 2008).

Table 1. Types of barriers to entry

Type	Description
Natural barriers	Result from the resources/raw materials or technology needed to become a supplier in the market. They could include the existence of large economies of scale, such as with network industries. Economies of scale arise when the average cost per unit of output decreases with the increase in the scale of the output produced and economies of scope occur when it is cheaper to produce two products together than to produce them separately. When economies of scale and scope are present, new entrants or smaller firms are unable to produce as efficiently as larger firms or produce as many products. Another example is where entry into a market would require large ‘sunk costs’ (i.e., those that could not be recovered if an entrant subsequently decided to leave the market.)
Strategic barriers (or Conduct of incumbent firms)	Result from actions by existing suppliers to protect their position in the market, which could include: <ul style="list-style-type: none"> • ‘bundling and tying’ (to force new entrants either to compete for the grouped products or to compete on one product) • arranging long term exclusive contracts and exclusive supply and distribution agreements; • fixed-term/exclusive contracts to lock-in customers; • denying/restricting access to essential facilities, etc.
Policy & Regulatory barriers (can exist at any level of government)	Regulatory rules that limit the number of market participants Government licensing requirements and planning regulations, statutory monopoly power and tariff and non-tariff barriers Regulations by professional organizations Lengthy and costly bureaucratic procedures to start new businesses. With regard to industrial property, namely patents for inventions, and copyright laws, new entrants and smaller firms may not be able to access patented technology or copyrighted content.

Sources: DFID (2008, pp. 16 – 19); ASEAN (2020, pp. 28-29); CCS (2017)

There could be good reasons for the existence of strategic and regulatory barriers. For example, bundling and tying practices could result in cheaper bundled products than when sold separately or long term exclusive contracts could also result in more stable or predictable supply. Regulatory barriers could also be based on legitimate public policy reasons, such as health and safety concerns as well as those relating to national security.

Sector-specific barriers arise as a result of the intrinsic characteristics of an industry or legacy laws and regulations that have not been updated with changes in technology. Some of the competition issues in the telecommunications sector are featured in Box 1.

Box 1. Barriers identified in the telecommunications sector

Additional forms of competition issues may arise due to network externalities and the dynamic nature of the telecommunications industry. The following are some issues that may emerge during or after liberalization process:

- A conflict of interest may arise when the incumbent operator continues to play a part in the sector's policy-making or regulation.
- Buyers of privatized telecommunications firms might be granted exclusive rights to offer services for a substantial amount of time, hindering competition during such time.
- There may be issues with interconnection of new entrants with incumbent operators, such as in terms of the basis for charging calls. There may also be allegations wherein the dominant player is not providing quality and efficient services to other players.
- Different license fees could be set for various service types, such as the cost for wireless in local loop services versus mobile services, which would distort entry patterns.
- Customers may be less willing to switch service providers if phone numbers are not portable. The ability to choose a provider may be further restrained if consumers of new telecommunications firms must also use additional access codes.
- It is vital to strategize how universal service obligations can be funded.
- Possible anti-competitive behavior of incumbent players might include service bundling, predatory behavior, and exclusionary agreements (e.g., between dominant player and mobile phone distributors).
- In some circumstances, expensive long-distance service fees may continue to cross-subsidize local basic services. The degree of any such cross-subsidies can be determined by accounting separation. More stringent solutions may be necessary to eliminate them.
- It may be necessary to clarify the functions of the telecommunications regulator and the competition authority (if one exists).

It is vital to take into account how prospective service providers will have access to radio spectrum given the growing convergence of electronic communications.

Source: DFID (2008 pp. 47-48)

In order to curtail the power of a vertically integrated firm from abusing its dominant position through exclusionary practices, access regulation is often applied in the telecommunications industry. The goal is to reduce the likelihood that a vertically integrated business would exploit its market dominance in the wholesale market into downstream markets. This is crucial in the telecommunications industry since new players and resellers depend on the supply of wholesale input for their retail services.

In the internet connectivity segment, bottlenecks could also arise from practices employed by vertically integrated companies which have substantial control over the infrastructure (Akue-Kpakpo, 2013). Examples of such practices include denial of access to the local loop, refusal to lease bandwidth or setting high tariffs to lease bandwidth (See Box 2).

Box 2. Bottlenecks in the provision of internet connectivity

The market for internet service provision

- Anti-competitive practices - These occur routinely and are mainly related to the wired local loop. They may take the form of long delays in conversion to ADSL or to repair customers' lines.
- Denial of access to the local loop.
- Competition with ISPs by incumbent operators - In many countries, incumbent operators are direct competitors with their own customers, competing, through the parent organization or a subsidiary, with the Internet service providers.
- Refusal to lease international bandwidth to restrain competition – Operator may refuse on the grounds that the service provider does not have a license to provide telecommunications services to the public. Setting prohibitively high tariffs for small service providers is another way they restrain competition.

The market for Internet backbone provision

- Inadequate infrastructure leading to uncompetitive infrastructure leasing market
- Monopoly over existing infrastructure and anticompetitive practices with regard to infrastructure access – For example, refusal to lease bandwidth on optical fiber or radio relay links, despite spare capacity. Operators do not have access to incumbent operators' infrastructure which they need in order to use the international Internet bandwidth have to go through a VSAT link, which costs more.

Source: Akue-Kpakpo (2013, pp. 17-21)

2.2.2 Issues and challenges with digitalization

As discussed in Geradin and Katsifis (2021), traditional markets and digital markets have common features that concern economies of scale, network externalities, relevant role of data, and economies of scope. However, digital markets, particularly established digital companies, are able to leverage on a combination of these features, magnifying the market power, in contrast with traditional markets. Established platforms can deliver service to additional users without incurring much cost because of its large user base. A large user base can also imply network effects since users receive more substantial services as the number of users increases. Digital platforms are also able to collect data from their users, allowing them to generate insights and enhance machine learning to improve their marketing strategies and services, retain their users, and increase revenues. Additionally, because of data that they hold, these companies can make additional services other than the main products or services that they offer. Because of these advantages, they can offer much more products and services that are of higher quality and cheaper than those offered by new entrants, making competition challenging to enforce and maintain in the digital economy.

How the market is defined

A central concept in analyzing the constraints to competition is the identification of the relevant market, which is characterized by three things - the products (goods or services), the geographic boundary, and the period of time. Moreover, the products are regarded as substitutes by the buyers, taking into consideration the respective prices and conditions of sale (DFID 2008, ASEAN 2020).

In the digital world, additional competition by Internet players in the market needs to be properly considered when defining and assessing markets. For example, are free products or services considered substitutes for products and services sold for a fee? Are Over-the-top services substitutes of complements to traditional services? How is the geographic boundary

set when digital services are not only enjoyed locally but are provided across regions and even globally? Also, how suitable is the Small Significant Non-transitory Increase in Price (SSNIP) test when products and services are sometimes offered for free? Adapting the SSNIP test in the context of multi-sided platforms may need to focus on the cost of switching instead (GSMA 2015).

How market power (dominance) is determined

Market shares and concentration ratios are standard indicators used in market reviews to determine market power. In digital sectors, high market share or HHI is not a sufficient evidence to prove that there exists a significant market power or dominance. Conversely, a low market share does not necessarily imply a competitive market (GSMA 2015).

Simple supply shares used as a measure of market power for similar products or services may not apply to platforms, according to Collyer et al. (2017), because it is not always apparent how shares should be calculated to account for all market participants (i.e. the multi-sidedness of the market). The degree to which clients on both side of the market single- and multi-home is another issue to take into account. If users on one side of the transaction only sign up for one platform, users on the other side can only access those users by signing up for the same platform. If there is evidence that a certain side of the market is prone to single-homing, then higher weight may be given to market shares on that side.

Suitability of market shares based on revenues only

Market shares based on consumer revenues are difficult to determine because of "freemium" applications and free products. For instance, no revenue is generated in internet applications because consumers do not buy upgrades or add-ons. Furthermore, as innovation progresses and customer preferences shift, market shares are likely to become unstable. Therefore, current market share figures are not always a reliable indicator of future or current market power. In volatile markets, market shares are less informative (GSMA 2015).

Given the dynamic nature of competition, rather than relying on traditional indicators such as market shares or profit margins, regulatory and competition authorities should focus on "indicators that inform about contestability, such as the presence of entry barriers, the availability of alternative routes to reach end users (including the presence of measures aimed at locking-in end users), and the degree of innovation in unexplored technologies / services." (GSMA 2015, p. 106)

Barriers to entry

Even large market shares might not indicate market dominance if the market is contestable. If the barriers to entry are low, rival firms are likely to enter the market if incumbents raise prices. In contrast, high barriers to entry enables established businesses to exercise their market dominance. See Box 3 for examples of barriers to entry in the digital sector.

Box 3. Examples of barriers to entry in the digital age

- **Intellectual property rights** can be a bottleneck, leading to consumer harm and refusal to supply although the existence and ability for firms to obtain a patent or other IPR also provides an incentive to innovate, potentially increasing consumer choice
 - **Ownership of an essential facility** can result in barriers to entry. The term “essential facility” is a formal competition law concept
 - **Access networks and spectrum** have traditionally been considered bottlenecks, whereas new bottlenecks emerging in the digital age, such as the existence of closed OTTs and ownership of Operating Systems, Apps and App Stores are emerging as new bottlenecks in the digital age.
 - **Access to adequate sites** can prove to be a bottleneck for wireless providers. Wireless service, wireless carriers in other countries can experience bottlenecks in gaining access to necessary siting, which can hinder the delivery of services that compete with cable, fiber and satellite providers
 - **Network effects** - As the number of people communicating via a messaging or voice service increases, the more functional or convenient it is for users, for they are able to communicate directly with a larger number of their contacts. This phenomenon is known as a ‘network effect’. Network effects can create a barrier to entry for potential competitors, if new entrants cannot immediately attain the level of functionality offered by the incumbent. They can also lead to massive consumer benefits
- Traditional barriers to entry are declining as some bottlenecks are removed:**
- **Opensource software**, for example, whereby a copyright holder provides the rights to study, change and distribute the software to anyone and for any purpose, has allowed for collaborative competition in the provision of browsers, content players and other software, enabling innovation and generating savings for consumers.
 - **Consumers’ ability to switch suppliers** has been strengthened by the regulatory evolution of the mobile sector, together with the emergence of firms offering rival services to those provided by mobile operators.
- **Sunk costs are lowered, for new entrant Internet apps at least.** Messaging technology today can be developed by software providers without the significant sunk infrastructure costs and the development of a mobile network that a traditional messaging technology required
- New barriers to entry are emerging:**
- **Customer data:** Internet network effects have enabled a small number of applications to currently become dominant in the freemium messaging market, enabling them to acquire large amounts of customer data.
 - **New switching costs:** due to a lack of interoperability. In particular, content provided by non-regulated Internet apps, may not be ‘portable’ onto a new handset or system, increasing consumer switching costs. The costs of changing operating system, through e.g. loss of content or functionality, may outweigh the benefits.

Source: Lifted in full from GSMA (2015; p. 108, 111-112)

Barriers to expansion

Even though market entry is possible in a small scale and without much barriers to entry, firms may still encounter expansion barriers, which are challenging to understand in the digital age.

On the one hand, although market entry is possible in the digital web and new business models can be created, the chances of success (expansion) are unclear. On the other hand, (1) Firms that enter one market often use their brand recognition as a basis to move into an adjacent market and to grow market share. For example, Whatsapp, which began as a messaging only application, is moving into providing call services between its subscribers and (2) Traditional

service providers are moving into other markets in order to play across the digital value chain. (GSMA 2015)

Beyond the static efficiency benchmark

With the growth in online services and data flows, the requirement for bandwidth means that increased investment and innovation will take precedence over decreasing consumer prices as the main goal of competition (GSMA 2015). As Geradin and Katsifis (2021) pointed out, antitrust laws should not only focus on price and output aspects of competition since digital companies also offer many products and services without a fee and compete based on innovation. This means that consumption of innovative services can outweigh cheaper services. Hence, antitrust authorities should also ensure that companies are protected from anti-competitive acts that could hinder them from innovating.

Other competition concerns that are problematic in the digital markets include non-neutrality, self-preferencing, and technology-assisted collusion using algorithms. The monopoly of data may not only harm individuals but also carry risks that can be harmful to the economy and society in general. Risks may include cyberattacks, search bias through algorithms, addictive nature of products offered, political manipulation and influence (Silva & Nuñez, 2021).

2.2.2.1 Recent examples of competition cases

Table 2 features recent competition issues in the digital sector.

Table 2. Examples of recent competition cases or concerns

Issue	Country	Source Date	Description
Merger and acquisition	Thailand	October 2022	The National Broadcasting and Telecommunication Commission (NBTC), a telecommunications regulator in Thailand, allowed two major mobile operators, True Corp and Total Access Communication (DTAC), to merge. The market competition would be reduced to the merged firm, which will overtake Advanced Info Service (AIS) as the market leader. Conditions include price ceiling and control and at least five (5) years of independent verification of the merged firm's cost structure and services fees (Setboonsarng 2022).
	UK	October 2022	The Competition and Markets Authority (CMA) ordered Facebook to sell off Giphy, which it bought in 2020 for USD400 million to resolve competition concerns. Facebook's purchase of Giphy has reduced competition in two markets: (1) the display ad market where Giphy was supposed to develop ad business before its merger with Facebook and (2) Social media platforms since Facebook can increase its market power by cutting supplies of GIF to social media competitors or demanding user data from them in order to keep using Giphy services (Sweney 2022).
Collusion	US	November 2022	A lawsuit filed by Hagens Berman (law firm) alleged Apple and Amazon of collusion by removing Apple resellers who sell apple products at lower prices on Amazon. Allegedly, after Apple and Amazon deal in 2019, the number of third-party resellers of Apple products significantly reduced from 600 to 7, while

			Apple gave a 10 percent product discount to Amazon (CPI 2022).
	US	October 2022	Texas-based RealPage, a company selling rent-setting software, was alleged of collusion with the nine biggest property landlords of indirectly coordinating rent prices and artificially raising the cost of rents and lowering the supply of residential real estate. RealPage explained that they legally use aggregated market data from different sources and uses the property's internal factors rather than its competitors' prices, hence, eliminating manual pricing, which is typically based on phone surveys done by landlords' employees to know competitors' rent prices which conduct is considered anti-competitive (Vogell 2022).
Abuse of dominant position	Europe	November 2022	CISPE, a non-profit association of cloud infrastructure services in Europe, filed a grievance alleging Microsoft of using its dominance in productivity software to attract customers to use its Azure Cloud Infrastructure and using anti-competitive practices such as discriminatory tying and bundling products, lock-ins, self-preference. The company was previously fined for antitrust violations by cloud service providers in different European countries (Reuters 2022b).
Exclusivity (bundling and tying)	India	October 2022	Google was fined USD161.9 million for its anti-competitive practices to assert dominance in five markets involving android mobile devices: (1) the Online search market, (2) the App store market for Android OS, (3) Non-OS specific web browsers, (4) online video hosting platform service (OVHPS) market, (5) Licensable OS for smartphones. India is Google's biggest consumer in terms of users, where 97 percent of India's 600 million smartphones are powered by Google's Android operating system (Singh 2022).

3. Participants in the internet value chain

3.1 Content rights

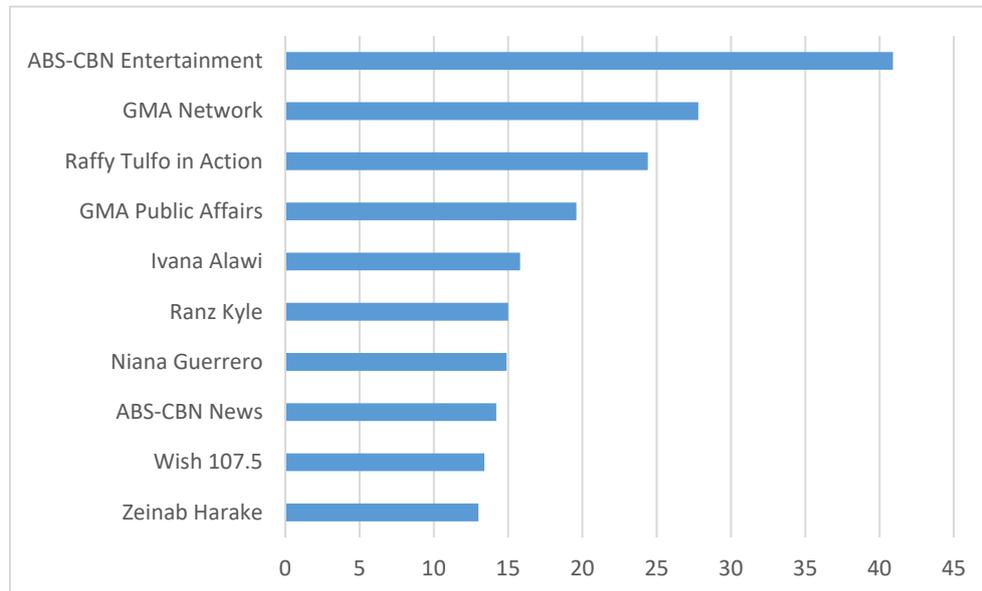
Proportion of revenues from different categories of online services are paid to content right owners which come from sales after commission or acquisition or license cost of content (AT Kearney 2010). Content rights include premium rights for video, sports, music, publishing, and gaming services, as well as contents that are made for digital rights which are created by influencers and content creators.

Netflix has the highest market share holding 31 percent market share of streaming services in the Philippines, while iflix holds 21 percent (Statista 2022d). Through a convenience sampling of 1,949 respondents conducted by Finder, Laycock (2021) reported that the top five (5) most popular streaming platforms are Netflix, YouTube Premium, iflix, HBO GO, and Amazon Prime Video, where monthly subscription of Netflix Philippines costs USD9.52.

Top 10 youtube channels in the Philippines based on the number of subscribers as of September 2022 include ABS-CBN Entertainment and GMA Network which are both dominant television channels before ABS-CBN's franchise expired in 2020; Filipino broadcast journalist, Raffy

Tulfo; news channels (GMA Public Affairs and ABS-CBN News), and other bloggers such as Ivana Alawi, Ranz Kyle, Niana Guerrero, and Zeinab Harake. Wish 107.5 (radio station) was also included See Figure 3.

Figure 3. Most popular YouTube channels in the Philippines by number of subscribers, September 2022



Source: Statista (2022i)

Top 10 celebrities in the Philippines with the highest earnings from Instagram sponsored posts earned an average of USD1.46 million in 2021 (Neomam 2022). Amidst the growing number of content creators and influencers in the Philippines, the Creator and Influencer Council of the Philippines (CICP) was established in January 2020 to support creators and influencers, together with marketing professionals, in optimizing their platforms and using them in business and marketing (CICP 2022). Another organization called Creative Content Creators Association of the Philippines or SIKAP was created to assist local content creators in Animation, Game Development, Comics, Character, and Music to be globally competitive (SIKAP 2020).

3.2 Online services

Regarding online services in the Philippines, e-commerce, transport and food, online travel, and online media cumulatively recorded a USD17 Billion Gross Merchandise Value (GMV), where 70 percent (USD12 billion) are from the e-commerce segment, USD 2.8 billion for online media, USD1.4 billion for transport and food, and 0.7 billion for online travel (Google et al. 2021).

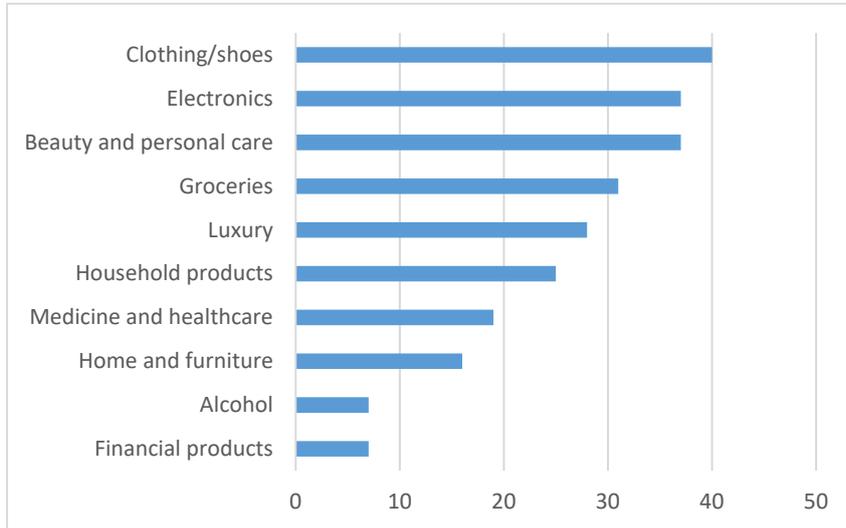
3.2.1 E-retail

In the 2nd quarter of 2020, top 5 e-commerce in the Philippines included Lazada, Shopee, Zalora, eBay, and BeautyMnl (Serafica and Oren 2020). Based on 2015 data, the retail sale via internet industry which had 10 firms at that time, was determined to be highly concentrated (Serafica et al. 2020).

E-commerce retail sales value reached USD5.83 billion in 2021 (Statista 2022e). Among internet users ages 16 to 64, most online purchases include clothing or shoes, beauty and personal care, electronics, groceries, and luxury, among others (See Figure 4). Annual spend in consumer goods in 2021 is listed in Figure 5 where consumers have the highest annual

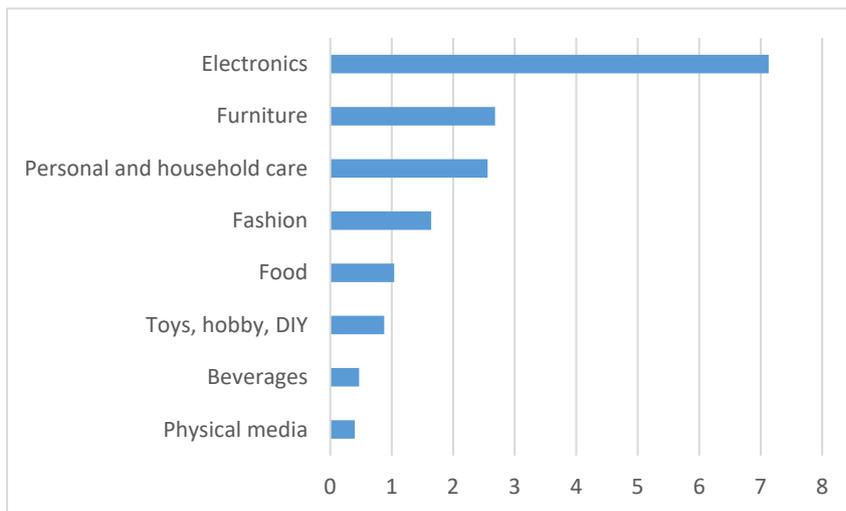
spending in electronics, followed by furniture, personal and household care, and fashion. The total annual revenue of food delivery services in 2021 reached USD304.7 million with 10.63 million individuals ordering food online (Kemp 2022).

Figure 4. Percentage of internet users ages 16 to 64 who have purchased the following products online, Q2 to Q3 2021



Source: GWI (2022)

Figure 5. Annual spend in each consumer goods e-commerce category (in USD billion), 2021



Source: Kemp (2022)

3.2.2 E-travel

In terms of online travel and tourism services in 2021, among internet users, consumers in the Philippines spent around USD1.37 billion on flights booked online, USD693 million for hotel, 394 million for package holidays (Statista 2022f). Top websites based on web traffic share include Cebupacificair.com, booking.com, agoda.com, tripadvisor.com.ph, and philippineairlines.com (see Table 3).

3.2.3 Video and audio

For the entertainment sector, Statista (2021a) estimated digital market revenue at USD1.91 billion which includes digital video contents (USD160.8 million), digital music (USD28.86 million), digital games (USD1.48 billion), and electronically published content (USD238.4 million). The revenue of subscription-based video-on-demand services in the Philippines is estimated at USD103 million in 2021 (Statista 2022c). Top 5 streaming services includes YouTube (90%), Netflix (72%), Viu (80%), iFlix (28%), and iWantTFC (23%), according to GWI (2022) conducted among internet users ages 16 to 64 based on their use in the past month. Music streaming services in the country recorded about USD24 million revenue in 2021 and is forecasted to increase by 1.4 percent in 2022 (Statista 2022g; Statista 2022h). About half of the internet users (49.6%) listen to music streaming services. Other audio content they listen to are podcasts (21.9%), online radio shows or stations (19.6%), and audio books (12%) (Kemp 2022).

3.2.4 Gaming and Gambling

Among the top mobile games based on the number of active users in 2021 were Mobile legends, Call of Duty, Minecraft pocket edition, Roblox, Clash of Clans, League of legends, Genshin Impact, Pokemon Unite, Mir4, and Among us. Consumers spent most on Mobile legends, followed by Genshin impact, Roblox, Call of Duty: Mobile, and Ragnarok (Kemp 2022).

3.2.5 Search and information and reference

Search engine hosts' market share in the Philippines is dominated by Google (92.83%), followed by Bing (3.39%), Petal search – Huawei (0.73%), and Yahoo (1.05%) (Statcounter 2022a). In accessing information, 60.3 percent internet users ages 16 to 64 visit social networks to search products and brands. About 36 percent weekly translate words into another language using online tools. Every month, 34.6 percent use image recognition tools, while 15.4 percent use voice assistants to search for information weekly (Kemp 2022).

3.2.6 Social

The Philippines has around 76.01 million internet users and 156.5 million cellular mobile connections among the 111.8 million total population as of February 2022. In terms of social media and communications, the Philippines has 92.05 million social media users as of January 2022: 83.85 million Facebook users, 56.50 million YouTube users, 18.65 million Instagram users, 35.96 million TikTok users, 55.15 million Facebook messenger users, 11 million LinkedIn users, 10.60 million Snapchat users, and 10.50 million Twitter users in early January 2022 (Kemp 2022). Note that these figures may not necessarily represent unique individual users. Social media market share Facebook (90.11%), YouTube (3.58%), Twitter (2.53%), Instagram (1.46%), Pinterest (1.36%), and Reddit (0.59%) (Statcounter 2022b). In addition, GWI (2022) reported that Filipinos ages 16 to 64 spends 4 hours and 7 minutes per day in social media, compared to the global average of 2 hours and 28 minutes.

3.2.7 Other online services

There are many other online services being offered by available applications in digital distribution services such as app store and google play store. App developers in the Philippines are expected to earn an annual income of USD7.8 million (Alphabeta 2021).

See table 3 for top websites for online services based on website traffic from August to October 2022, such as arts and entertainment, news and media, music, books and literature, publishing and printing, gaming, marketplace, travel and tourism, gambling, reference materials, and social networks and online communities.

Table 3. Online services segment: Top websites by traffic share in the Philippines from August to October 2022

Segment	Category	Top websites
Content rights and online services	News and media	Yahoo.com, inquirer.net, rappler.com, philnews.ph, gmanetwork.com
	Music	Spotify.com, ultimate-guitar.com, ytmp3.cc, genius.com, zlyrics.com
	Arts and entertainment	Youtube, netflix, fandom, spotify, mangago
	TV movies and streaming	Youtube.com, netflix.com, Abs-cbn.com, imdb.com, sflix.to
	Books and literature	Archiveofourown.org, wattpad.com, novelfull.com mtlNation.com, allnovelfull.com
	Publishing and printing	Springer.com, emerald.com, igi-global.com, vista.com, ebSCO.com
	Gaming	Roblox.com, twitch.tv, gogoanime.ee, asura.gg, mir4global.com
Online services	Marketplace	Shopee.ph, Lazada.com.ph, Amazon.com, Alibaba.com, Ebay.com
	Travel and tourism	Cebupacificair.com, booking.com, agoda.com, tripadvisor.com.ph, philippineairlines.com
	Gambling	LottopcsO.com, bingoplus.com, 747live.net
	Reference materials	Wikipedia.org, pinterest.ph, quora.com, britannica.com, merriam-webster.com
	Social networks and online communities	Facebook.com, Twitter.com, Messenger.com, Tiktok.com, Instagram.com

Source: Similarweb (2022a)

3.3 Enabling technology and services

These services are usually hidden to internet users but are a very important part of the value chain since it supports online services. It comprises of Design and hosting of websites, Online payment gateways and e-wallets, Cloud-based infrastructure and platform services, platforms that manage and process data from the Internet of Things (IoT) devices, Online advertising services, and Content delivery services (Examples are shown in Table 4).

Table 4. Enabling technology and services segment: Top websites by traffic share in the Philippines from August to October 2022

Segment	Category	Top websites
Enabling technology and services	Visual arts and design	Deviantart.com, pixiv.net, behance.net, artstation.com, vecteezy.com
	Graphics multimedia and web design	Canva.com, remove.bg, wixsite.com, bingoplus.net, twibbonize.com
	Web hosting and domain names	Weebly.com, pastebin.com, wix.com, aws.amazon.com, godaddy.com
	Finance	BPI.com.ph, BDO.com.ph, Paypal.com, Maya.ph, Coingecko.com
	Marketing and advertising	Tsyndicate.com, Cint.com, Ssisurveys.com, Lifepointspanel.com, Samplicio.us
	Online marketing	Hubspot.com, tatlerasia.com, writer.com, involve.asia, ahrefs.com

Source: Similarweb (2022a)

3.3.1 Payment platforms

About 43.44 million individuals made digital payments in 2021 with total annual value of USD16.11 billion (Kemp 2022). Among Filipinos ages 15 and above in 2021, 25.1 percent made or received digital payments, 9.1 percent made online purchase, 7 percent used online banking, 4.5 percent have mobile wallet account and 3.3 percent paid bills online (Kemp 2022). Top digital wallets used in the Philippines in 2020 were Gcash (49.4%), PayMaya (41.9%), GrabPay (7.5%), and PayPal (0.7%) (Statista 2021b).

About 97 percent of digital merchants surveyed by Google et al. (2021) are already accepting digital payments, while 67 percent are utilizing digital lending solutions. About 68 percent are expected to increase the usage of digital marketing tools in the next five years.

3.3.2 Content delivery services

Data centers have been used to consolidate data resources into one location. These data centers usually contain expensive backup generators and other structures to protect them from natural disasters, vibrations, and power outages. These are often built in a suburban location near business users where there is a cheaper supply of electricity, an expanse of land, and a fast and reliable internet connection. A cloud service rents its data centers for storing and processing data (Greenstein 2020). The Philippine Trade and Investment Center in Hong Kong, the Philippine Consulate General Hong Kong (PCGHK), and the Board of Investments (BOI) recently organized a webinar entitled “The Philippines as the next hyperscaler hub in Asia Pacific: Opportunities for investments and partnerships” last August 2022 to promote investment in the hyperscale data center sector. It mentioned that the sector has the potential to grow because Filipino consumers are likely to consume foreign content and the country's large mobile phone and internet users and enabling regulatory environment (DTI 2022). Content delivery networks (CDNs) are networks of servers that are geographically dispersed and close to end users to facilitate smooth data traffic. Other ways to transmit data include server contracting directly to the ISP, private peering where two service providers are bound with a bilateral contract to exchange data, internet exchange points where the data carrier pays a separate organization equipped with facilities for data exchange, and transit carriers where one or multiple lines serve as transit carrier between the ISPs (Greenstein 2020).

3.3.3 Online advertising services

Online advertising services are funded by advertisements in exchange for human attention, which is a scarce and valuable resource. They are often multisided platforms to reach a large number of audiences. Because of advanced technologies, firms can now target audiences, making it possible to personalize advertisements at an individual level. Annual spend in digital advertising in 2021 reached USD1.07 billion which is an increase of about 21 percent compared to 2020. The majority was spent on banner ads (USD408.4 million). Other digital advertising platform used are search ads, digital video ads, and digital classified ads (Kemp 2021). Google Ads is estimated to generate USD7.3 billion annual net returns to businesses in the Philippines (Alphabeta 2021). Social media are also used as enabling technology for business to advertise their products and services. In February 2022, 75 percent potential audience can be reached via Facebook relative to the total population, while 49 percent via Facebook messenger, 50 percent via YouTube, 16.7 percent via Instagram, 32 percent via Tiktok, 9.8 percent via LinkedIn, 9.5 percent via Snapchat, and 9.4 percent via Twitter (Kemp 2022).

3.3.4 Design and hosting

Top websites for domain names and website hosting in the Philippines based on traffic share are Weebly, Pastebin, Wix, Aws Amazon, and GoDaddy. These are also included in the top 20 list worldwide, where desktop traffic share from the Philippines only constitute at most 6 percent of the total desktop traffic share. In contrast, Dot.ph, a private company owning the PH domain receives 81.56 percent of its desktop traffic share from the Philippines with an average of more than 11 thousand domestic monthly traffic (See Table 5). The DotPH previously faced controversies due to its ownership of PH domain. Since PH is a globally recognized country code of the Philippines, advocates claim that the PH domain is a natural resource and not be owned and monopolized by a private person. PH domain is owned and managed by a Joel Disini since 1990. He transferred administration of edu.ph, gov.ph, and org.ph to the Philippine educational institutions and Philippine government (DICT as a current administrator), respectively (Olandres 2008; PhilDAC n.d.; dotPH 2022).

Table 5. Web hosting and domain names websites in the Philippines by traffic share, August to October 2022

Website	Average monthly visits (in millions)	Traffic share from the Philippines, desktop (%)	Philippines: Average monthly traffic via desktop (in thousands)
Weebly.com	47.20	2.41	647.48
pastebin.com	15.56	5.45	629.57
wix.com	47.78	1.17	422.79
aws.amazon.com	68.77	0.66	407.20
godaddy.com	41.30	1.09	347.04
Dot.ph	0.02	81.56	11.57

Source: Similarweb (2022b; 2022c)

3.4 Internet access connectivity

Technologies used for internet service provision can be in the form of satellite, digital subscriber line (DSL), cable modem, or fiber which may vary in function, capacity, and affordability and are usually provided by telecommunication operators, alternative network operators using their own network (e.g., cable operators), and Mobile virtual network operator (MVNOs) or value-added service. It can be a wired or wireless connection. Satellites transmit and receive data to and from practically any location on Earth equipped with a "dish" that connects to the satellite. DSL carries data over telephone lines. A cable modem refers to

additional services of existing cable television systems by adding switches and modems compliant with the Data Over Cable Service Interface Specification (DOCSIS). Fiber is a wired connection that uses fiber optic for fast internet (DICT 2017; Greenstein 2020). As of 2020, there are 64 active mobile-broadband subscriptions and about seven fixed broadband subscriptions per 100 inhabitants in the Philippines. There are 156.5 million cellular mobile connections as of early 2022, where 96.5 percent are broadband connection. This is more than the number of population in the Philippines of about 111 million (Kemp 2022). Additionally, 50 percent of individuals in the Philippines are internet users (ITU 2021a). See Chapter 4 for more details in this segment.

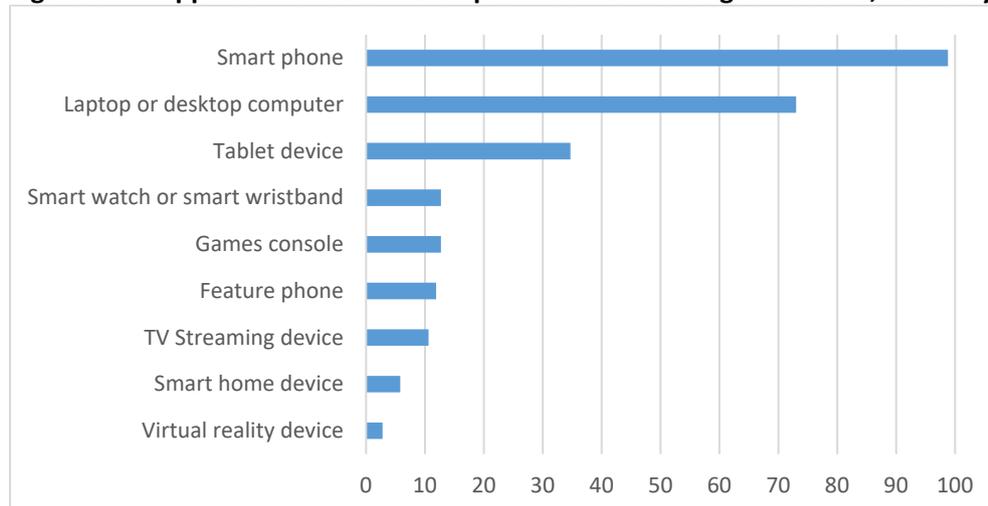
3.5 User interface

3.5.1 Hardware devices

Fast and reliable networks consequently drive the upgrading of hardware devices to connect with the internet more powerfully, encouraging more innovative applications and content (DICT 2017). Other appliances and devices can now be connected to the internet (IoT) besides computers and mobile phones. User interface covers hardware devices, accompanied by built-in software and stand-alone software acquired separately (GSMA 2022). Kemp (2022) reported that internet users ages 16 to 64 in the Philippines most likely access the internet via smartphone, followed by desktop or laptop, and tablet. More than 10 percent of internet users have smart watch or smart wristband, games console, feature phone, and TV streaming device. About 5.8 percent have smart home device, while 2.8 percent have virtual reality device (see Figure 6).

About 1.69 million homes in the Philippines have smart home devices. These include smart home appliances, control and connectivity devices, security devices, entertainment devices, comfort and lighting, and energy management devices. The total annual revenue of smart home devices reached USD168.9 million (Kemp 2022).

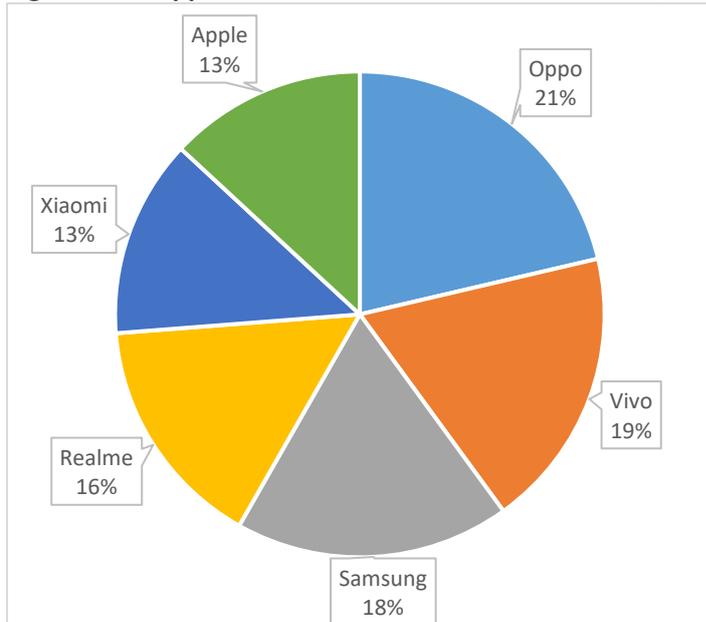
Figure 6. Philippines: Device ownership of internet users aged 16 to 64, February 2022



Source: Kemp (2022)

Mobile vendor in the Philippines from October 2021 to October 2022, Oppo holds about 18 percent of the market share, followed by Vivo (15.77%), Samsung (15.34%), Realme (13.12%), Xiaomi (11.12%), and Apple (11.01%). As seen in Figure 7, there is a competitive market for mobile devices.

Figure 7. Philippines: Market share for mobile vendor, October 2021 to October 2022

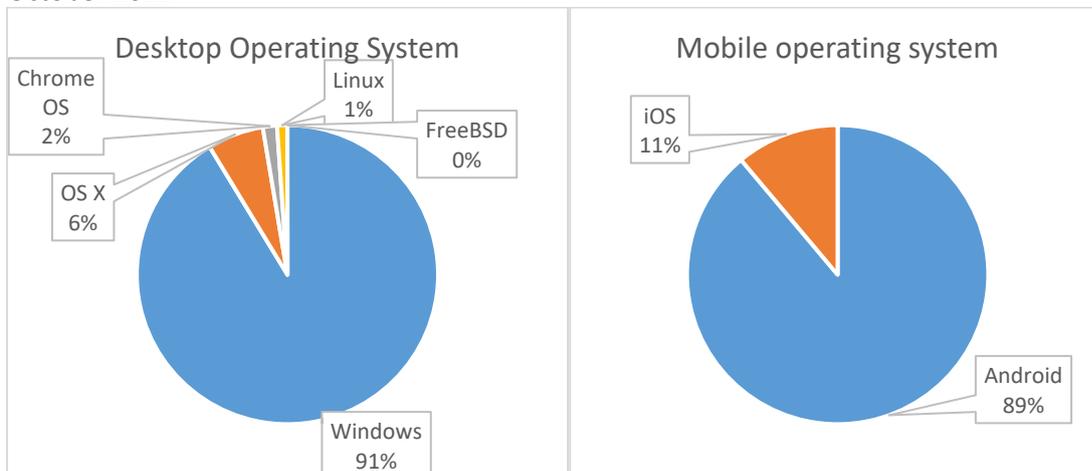


Source: Statcounter (2022c)

3.5.2 Systems and software

Windows dominates in desktop operating system market, while android dominates in mobile operating systems market, and Google Chrome in browser market in the Philippines (See Figure 8).

Figure 8. Philippines: Market share for mobile and desktop operating system, October 2021 to October 2022



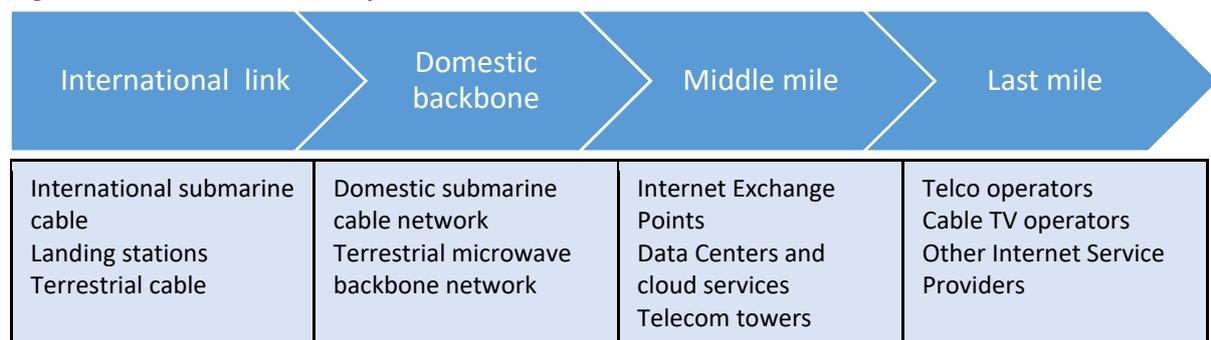
Source: Statcounter (2022d; 2022e)

4. Internet connectivity value chain

Communications via the internet connects various foreign and domestic networks, down to end-users. Data transmission is in a form of digital or digitalized analog signal which includes Voice over Internet Protocol but does not include basic telephone services. Senate Bill 911 filed in the 18th Congress (An Act Promoting Open Access in Data Transmission, providing additional powers to the National Telecommunications Commission, and for other purposes) defines the data transmission industry as having four segments (See Figure 9):

- **International gateway/Landing** - segment of data transmission that consists of any facility that provided an interface to send and receive data traffic between one country's domestic network facilities and those in another country;
- **Core/Backbone network**- the main line (or connection) that ties networks; delivers routes to exchange information among various sub-networks, connects regional distribution and, in some instances, provides connectivity to other peer networks;
- **Middle mile** - segment of data transmission that carries data from the back-haul network to the nearest aggregation point, then from the aggregation point to the nearest point of presence (PoP); and
- **Last mile** - segment of data transmission from the network to the end-users.

Figure 9. Internet connectivity value chain



Source: Mirandilla-Santos (2021); Senate Bill 911 (18th Congress); DICT (2017)

4.1 International link

Surrounded by bodies of water, the Philippines is connected to other countries via international submarine cable systems or satellite internet providers, instead of terrestrial cables (DICT 2017). The country is currently connected to 10 international submarine cable systems and seven (7) are under construction. There are currently eight (8) cable landing points (La Union, San Fernando, Cavite, Nasugbu/Batangas, Ballesteros, Baler/Aurora, Daet, and Davao) and one in construction (Pagudpud). See Figure 10.

PLDT is one of the owners for seven (7) out of 17 existing and under construction international submarine cable systems, Globe Telecom owns three (3), DITO Telecommunity owns ALC, and Converge ICT owns SEA-H2X (See Table 6). In terms of cable landing stations (CLS) in the country, PLDT currently has three (Nasugbu/Batangas, La Union, and Daet), while two (2) are under construction (Baler/Aurora and Davao). Globe currently has cable stations in Nasugbu/Batangas, Davao, and Ballesteros and plans to have another in La Union. Converge ICT has cable landing station (CLS) in Cavite and aims to have two (2) Davao and La Union. For the Luzon Bypass infrastructure project under the National Broadband Plan, the state-owned Bases Conversion and Development Authority (BCDA) signed agreement with Facebook (Meta) to build Baler CLS and San Fernando CLS to connect with PLCN (Submarine Cable Networks 2022; Telegeography 2022; PLDT 2022d; Globe 2022d).

Figure 10. Cable landing stations in the Philippines and connected international submarine cable systems



Note: Pagudpud cable station still in construction

Source: Authors' own, based on Telegeography (2022); Submarine Cable Networks (2022a); and Atienza (2021)

Table 6. International Submarine Cable Systems with Landing Stations in the Philippines

Cable System; Ready for service; Cable length	Owners	Countries being linked	Landing points in the Philippines
APCN-2; December 2001; 19,000 km	AT&T, BT, China Telecom, China Unicom, Chunghwa Telecom, HKBN Enterprise Solutions, KDDI, KT, LG Uplus, NTT, Orange, PCCW, PLDT, Singtel, Singtel Optus, Softbank Corp, Starhub, Tata Communications, Telekom Malaysia, Telstra, Verizon, Vodafone	Hong Kong SAR, China, Japan, Malaysia, Singapore, South Korea, Taiwan, Philippines	Batangas (PLDT)
Apricot; Q4 2024; 11,972 km	Chunghwa Telecom, Google, Meta, NTT, PLDT	Guam, Indonesia, Japan, Singapore, Taiwan, Philippines	Baler (PLDT); Davao (PLDT)
Asia-America Gateway (AAG) Cable System; November 2009; 20,000 km	AT&T, Airtel (Bharti), BT, BayanTel, Eastern Telecom, EzeCom, Indosat Ooredoo, National Telecom, PLDT, Saigon Postel Corporation, Spark New	Brunei, China, Guam, Malaysia, Singapore, Thailand, Hawaii and United States Mainland, Vietnam,	La Union (PLDT)

	Zealand, Starhub, Telekom Malaysia, Telkom Indonesia, Telstra, Unified National Networks (UNN), VNPT International, Viettel Corporation	Philippines, Hong Kong SAR	
Asia Connect Cable-1 (ACC-1); 2025; 18,000 km	Inligo Networks Inligo Networks is an independent private subsea cable owner and operator.	Australia, Indonesia, Singapore, Timor-Leste, Philippines	Davao (PLDT)
Asia Direct Cable (ADC); 2023; 9,800 km	China Telecom, China Unicom, National Telecom, PLDT, Singtel, Softbank Corp, Tata Communications, Viettel Corporation	China, Japan, Singapore, Thailand, Vietnam, Philippines	Batangas (PLDT)
Asia Link Cable (ALC); Q3 2025; 6,000 km	China Telecom, DITO Telecommunity, Globe Telecom, Singtel, Unified National Networks (UNN)	Brunei, China, Singapore, Hong Kong SAR, Philippines	Bauang; Luna (Globe)
Asia Submarine-cable Express (ASE)/Cahaya Malaysia; August 2012; 8,148 km	NTT, PLDT, Starhub, Telekom Malaysia	China, Japan, Malaysia, Singapore, Philippines	Daet (PLDT)
Bifrost; 2024; 15,000 km	Keppel T&T, Meta (Facebook), Telin	Indonesia, Mexico, Singapore, United States	Davao (Converge ICT)
CAP-1; Q4 2023; 12,000 km	Amazon Web Services, Meta	United States, Philippines	Pagudpud
EAC-C2C; November 2002; 36,500 km	Telstra	China, Japan, Singapore, South Korea, Taiwan, Philippines, Hong Kong SAR	Nasugbu (Globe Telecom); Cavite (Converge ICT)
JUPITER; 2020; 14,557 km	Amazon Web Services, Meta, NTT, PCCW, PLDT, Softbank Corp	Japan, United States, Philippines	Daet (PLDT)
Pacific Light Cable Network (PLCN); January 2022; 11,806 km	Google, Meta	Taiwan, United States, Philippines	Baler (BCDA); San Fernando – pending (BCDA)
SEA-H2X; 2024; 5,000 km	China Mobile, China Unicom, Converge ICT, PP Telecommunication Sdn Bhd	China, Malaysia, Singapore, Thailand, Philippines	La Union (Converge ICT)
SEA-US; August 2017; 14,500 km	GTA TeleGuam, Globe Telecom, Hawaiian Telcom, RTI, Telin	Guam, Indonesia, Micronesia, Palau,	Davao (Globe Telecom)

		United States, Philippines	
SeaMeWe-3; September 1999; 39,000 km	A1 Telekom Austria, AT&T, Altice Portugal, BICS, BT, CTM, China Telecom, Chunghwa Telecom, Cyta, Deutsche Telekom, Djibouti Telecom, Embratel, Etisalat UAE, Indosat Ooredoo, Jabatan Telecom Brunei, KDDI, KPN, KT, LG Uplus, Maroc Telecom, Myanmar Post and Telecommunication (MPT), National Telecom, OTEGLOBE, Omantel, Orange, Orange Polska, PCCW, PLDT, Pakistan Telecommunications Company Ltd., Rostelecom, Saudi Telecom, Singtel, Singtel Optus, Softbank Corp, Sri Lanka Telecom, Tata Communications, Telecom Argentina, Telecom Egypt, Telecom Italia Sparkle, Telekom Malaysia, Telkom South Africa, Telstra, Tunisia Telecom, Turk Telekom, Turk Telekom International, Ukrtelecom, VNPT International, Verizon, Vocus Communications, Vodafone, eir	Australia, Belgium, Brunei, China, Cyprus, Djibouti, Egypt, France, Greece, India, Indonesia, Italy, Japan, Malaysia, Morocco, Myanmar, Oman, Pakistan, Portugal, Saudi Arabia, Singapore, Sri Lanka, Taiwan, Thailand, Turkey, United Arab Emirates, United Kingdom, Vietnam, South Korea, Hong Kong, Macau SAR, Philippines, Germany	Batangas (PLDT)
Southeast Asia-Japan Cable (SJC); June 2013; 8,900 km	China Mobile, China Telecom, Chunghwa Telecom, Globe Telecom, Google, KDDI, National Telecom, Singtel, Telkom Indonesia, Unified National Networks (UNN)	Brunei, China, Japan, Singapore, Philippines	Nasugbu (Globe Telecom)
Tata TGN-Intra Asia (TGN-IA); March 2009; 6,700 km	Tata Communications	China, Singapore, Vietnam, Philippines	Ballesteros (Globe Telecom)

Source: Telegeography (2022); Submarine Cable Networks (2021; 2022); PLDT (2022d); Globe (2022d; 2022f); Inligo Networks (2022);

4.2 Domestic backbone

The Philippines' domestic backbone infrastructure includes PLDT's Domestic Fiber Optic Network (DFON), Globe Telecom's two (2) Fiber Optic Backbone Networks (FOBNs), Converge ICT's Domestic Submarine Cable Network (CDSCN), and NGCP/TransCo Backbone Network, connecting various regions in the country (Submarine Cable Network 2022). The PLDT's DFON is made up of transport nodes connected by terrestrial and submarine cable lines arranged in 11 loops, with two appendages stretching to Palawan and

Iligan. The loops provide alternative segment routes for network resilience and has a 19.2 Tbps per fiber pair capacity. It is complemented with terrestrial microwave backbone network to reach remote areas. Globe Telecom’s FOBNs also link Luzon Visayas, and Mindanao. Globe has fiber optic backbone linking Luzon and Palawan and provides VSAT to deliver 2G to 4G/LTE services for remote areas (PLDT 2022d; Globe 2022d). In 2021, Converge ICT finished constructing the CDSCN which connects submarine network and terrestrial backbone, linking all major regions in the country (Converge ICT 2022b). See Table 7.

Table 7. Domestic Submarine Cable Systems

Cable System	Ready for service	Cable length (in km)	Owners	Landing points
Boracay-Palawan Submarine Cable System (BPSCS)	June 2013	332	Globe Telecom	Boracay, Caticlan, Coron, San Jose, Taytay
Converge Domestic Submarine Cable Network (CDSCN)	Q4 2021	1,300	Converge ICT	Baclayon, Bacong, Bogo, Boracay, Buenavista, Cagayan de Oro, Coron, Leganes, Masbate City, Milagros, Naga, Ormoc, Pasacao, Roxas City, Roxas, San Carlos, San Juan, San Remigio, Tagbilaran, Talisay City, Taytay, Toledo
National Digital Transmission Network (NDTN)	March 1999	1,400	TelicPhil	Dumaguete, Iloilo City, Lucena, San Jose
Palawan-Iloilo Cable System	January 2014	300	PLDT	San Jose de Buenavista, Taytay
Philippine Domestic Submarine Cable Network (PDSCN)	April 2023	2,500	Eastern Telecom, Globe Telecom, Infinivan Inc.	Baclayon, Bacolod, Boac, Boracay, Bulan, Cagayan de Oro, Cagdianao, Calatrava, Calbayog, Camiguin Island, Caticlan, Dipolog City, Iligan, Iloilo City, Kinoguitan, Liloan, Liloan, Lucena, Maasin, Palanas, Palompon, Pasacao, Pinamalayan, Placer, Roxas City, San Carlos, Siargao Island, Surigao City, Tagbilaran, Talisay, Toledo, Zamboanga City, Zamboanguita
PLDT Domestic Fiber Optic Network (DFON)	1997	11,100	PLDT	Butuan City, Cadiz City, Cagayan de Oro, Calbayog, Cebu, Dumaguete, Legazpi City, Masbate City, Nasugbu, Ormoc, Ozamiz City, Pinamalayan, Roxas City
Sorsogon-Samar Submarine Fiber Optical Interconnection Project (SSFOIP)	2019	21	National Grid Corporation of the Philippines	Allen, Santa Magdalena

Note: TelicPhil= Telecoms Infrastructure Corporation of the Philippines; PLDT = Philippine Long Distance Telephone Company

Source: Telegeography (2022)

4.3 Middle mile

Table 8 describes the different ways by which data travel between the internet service providers of the user and a content provider and vice versa. The market transaction that takes place in this segment is invisible to users.

Table 8. How data can travel between content provider and internet service provider

Option	Description
Within the network of a single ISP	User and the server have an agreement with the same ISP. This approach is common for bilateral exchanges that include two people who are physically close to one another.
Content delivery network	<p>The most popular method used nowadays to reduce delays on the internet is to reroute user requests from servers to content delivery networks (CDNs), which are geographically dispersed networks of servers situated close to end users. Because such networks are physically close to users, CDNs lower the response time, which is sometimes referred to as "moving data to the edge of the network."</p> <p>The majority of users are actually exchanging content with the CDN rather than the original content source when content providers choose to cache content at the CDN and only update the most timely and popular content. Additionally, CDNs can add a degree of security and reliability.</p> <p>Nowadays, practically every commercial player of any size uses them in some capacity for popular content. Although CDNs are invisible to the user, this is the primary way that most of the data that a user receives is delivered.</p>
Private peering	<p>"Private peering" is when the user and the content provider (as well as the CDN assisting the user) have different internet service providers but those two providers have a direct point of contact and formed a bilateral agreement with each other to manage the transmission of data.</p> <p>In a typical contract, no money is exchanged if the parties' data goes back and forth over the course of a month in about proportion to one another. If one party delivers more data to the other, the carrier that provides the greater amount of data (net) compensates the other carrier for accepting the traffic.</p>
Internet exchange points	An internet exchange point (IXP) serves as another location where two or more internet service providers may interconnect to exchange data. IXPs are usually administered by an external organization. Each carrier pays a fee to the IXP for building and maintenance of technology that enables data exchange. All participants agrees to send and take as much data as their connection can support. Charges may differ for each renter and frequently have no relation to traffic volume.
Transit carriers	This is the last means of communication when internet service providers of users and the content are not in direct contact with one another, not even through an internet exchange point. Between the two ISPs, one or more networks' lines serve as a transit carrier. The compensation for transit carriers depends on all of their agreements with other carriers.

Source: Greenstein (2020)

4.3.1 Internet exchange points (IXPs)

Internet service providers can choose to exchange data traffic via an internet exchange points (IXP) which can be offered and maintained by an external organization. There are about eight (8) IXPs in the Philippines (See Table 9). Most of these are located in Luzon (Atienza 2021). See Appendix A on the list of members for selected IXPs in the Philippines with details on speed and country location.

Table 9. Internet exchange points in the Philippines

Internet exchange point	Description
ComClarkIX	ComClarkIX owned by the ComClark Network and Technology Corp., which also owns Converge ICT, provides both internet exchanges and data centers located in Luzon. The company also provides satellite, content delivery network, and datacasting services (Comclark 2022a).
MIX	MIX or Manila IX includes five (5) peering points, namely: Pacnet, Eastern Telecommunications Philippines, Globalreach, Bayan Telecommunications, and IP Converge Data Services (Inflect n.d.).
GetaFIX	GetaFIX, which is located in Manila and Cebu allows interconnection among 12 data centers in Manila, Cebu, Hongkong, and Singapore. With over 45 members and 60 content providers, its monthly subscription ranges from USD500 to about USD21,800 which follows a standard pricing model (GetaFIX n.d.). On the one hand, GetaFIX Manila has 21 members from seven (7) countries and 28 members from the Philippines. On the other hand, GetaFIX Cebu has a member in Hong Kong and US and two (2) members in the Philippines (See Appendix A).
GIX	Globe Internet Exchange (GIX) has 11 members, with only 1 from Hong Kong (IPIP 2022).
PCTA-IX	PCTA-IX, supported by the Philippine Cable and Telecommunications Association (PCTA), provides interconnection among cable operators, as well as ISPs, businesses, and public institutions. Its eight (8) members are from the Philippines where majority are cable TV operators (IPIP 2022).
PhIX	The Philippine Internet Exchange (PhIX) allows direct peering with PLDT's subscriber base and other content providers. It currently has three (3) members from the US (IPIP 2022); ePLDT 2022a).
PHOpenIX	The Philippine Open Internet Exchange (PHOpenIX) is an open and carrier-neutral internet exchange in the Philippines. It has four locations (Makati City, Quezon City, Pasig City, and Cebu City) and is managed by DOST-ASTI. It currently has 60 members from US, Hong Kong, and Philippines. Its services include Root DNS mirror instance, mandatory route server peering, public looking glass, and network time protocol (PHOpenIX 2022).
VIX	Vitro peering solutions or VIX by PLDT enterprise, facilitates direct peering with local telcos and internet service providers (ISPs) to minimize latency in delivering contents hosted locally (PLDT 2021).

Source: Authors' compilation

4.3.2 Data centers and cloud services

Growing number of firms are investing in building data centers in the Philippines (JLL 2022). Currently, there are about ten (10) data centers in the Philippines, many of which are located in Luzon area, some are found in Cebu and Davao (See Table 10). Many of these data centers

are telco-grade and carrier-neutral. They also offer other services such as cloud services, connectivity service, and security systems.

Apart from these, other firms have been investing in the data center market. Converge ICT Solutions plans spends PHP1 Billion in building data center facility in Cebu which is planned to be finished in 2024 (Piad 2022). Alibaba Cloud, a foreign company, will set up its first data center in the country to be located in Manila. DITO Telecommunity Corp. is planning to build data center in Pampanga (Conoza 2022). Digital Edge has been developing data center facility located in Manila which will be ready for service in 2023 (Digital Edge 2022). Megawide Construction Corp., an infrastructure and engineering firm, plans to venture into the data center market with a foreign partner (Swinhoe 2022). Space DC, a Singapore-based firm, plans to open green data center (MNL1) in Rizal in 2022 (Balinbin 2022). YCO Cloud Centers (YCC) plans to invest USD500 million, including data center projects in Batangas and expected to finish by 2nd quarter of 2023 (Crismundo 2022).

Table 10. Datacenters in the Philippines

Data Center	Description
Bee Info Tech	Bee info tech, located in Pasig City, is a telco-neutral data center services provider with 19,000 sqm facility and over 2,800 racks, located in Pasig City offering tailor-fit digital solutions for enterprises. Its products include rack space colocation, cloud services in partnership with Amazon Web Services (AWS) outposts, equal access to networks via BConnect Managed Connectivity, and cybersecurity through BProtect WAF, BProtect SIEM, and BProtect DDoS (Beeinfotech PH n.d.).
Comclark	Content delivery services of ComClark uses intelligent caching technology to allow faster transfer of content from origin servers to users using edge nodes. This reduces number of requests to origin servers, saving at most 70 percent of bandwidth costs (ComClark 2022b).
DataOne	DataOne Asia equipped with tier 3 data center providing data center outsourcing: colocation and dedicated server hosting for primary use or business continuity planning, and infrastructure and IT outsourcing services to assist businesses in handling MIS and IT system (DataOne Asia 2018).
Eastern Communications	Eastern communications offers data center and cloud services, collaboration tools, cybersecurity such as firewall, VPN, DDos protection, managed services. It also offers internet services for businesses and voice services to connect businesses to customers (Eastern communications 2022).
IP Converge	IP Converge Data Services (IPC) has data centers in Makati, Parañaque, Taguig, offers internet data center services, managed data services, dedicated internet connectivity, IT services, and cloud services to enterprises (IPC n.d.). It is indirectly owned by PLDT through ePLDT (PLDT 2022e).
VST ECS	VST ECS, formerly MSI-ECS, has offices in Pasig, Taguig, Cebu, and Davao. Apart from data center services, it also offers cloud services, IT support services, ICT platform and training skills upgrade, repair and maintenance IT services (VSTECS 2019).
Globe Telecom	Globe data center offers data center hosting and management: colocation, full functioning office amenities for business continuity, and local area network (LAN)-based internet with speed from 256 kbps to 1 Gbps. It also offers cloud services (Globe 2022e). Ayala Corporation, which owns Globe Telecom, also has joint venture partnership with STTelemedia, data center provider, for the development of data centers in the Philippines (STTelemedia 2022).

PHCOLO	PHCOLO has a 2,385 sqm, 226 capacity rack space providing telco-grade and carrier-neutral colocation facilities connecting global carriers, ISPs, and users via fiber, wireless, ethernet, cable, and copper. Collocation options for clients include RU cabinets, cages with 3-4 cabinets, dedicated vaults, data center, and spot location services (PHCOLO 2022).
ePLDT	ePLDT carrier-neutral VITRO data center for foreign and local telcos to provide network connections to their consumers. It has a total of ten (10) data centers in Pasig, Makati (2), Cebu (2), Taguig, Subic, Parañaque, Clark, and Davao. It provides businesses with data back-up and office space for business continuity and connectivity (ePLDT 2022b). 74 percent of the total six thousand racks are in service, while the 11 th largest in laguna is in construction (Rosales 2022).
TIM	Total Information Management Corporation (TIM) offers both data center subscription and cloud services. It has two (2) data centers located in Cavite and Makati (TIM 2020).

Source: Authors' compilation

4.3.3 Telecommunications tower

As of the end of 2021, Smart already had a total number of 38,600 4G, 16,900 3G, and 7,200 5G base stations nationwide (PLDT 2022d). Globe built 572 new cell towers and upgraded 6,800 towers to 4G LTE. It targets to build a total of 1700 new cell towers by the end of 2022 (Dela Cruz 2022). DITO CME has network coverage in 496 cities and municipalities with a total of 5,066 cell sites and towers in 2021 (DITO 2022b).

Apart from the initiatives of incumbent players to construct communication infrastructures, independent tower companies are also available to expand the coverage of incumbent telco operators and provide infrastructure for new players. Tower companies offer wireless applications, colocation, and built-to-suit towers, among others. Shared infrastructure helps avoid redundant towers and speeds up the process of providing internet access to many parts of the country. Common towers can also host multiple mobile operators. There are currently 19 registered common towers or independent tower companies (ITCs) in the Philippines. Typically, they construct communication infrastructures or acquire towers from incumbent telco operators through sale and leaseback agreements. At least nine (9) independent tower companies (ITCs) have foreign head offices. See Table 11 for the list of registered ITCs as of August 2022 (DICT 2022).

Table 11. List of Independent Tower Companies (ITCs), August 2022

Independent Tower Companies (ITCs)	Date of issuance of ITC Certificate of Registration	Description
Unity Digital Infrastructure Inc. (Philippines)	August 16, 2021	Provides telco towers for wireless applications such as mobile telephony, TV, radio, and public safety communication networks to address the need for internet access, expand network of incumbent telco operators, and build shared telecommunication infrastructure for entrant telecom operators (Unity Digital Infrastructure 2021).
Alt-Global-Solutions Inc. (Philippines)	January 20, 2021	Plans to build 300 to 400 towers. In partnership with DITO and Smart in building at least 50 towers (Balinbin 2020).

American Towers Inc. ATC Asia Pacific Pte. Ltd. (United States)	November 23, 2020	Present in 25 countries with 223,000 sites. Launched operations in 2021 providing wireless communication infrastructure (American Tower 2022).
CEEC Tower, Inc. (China)	December 29, 2020	Expressed willingness to invest at most USD4.4 Billion in building towers in the country which will be used by incumbent telco operators (Cabuenas 2019)
Communication and Renewable Energy Infrastructure CREI Phils Inc. (Philippines)	August 19, 2020	Plans to build more than 600 new towers by 2023 (Domingo 2022)
Comworks Infratech Corp. (Singapore)	September 22, 2021	A subsidiary of Singapore-based telecommunication infrastructure company. Took over 1,512 tower sites in Luzon last June 2022 and will take over the remaining 1,422 by the end of 2022 under the sale and leaseback agreement with PLDT Inc, where Smart will be leasing towers (Commsupdate 2022).
Desarrollos Terrestres Inc. (Brazil)	September 24, 2020	Serves 20+ countries including the Philippines (Desarrollos Terrestres 2020)
EDOTCO Group SDN BHD (Malaysia)	December 22, 2020	Built 100 towers and acquired 2,973 telecom towers from subsidiaries of PLDT Inc. under the sale and leaseback agreement for a total of 3,073 towers (EDOTCO 2022)
Frontier Tower Associates Management Pte. Ltd. (Philippines)	January 25, 2021	Started in Davao and spread across the country with 500 towers, as of July 2022 where they are rented by Globe, Smart, and DITO. Built 300 towers in Mindanao and plans to construct 1500 to 2000 more for the next 4-5 years (Alama 2022).
ISON ECP Tower Singapore Pte. Ltd. (Singapore)	December 16, 2020	Has market presence in 30 countries, with more than 10,000 telecom sites around the globe (iSON tower 2019)
LBS Digital Infrastructure Corp. (Philippines)	September 1, 2021	Plans to acquire 10,000 towers via sale and leaseback acquisition in three years, in partnership with Sojitz Corp., a Japan-based Telecom firm (Villanueva 2022)
MIESCOR Infrastructure Development Corporation (Philippines)	February 22, 2022	Expects to acquire 2,180 telecom infrastructures from Globe Telecom under sale and leaseback agreement for completion in 3 rd quarter of 2023 (MIESCOR n.d.)
SBA Towers Philippines, Inc. (Florida USA)	January 18, 2021	Present in 16 countries. Have committed PHP1 Billion investment in telecom infrastructure in the Philippines and plans to install 1,470 towers in the next five years (Isip 2022).
Skytowers Infra Inc. (Thailand)	April 23, 2021	Invested THB900 million to install telecommunication poles for rent in the Philippines (RYT9 2022)

Tiger Infrastructure Philippines, Inc. (Singapore)	March 16, 2021	Seeks USD25 million loan from ADB to build 380 telecom towers in Visayas and Mindanao. The project is in pre-construction stage as of October 2022. (Jocson 2022)
Torre, Inc.	February 24, 2021	No data found
Zeal Power Construction & Dev't. Corp. (Philippines)	June 04, 2021	Construction company which includes building tower, telecom, road, and site acquisition and permitting works (Zeal Power n.d.).
Phil-Tower Consortium Inc. (Philippines)	October 6, 2021	Completed 200 cell sites nationwide, as of June 2022. (Manila Standard Business 2022)
Tower Magkasama, Inc.	August 9, 2022	No data found

Source: Authors' compilation

4.4 Last mile

The final stage is referred to as the last mile. Whereas the other activities in the value chain occur behind the scenes, transactions that take place in the last mile are visible to the consumers, who typically pay the ISPs on a monthly basis (Greenstein 2020). The types of broadband connections include (FCC 2014; Greenstein 2020):

- DSL service is a retrofit on top of telephone lines to suit it to carrying data. DSL is a wireline transmission technology that transmits data faster over traditional copper telephone lines already installed to homes and businesses.
- Cable modem service involves the addition of switches and modems consistent with Data Over Cable Service Interface Specification (DOCSIS), which adds data services to cable television systems. Cable modem service enables cable operators to provide broadband using the same coaxial cables that deliver pictures and sound to your TV set,
- Fiber typically involves newly laid lines of fiber optic wire to the customer. Fiber optic technology converts electrical signals carrying data to light and sends the light through transparent glass fibers about the diameter of a human hair.
- Wireless broadband connects a home or business to the Internet using a radio link between the customer's location and the service provider's facility. Wireless broadband can be mobile or fixed.
- Satellite in geostationary orbits deliver and receive data to and from almost any earthly location fitted with a "dish," which communicates with the satellite. Satellite broadband is another form of wireless broadband, and is also useful for serving remote or sparsely populated areas.
- Broadband over Powerline (BPL) - BPL is the delivery of broadband over the existing low- and medium-voltage electric power distribution network.

Based on NTC, NCR has the most number of ISPs in terms of valid certificates issued by NTC, followed by Region IV-A, and Region III. Across the country, about 69 percent of certificates were given to Non-telco ISPs, 28 percent to Cable Operators, and 4 percent to Telco operators, as shown in Table 12.

Table 12. Internet Service Provider with valid certificate from the NTC (as of 31 August 2022)

REGIONAL ADDRESS	TELCO	CABLE	NON-TELCO	Total
Cordillera Administrative Region (CAR)		1	2	3
National Capital Region (NCR)	12	12	135	159
Region I (Ilocos Region)		3	13	16
Region II (Cagayan Valley)		7	15	22
Region III (Central Luzon)	1	19	48	68
Region IV-A (CALABARZON)	2	33	45	80
Region IV-B (MIMAROPA)	2	7	2	11
Region V (Bicol Region)	1	11	20	32
Region VI (Western Visayas)	1	14	6	21
Region VII (Central Visayas)		11	32	43
Region VIII (Eastern Visayas)		8	15	23
Region IX (Zamboanga Peninsula)		1	13	14
Region X (Northern Mindanao)		7	9	16
Region XI (Davao Region)		6	7	13
Region XII (SOCCSKSARGEN)	2	5	7	14
Region XIII (CARAGA)		5	4	9
Total	21	150	373	544

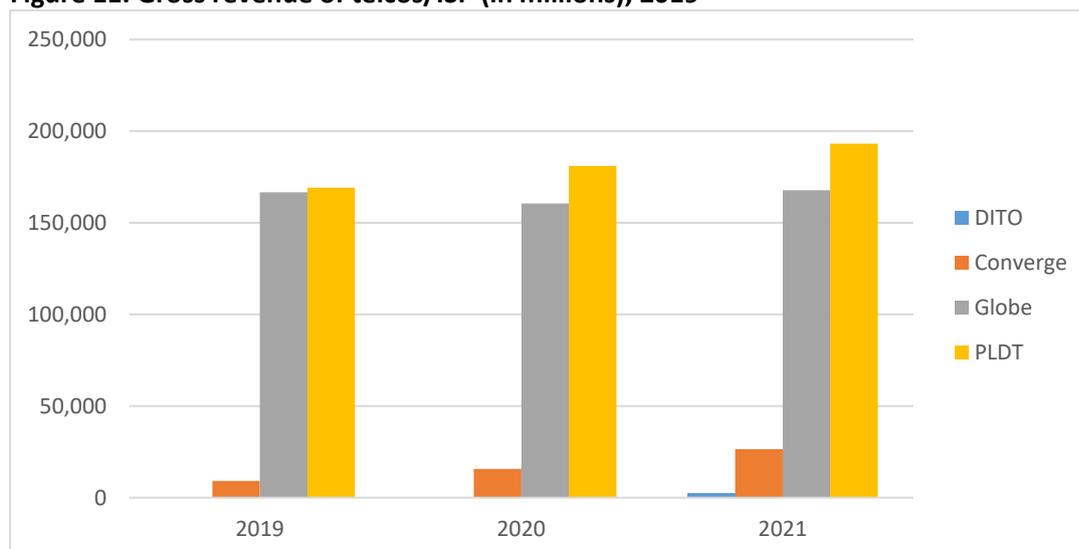
Note: Regional addresses may not necessarily reflect areas of coverage.

Source: NTC (2022)

4.4.1 Telco operators

Figure 11 shows the major internet service providers in the Philippines and the corresponding gross revenues (in millions) from 2019 to 2021. In 2021, PLDT Inc. (PLDT) generated the highest gross revenue amounting to PHP193 billion with service revenues of PHP98.5 billion for wireless services and PHP87.3 billion for fixed line services (PSE 2022; PLDT 2022a). This is followed by Globe Telecom Inc. (Globe) with an approximate gross revenue of PHP168 billion in 2021 with mobile data revenue of PHP77.8 billion and home broadband revenue of PHP29.4 billion (PSE 2022; Globe 2022a). Converge ICT Solutions Inc. (Converge) shows an increasing trend with 26 billion gross revenue where majority (PHP23 billion) is accounted from residential services and PHP3.35 billion accounted from enterprise services (PSE 2022; Converge ICT 2022a). DITO CME Holding Corp (DITO) recorded a PHP2 billion gross revenue (PSE 2022). It only has data in 2021 since its franchise as a third telco player was in March 2021 (Commsupdate 2021).

Figure 11. Gross revenue of telcos/ISP (in millions), 2019



Telco/ISP	2019	2020	2021
DITO	NA	NA	2,189
Converge	9,139	15,652	26,479
Globe	166,660	160,520	167,747
PLDT	169,187	181,004	193,257

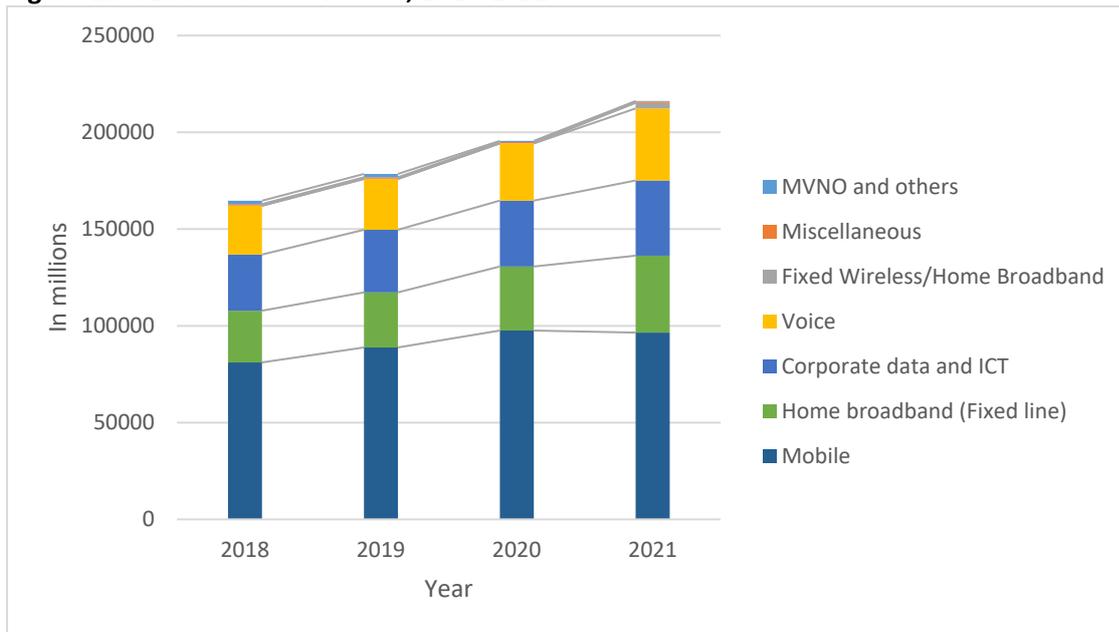
Note: NA = Not applicable

Source: PSE (2022)

PLDT's service revenues comprised of mobile (prepaid, postpaid, and inbound roaming), home broadband (fixed line), corporate data and ICT, and voice, among others. Mobile, corporate data and ICT, home broadband, and voice have been the most significant contributors of PLDT revenues. Both data services, namely: (1) corporate data and ICT¹ for enterprise customers and (2) home broadband for residential customers have continuously increased from 2018 to 2021 (See Figure 12).

¹ Corporate data and ICT also include data center, cloud, cyber security, and managed IT offerings

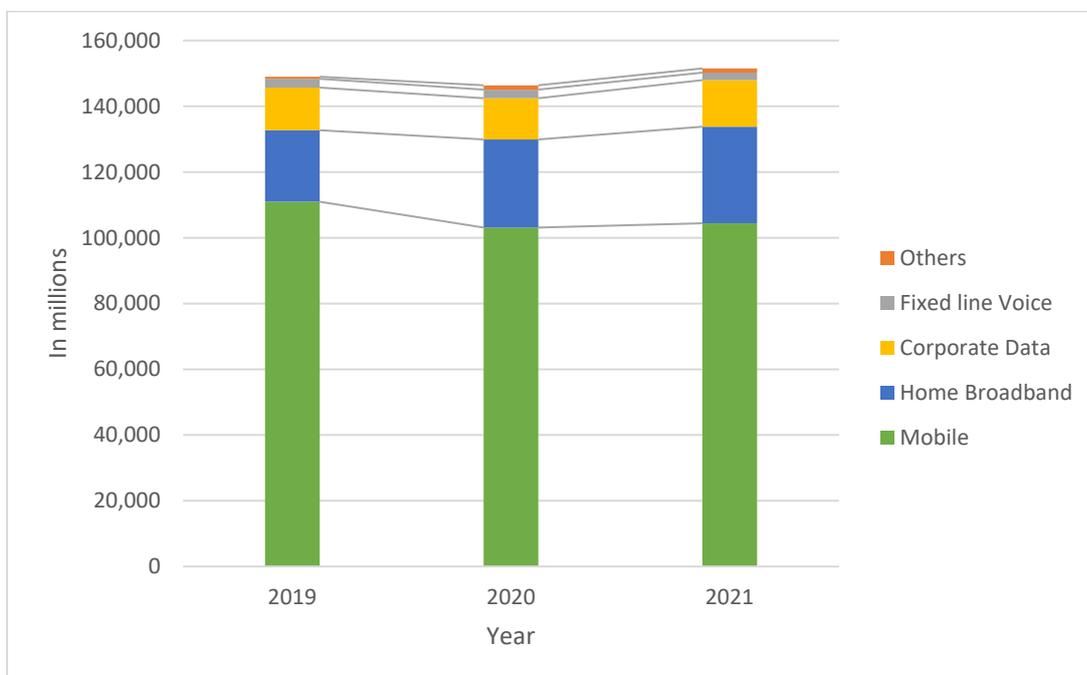
Figure 12. PLDT service revenues, 2018-2021



Source: PLDT (2022d)

Globe’s majority of services revenue is from mobile services (includes mobile and fully mobile broadband), followed by home broadband (both fixed wireless and wired broadband), corporate data (including value-added services and ICT), fixed line voice, and others (non-telco revenues from subsidiaries). From 2020 to 2021, revenues from corporate data and home broadband increased by 13 percent and 10 percent, respectively. See Figure 13.

Figure 13. Globe service revenues, 2019-2021

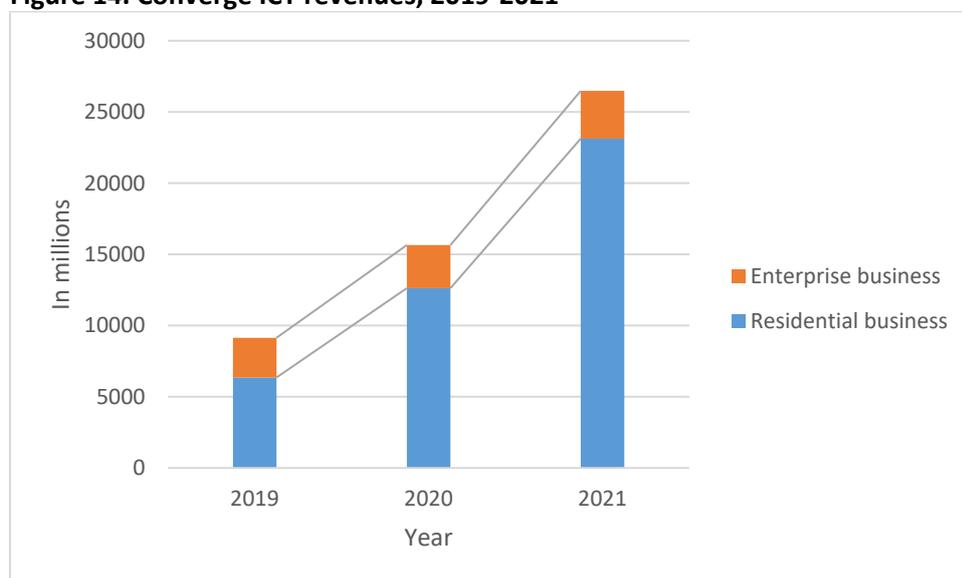


Source: Globe (2022d)

Converge offers two (2) business segments, (1) enterprise² and (2) residential³. Both segments show an increasing trend from 2019 to 2021, with 83 percent year on year change for residential business revenue and 11 percent for enterprise business revenue (Figure 14). Residential business refers to “high-speed fixed broadband internet services to residential customers”, while enterprise business refers to “high-speed fixed broadband internet services, private data network solutions, cloud and colocation services and other connectivity solutions to enterprise customers of varying sizes, industries and types” (Converge ICT 2022b, p. 6).

DITO’s service revenues reached PHP2.186 Billion in 2021. Its business operations involve telecommunications services through DITO Telecommunity, investments in digital media and content (Acuity Global and Luna Academy), managed analytics, intelligent lifestyle and commerce platforms, and enabling infrastructure such as data centers, managed information technology, and cloud services (DITO 2022b).

Figure 14. Converge ICT revenues, 2019-2021



Source: Converge ICT (2022b)

4.4.1.1 Service Portfolios. Through gaining franchise and licenses and mergers and acquisitions of businesses, PLDT and Globe was able to expand their businesses from providing fixed and mobile telecommunication services, respectively, enabling them to participate across the various components of the internet value chain and have presence across all the components of the internet access connectivity segment, as shown in Figure 15, Figure 16, and Chapter 4.

PLDT

PLDT was given franchise in 1928 to install, operate, maintain telephone system in the Philippines. The franchise was amended in 1991, allowing the company to provide virtually any type of telecommunication services. Since then, the company was able to acquire and

²Residential business offers “high-speed fixed broadband internet services to residential customers” (Converge ICT 2022b, p.6)

³ Enterprise business refers to high-speed fixed broadband internet services, private data network solutions, cloud and colocation services and other connectivity solutions to enterprise customers of varying sizes, industries and types (Converge ICT 2022b)

merge with businesses, such as Smart which has a franchise granted under RA 7924 and Digitel Mobile Philippines, Inc. (DPMI) which operates Sun mobile, both providing wireless telecommunication services. It also expanded its business in fixed line segment throughout the Philippines by acquiring majority of shares of various companies such as ClarkTel, Bonifacio Communications Corporation (BCC), Maratel, previously joint venture SubicTel, Philcom, and JG Summit Holdings, Inc, where some of them are already ceased operations due to expired franchise.

Currently, it has various subsidiaries with portfolios relating to cellular mobile services, telecommunication, ICT infrastructure, media distribution, and value-added services. It also has ownership or shares in satellite information and messaging services, cross-border digital platforms, business infrastructure and solutions, air transportation, and investment (See Table 13).

Table 13. PLDT Subsidiaries, ownership, and principal business activities

Name of Subsidiary	Ownership	Principal business activity
Smart Franchise expires in 2042	100	Cellular mobile services
PLDT Global, Inc	100	Cross-border digital platforms and other allied services
ACeS Philippines Cellular Satellite Corporation (AceS Philippines)	88.5	Satellite information and messaging services
Digitel Mobile Philippines, Inc. (DMPI) Franchise expires in 2028	99.6 (indirect)	Cellular mobile services
PLDT Clark Telecom, Inc. (ClarkTel) Franchise expires in 2024	100	Telecommunications services
PLDT Global Corporation (PLDT Global and Subsidiaries)	100	Telecommunications services
Talas Data Intelligence, Inc.	100	Business infrastructure and solutions; intelligent data processing and implementation services and data analytics insight generation
ePLDT, Inc. (ePLDT) and Subsidiaries	100	Information and communications infrastructure for internet-based services, e-commerce, customer relationship management and IT related services
Bonifacio Communications Corporation (BCC)	75	Telecommunications, infrastructure and related VAS
Pacific Global One Aviation Company, Inc. (PG1)	65.3	Air transportation business
Pilipinas Global Network Limited (PGNL and Subsidiaries)	64.6	International distributor of Filipino channels and content
PLDT Global Investments Holdings, Inc. (PGIH)	100	Investment company

PLDT Digital Investments Pte. Ltd. (PLDT Digital and Subsidiaries)	100	Investment company
PLDT Global Investments Corporation (PGIC)	100 (indirect)	Investment company
PLDT Communications and Energy Ventures, Inc. (PCEV)	99.9 (indirect)	Investment company

Source: PLDT (2022d)

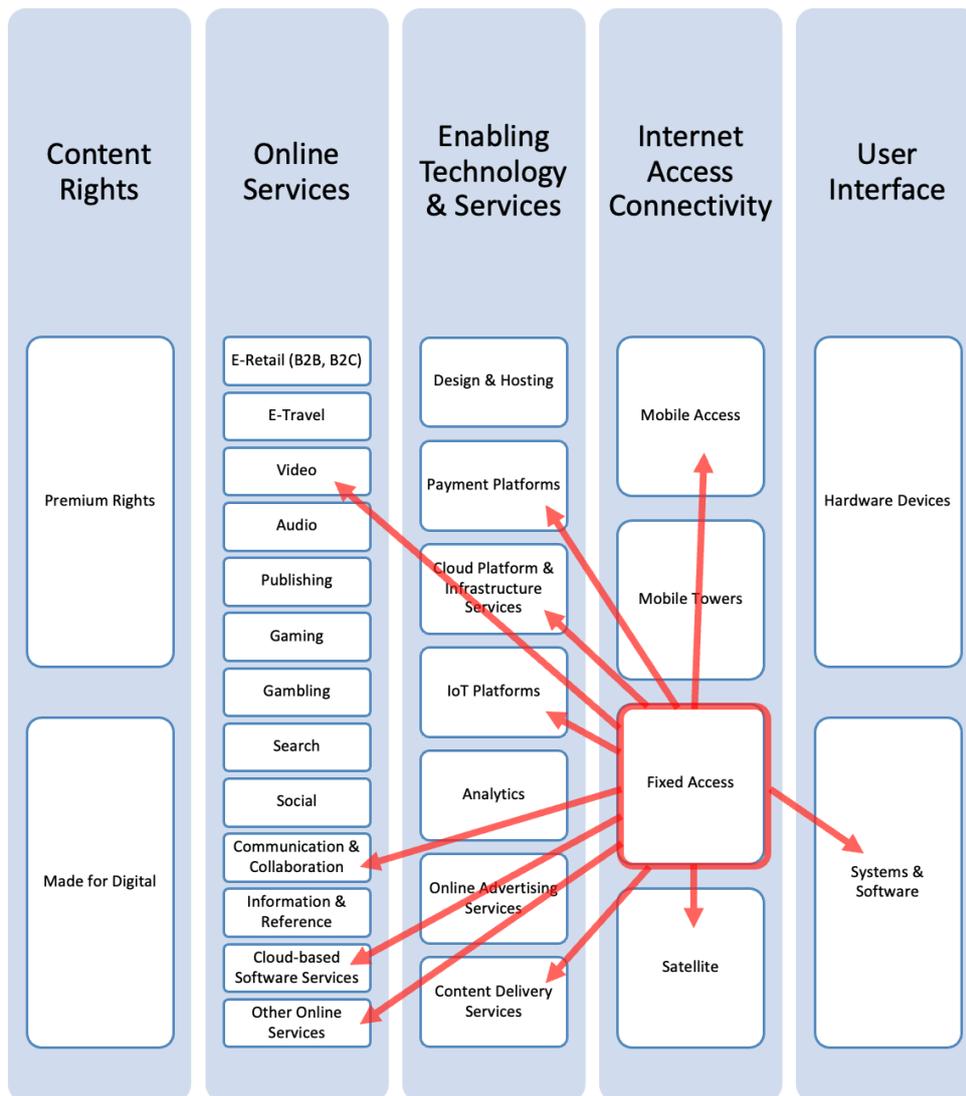
Initially providing fixed telecommunication services, PLDT and its subsidiaries such as ePLDT, Smart, DMPI, and market shares from other companies, PLDT's services expanded across various internet segments, as shown in Figure 15:

- Other online services: Smart Home and mWell PH
- Fixed access: Home broadband services, PLDT Smart Home, Home Biz, Home Rewards
- Online services – Video (Partnership): Cignal⁴, NBA League Pass, Viu, HBO GO, and Lionsgate Play
- Communication and collaboration: Cloud PTT, PLDT's Collaboration Suite
- Cloud-based software services: Data center, managed server hosting, disaster recovery as service
- IoT Platforms: Smart trackers for vehicles, Digital Forms, Smart internet of things
- Systems and software: Cybersecurity
- Content delivery services: VITRO internet exchange
- Cloud platform and infrastructure services: SmartSat (Satellite) Managed information technology services, Salesforce Commerce Cloud
- Mobile access: Prepaid and postpaid mobile services which may include devices, Fixed Wireless Broadband Services
- Payment platforms: PayMaya⁵ financial services ecosystem

⁴Owned by Cignal TV which is a subsidiary of MediaQuest Holdings, a media partner of PLDT group of companies (Cignal n.d.)

⁵ "Owned by Voyager Innovations where PLDT has 38.45% stake (PLDT 2022d)

Figure 15. PLDT service portfolio



Source: PLDT (2022a; 2022b; 2022c; 2022d)

Globe

The NTC granted Globe various licenses to provide data services via Very Small Aperture Terminal (VSAT) technology, inter-exchange services, international gateway facility, wireless, international long distance, nationwide local exchange carrier (LEC) services, and operate international cable landing stations, allowing the firm to participate in all internet connectivity, from international link, inter-exchange, local exchange, to last mile data transmission.

Apart from Globe's main business of providing wireless telecommunication services, it also acquired Innove Communications Inc. (Innove), previously named as Isla Communications Company Inc. (Islacom), in 2001 which gained a franchise to provide fixed line voice and data communication services in 2005. It later expanded its market by acquiring Yondu's 100 percent shares and EC Pay's 77 percent share to provide IT and software development and IT and electronic services. Other subsidiaries are listed in table 14.

Table 14. Globe Subsidiaries, ownership, and principal business activities

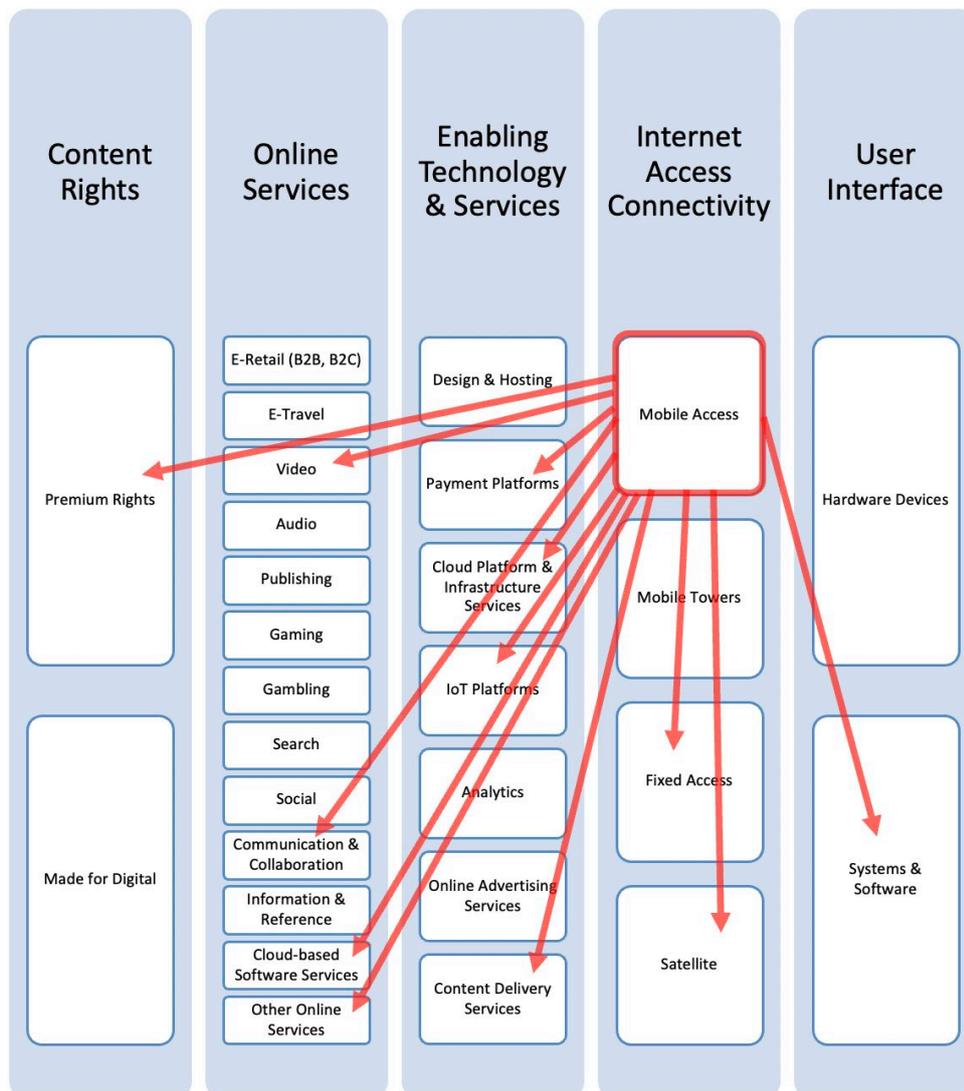
Name of Subsidiary	Ownership	Principal business activity
Innove Communications Inc. (Innove)	100	Wireline voice and data communication services
GTI Business Holdings, Inc. (GTI)	100	Holding company
Kickstart Ventures, Inc. (Kickstart)	100	Venture capital company
Asticom Technology, Inc	100	Support and shared services provider
Globe Capital Venture Holdings, Inc. (GCVHI) (rebranded as 917 Ventures)	100	Holding company
Bayan Telecommunications, Inc. (Bayan)	99	Wireline voice and data communication services
TaoDharma (Tao)	67	Distributing company
GTowers Inc. (GTowers)	100	Tower company
Yondu, Inc.	100	Information technology and software development
Electronic Commerce Payments, Inc. (ECPay)	77	Information technology and electronic services

Source: Globe (2022d)

Initially providing mobile telecommunication services, Globe, with its subsidiaries expanded its services across various internet segments, as shown in Figure 16:

- Content rights – Premium rights and Online services – Video: Upstream.ph
- Communication and collaboration: Squadzip, Amazon End User Computing Services, Office 365 (O365) with Microsoft Teams, Zoom
- Cloud-based software services and other e-services: Cloud solutions – public cloud, professional services, managed services, collaboration tools, and premium cloud connect
- Other online services: KonsultaMD
- Payment platforms: GCash
- Cloud platform and infrastructure services: ChatGenie, virtualized solutions, Business application services such as human capital management solutions, digital and automation, Customer Relationship Management (CRM)
- IoT: Vehicle tracker, all-in-one device management solutions
- Content delivery services: International and domestic data
- Mobile and Fixed access: Postpaid and prepaid plan which may include devices, Prepared mobile wifi, GPlan Biz, GFiber Biz Plus
- Satellite: IsatPhone Pro
- Systems and software: Cybersecurity

Figure 16. Globe service portfolio



Source: Globe (2022a; 2022b; 2022c; 2022d)

4.4.1.2 Market shares. Smart and Globe have dominated the market in terms of postpaid and prepaid mobile services. Globe has the highest broadband fixed wireless users, while PLDT/Smart has the highest fixed-line users. Converge participates in the fixed-line broadband services market (Figure 17).

Figure 17. Market share based on number of subscriptions



Source: NTC annual reports (2016-2020)

4.4.1.3 Market concentration. Market concentration can be determined using the Herfindahl-Hirschman Index (HHI). An HHI score of 1500 would be considered ‘unconcentrated,’ an HHI score between 1500 and 2500 is considered ‘moderately concentrated,’ and HHI score above 2500 is ‘highly concentrated’ (see for example Serafica et al. 2020). According to the ITU (2021c), the optimal mobile industry concentration level that maximizes capital investment as measured by the HHI is close to 4113.

In the Philippines, regarding connectivity services, prepaid subscriptions contribute 96.8 percent of the market share, and postpaid subscriptions contribute only 3.2 percent (MCMC 2021). Having three (3) telcos: DITO Telecommunity, Globe Telecom, and PLDT, telecommunications sector have a high market concentration based on the computed HHI (4942) using the number of mobile subscribers as of the 1st quarter of 2022 (See Table 15). Globe and Smart hold 54 percent and 45 percent share, respectively, while DITO has 1 percent of the market share (Ookla 2022). It implies that two industry players, PLDT and Globe, dominate the market (See also Section 4.4.1). The market concentration is also high in terms

of fixed broadband subscriptions (3546) where PLDT and Globe dominates. PLDT holds 48 percent, while Globe has 32 percent, Converge has 13 percent, and Sky has 7 percent of the market share based on the number of subscribers (Statista 2021a).

In Vietnam, VNPT and Viettel dominated the market share in both broadband and mobile services in terms of subscriptions in 2019. Viettel obtained the majority of mobile subscriptions (56.77%), while VNPT had about 21 percent, Mobifone had 20 percent, and Vietnamobile had 1 percent. Other mobile services providers, including MVNOs, has only 0.17 percent of the market share. Regarding broadband service providers, VNPT, Viettel, and FPT have 43 percent, 37 percent, and 15 percent of the market share, respectively, while other broadband service providers hold only less than 5 percent share (MIC 2020).

Malaysia's telecommunication sector generated revenue of RM40.31 billion in 2021, with a 'moderately concentrated' market in terms of revenue. Mobile services contributed 68 percent (RM27.38 billion): Maxis, 22.8 percent; Celcom, 16.4 percent; Digi, 15.7 percent; and Others, 13 percent. Fixed services contributed 32 percent to the total revenue (TM contributed 28.6 percent, while TIME contributed 3.5 percent). Specifically, mobile services show a moderately concentrated market in terms of mobile cellular subscriptions. Maxis and Digi captured almost half the market share (27.4% for Maxis and 21.6% for Digi), while Celcom had 18.7 percent and U mobile had 16 percent. Other providers, including MVNOs, have 16.3 percent of the market share (MCMC 2021).

In terms of the market share of subscribers in Thailand, 69.2 percent are from prepaid subscriptions, while 30.8 percent are from postpaid subscriptions (MCMC 2021). Two (2) players dominate the mobile market in terms of the number of subscribers. AIS has 44.38 percent, while True has 32.44 percent of the market. DTAC has about 19.68 percent, National Telecom has 3.45 percent, and MVNOs have 0.05 percent of the market share (Rasmussen 2022).

In 2021, the market share of subscribers in Singapore is 76.4 percent postpaid subscriptions and 23.6 percent prepaid subscriptions. As of 2019, the mobile market is dominated by Singtel (50%) and Starhub (26%), M1 has 23.3 percent of the market share, and about 0.9 percent is attributed to MVNOs (Statista 2022a; Statista 2022b). Additionally, comparing the revenues among four major telcos, Singtel generated annual revenue of about SGD15 billion from April 2021 to March 2022, while Starhub generated about SGD2 billion from July 2021 to June 2022. M1 earned about SGD1 billion in 2021 and NetLink recorded an SGD377 million revenue from April 2021 to March 2022 (SGX 2022).

Table 15 shows the market concentration (computed HHI) of mobile services for selected ASEAN countries.

Table 15. Market concentration of mobile services in selected ASEAN countries

Country	Population (2021)	Population density (2021)	Land area in sq. km (2021)	Income status	HHI	Market Concentration	Major rival firms or industry players (rounded down)
Philippines	111,046,910	372	298,170	Lower middle income	4,942	Highly concentrated	Globe and Smart
Vietnam	98,168,829	317	310,070	Lower middle income	4,099	Highly concentrated	Viettel and VNPT

Malaysia	32,776,195	100	328,550	Upper middle income	2,089	Moderately concentrated	Maxis, Digi, Celcom, and MVNOs
Thailand	69,950,844	137	510,890	Upper middle income	3,425	Highly concentrated	AIS and True
Singapore	5,453,566	7,692	709	High income	3,705	Highly concentrated	Singtel and Starhub

Note: This table is used only as a summary. The computed HHI may not be comparable across the countries since it was based on mobile subscriptions or revenue at different years, depending on data availability. For the Philippines, HHI is computed in terms of mobile subscriptions as of the 2nd quarter of 2022; For Malaysia and Thailand, HHI is computed in terms of mobile subscriptions in 2021; For Singapore and Vietnam, HHI is calculated using the mobile market share by revenue in 2019. Population density = People per sq. km of land area.

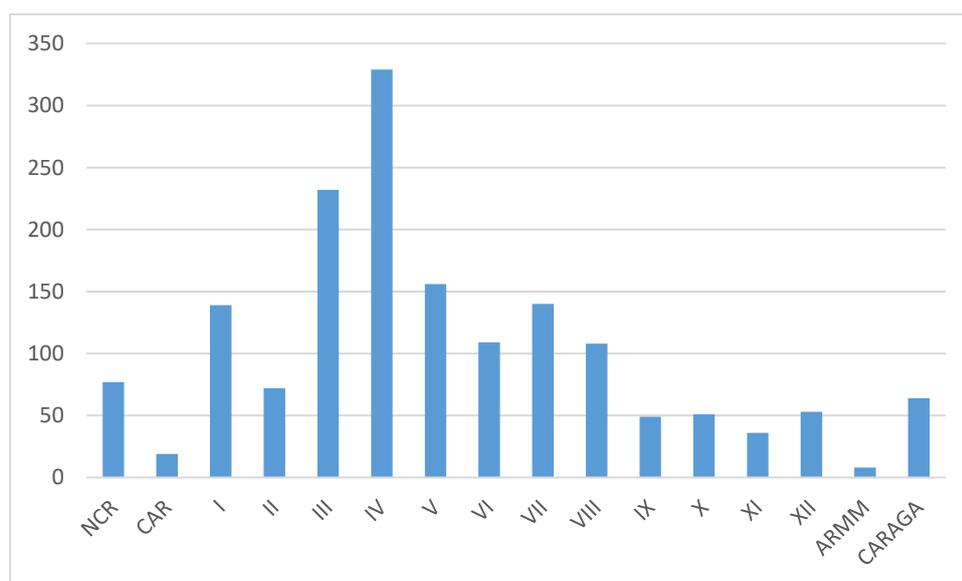
Sources: MCMC (2021); Statista (2021c; 2022a); Rasmussen (2022); MIC (2020)

4.4.2 Cable TV operators

In the US, Cablecos or companies offering cable services have been the primary broadband and TV service providers and hold more than 60 percent of homes with internet access (Bandyopadhyay et al. 2020). In EU countries (e.g., the UK, Germany, Belgium, and the Netherlands), the next-generation access (NGA) networks, which involves cable TV and telecom operators, use partly or fully fiber optic technologies that provide high-speed broadband internet service to businesses and residential customers. Cable operators have been providing TV content, internet access, and basic telecom services and are the major competitors of incumbent telecom operators (Briglauer et al. 2018).

E.O. 436, s. 1997 (Prescribing Policy Guidelines to Govern the Operations of Cable Television in the Philippines) recognized the role of CATV systems as the national information highway to the countryside. In 2019, there were 1,642 CATV stations nationwide. Twenty percent of stations were in region IV (NTC 2019). See Figure 18.

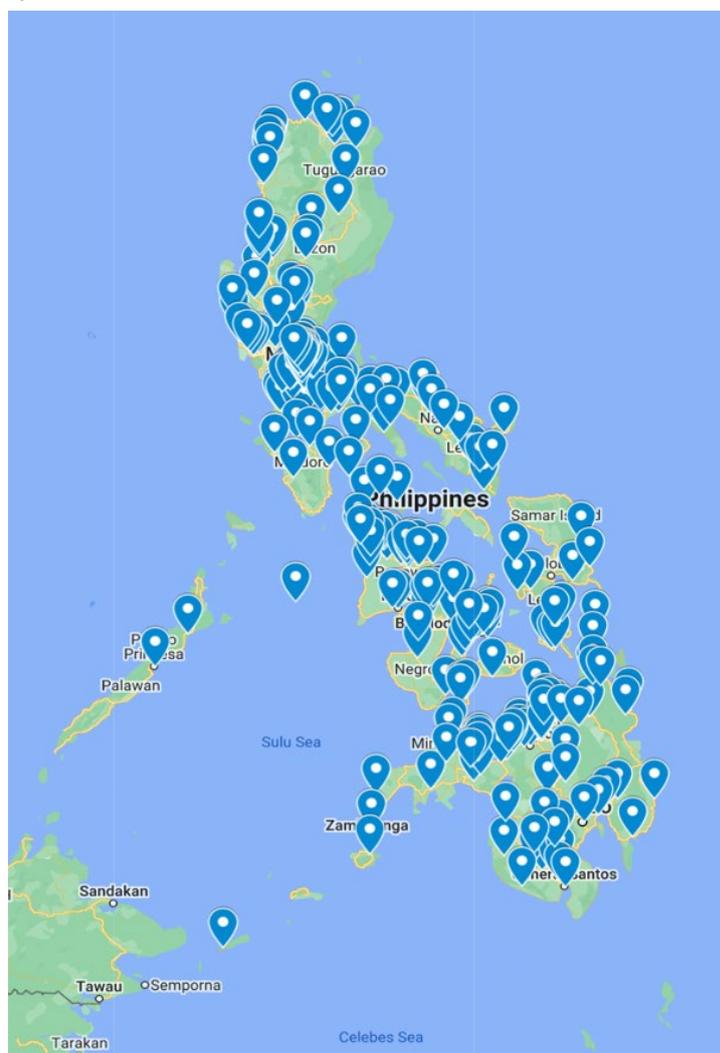
Figure 18. CATV Stations by region, 2019



Source: NTC (2019)

The Philippine Cable and Telecommunication Association, Inc. (PCTA) is an association of cable TV operators in the Philippines with members all over the country. As of September 2022, there are about 281 PCTA members nationwide serving more than 84 cities and 192 municipalities (See Table 16).

Table 16. Estimated number of member cable TV operators of PCTA by region, September 30, 2022



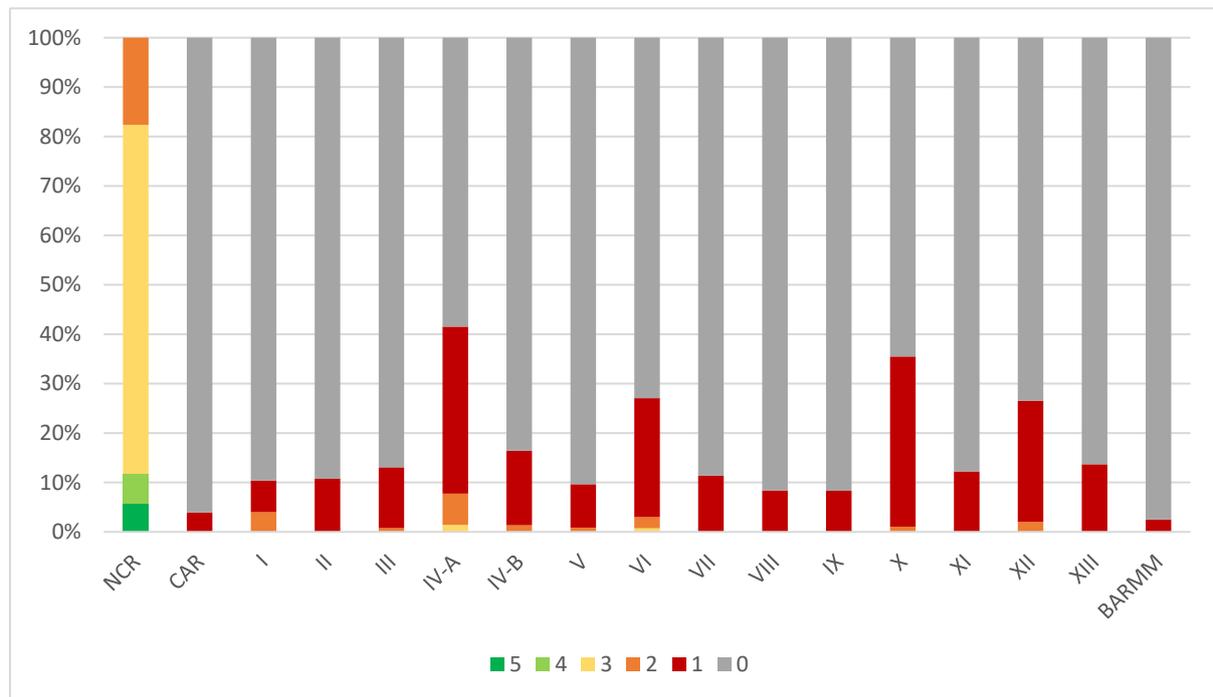
Region	Services areas
IV-A	59
VI	36
X	33
III	17
NCR	17
VII	15
I	13
XII	13
VIII	12
IV-B	12
V	11
II	10
XIII	10
IX	6
XI	6
BARMM	3
CAR	3
Total	276

Note: Service areas refer to the number of cities and municipalities covered by at least one PCTA member (Cable TV operators). This is an underestimation since there is no regional data for 175 cities and municipalities served by First United Broadcasting Corporation (FUBC). Source: Authors' own based on personal communications with PCTA on October 26, 2022

Figure 19 shows the proportion of cities and municipalities being served by PCTA member cable operators. At least one PCTA member is present in all cities and municipalities in NCR. The majority of cities/municipalities (14 out of 17) in NCR are each being served by at least three PCTA cable TV operators. PCTA members have the potential to expand their services in regions outside NCR, particularly in regions VIII, IX, CAR, and BARMM, where its presence in cities and municipalities is less than 10 percent. Among service areas served by PCTA members, more than 45 percent in regions NCR, XI, CAR, III, IV-A, XII, IV-B, II, and V are classified as 1st class cities and municipalities. PCTA members are also present in some of 1st to 3rd class cities and municipalities in region IX. They also serve some 1st to 5th class areas in

Region VII, XIII, VI, I, and VIII and they even reach some 6th class cities and municipalities in Regions X and BARMM (See Figure 20).

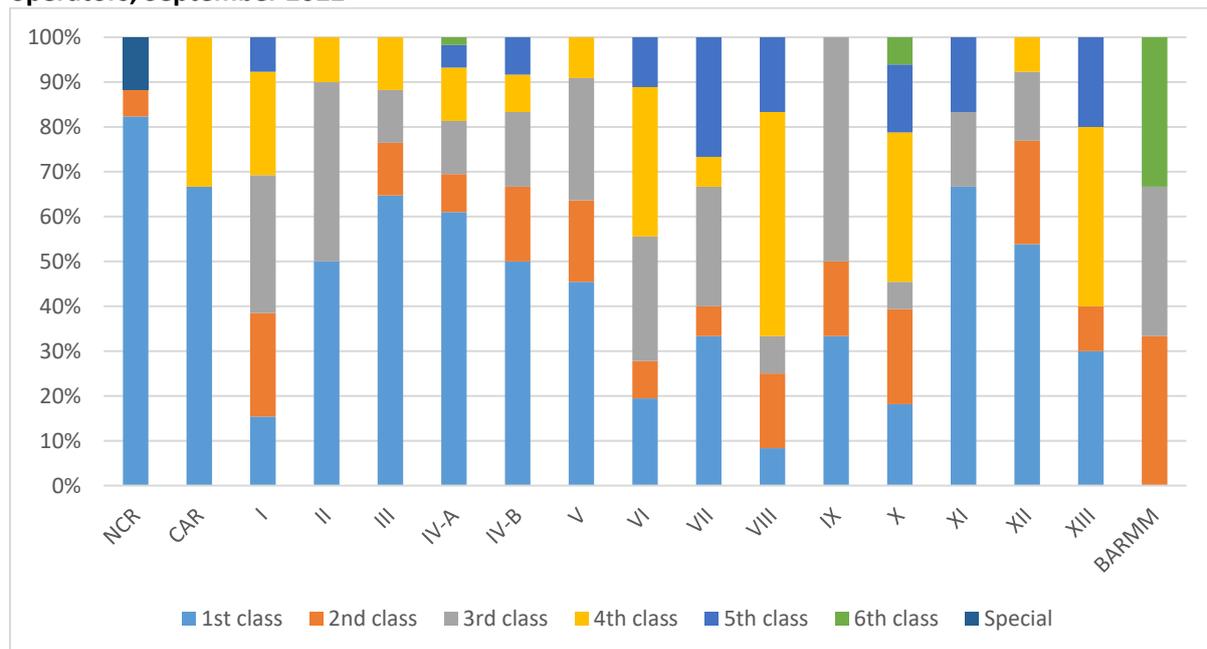
Figure 19. Cities and municipalities with PCTA cable TV operators by region, September 2022



Note: 5= percentage of cities and municipalities each served by 5 PCTA cable TV operators, 4= percentage of cities and municipalities each served by 4 PCTA cable TV operators, 3= percentage of cities and municipalities each served by 3 PCTA cable TV operators, 2= percentage of cities and municipalities each served by 2 PCTA cable TV operators, 1= percentage of cities and municipalities each served by 1 PCTA cable TV operator. The figure is an underestimation since there is no regional data for 175 cities and municipalities served by First United Broadcasting Corporation (FUBC).

Source: Authors' own based on personal communications with PCTA on October 26, 2022.

Figure 20. Income classification by region for cities/municipalities with at least one PCTA cable TV operators, September 2022



Note: This is an underestimation since there is no regional data for 175 cities and municipalities served by First United Broadcasting Corporation (FUBC).

Source: Authors' own based on personal communications with PCTA on October 26, 2022

The majority of these cable operators also provides internet services to its subscribers. The National ICT Household Survey (DICT 2019) showed that only about 17.7 percent of households (4,123,881 out of 23,360,960 households) in the Philippines have access to internet via fixed wired and wireless broadband, satellite, and mobile. However, the industry survey by PCTA in 2020 shows that there are 2 million homes connected to the internet via cable ISPs out of 5 million cable TV subscribers which were not accounted for. It may have been a significant portion of the households with internet access in the country if it were included in the number of households connected to fiber internet since most cable ISPs use fiber to the home or fiber to the neighborhood (Dabao 2021).

The figures above illustrate the potential for cable TV to further strengthen its role as the national information highway to the countryside by providing internet services, especially in rural areas. There are communities where a PCTA member is the sole provider of internet connection particularly in small towns the telcos are typically not interested in, while urban areas have an abundant number of ISPs. The digital divide is a major concern in the country which the PCTA strives to address. One of the visions of the PCTA is for the remaining member cable TV operators to become ISPs by guiding them regarding relevant policies to make it easier to enter the market, capacitating them with sharing best practices and conducting training, and developing initiatives to make it economically feasible for them to participate in the internet service market.

4.4.3 Other Internet Service Providers

Table 12 does not show any telco, cable, nor non-telco ISPs (fixed-line) with valid certificates in BARMM. Instead, consumers connect to the internet through neighboring regions. For example, although there is an option for wireless internet access, teachers in Tawi-Tawi still have to travel to Zamboanga (located in Region IX) to access stable internet connection. Other than cable operators, non-telco operators, including internet resellers and VSAT/satellite

providers, are alternative options for internet connectivity in areas where there are no telcos present. Very Small Aperture Terminal (VSAT) or satellite systems are useful, particularly to areas with poor telecommunications infrastructure. Table 17 lists some examples of satellite ISPs covering the Philippines.

Table 17. Satellite/VSAT providers with coverage including Philippines

Satellite/VSAT providers	Office location	Website address
TS2 Space	Poland	https://ts2.space/en/
Starlink SpaceX	California, US	https://www.spacex.com/
Kacific	Singapore	https://kacific.com/ph/
Businesscom Networks	South Africa	https://www.bcsatellite.net/
OneWeb	United Kingdom	https://oneweb.net/
Syntelix	Panama	https://www.syntelix.net/en
Enhanced Electronics and Communication Services, Inc.	Pasig City, Philippines	https://www.enhanced.com.ph/
Thaicom (IPSTAR)	Makati City, Philippines	https://www.thaicom.net/
AZ Communications Network, Inc.	Makati City, Philippines	https://azcomm.net/
Jason Electronics Philippines Co., Inc.	Quezon City, Philippines	https://jasonelectronicsph.com/
DeINet International Corp.	Manila, Philippines	https://www.delnetinternational.com/
iXForAll, INC.	Makati City, Philippines	https://www.ixs.ph/
We Are IT Philippines Inc.	Mandaluyong City, Philippines	http://www.philsat.com/
Philippine Communications Satellite Corporation (PHILCOMSAT)	Makati City, Philippines	https://www.philcomsat.com.ph/
EasyCall Communications Philippines Inc. (ECP)	Taguig City, Philippines	https://www.easycall.com.ph/

Source: ISP.today (2022), with modifications

5. Regulatory framework

5.1 Sector laws and regulations

It is the role of the National Telecommunication Commission to “foster fair and efficient market conduct through, but not limited to, the protection of telecommunications entities from unfair trade practices of other carriers” (RA 7925 Art III Sec 5 d). Below are the key regulations that govern the telecommunications market and firm conduct. See also Serafica and Oren (2022) for a discussion of the ICT regulatory environment.

Level of competition and foreign ownership allowed

By law, there are no limits on the number of service providers in the various segments of the telecommunications market (Table 18).

Table 18. Level of competition allowed in each service

Local and long distance (domestic and international) fixed line services	Full competition
IMT (3G, 4G, etc.) services	Full competition
Cable modem, DSL, fixed wireless broadband	Full competition
Leased lines	Full competition
International Gateways	Full competition

Note: Refers to what is legally permissible

Source: ITU (2020b)

The recently passed amendments to the Public Service Act have opened up the telecommunications and other public services such as transport to 100% foreign ownership. Thus, the internet access connectivity segment which used to limit foreign ownership to 40% has been liberalized.

There are other remaining restrictions however which might be relevant to other segments of the value chain. Foreign ownership is still limited to 40% in public utilities including Public Utility Vehicles (PUVs) although transport vehicles accredited with and operating through transport network corporations shall not be considered as public utility vehicles.⁶ For the retail sector, the threshold for foreign ownership has been lowered to a paid up capital of \$425,000. The Constitution restricts foreign ownership in advertising to 30% and for education the restriction is set at 40%. In mass media, no foreign ownership is allowed.

It is not clear if there are any ownership restrictions in the provision of Cable TV. According to E.O. 436, s. 1997, sec. 1, “the operation of cable television systems, as a subscriber service undertaking with a unique technology, shall be maintained separate and distinct from telecommunications or broadcast television.”

Licensing

The Public Telecommunications Policy Act of the Philippines (**RA 7925**) passed in 1995 requires a legislative franchise to enter the Philippine market. A Certificate of Public Convenience and Necessity (CPCN) must also be obtained from the NTC. The requirement to obtain a franchise applies to the six types of telecommunications entities listed in RA 7925, namely: local exchange operator, inter-exchange carrier, international carrier, value added services (VAS), mobile radio services, and radio paging services. A VAS provider is defined as “an entity which, relying on the transmission, switching and local distribution facilities of the local exchange and inter-exchange operators, and overseas carriers, offers enhanced services beyond those ordinarily provided for by such carriers” (RA 7925, Section 3). A franchise is not required for VAS providers which do not put up its own network.

As elaborated in the Implementing Rules and Regulations (IRR) for RA 7925 (**NTC MC 08-09-95**):

- a) A non-PTE VAS provider shall not be required to secure a franchise from Congress.
- b) A non-PTE VAS provider can utilize its own equipment capable only of routing, storing and forwarding messages in whatever format for the purpose of providing enhanced or augmented telecommunications services. It shall not put up its own network. It shall use the transmission network, toll or local distribution, of the authorized PTEs.

⁶ PUVs refer to “internal combustion engine vehicles that carry passengers and/or domestic cargo for a fee, offering services to the public, namely trucks-for-hire, UV express service, public utility buses (PUBs), public utility jeepneys (PUJs), tricycles, filcabs, and taxis” (RA11659, Section 2).

- c) The provision of VAS shall not in any way affect the cross subsidy to the local exchange network by the international and national toll services and CMTS service.
- d) Entities intending to provide value added services only shall submit to the Commission application for registration for approval. The application form shall include documents showing, among other, system configuration, mode of operation, method of charging rates, lease agreement with the PTE, etc.
- e) The application for registration shall be acted upon by the Commission through an administrative process within thirty (30) days from date of application.
- f) PTEs intending to provide value added services are required to secure prior approval by the Commission through an administrative process.
- g) VAS providers shall comply strictly with the service performance and other standards prescribed by the Commission.

Telecommunications entities may provide VAS, subject to the additional requirements that: a) prior approval of the Commission is secured to ensure that such VAS offerings are not cross-subsidized from the proceeds of their utility operations; b) other providers of VAS are not discriminated against in rates nor denied equitable access to their facilities; and c) separate books of accounts are maintained for the VAS. (RA 7925 Art IV. Sec. 11).

Internet and other Value Added Services

Internet service is considered a value added service (VAS). **NTC MC No. 02-05-2008**, classified the following services as VAS - messaging services; audio conferencing; audio and video conferencing; voice mail service; electronic mail service, information service, electronic gaming service except gambling; applications service; content and program service; audiotext service; facsimile service; virtual private network service; and hosting service. NTC MC No. 02-05-2008 also stipulates that:

Public telecommunications (PTEs) shall offer leased line service to VAS providers at the same quality and at a price not higher than the the prevailing leased line prices offered by the PTEs *to the public* [emphasis added]. Moreover, the PTE shall not deny requests by VAS providers for leased line service. (Sec. B.4)

In terms of registration requirements, the VAS applicant must, among other things, have a facilities lease agreement with duly enfranchised and certificated public telecommunications entity. (Sec. B.6.d)

For duly enfranchised and certificated public telecommunications entity, they must submit a written undertaking that they will not discriminate other VAS providers in terms of rates and service quality for similar facilities leased to them (Sec. B.6.e)

In terms of final prices, rates for VAS services are deregulated.

Voice over IP (VOIP) is governed by **NTC MC No. 05-08-2005**, which states that local exchange and interexchange operators and overseas carriers are allowed to offer VoIP without need of further registration, provided that they ensure that such VoIP offerings are not cross-subsidized from the proceeds of their utility operations; other providers of VoIP are not discriminated against in rates nor denied equitable access to their facilities; and separate books of accounts are maintained for VoIP (Sec. 3).

Interconnection and access pricing

According to RA 7925, the access charge or revenue sharing arrangements should be negotiated between interconnecting carriers. The NTC only intervenes when parties fail to

reach an agreement to ensure equity, reciprocity, and fairness. Moreover, the following factors are taken into account (Sec. 18): (1) the costs of the facilities needed to complete the interconnection, (2) the need to provide the cross-subsidy to local exchange carriers to enable them to fulfill the primary national objective of increasing telephone density in the country and (3) assure a rate of return on the total local exchange network investment that is at parity with those earned by other segments of the telecommunications industry.

Executive Order No. 59, s.1993 (Prescribing the Policy Guidelines for Compulsory Interconnection of Authorized Public Telecommunications Carriers in order to Create a Universally Accessible and Fully Integrated Nationwide Telecommunications Network and Thereby Encourage Greater Private Sector Investment in Telecommunications), which predates RA 7925 required mandatory interconnection “with regard to connecting other telecommunications services such as but not limited to value-added services of radio paging, trunking radio, store and forward systems of facsimile or messaging (voice or data), packet switching and circuit data switching (including the conveyance of messages which have been or are to be transmitted or received at such points of connection), information and other services as the NTC may determine to be in the interest of the public and in the attainment of the objective of a universally accessible, fully integrated nationwide telecommunications network.” (Sec. 5). Moreover, interconnection shall be negotiated and effected through bilateral negotiations between the parties involved subject to certain technical/operational and traffic settlement rules set by the NTC, which can intervene if parties fail to reach an agreement (Sec. 6). The implementing guidelines are contained in **NTC MC 09-07-93** and updated in **NTC MC 14-07-2000**. Notably, NTC MC 14-07-2000 enumerates the factors to be considered by the Commission in the exercise of its duty to mandate interconnection among disputing telecommunications carriers. Under Compulsory Arbitration and Interconnection Mandate, the following factors shall be taken into account:

1. the interest and convenience of the public;
2. the necessity of interconnection;
3. the desirability of stimulating innovative market offerings and of providing users with a wide range of telecommunications services both at national and local level;
4. the availability of technically and commercially viable alternatives to the interconnection requested;
5. the desirability of ensuring equal access arrangements;
6. the need to maintain the integrity of the public telecommunications network and the interoperability of services;
7. the nature of the request in relation to the resources available to meet the request;
8. *the relative market positions of the parties*;
9. *the promotion of competition* [emphasis added];
- and 10. the need to achieve and maintain universal access. (Article V. Section 14.V.d)

NTC MC 06-10-2008 (Rules on the Mandatory Interconnection of Cable Landing Stations to Backhaul Networks) requires the interconnection of backhaul networks to all cable landing stations. The terms of the interconnection agreement are negotiated between the parties.

NTC MC 10-07-2007 (Mandating the Development of Reference Access Offers (RAO) to Facilitate Fair and Expedient Interconnection or Access Between Service Providers) requires all authorized public telecommunications entities to submit a RAO, which contains the terms and conditions, including prices, for which an access provider is prepared to provide access to its telecommunications network or facility to any requesting service provider. The following services, whether domestic or international, must be offered under RAOs: Fixed network origination/transit/termination services; Mobile network origination/transit/termination services; Fixed internet access call origination/transit/termination services; Mobile internet access call origination/transit/termination services; Retail narrowband and broadband services; and Mobile data origination/termination services.

The NTC is responsible for determining if the terms and conditions of the RAO are reasonable, fair, consistent and non-discriminatory, in line with EO 59 s.1993 and RA7925. The terms and conditions of access are deemed discriminatory if they have an effect on the quality and timing of access that are not equivalent to that which the access provider supplies *to itself or affiliates* [emphasis added] (Art. II Sec.6.4). Access seekers may negotiate a separate or individualized agreement with an access provider, under terms and conditions different from the RAO. However, the NTC can reject the individualized agreement if found to be unreasonably discriminatory against other licenses. The NTC may also require that the terms and conditions be incorporated into the RAO and extended to all other existing agreements.

The terms and conditions of access are deemed discriminatory if they have an effect on the quality and timing of access that are not equivalent to that which the access provider supplies to itself or affiliates.

Accounting separation

RA 7925 Art VI Sec. 19 states that “The Commission shall require telecommunications entities to set up a uniform system of accounts which shall be one of the bases in establishing rates and tariffs. Where a single entity spans more than one category of telecommunications service, a separate book of accounts shall be maintained for each category or specialized classification.” As noted above, PTEs must maintain separate books of accounts for their VAS. (RA 7925 Art IV. Sec. 11c).

In line with RA 7925 and in order to establish a method by which the regulator can effectively compare the operations of the public telecommunications entities (PTEs), **NTC MC 12-05-2000** (Uniform System of Accounts) was developed which PTEs must use in all of the reports required to be submitted to the Commission.

Infrastructure and site sharing

DICT Department Circular No 8 s.2020 sets the policy guidelines on the co-location and sharing of passive telecommunications tower infrastructure for macro cell sites. Among other things, it prohibits predatory or anti-competitive conduct by the Independent Tower Company (ITC) or Mobile Network Operator (MNO) with respect to the construction, management, operation and maintenance of Passive Telecommunications Tower Infrastructure (PTTI). Moreover, all private sector agreements for co-locating in Shared PTTIs shall: “(i) provide for fair, cost-based, reasonable, competitive, transparent, non-exclusive, and non-discriminatory terms, conditions, fees, and charges; (ii) be complemented by appropriate service level agreements compliant with global and domestic industry standards; and (iii) be subject at all times to pertinent laws and departmental circulars, rules and regulations, and other issuances. All private sector MNOs shall be offered the same or reasonably equivalent terms, conditions, fees, and charges for co-locating or sharing in the same PTTI”(Title III Sec.11 (b)).

To ensure consumer protection and welfare, foster competition, and discourage anti-competitive practices, all ITCs are also required to maintain transparency in their transactions with the MNOs and the DICT. An ITC or Independent Tower Company refers “to a private entity duly organized and existing under the laws of the Philippines, registered with the DICT as an ITC, and engaged in the business of establishing or operating one or more Shared PTTIs, that is neither a private sector MNO nor a “Related Party” thereto, as defined by the rules and regulations issued by the SEC” (Title I Sec 3 (m)).

Number portability

Being able to keep one's number reduces the switching costs of users and increases competition. Number portability is available to consumers and required from mobile operators as mandated in the Mobile Number Portability Act (RA 11202) passed in 2019. Number portability is not required from fixed-line operators.

5.2 Competition law

Competition Law

The Philippine Competition Act of 2015 (RA No. 10667) prohibits anti-competitive agreements, abuse of dominant position, and anti-competitive mergers and acquisitions. Recently, the Philippine Competition Commission provisionally set new thresholds for compulsory notification of mergers and acquisitions. Starting September 16, 2022, mergers and acquisitions that reach a Size of Party (SoP) of P6.1 billion and a Size of Transaction (SoT) of P2.5 billion will have to be notified to the PCC for mandatory merger review. The SoP refers to the aggregate value of assets or revenues in the Philippines of the ultimate parent entity of one of the parties to a transaction, while the SoT refers to the value of assets or revenues of the acquired entity and the entities it controls. If mergers and acquisitions meet the thresholds for compulsory notification, these transactions will be subject to review by the PCC before they can be consummated.

Legal concept of dominance or Significant Market Power

Defining the concept of Significant Market Power (SMP) is an important step to avoid anti-competitive behavior. When operators are classified as having significant market power, it is possible for the regulator to impose *ex ante* regulations (i.e. mandatory publication of Reference Interconnection Offers) to avoid abuse of this power.

The term "dominance" is recognized in the Philippine Competition Act (Republic Act No. 10667) and its IRR. As stated in Rule 2 of the IRR, "Dominant position' refers to a position of economic strength that an entity or entities hold which makes it capable of controlling the relevant market independently from any or a combination of the following: competitors, customers, suppliers, or consumers." Market share is not the only basis for determining SMP. Rule 8, Section 2 of Philippine Competition Act's IRR lists multiple criteria in determining dominance or SMP (e.g. its ownership possession or control of infrastructure which are not easily duplicated, its technological advantages or superiority compared to other competitors, its easy or privileged access to capital markets or financial resources, its economies of scale and of scope, its vertical integration, and the existence of a highly developed distribution and sales network).

Mainstreaming of competition policy

Last year, Administrative Order (AO) No. 44 (s. 2021) by the Office of the President was signed directing government agencies to adopt and implement the National Competition Policy (NCP), marking a milestone in mainstreaming competition policy across the public sector. Under AO 44, all national government agencies, government-owned or -controlled corporations (GOCCs), and local government units (LGUs) are directed to comply with the NCP by 1) adopting pro-competitive policies and interventions, 2) fostering a level playing field between public and private sector businesses, and 3) assisting the Philippine Competition Commission in enforcing the competition law.

6. Competition issues in the internet access connectivity segment

This chapter focuses on barriers to entry and expansion in the Philippine digital sector particularly in the internet access connectivity segment. The identified bottlenecks have been identified in the literature and validated in our interviews. Complaints or cases of anti-competitive conduct are also described.

6.1 Barriers to entry and expansion

High cost of bandwidth

Internet service providers can only purchase bandwidth from enfranchised public telecommunications entities. International bandwidth providers are not allowed to sell bandwidth to local clients without going through a commercial agreement with a local telco. These telcos are able to buy capacity from the source at a low price and adjust their selling prices. According to Mirandilla-Santos (2016), smaller players suffer high wholesale prices from big telcos owning the landing stations and backbone networks. For example, 75 percent of the cost of purchasing bandwidth is accounted from the backhaul network provided by incumbent players, PLDT and Globe.

“Unregulated local-loop unbundled access prices, i.e. discretionary access prices for broadband service provision not only increase the provision costs of broadband services but also make it difficult for potential entrants to achieve a level playing field” (World Bank 2018, p. 91). Additionally, the inability to access some parts of the broadband infrastructure increases the costs of providing mobile services and restricts competition in favor of incumbent players. The lack of legislation to unbundle the local loop exacerbates this issue, allowing the incumbent telco, who control the control loop, to set discretionary access prices for the provision of wholesale and retail broadband services at levels that weaken competition, driving up the cost of broadband services and lowering the penetration of digital services in far-flung areas (World Bank 2022).

Salac and Kim (2016) also highlight the control that internet access providers have over internet service providers who are also their competitors. Actions restricting competition could include denial of access to the wired local loop and refusal to lease international bandwidth. Although the law requires carriers to provide access, the terms including prices and fees are negotiated between parties and the regulator is not directly involved in the negotiations.

Requirement for Congressional franchise

An ISPs will need to obtain a congressional franchise if it wants to directly purchase from international bandwidth providers. Further development of the digital infrastructure is being hindered by restrictions on investment and competition. New telcos and independent internet service providers are limited in their ability to develop their infrastructure, get access to spectrum, and deploy various internet technologies because of the necessity to acquire a congressional franchise (World Bank 2022; See also Serafica and Oren 2022). Similarly, the franchise requirement and licensing framework on cable TV operators make it costly and cumbersome to compete in providing broadband services.

Expensive pole rental and bureaucratic requirements

In 2018, the National Electrification Administration (NEA) collaborated with electric cooperatives (ECs) and issued a standard pole rental rate of PHP420 per cable position per pole annually, which serves as a guide for ECs (NEA Memorandum No. 2018-055). The standard rental rates are equal regardless of whether the location is at a 6th-class municipality (where there are 3 to 5 posts between subscribers) or 1st-class (highly-urbanized areas). Furthermore,

it is usually not followed by the ECs since some base their computation on the weight of cables attached to the poles. These discourage companies from expanding their networks, especially in rural areas, requiring more posts to reach subscribers (the smallest fiber optic devices are built to carry 1,000 subscribers). Some associations of cable TV operators requested for NEA to lower the standard pole rental fees, which was set four years ago. NEA responded that they would create a technical working group and organize stakeholder consultations (Velasco 2022).

The network expansion is being hampered by complicated permitting for network equipment and a lack of policy on infrastructure sharing. While local authorizations for the construction of towers and poles have improved, the remaining clearances for the installation of network equipment and its electrification are administratively awarded, and the process can be time-consuming. The network rollout may be delayed or even stopped if there is no guidance for an expeditious awarding process. The NTC also continues to place stringent restrictions on the importation, distribution, and installation of equipment. Furthermore, there are no rules governing how the private sector may utilize public resources like landing stations (e.g., the Pacific Light Cable Network) and the fiber-optic network of the National Grid Corporation of the Philippines (World Bank 2022).

Lack of technical competence

The lack of technical expertise hinders ISPs from understanding the internet connectivity landscape and adopting technologies that would make operations more efficient. Continued sharing of best practices among private industries is helpful in technically capacitating ISPs, such as those initiatives done by PCTA where they conduct training for their members. The association also developed their own set of standards as guide that their member cable operators follow. Training fiber technicians is also essential to lower operational cost.

6.2 Examples of complaints or cases

The following are examples of competition issues or cases in the Philippines for the past ten years (PCC 2016-2022; Commsupdate 2011-2016):

Interconnection

August 2022 - DITO filed a complaint against Globe Telecom and Smart Communications for an assumed breach of interconnection agreements. The PCC opened a preliminary inquiry to investigate on the potential abuse of dominance or other anti-competitive acts that may have been committed. PCC will also coordinate with the NTC.

March 2013 - NTC stepped in to resolve the dispute between Globe and PLDT because of the failure to interconnect in Northern Luzon.

Mergers & Acquisitions

June 2016 – PCC stated that it will review the transactions pertaining to Globe and PLDT's purchase of San Miguel Corporation's Telecommunications which may significantly lessen competition. However, the Court of Appeals (CA) restrained the PCC's review of the transactions in August 2016. The PCC filed a motion for reconsideration in February 2017. However, it was denied. The PCC filed another petition to the Supreme Court to reverse the restraining order of the CA.

November 2013 – PLDT filed a complaint to NTC against Globe's acquisition of Bayan Telecommunications, leading to a transfer of frequency bands to Globe, which would provide Globe with more frequencies per subscriber than PLDT. The Court of Appeals released a

restraining order in October 2014 following the complaint of PLDT. In July 2015, the NTC decided to approve the Globe's takeover of Bayan.

Exclusive dealings

October 2019 – The PCC ceased the internet exclusivity dealings between Urban Deca Homes Manila Condominium Corporation and its in-house internet service provider, “Fiber to Deca Homes”, involving nine (9) projects. The developer's act of limiting its residents with a single ISP violated the Philippine Competition Act (RA 10667). The residents complain of expensive internet connection (the in-house ISP charges PHP1,249 per month for 2 Mbps, when residents can access 5Mbps from other ISPs at the same price). In addition, the developer was charged a fine of PHP27.11 million.

February 2022 – The PCC filed a case against Greenfield Development Corporation (a condominium developer in Mandaluyong City) for limiting its residents to exclusively use their in-house ISP (Leopard Connectivity Business Solutions Inc.) and preventing entry of other competitors, restricting alternatives for consumers. Residents complain that Leopard connectivity is more expensive than other alternative ISPs. For instance, it charges PHP2,699/month for 20 Mbps, when consumers can get 50-75 Mbps from other ISPs at the same price.

March 2021– PCC created an ISP Task Force in March 2021 to handle cases related to internet access and provision. Similar concern continues to persist as of March 2022 in many condominium, subdivision, and other property developers. PCC also issued Enforcement Advisory Letters (EALs) obliging property developers to end their exclusivity dealings with internet service operators. As of March 2022, eight (8) developers have already complied and allowed their residents to access alternative ISPs.

Spectrum assignment

Feb 2016 – Globe and PLDT, two dominant telcos, complain about assigning most of the 700MHz band to the San Miguel Corporation (SMC) and other frequency bands, which they claim to be anti-competitive. SMC responded that Globe and PLDT almost have the 300MHz band, apart from their technology.

7. Key findings and implications

Digitalization has disrupted industries and how firms compete. The interdependence of different markets within and across segments of the digital value chain implies that barriers to entry and expansion in one industry can have far reaching effects on the growth of the rest of the digital sector and the economy, more widely.

The size of the digital sector is significant and comprises various activities, processes and industries.

The economic contribution of the digital economy is significant and growing. In 2021, digital transactions covering digital-enabling infrastructure, e-commerce, and digital media/content accounted for 9.6 percent of GDP. The internet value chain is composed of content rights, online services, enabling technology and services, internet access connectivity, and user interface (GSMA 2022). Online services, particularly the e-commerce segment's retail sales value reached USD5.83 billion in 2021. Filipinos are also online media consumers, having around 76.01 million internet users and 156.5 million cellular mobile connections among the 111.8 million total population as of February 2022. Statista (2021b) estimated digital market revenue at USD1.91 billion, including digital video content, digital music, digital games, and electronically published content. About 43.44 million individuals made digital payments in

2021 with total annual value of USD16.11 billion (Kemp 2022), and 97 percent of digital merchants surveyed by Google et al. (2021) are already accepting digital payments.

The internet connection segment is composed of international links, domestic backbone, middle mile, and last mile, where major telcos, particularly PLDT and Globe dominate. The number of data centers, internet exchange points, and common towers is continuously growing. Fast and reliable networks consequently drive the upgrading of hardware devices to connect with the internet more powerfully, encouraging more innovative applications and content (DICT 2017). Other appliances and devices can now be connected to the internet (IoT) besides computers and mobile phones, such as smart watches, game consoles, TVs, and smart home and virtual reality devices.

Along the entire value chain, internet access connectivity is the most critical element in linking the various participants in the digital sector.

From content creators, online services, and producers of hardware devices, participants in the digital value chain ultimately depend on the broadband access network to reach the final users or consumers.

There are various technologies that can provide internet services today. Examples include fixed telephony operators, mobile telephony, satellite communications, and cable television operators (Czaplewski 2021). These technologies offer competition to existing dominant operators particularly in providing fixed broadband services.

Of the various segments of the internet value chain, it is internet access connectivity that has the highest barriers to entry. Although natural barriers to entry exist (e.g. economies of scale and scope, sunk costs, limited spectrum), regulatory and strategic barriers further constrain competition.

This segment of the digital value chain is currently dominated by two vertically integrated telecommunications companies as structural separation is not required in the Philippines unlike in other countries. While integration creates production efficiencies, a vertically integrated firm can leverage its market power in one segment of the market to limit competition in another. The lack of competition in upstream markets due largely to legal or artificial barriers rather than a natural one, as well as strategic practices of internet access providers have been identified as key impediments to the the entry and expansion of internet services throughout the country.

Internet resellers are dependent on the enfranchised PTEs for bandwidth. In terms of registration requirements, the VAS applicant must, among other things, have a facilities lease agreement with duly enfranchised and certificated public telecommunications entity. At the same time however, PTEs are also providing internet services and could be exercising a price squeeze on the resellers.

Access regulations exist to ensure that PTEs in the upstream wholesale market do not hurt the viability of downstream retail firms, but these will need to be strengthened and effectively enforced.

RA 7925 states that VAS providers should not be discriminated against in rates nor denied equitable access to facilities.

The interpretation of non-discrimination in NTC MC No. 02-05-2008 may need to be clarified to ensure consistency with the intention of the law. As discussed previously, PTEs must submit a written undertaking that they will not discriminate other VAS providers in terms of rates and service quality for similar facilities leased to them (Sec. B.6.e). However, the same circular states that PTEs shall offer leased line service to VAS providers at the same quality and at a

price not higher than the the prevailing leased line prices offered by the PTEs *to the public* (Sec. B.4). The correct phrase in this context to ensure non-discrimination by a vertically integrated firm is *to itself or affiliates*, the language used in NTC MC 10-07-2007.

The law also requires PTEs to maintain a separate book of accounts for their VAS operations, which would enable the NTC to validate any complaints of unfair or discriminatory treatment towards its downstream competitors.

As argued in Serafica and Oren (2022), in order to be effective, the NTC must be strengthened to ensure regulatory independence.

An open access framework and increased transparency will reduce the barriers to entry and help facilitate the growth of broadband.

An outdated legal framework has stifled the expansion of digital infrastructure and access to the internet (Mirandiilla-Santos (2016, 2021); Mirandiilla-Santos, et al. (2018). The proposed Open Access in Data Transmission bill relaxes a number of regulatory requirements which would lower the barriers to entry in the provision of internet services. Internet service providers will be able to connect to the internet access providers that can offer the most competitive rates. This would be especially useful for ISPs who aim to provide internet services to only targeted communities, consumers, or businesses in the country.

Greater transparency by requiring operators to publish their Reference Interconnection Offer (RIO) or Reference Access Offer (RAO) will also promote competition. According to international best practice, when operators are required to publish RIO, new entrants have sufficient information about the network to allow for decision-making, thus reducing entry time, and to provide a baseline for negotiation. The publication of a standard offer, in the form of a RIO, narrows the scope for a dominant operator to discriminate among applicants for interconnection. (Ortiz et al 2017). There should also be transparency. Making interconnection agreements public opens the discussion to other parties that might have issues at stake, it also ensures transparency for both the population and other market players about the interconnection (Ortiz et al 2017).

The dominant firms in the internet connectivity segment have also expanded their footprint to other segments of the internet value chain.

Global companies operate in a number of segments of the internet value chain. In the Philippines, the firms that dominate internet connectivity have expanded their service portfolio to other segments as well.

The expansion to the different segments of the digital value chain can be explained by a number of factors. Once consumers are connected to the internet, they start spending on online services since they are able to do more online. A significant portion of the value of the digitalisation is being captured by the services that are most consumed by end users (GSMA 2022). Access to large data sets particularly by vertically integrated firms also allows them to gain valuable insights that could be used to expand to other markets (GSMA 2018; see also Serafica and Oren 2020). Thus, there are economic incentives to expand to other segments of the digital value chain. In addition, network, service, and technological convergence have also led to corporate convergence or when firms from one sector acquire, merge, or collaborate with firms from another sector (Serafica and Oren 2022).

Vertical integration along the internet value chain could benefit consumers in terms of bundled products and lower prices but may also result in anti-competitive conduct by favoring affiliate services, for example (Serafica, et al. 2020). In the digital age, the focus is not on the size of the firms per se but on lowering barriers to entry and expansion, removing bottlenecks to

innovation, and reducing switching costs so that competitive pressures are built into the entire value chain.

M&A review criteria may need to adapt.

Thresholds for compulsory notification or M&As are based on the value of assets or revenues, which determine the size of the party or transaction.

The increasing convergence of electronic communications makes it necessary to consider also the access that prospective service providers have to radio spectrum. Similarly, in the digital economy, large datasets could provide companies with a competitive advantage, by helping them to improve the merged entity's product or service post-merger in a way that competitors are unable to match. The scale and scope of data confers market power and erects entry barriers for competitors (GSMA 2015 p. 153). A firm that is vertically integrating along the internet value chain will have significant market power not only in a particular industry but across the digital sector.

Cross-sectoral cooperation is also needed

The ITU collaborative regulation benchmark (ITU 2021b) stresses the growing significance of more flexible and collaborative regulatory frameworks capable of tackling the digital economy's impacts across sectors. ARTA, in collaboration with various government agencies created the JMC Circular No. 1, s. 2021 and Revised JMC Circular No. 1, s. 2021 to streamline the process of building shared Passive Telecommunications Tower Infrastructure (PTTIs) to accelerate internet connectivity in the country. They are also actively engaged in collaborating with relevant private industries, including ISPs such as telco operators and association of cable TV operators as well as tower and electric companies.

Continued collaboration of relevant government entities such as LGUs, electricity, and communications regulators with private stakeholders, including telco operators and other ISPs, electric cooperatives, and telecommunication, electric, and infrastructure experts are needed to identify existing and emerging issues related to telecommunication sector and reduce the barriers to expansion of internet services. For example, local building officials in every LGUs should be proactive in ensuring that electric code and national building code is followed by owners and users of the PTTIs to ensure safety and avoid outages in internet connection caused by spaghetti wiring or entangled wires. Consultations with stakeholders and involvement of multiple relevant regulators (e.g., ICT, electricity, and infrastructure regulators, and local government) should be a prerequisite in creating any policies and regulations in telecommunication industry, which may involve infrastructure sharing, pole rental fees, and fiber co-deployment regulation, among others. Regulatory impact analysis should also be mandatory to regularly reassess their effectiveness and adapt to rapid technological development.

Invest in developing the broadband workforce.

A shortage of talent and skilled workers is a key barrier to expansion of firms in any industry.

There are numerous government and industry courses providing training in various digital skills and competencies. In line with its push for digitalization and internet connectivity, the government should also provide or fund training and certification programs to ensure that the workforce needed for the deployment of broadband networks across the country is available. Industry must be consulted in order to identify the skills gap and better forecast the demand for technicians.

Reducing the digital divide in terms of internet access must continue to be the policy priority.

The ultimate policy goal should be providing accelerated and inclusive internet connectivity across the country for economic and social benefit. Partnerships between the private and public sectors will be needed to reduce the digital divide, including the delivery of government plans and programs such as Free WIFI projects. Best practice models of achieving universal internet access should be studied to develop schemes targeted at specific markets or user groups. For example, the government could provide the service at a lower cost or build infrastructure that private companies can use to offer internet services for underserved and unserved areas in the country. The government may also incentivize facilities-based broadband providers in areas where internet service is unavailable or inadequate (Brake and Atkinson 2019).

Key to developing viable and sustainable solutions is knowing where the gaps exist. The NTC could develop a uniform reporting system for ISPs while the DICT could compile and publish a broadband map which identifies internet service availability down to the barangay level where competition in the last mile occurs.

In addition to examining options to address the digital divide, other areas of research could be useful.

This paper provided an overview of the digital sector landscape and discussed in greater detail the value chain and barriers to competition in the internet access connectivity segment. Future research could focus on the other segments, such as content rights, online services, and user interface or specific industries such as digital advertising, software development, gaming, or e-sports. Specific issues could also be examined such as self-preferencing and net neutrality.

8. References

- Administrative Order No. 44, s. 2021. Directing the adoption and implementation of the National Competition Policy. Manila: Malacañang Palace.
- Alama, R. I. 2022. Firm to build 2,000 cellular towers across Mindanao. <https://pia.gov.ph/news/2022/06/30/firm-to-build-2000-cellular-towers-across-mindanao> (accessed on November 29, 2022).
- Alphabeta. 2021. The growing digital economy in the Philippines: opportunities, challenges, and google's contributions. <https://alphabeta.com/wp-content/uploads/2021/10/philippines-economic-impact-report.pdf> (accessed on October 01, 2022).
- American Tower. 2022. We are a global provider of wireless communications infrastructure. <https://www.americantower.com/> (accessed on November 29, 2022).
- ASEAN. 2020. ASEAN Trainers Guide to Market Studies. Jakarta: ASEAN Secretariat. <https://www.phcc.gov.ph/trainers-guide-to-market-studies-1/> (Accessed on September 20, 2022).
- AT Kearney. 2010. Internet value chain economics. https://www.kearney.com/communications-media-technology/article/-/insights/internet-value-chain-economics?utm_camapaign=marcotundo.com (accessed on November 7, 2022).
- Atienza. 2021. PH Internet Landscape. <https://2021v.peeringasia.com/files/PHInternetLandscape.pdf> accessed on November 19, 2022)
- Balinbin, A. L. 2020. Local firm ALT-Global targets to build up to 400 shared cell towers. *BusinessWorld*. November 09. <https://www.bworldonline.com/editors-picks/2020/11/09/327403/local-firm-alt-global-targets-to-build-up-to-400-shared-cell-towers/> (accessed on November 29, 2022).
- Balinbin, A. L. 2022. Singapore's SpaceDC eyes \$700-M investment for PHL data center. *Business World*. <https://www.bworldonline.com/corporate/2022/02/07/428164/singapores-spacedc-eyes-700-m-investment-for-phl-data-center/> (accessed on November 23, 2022).
- Bandyopadhyay, S., J. Jubas, M. Vaidya, and S. Yeboah-Amankwah. 2020. Maintaining a high-speed connection: A new playbook for cable growth. <https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/maintaining-a-high-speed-connection-a-new-playbook-for-cable-growth> (accessed on November 01, 2022).
- Beeinfotech PH. n.d. About Beeinfotech PH. Bee Information Technology PH, Inc. <https://www.beeinfotech.ph/> (accessed on November 22, 2022).
- Brake and Atkinson. 2019. A Policymaker's Guide to Broadband Competition. *Information Technology and Innovation Foundation*. <https://itif.org/publications/2019/09/03/policymakers-guide-broadband-competition/> (accessed on August 08, 2022).
- Briglauer, W., C. Cambini, and M. Grajek. 2018. Speeding up the internet: Regulation and investment in the European fiber optic infrastructure. *International Journal of Industrial Organization* 61:613–652.
- Cabuenas, J. V. 2019. Chinese firm wants to build 10,000 common towers in PHL. *GMA Network*. March 19. <https://www.gmanetwork.com/news/money/companies/688518/chinese-firm-wants-to-build-10-000-common-towers-in-phl/story/> (accessed on November 29, 2022).

- CICP. 2022. About us. Creator and Influencer Council of the Philippines. <https://www.cicp.com.ph/about-us/> (accessed on October 01, 2022).
- Signal. n.d. About us. <https://signal.tv/article/72/about-us> (accessed on November 02, 2022).
- Comclark. 2022a. Accelerating the ICT Revolution. Comclark Network and Technology Corp. <https://comclark.com/#solutions> (accessed on November 22, 2022).
- ComClark. 2022b. Content delivery network. ComClark Network and Technology Corporation. <https://comclark.com/content-delivery-network> (accessed on November 22, 2022).
- Commsupdate. 2011-2016. Commsupdate Philippines. <https://www.commsupdate.com/lists/country/philippines/> (accessed on October 20, 2022).
- Commsupdate. 2021. Senate grants DITO 25-year franchise. <https://www.commsupdate.com/articles/2021/03/11/senate-grants-dito-25-year-franchise/> (accessed on October 20, 2022).
- Commsupdate. 2022. EdgePoint takes control of first batch of PLDT towers. <https://www.commsupdate.com/articles/2022/06/01/edgepoint-takes-control-of-first-batch-of-pldt-towers/> (accessed on November 29, 2022).
- Conoza, A. P. 2022. Broader potentials in the Philippine data center market. *Business World*. <https://www.bworldonline.com/special-features/2022/03/28/438476/broader-potentials-in-the-philippine-data-center-market/> (accessed on November 23, 2022).
- Converge ICT. 2022a. Converge Annual Report 2021. <https://corporate.convergeict.com/wp-content/uploads/2022/08/CONVERGE-2020-Annual-Report.pdf> (accessed on June 20, 2022).
- Converge ICT. 2022b. Converge Information and Communications Technology Solutions, Inc.: Securities and Exchange Commission SEC Form 17-A. Annual report pursuant to section 17 of the securities regulation code and section 141 of the corporation code of the Philippines. https://edge.pse.com.ph/openDiscViewer.do?edge_no=54e4fa241d9982d83470cea4b051ca8f (accessed on November 21, 2022).
- Crismundo, K. 2022. PH gets \$500-M investment for world-class data center. <https://www.pna.gov.ph/articles/1168051> (accessed on November 23, 2022).
- Czaplewski, M. 2021. Communication networks as the basis for functioning of the Internet. *Procedia Computer Science* 192:1770–1778.
- Dabao, J. L. 2021. Reaction at the Webinar: Analyzing the Results of the 2019 National ICT Household Survey, November 11. https://pidswebs.pids.gov.ph/CDN/OTHERS/dabao_reaction_pids_webinar_november_11.pdf (accessed on October 22, 2022).
- DataOne Asia. Entrust your data center requirements to us so you can focus on your business. <https://data1asia.com/webdata/data-center-services> (accessed on November 22, 2022).
- Dela Cruz, R. C. 2022. Globe builds over 570 new towers in H1 2022. *Philippine News Agency*. August 26. <https://www.pna.gov.ph/articles/1182284> (accessed on November 29, 2022).
- Desarrollos Terrestres. 2020. Homepage. <https://desarrollosterrestres.com/> (accessed on November 29, 2022).
- DFID. 2008. Competition Assessment Framework. London: Department for International Development. <https://www.oecd.org/daf/competition/reducingregulatoryrestrictionsoncompetition/46192459.pdf> (Accessed on September 1, 2022).

- DICT. 2017. National Broadband Plan: Building Infrastructures for a Digital Nation. Quezon City: Department of Information and Communications Technology (accessed on September 30, 2022).
- DICT. 2019. National ICT Household Survey 2019. Department of Information and Communications. <https://dict.gov.ph/ictstatistics/nicths2019/> (accessed on October 01, 2022).
- DICT. 2022. Registered Independent Tower Companies (ITCs) as of 15 August 2022. Department of Information and Communications Technology. <https://commontower.gov.ph/registered-itc/> (accessed on November 28, 2022).
- DICT Department Circular No 8, s. 2020. Policy guidelines on the co-location and sharing of passive telecommunications tower infrastructure for macro cell sites. Quezon City: Department of Information and Communications Technology.
- Digital Edge. 2022. Narra1: Manila. https://www.digitaledgedc.com/wp-content/uploads/2022/04/Specsheet-NARRA1_EN.pdf (accessed on November 23, 2022).
- DITO. 2022. DITO CMR Holdings Corp.: Securities and Exchange Commission SEC Form 17-A. Annual report pursuant to section 17 of the securities regulation code and section 141 of the corporation code of the Philippines. https://edge.pse.com.ph/openDiscViewer.do?edge_no=0198c90320af8b563470cea4b051ca8f (accessed on November 21, 2022).
- Domingo, R. W. 2022. Tower firm to build 600 cell sites. *Inquirer.net*. August 08. <https://business.inquirer.net/356355/70-m-funding-for-cell-towers> (accessed on November 29, 2022).
- dotPH. 2022. About dotPH. <https://www.dot.ph/about-dotph> (Accessed on Nov 21, 2022).
- DTI. 2022. PTIC-HK together with PCGHK and BOI organized a webinar to promote PH as the next hyperscaler hub in APAC. <https://www.dti.gov.ph/overseas/hongkong/hongkong-news/ptic-hk-together-with-pcghk-and-boi-organized-a-webinar-to-promote-ph-as-the-next-hyperscaler-hub-in-apac/> (accessed on October 01, 2022).
- Eastern Communications. 2022. Digital is the new normal. <https://www.eastern.com.ph/> (accessed on November 22, 2022).
- EDOTCO. 2022. edotco Acquires Tower Portfolio from PLDT to Become the Leading TowerCo in the Philippines. <https://edotcogroup.com/media/news/edotco-acquires-tower-portfolio-from-pldt-to-become-the-leading-towerco-in-the-philippines> (accessed on November 29, 2022).
- ePLDT. 2022a. Direct Content Peering. <https://www.pldtenterprise.com/solutions/internet/content-delivery-ip-peering/direct-content-peering> (accessed on November 22, 2022).
- ePLDT. 2022b. Data center. <https://pldtenterprise.com/enterprise/products/data-center> (accessed on November 22, 2022).
- Executive Order No. 59, s.1993. Prescribing the policy guidelines for compulsory interconnection of authorized public telecommunications carriers in order to create a universally accessible and fully integrated nationwide telecommunications network and thereby encourage greater private sector investment in telecommunications. Quezon City: National Telecommunications Commission.
- Executive Order 436. Prescribing policy guidelines to govern the operations of cable television in the Philippines. Manila: Malacañang Palace.
- FCC. 2014. Types of Broadband Connections. <https://www.fcc.gov/general/types-broadband-connections> (accessed on November 21, 2022).

- Geradin, D. and D. Katsifis. 2021. Strengthening effective antitrust enforcement in digital platform markets. *European Competition Journal*. doi:10.1080/17441056.2021.2002589
- GetaFIX. n.d. GetaFIX: About. <https://getafix.ph/> (accessed on November 22, 2022).
- Globe. 2022a. Globe annual report. <https://www.globe.com.ph/about-us/sustainability/integrated-report.html#gref> (accessed on October 13, 2022).
- Globe. 2022b. Globe for business. <https://www.globe.com.ph/business.html> (accessed on October 13, 2022).
- Globe. 2022c. Globe at home. <https://shop.globe.com.ph/> (accessed on October 13, 2022).
- Globe. 2022d. Globe Telecom, Inc.: Securities and Exchange Commission SEC Form 17-A. Annual report pursuant to section 17 of the securities regulation code and section 141 of the corporation code of the Philippines. https://edge.pse.com.ph/openDiscViewer.do?edge_no=a878e6cd6b389d273470cea4b051ca8f (accessed on November 21, 2022).
- Globe. 2022e. Host your data in the Globe data center. <https://www.globe.com.ph/business/enterprise/data-center.html#gref> (accessed on November 22, 2022).
- Globe. 2022f. Planned ALC Subsea Cable System to Further Boost Globe's Connectivity Capabilities. <https://www.globe.com.ph/about-us/newsroom/corporate/alc-subsea-cable-system-to-boost-connectivity.html#gref> (accessed on December 03, 2022).
- Google, Temasek, and Bain & Company. 2021. E-economy SEA 2021: Roaring 20s: The SEA Digital Decade. https://services.google.com/fh/files/misc/e_economy_sea_2021_report.pdf (accessed on September 30, 2022).
- Greenstein, S. 2020. The Basic Economics of Internet Infrastructure. *Journal of Economic Perspectives* 34(2):192-214.
- GSMA. 2015. Competition Policy in the digital age. https://www.gsma.com/publicpolicy/wp-content/uploads/2016/09/GSMA2015_Handbook_CompetitionPolicyInTheDigitalAge_English.pdf (accessed on December 06, 2022).
- GSMA. 2018. The Data Value Chain. <https://www.gsma.com/publicpolicy/resources/the-data-value-chain> (accessed on October 03, 2022).
- GSMA. 2022. The internet value chain. <https://www.gsma.com/publicpolicy/resources/internet-value-chain> (accessed on October 03, 2022).
- GW. 2022. Consumer snapshot: Philippines. <https://www.gwi.com/reports/philippines-consumers> (accessed on November 01, 2022).
- Inflect. n.d. Find connectivity options between data centers, enterprise buildings, and cloud regions. <https://inflect.com/ix/manila-ix> (accessed on November 22, 2022).
- Inligo Networks. 2022. The Inligo Networks Asia Connect Cable System (ACC-1): Inligo Networks Provides Next-Generation Connectivity. <https://www.inligonetworks.com/asia-connect-cable-system/> (accessed on December 03, 2022).
- IPC. n.d. LinkedIn account: IPC (IP Converge Data Services, Inc.). <https://www.linkedin.com/company/ipc-ph/> (accessed on November 23, 2022).
- IPIP. 2022. Asia Pacific Internet Exchange Point. <https://whois.ipip.net/ix/> (accessed on November 22, 2022).
- Isip, I. 2022. US firms readying multibillion peso investments in PH. *Malaya Business Insight*. April 26. https://malaya.com.ph/news_business/us-firms-readying-multibillion-peso-investments-in-ph/ (accessed on November 29, 2022).

- iSON tower. 2019. Our offerings. http://isontower.com/our_services.php (accessed on November 29, 2022).
- ISP.today. 2022. <https://isp.today/en/list-of-all-services/PHILIPPINES> (accessed on Nov 24, 2022).
- ITU. 2020. ICT Regulatory tracker: Philippines. International Telecommunication Union. <https://app.gen5.digital/tracker/country-cards/Philippines> (Accessed on February 23, 2022).
- ITU. 2021a. Country ICT data. International Telecommunication Union. <https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx> (accessed on October 01, 2022).
- ITU. 2021b. G5 Benchmark: Philippines. <https://app.gen5.digital/benchmark/country-cards/Philippines> (accessed on October 25, 2022).
- ITU. 2021c. The impact of policies, regulation, and institutions on ICT sector performance. Geneva: International Telecommunication Union.
- JLL. 2022. The rise of data centers in the Philippines. <https://www.jll.com/ph/en/trends-and-insights/research/the-rise-of-data-centers-in-the-philippines> (accessed on November 23, 2022).
- Jocson, L. M. J. 2022. Firm seeks \$25-M ADB loan to build telco towers in PHL. *BusinessWorld*. October 25. <https://www.bworldonline.com/top-stories/2022/10/25/482717/firm-seeks-25-m-adb-loan-to-build-telco-towers-in-phl/> (accessed on November 29, 2022).
- Kemp. 2021. Digital 2021: The Philippines. <https://datareportal.com/reports/digital-2021-philippines> (accessed on November 10, 2022).
- Kemp. 2022. Digital 2022: the Philippines. Datareportal. <https://datareportal.com/reports/digital-2022-philippines> (accessed on October 01, 2022).
- Laycock. 2021. Streaming Statistics Philippines. *Finder*. <https://www.finder.com/ph/streaming-statistics> (accessed on October 01, 2022).
- Manila Standard Business. 2022. PhilTower completes 200 cell sites. *Manila Standard*. <https://manilastandard.net/business/314234885/philtower-completes-200-cell-sites.html> (accessed on November 29, 2022).
- MCMC. 2021. Industry performance report 2021. Malaysian Communications and Multimedia Commission. https://www.mcmc.gov.my/skmmgovmy/media/General/pdf/MCMC-IPR-2021_English_250822_Spread.pdf (accessed on 19 September 2022).
- MIC. 2020. White book of Vietnam information and communication technology. Ministry of Information and Communications. https://english.mic.gov.vn/Upload_Moi/TinTuc/WhiteBook2020-Final.pdf (accessed on 14 September 2022).
- MIESCOR. n.d. MIDC achieves first closing milestone in its acquisition of portfolio of towers from Globe Telecom. <https://www.miescor.ph/page/inner/midc-achieves-first-closing-milestone-in-its-acquisition-of-portfolio-> (accessed on November 29, 2022).
- Mirandilla-Santos, M. G. 2016. Philippine Broadband: A Policy Brief. <https://www.investphilippines.info/arangkada/wp-content/uploads/2016/02/BROADBAND-POLICY-BRIEF-as-printed.pdf> (accessed on October 24, 2022).
- Mirandilla-Santos, M.G., J. Brewer, and J. Faustino. 2018. From analog to digital: Philippine policy and emerging internet technologies. Manila, Philippines: The Asia Foundation and Better Broadband Alliance. https://asiafoundation.org/wp-content/uploads/2018/10/From-Analog-to-Digital_PhilippinePolicy-and-Emerging-Internet-Technologies.pdf (accessed on December 06, 2022).

- Mirandilla-Santos, M. G. 2021. Bridging the digital infrastructure gap: Policy options for connecting Filipinos. PIDS Policy Notes No. 2021-07. Quezon City: Philippine Institute for Development Studies. <https://pidswebs.pids.gov.ph/CDN/PUBLICATIONS/pidspn2107.pdf> (accessed on October 24, 2022).
- NEA Memorandum No. 2018-055. Standard joint pole agreement and pole rental rate. National Electrification Administration.
- NEDA. 2017. Philippine Development Plan 2017-2022. National Economic and Development Authority.
- NTC. 2021. 2019 Annual report. <https://ntc.gov.ph/all/> (accessed on April 20, 2022).
- NTC MC 09-07-93. Implementing guidelines on the interconnection of authorized public telecommunications carriers. Quezon City: National Telecommunications Commission.
- NTC MC No. 08-09-95. Implementing Rules and Regulations for Republic Act No. 7925 Re: An act to promote and govern the development of Philippine Telecommunications and the delivery of public telecommunications services. Quezon City: National Telecommunications Commission.
- NTC MC No. 12-05-2000. Uniform system of accounts. Quezon City: National Telecommunications Commission.
- NTC MC No. 14-07-2000. Implementing rules and regulations (IRR) for the interconnection of authorized public telecommunications entities of authorized public telecommunications carriers. Quezon City: National Telecommunications Commission.
- NTC MC No. 05-08-2005. Voice over internet protocol (VoIP). Quezon City: National Telecommunications Commission.
- NTC MC No. 10-07-2007. Mandating the development of reference access offers (RAO) to facilitate fair and expeditious interconnection or access between service providers. Quezon City: National Telecommunications Commission.
- NTC MC No. 02-05-2008. Value added services. Quezon City: National Telecommunications Commission.
- NTC MC No. 06-10-2008. Rules on the mandatory interconnection of cable landing stations to backhaul networks. Quezon City: National Telecommunications Commission.
- Olandres, A. 2008. dotPH taps PR to justify Domain Prices. <https://www.yugatech.com/the-internet/dotph-taps-pr-to-justify-domain-prices/> (Accessed on Nov 21, 2022).
- Ookla. 2022. The Philippines is a Duopoly No More: Assessing DITO's Impact on 4G and 5G Performance. <https://www.ookla.com/articles/philippines-mobile-performance-q1-2022> (accessed on September 19, 2022).
- Ortiz, M. K., R. B. Serafica, and J. C. Bairan. 2017. Rebooting Philippine telecommunications through structural reform. PIDS Discussion Paper Series 2017-19. Quezon City: Philippine Institute for Development Studies.
- PCC. 2016-2022. Philippine Competition Commission: Media. <https://www.phcc.gov.ph/category/phcc-news/> (accessed on October 20, 2022).
- PHCOLO. 2022. The Philippine's pioneer telecom cross-connection facility. <https://www.phcolo.ph/phcolo-inc/> (accessed on November 22, 2022).
- PhilDAC. n.d. The PH Domain and the Need for Policy Reforms: A Position Paper prepared and submitted by the Philippine Domain Name Authority Convenors (PhilDAC). Philippine Network Foundation, Inc. <https://www.ph.net/phildac/whitepaper.html> (Accessed on Nov 21, 2022).
- PHOpenIX. 2022. PHOpenIX, the only neutral internet exchange in the Philippines. Philippine Open Internet Exchange. <http://phopenix.net/> (accessed on November 22, 2022).

- Piad, T. J. 2022. Converge on course to finish P1-B Cebu data center in 2024. *Inquirer*. <https://business.inquirer.net/349058/converge-on-course-to-finish-p1-b-cebu-data-center-in-2024> (accessed on November 23, 2022).
- PLDT. 2021. PLDT Global | Enterprise: Welcome to the Philippines. Your next digital market destination. https://pldtenterprise.com/storage/app/media/pldt-global/brochures-downloadables/PLDT_Global_Enterprise_2021_Brochure.pdf (accessed on November 22, 2022).
- PLDT. 2022a. PLDT 2021 Annual report. Philippine Long Distance Telephone Company. <https://main.pldt.com/investor-relations/annual-and-sustainability-reports#annual-reports> (accessed on October 13, 2022).
- PLDT. 2022b. PLDT Enterprise. <https://pldtenterprise.com/> (accessed on October 13, 2022).
- PLDT. 2022c. PLDT Home. <https://pldthome.com/> (accessed on October 13, 2022).
- PLDT. 2022d. PLDT Inc.: Securities and Exchange Commission SEC Form 17-A, as amended. Annual report pursuant to section 17 of the securities regulation code and section 141 of the corporation code of the Philippines. 2022d. https://edge.pse.com.ph/openDiscViewer.do?edge_no=f316636e45e6997f3470cea4b051ca8f (accessed on November 21, 2022).
- PSA. 2022. Press Release: Country's Digital Transactions Reached PhP 1.87 Trillion in 2021, with 9.6 Percent Contribution to the Gross Domestic Product. https://psa.gov.ph/system/files/%28ons-cleared%29_1-PRESS-RELEASE_2021-Digital-Economy_Oct28_ONS-signed.pdf (accessed on October 31, 2022).
- PSE. 2022. Company list. Philippine Stock Exchange. <https://edge.pse.com.ph/companyDirectory/form.do> (accessed on August 25, 2022).
- RA 7925. An act to promote and govern the development of philippine telecommunications and the delivery of public telecommunications services. Metro Manila: Congress of the Philippines.
- RA 10667. 2015. An act providing for a national competition policy prohibiting anti-competitive agreements, abuse of dominant position and anti-competitive mergers and acquisitions, establishing the Philippine Competition Commission and appropriating funds therefor. Metro Manila: Congress of the Philippines.
- RA 11202. 2019. An act of requiring mobile service providers to provide nationwide mobile number portability to subscribers. Metro Manila: Congress of the Philippines.
- Rasmussen, A. 2022. Thailand's Mobile Market End of Year 2021. *Yozzo Insights*. <https://www.yozzo.com/insights/thailands-mobile-market-end-of-year-2021/> (accessed on September 15, 2022).
- Rosales, E. F. 2022. PLDT expands capacity of data centers. <https://www.philstar.com/business/2022/08/25/2204865/pldt-expands-capacity-data-centers> (accessed on November 23, 2022).
- RYT9. 2022. STOWER expects 2022 growth to more than double after investing 900 million baht to install telecommunication poles for rent in the Philippines. <https://www.ryt9.com/s/iq05/3306232> (accessed on November 29, 2022).
- Salac, R. A. and Y. S. Kim. 2016. A Study on The Internet Connectivity in The Philippines. *Asia-Pacific Journal of Business Review* 1(1): 67-88. <http://dx.doi.org/10.20522/APJBR.2016.1.1.67> (accessed on December 19, 2022).
- Senate Bill 45. 2019. An act promoting open access in data transmission, providing additional powers to the National Telecommunications Commission (NTC), and for other purposes". Pasay City, Philippines: Senate of the Philippines. <https://legacy.senate.gov.ph/lisdata/3026127094!.pdf> (accessed on November 23, 2022).

- Senate Bill 911. 2019. An act promoting open access in data transmission, providing additional powers to the National Telecommunications Commission, and for other purposes. Pasay City, Philippines: Senate of the Philippines. <https://legacy.senate.gov.ph/lisdata/3129628193!.pdf> (accessed on November 23, 2022).
- Serafica, R. B., M. A. L. Rosete, P. J. C. Camaro, and A. P. S. Salvanera. 2020. Issues Paper on the Philippine Digital Commerce Market. Philippine Competition Commission. <https://www.phcc.gov.ph/wp-content/uploads/2020/07/PCC-Issues-Paper-2020-03-Issues-Paper-on-the-Philippine-Digital-Commerce-Market.pdf> (accessed on October 19, 2022).
- Serafica, R. B. and Q. C. Oren. 2020. Understanding the Costs and Benefits of Digital Platforms and the Implications for Policymaking and Regulation. PIDS Discussion Paper Series No. 2020-52. Quezon City: Philippine Institute for Development Studies.
- Serafica, R. B. and Q. C. Oren. 2022. Upgrading the ICT Regulatory Framework: Toward Accelerated and Inclusive Digital Connectivity. <https://www.pids.gov.ph/publication/discussion-papers/upgrading-the-ict-regulatory-framework-toward-accelerated-and-inclusive-digital-connectivity> (accessed on December 06, 2022).
- SGX. 2022. Annual Reports & Related Documents. Singapore Exchange Limited. <https://www.sgx.com/securities/annual-reports-related-documents> (Accessed on 14 September 2022).
- SICT. 2017. Survey on Information and Communication Technology (SICT). https://psa.gov.ph/sites/default/files/2017%20SICT%20Publication_signed.pdf (accessed on September 12, 2022).
- SIKAP. 2020. What is SIKAP? <https://www.sikapphilippines.org/> (accessed on November 9, 2022).
- Silva, F. D. and G. Nuñez. 2021. Free competition in the post-pandemic digital era: the impact on SMEs. Project Documents.
- Similarweb. 2022a. Top websites ranking: Philippines (August to October 2022). <https://pro.similarweb.com/#/digitalsuite/webmarketanalysis/home> (accessed on November 9, 2022).
- Similarweb. 2022b. Web hosting and domain names market leaders. https://pro.similarweb.com/#/digitalsuite/markets/webmarketanalysis/mapping/Computers_Electronics_and_Technology~Web_Hosting_and_Domain_Names/608/3m?webSource=Total (Accessed on Nov 21, 2022).
- Similarweb. 2022c. Web performance: dot.ph. https://pro.similarweb.com/#/digitalsuite/websiteanalysis/overview/website-performance/*/999/3m?webSource=Total&key=dot.ph (accessed on November 26, 2022).
- STTelemedia. 2022. Globe, STT GDC and Ayala enter into \$350M venture. <https://www.sttelemediagdc.com/newsroom/globe-stt-gdc-and-ayala-enter-350m-venture-expand-current-data-centre-footprint-philippines> (accessed on November 23, 2022).
- Statcounter. 2022a. Search Engine Host Market Share Philippines Oct 2021 – Oct 2022. <https://gs.statcounter.com/search-engine-host-market-share/all/philippines/#monthly-202110-202210> (accessed on November 8, 2022).
- Statcounter. 2022b. Social Media Stats Philippines Oct 2021 - Oct 2022. <https://gs.statcounter.com/social-media-stats/all/philippines> (accessed on November 9, 2022).

- Statcounter. 2022c. <https://gs.statcounter.com/vendor-market-share/mobile/philippines> (accessed on November 10, 2022).
- Statcounter. 2022d. <https://gs.statcounter.com/os-market-share/desktop/philippines/#monthly-202110-202210> (accessed on November 10, 2022).
- Statcounter. 2022e. <https://gs.statcounter.com/os-market-share/mobile/philippines/#monthly-202110-202210> (accessed on November 10, 2022).
- Statista. 2021a. Revenue of the digital media market in the Philippines from 2017 to 2025. <https://www.statista.com/forecasts/1272332/digital-media-revenue-philippines> (accessed on November 01, 2022).
- Statista. 2021b. Market share of leading mobile wallet applications in the Philippines in 2020. <https://www.statista.com/statistics/1258098/philippines-mobile-wallet-apps-market-share/> (accessed on November 10, 2022).
- Statista. 2021c. Market share of fixed and mobile broadband in the Philippines in 2020, by service providers. <https://www.statista.com/statistics/1194825/philippines-market-share-fixed-mobile-broadband-by-service-providers/> (accessed on October 19, 2022).
- Statista. 2022a. Share of the mobile revenue market in Singapore as of 2019, by operator. <https://www.statista.com/statistics/1007915/singapore-mobile-revenue-market-share/>. (Accessed on 15 September 2022).
- Statista. 2022b. M1's operating revenue in Singapore 2017 to 2021. <https://www.statista.com/statistics/747774/m1-s-total-revenue-singapore/> (September 15, 2022).
- Statista. 2022c. Revenue of video streaming (SVoD) in the Philippines from 2017 to 2027. <https://www.statista.com/forecasts/1258004/video-streaming-svod-revenue-philippines> (accessed on October 27, 2022).
- Statista. 2022d. Market share of most popular streaming services in the Philippines as of 1st quarter 2022. <https://www.statista.com/statistics/1257753/philippines-leading-streaming-services-market-share/> - (November 09, 2022).
- Statista. 2022e. <https://www.statista.com/statistics/1327852/philippines-e-commerce-retail-sales-value/> (November 8, 2022).
- Statista. 2022f. <https://www.statista.com/statistics/1291025/philippines-online-travel-and-tourism-services-annual-spending/> (accessed on November 9, 2022).
- Statista. 2022g. <https://www.statista.com/forecasts/1258029/music-streaming-revenue-philippines>; Revenue of music streaming in the Philippines from 2017 to 2027; November 09, 2022).
- Statista. 2022h. <https://www.statista.com/outlook/dmo/digital-media/digital-music/philippines>
- Statista. 2022i. Most popular YouTube channels in the Philippines as of September 2022, by number of subscribers (in millions). <https://www.statista.com/statistics/1031926/popular-youtube-channels-philippines-number-subscribers/> (accessed on November 22, 2022).
- Submarine Cable Networks. 2021. <https://www.submarinenetworks.com/en/systems/intra-asia/apricot/google-facebook-and-pldt-to-build-apricot-subsea-cable> (accessed on December 03, 2022).
- Submarine Cable Networks. 2022. Cable Landing Stations in the Philippines. <https://www.submarinenetworks.com/stations/asia/philippines> (accessed on November 23, 2022).
- Swinhoe, D. 2022. Philippines' Megawide to move into developing data centers. *Data Center Dynamics*. <https://www.datacenterdynamics.com/en/news/philippines-megawide-to-move-into-developing-data-centers/> (accessed on November 23, 2022).

- Telegeography. 2022. Submarine Cable Map. <https://www.submarinecablemap.com/country/philippines> accessed on November 13, 2022).
- TIM. 2020. The pioneer datacenter services you can trust. Total Information Management Corporation. <https://www.phcolo.ph/phcolo-inc/> (November 22, 2022).
- Unity Digital Infrastructure. 2021. Enabling safe, fast, and reliable communication. <https://www.unitydigitalinfra.com/> (accessed on November 29, 2022).
- Velasco, M. 2022. NEA, cable TV operators to resolve pole rental rate. Manila Bulletin. October 2. <https://mb.com.ph/2022/10/02/nea-cable-tv-operators-to-resolve-pole-rental-rate/> (accessed on December 08, 2022).
- Villanueva, V. A. 2022. LBS Digital-Sojitz partnership—a boon to telecom sector. *Business Mirror*. May 19. <https://businessmirror.com.ph/2022/05/19/lbs-digital-sojitz-partnership-a-boon-to-telecom-sector/> (accessed on November 29, 2022).
- VSTECs. Services. <https://vstecs.com.ph/Services> (accessed on November 22, 2022).
- World Bank. 2022. Strengthening the Digital Economy to Boost Domestic Recovery. Philippines Economic Update. <https://www.worldbank.org/en/events/2022/06/09/philippines-economic-update-june-2022-report-launch-and-forum> (accessed on December 5, 2022).
- Zeal Power. n.d. Building the future together. <https://zealpower.net/> (accessed on November 29, 2022).

9. Appendix A. Members of selected IXPs

IXP	Country	Member	Speed
GetaFIX Manila	Israel	CATON - CATO NETWORKS LTD, IL	10 Gbps
GetaFIX Manila	China	TENCENT-NET-AP-CN - Shenzhen Tencent Computer Systems Company Limited, CN	10 Gbps
GetaFIX Manila	Philippines	PBATC-AS-AP - Pipol Broadband and Telecommunications Corporation, PH	1 Gbps
GetaFIX Manila	United States	CLOUDFLARENET - Cloudflare, Inc., US	20 Gbps
GetaFIX Manila	Hong Kong	BITC-AS-AP - Brother Internet Technology Co.,Ltd, HK	10 Gbps
GetaFIX Manila	Philippines	RCC-AS-AP - Royal Cablevision Corp., PH	10 Gbps
GetaFIX Manila	Philippines	NEXLOGIC-AS-AP - Nexlogic Telecommunications Network, Inc., PH	10 Gbps
GetaFIX Manila	Philippines	NEWMOUNTAINVIEW-PH - NewMountainView Satellite Corporation, PH	10 Gbps
GetaFIX Manila	Philippines	TIM-GNS-AS-AP - Total Information Management Corporation, PH	10 Gbps
GetaFIX Manila	Philippines	INFINIVAN-AS-AP - Infinivan Incorporated, PH	2 Gbps
GetaFIX Manila	Philippines	DCSI-AS-AP - Dasca Cable Services, Inc., PH	5 Gbps
GetaFIX Manila	Hong Kong	HWCLOUDS-AS-AP - HUAWEI INTERNATIONAL PTE. LTD., HK	10 Gbps
GetaFIX Manila	Philippines	SUNIWAYTELECOM-AS-AP - Suniway Group of Companies Inc., PH	10 Gbps
GetaFIX Manila	Philippines	KOMSPEC1-AS-AP - Butuan Baulete Corporation, PH	1 Gbps
GetaFIX Manila	Philippines	SSTI-AS-AP - Streamtech Systems Technologies Inc., PH	10 Gbps
GetaFIX Manila	Philippines	KMCMAGSOLUTIONS-AS-AP - KMC Mag Solutions, PH	1 Gbps
GetaFIX Manila	Philippines	DTC-AS-AP - DITO TELECOMMUNITY CORP., PH	20 Gbps
GetaFIX Manila	Philippines	ULAP-AS-AP - ULAP Networks Inc., PH	10 Gbps
GetaFIX Manila	Philippines	RISE-AS-AP - Responsible Internet Sustainability Effort, PH	40 Gbps
GetaFIX Manila	Philippines	DOUBLESQUARE-AS-AP - DoubleSquare Networks Inc., PH	10 Gbps
GetaFIX Manila	Australia	APNIC ASN block, AU	1 Gbps
GetaFIX Manila	Philippines	IICS-AS-AP - IMJWANKLIK INTERNET COMMUNICATION SERVICES, PH	10 Gbps
GetaFIX Manila	Philippines	RFINETWORK-AS-AP - Rfi Fiber, PH	10 Gbps
GetaFIX Manila	Philippines	VTSI-AS-AP - VICTORIAS TELEPHONE SYSTEM INC., PH	10 Gbps
GetaFIX Manila	United States	AMAZON-02 - Amazon.com, Inc., US	20 Gbps
GetaFIX Manila	Philippines	SOURCETELECOMS-AS-AP - WifiCity, Inc, PH	10 Gbps
GetaFIX Manila	Philippines	PTTNET - Philippine Telegraph & Telephone, PH	5 Gbps

GetaFIX Manila	United States	UNITAS - Unitas Global LLC, US	10 Gbps
GetaFIX Manila	United States	INCAPSULA - Incapsula Inc, US	10 Gbps
GetaFIX Manila	United States	ZEN-ECN - Zenlayer Inc, US	10 Gbps
GetaFIX Manila	Philippines	GETAFIX - Responsible Internet Sustainability Effort, PH	10 Gbps
GetaFIX Manila	Philippines	SKYBB-AS-AP - Sky Cable Corporation, PH	10 Gbps
GetaFIX Manila	United States	PCH-AS - Packet Clearing House, Inc., US	10 Gbps
GetaFIX Manila	United States	WOODYNET-1 - WoodyNet, Inc., US	10 Gbps
GetaFIX Manila	United States	ALIBABA-CN-NET - Alibaba (US) Technology Co., Ltd., US	10 Gbps
GetaFIX Manila	Philippines	CABLELINK-TRANSIT-AS-AP - Cablelink Internet Sservices Inc., PH	1 Gbps
GetaFIX Manila	Hong Kong	ASN-TELSTRA-GLOBAL - Telstra International Limited, HK	10 Gbps
GetaFIX Manila	United States	TWITCH - Twitch Interactive Inc., US	10 Gbps
GetaFIX Manila	United States	FASTLY - Fastly, Inc., US	10 Gbps
GetaFIX Manila	Philippines	RADIUSTELECOMS-AS-AP - RADIUS TELECOMS, INC., PH	10 Gbps
GetaFIX Manila	Philippines	AVCHI-CLICK-AS-AP - Asian Vision Cable Holdings Inc, PH	10 Gbps
GetaFIX Manila	Philippines	IXS-AS-AP - IXSFORALL, INC., PH	3 Gbps
GetaFIX Manila	United States	FACEBOOK-OFFNET - Facebook, Inc., US	20 Gbps
GetaFIX Manila	Hong Kong	RISE-HK - RISE ASIA TECHNOLOGY LIMITED, HK	10 Gbps
GetaFIX Manila	United States	RIOT-NA1 - Riot Games, Inc, US	10 Gbps
GetaFIX Manila	Sweden	NETNOD-IX - Netnod AB, SE	10 Gbps
GetaFIX Manila	United Kingdom	RETN-AS - RETN Limited, GB	10 Gbps
GetaFIX Manila	Philippines	ETPI-IDS-AS-AP - Eastern Telecommunications Philippines, Inc., PH	2 Gbps
GetaFIX Manila	Philippines	PHILCOMNET-PH - PhilCom Corporation, PH	10 Gbps
GetaFIX Cebu	United States	FACEBOOK-OFFNET - Facebook, Inc., US	20 Gbps
GetaFIX Cebu	Hong Kong	RISE-HK - RISE ASIA TECHNOLOGY LIMITED, HK	10 Gbps
GetaFIX Cebu	Philippines	JIS-AS-AP - JellyBoba IT Solutions, PH	10 Gbps
GetaFIX Cebu	Philippines	GETAFIX - Responsible Internet Sustainability Effort, PH	10 Gbps
GIX	Philippines	ETPI-IDS-AS-AP - Eastern Telecommunications Philippines, Inc., PH	10 Gbps
GIX	Philippines	SKYBB-AS-AP - Sky Cable Corporation, PH	10 Gbps
GIX	Philippines	DTC-AS-AP - DITO TELECOMMUNITY CORP., PH	10 Gbps

GIX	Philippines	RADIUSTELECOMS-AS-AP - RADIUS TELECOMS, INC., PH	10 Gbps
GIX	Philippines	CLEARPATH-AS-AP - Clear Path Networks Inc, PH	10 Gbps
GIX	Philippines	TIM-GNS-AS-AP - Total Information Management Corporation, PH	10 Gbps
GIX	Philippines	SOURCETELECOMS-AS-AP - WifiCity, Inc, PH	10 Gbps
GIX	Philippines	PTTNET - Philippine Telegraph & Telephone, PH	100 Mbps
GIX	Hong Kong	HUTCHISON-AS-AP - HGC Global Communications Limited, HK	10 Gbps
GIX	Philippines	CONVERGE-AS - ComClark Network & Technology Corp, PH	20 Gbps
GIX	Philippines	GLOBE-TELECOM-IX - Globe Telecom (GMCR,INC), PH	1 Gbps
PCTA IX	Philippines	WCS-AS-AP - Wesfardell Cable Services, PH	1 Gbps
PCTA IX	Philippines	KALIBOCABLE-PH - Kalibo Cable Television Network Inc, PH	1 Gbps
PCTA IX	Philippines	PARASATCABLETV-AS-AP - Parasat Cable TV, Inc, PH	2 Gbps
PCTA IX	Philippines	TIM-GNS-AS-AP - Total Information Management Corporation, PH	10 Gbps
PCTA IX	Philippines	DCNBSI-AS-AP - DCTV Cable Network & Broadband Services Inc., PH	1 Gbps
PCTA IX	Philippines	AVCHI-CLICK-AS-AP - Asian Vision Cable Holdings Inc, PH	1 Gbps
PCTA IX	Philippines	PCTA-AS-AP - Philippine Cable Television Association, Inc., PH	10 Gbps
PCTA IX	Philippines	SSTI-AS-AP - Streamtech Systems Technologies Inc., PH	10 Gbps
PhIX	United States	RIOT-NA1 - Riot Games, Inc, US	20 Gbps
PhIX	United States	NETSKOPE - Netskope Inc, US	10 Gbps
PhIX	United States	FASTLY - Fastly, Inc., US	40 Gbps
PHOpenIX	Philippines	Bitstop	100 Mb or less
PHOpenIX	Philippines	PREGINET	10 Gb
PHOpenIX	United States	WoodyNet	1 Gb
PHOpenIX	United States	Packet Clearing House	1 Gb
PHOpenIX	United States	D-Root(UofMaryland)	1 Gb
PHOpenIX	United States	E-Root(NASA)	1 Gb
PHOpenIX	Sweden	I-Root (Netnod)	1 Gb
PHOpenIX	United States	L-Root (ICANN)	1 Gb
PHOpenIX	Philippines	Globe	1 Gb
PHOpenIX	Philippines	IRRI	1 Gb

PHOpenIX	Philippines	Philcom Inc	1 Gb
PHOpenIX	Philippines	Manila Internet Exchange	1 Gb
PHOpenIX	Philippines	Belltel	100 Mb or less
PHOpenIX	Philippines	Comclark Internet Exchange	10 Gb
PHOpenIX	Philippines	Ateneo de Manila	1 Gb
PHOpenIX	Philippines	WifiCity	1 Gb
PHOpenIX	Philippines	RADIUS	1 Gb
PHOpenIX	Philippines	DataOne	100 Mb or less
PHOpenIX	Philippines	CableLink	1 Gb
PHOpenIX	Philippines	St Lukes Medical Center	100 Mb or less
PHOpenIX	Philippines	DCTV Cable Network	1 Gb
PHOpenIX	Philippines	PTT	10 Gb
PHOpenIX	Philippines	iXSforall	1 Gb
PHOpenIX	Philippines	DLSU-Taft	100 Mb or less
PHOpenIX	Philippines	UPM	1 Gb
PHOpenIX	Philippines	Sky	10 Gb
PHOpenIX	Philippines	Planet Cable	100 Mb or less
PHOpenIX	Philippines	BayanTel	1 Gb
PHOpenIX	Philippines	KeySquare	10 Gb
PHOpenIX	Philippines	DSWD	1 Gb
PHOpenIX	Philippines	SSS	1 Gb
PHOpenIX	United States	J-Root(Verisign)	1 Gb
PHOpenIX	United States	Akamai	1 Gb
PHOpenIX	Philippines	DLSU-Benilde	100 Mb or less
PHOpenIX	Philippines	ABS-CBN	100 Mb or less
PHOpenIX	Philippines	Tri-Isys	1 Gb
PHOpenIX	Philippines	DLSU-Dasmarinas	100 Mb or less
PHOpenIX	Philippines	DotPh	100 Mb or less
PHOpenIX	Philippines	UP Baguio	100 Mb or less
PHOpenIX	Hong Kong	RISE	1 Gb
PHOpenIX	Philippines	DoF	1 Gb
PHOpenIX	Hong Kong	Telstra	100 Mb or less
PHOpenIX	Philippines	LSGH	100 Mb or less
PHOpenIX	Philippines	Asian Vision	100 Mb or less
PHOpenIX	Philippines	Naic Cable TV Corp	100 Mb or less
PHOpenIX	Philippines	NexLogic	100 Mb or less
PHOpenIX	Philippines	DLSU-Zobel	100 Mb or less
PHOpenIX	Philippines	ClearPath	1 Gb
PHOpenIX	Philippines	Mapua	100 Mb or less
PHOpenIX	Cannot identify	ITDC	1 Gb
PHOpenIX	Philippines	PLDT	1 Gb

PHOpenIX	Philippines	HTech	100 Mb or less
PHOpenIX	Cannot identify	ATCloud	100 Mb or less
PHOpenIX	Cannot identify	CCVC	1 Gb
PHOpenIX	Philippines	FCCDCI	100 Mb or less
PHOpenIX	Philippines	DLSL	100 Mb or less
PHOpenIX	Philippines	MillaWave	100 Mb or less
PHOpenIX	Philippines	IPConverge	1 Gb
PHOpenIX	Philippines	Galaxy Cable	1 Gb
PHOpenIX	Philippines	Malayan Colleges Laguna	100 Mb or less
PHOpenIX	Philippines	DLS Health Science Inst	100 Mb or less

Source: IPIP (2022) and PHOpenIX (2022), with authors' edits