The Impacts of Over-the-Top (OTT) Communication Services on the Telecommunications Sector in Thailand

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ATTESTATION OF AUTHORSHIP

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person except that which appears in the citations and acknowledgements, nor does it contain material which to a substantial extent I have submitted for the qualification for any other degree of another university or other institution of higher learning.

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SUMMARY

Over-the-top (OTT) services—online services provided on the Internet that potentially substitute or complement traditional services, have become crucial players in the telecommunications market nowadays. Their rapid growth over the past decade has raised concerns from stakeholders in the telecommunications field, including in the private sector from Internet service providers (ISPs) and mobile network operators (MNOs), and within the governmental sector among policymakers and telecom regulators, along with scholars and analysts around the world. This study aims to investigate the impacts of Over-the-top (OTT) communication services—applications provided on the mobile devices applications provided on mobile devices that contain voice calling and instant messaging as the main features, on the telecommunications sector in Thailand. OTT communications in this study refers to online applications distributed on the Internet and contains identical features to traditional telecommunications services, which consist of mobile voice calling and SMS. There are four main issues for OTT which are the motivations for this study. First, OTT is increasing rapidly in Thailand in a variety of ways, including usage, revenue, and engagement in users' lives. Second, along with its rapid growth, the impacts it is having, especially on traditional telecommunications services, is a concern of stakeholders in the telecommunications market. Third, addressing these concerns, the regulator is confronting the demand to take action to curtail the decline of traditional services and create a level playing field. However, a concrete plan from the Thai telecom regulator is still unclear. Fourth, the studies, which are supposed to be used to complement the decision to establish a regulatory framework, are insufficient, especially in the case of OTT in Thailand. With these four areas of motivation, this research was conducted to contribute to the field of telecommunications, especially in Thailand. The study was conducted in order to mainly examine the impacts of OTT on the Thai telecommunications sector. Furthermore, in order to narrate clearer a picture of the Thai market, the responses to OTT were also investigated. With this main focus, the overarching research question posited is, "what are the impacts of OTT communication services on stakeholders in the telecommunications sector and their responses to OTT in the context of Thailand?"

There are three main contributions of the study. First, the results in this study will extend the understanding of the impacts of OTT on each of the stakeholders in the telecommunications sector and how those stakeholders respond to OTT. This knowledge has previously been limited, especially in Thailand. Second, the results will contribute to stakeholder knowledge as guidelines from which they can adjust their plans in order to retain benefits. Third, the results will serve as guidelines for policymakers in Thailand, who need to understand the impacts in order to improve policy towards OTT and the telecommunications sector in Thailand.

The telecommunications sector as it relates to OTT communications in this study is comprised of three main stakeholders - users, MNOs, and the government. As this study primarily aims to

contribute to the government side, the main analyses are carried out from the side of users and MNOs. Moreover, the users and MNOs are interrelated on the demand and supply sides of traditional telecommunication services, one of the areas most affected by the rise of OTT. The first part, investigating the users' side, focuses on individual users in Thailand. In this section, usage behavior of OTT and traditional telecommunications services are examined in order to better understand the impacts of the use of OTT on traditional telecommunications services usage. Thus, the research questions asked are, "What extent does OTT communication services use affect mobile voice calling and SMS use?". The study relies on quantitative methodology, keeping in mind choice modeling based on random utility theory. The data, comprising 1,052 observations, was collected from five regions in Thailand in 2019. Following a previous study (Cecere & Corrocher, 2012), probit analysis was performed. The results revealed that use of OTT voice calling is positively related with use of mobile voice calling. On the other hand, it is negatively related to the use of SMS. However, OTT messaging is not statistically associated with both mobile voice calling and SMS. As the study looks at the response of users to OTT, the adoption of OTT was of interest. The research question in this section is posited as, "What are user characteristics and factors associated with the adoption of OTT communication services, including OTT voice calling and messaging?" By elaborating on the diffusion of innovation theory composed by Everett Rogers (1995), three groups of factors relating to the adoption of OTT and user characteristics were examined: complexity of technology in relation to individual skills, supportive devices and environments, and socio-demographic characteristics. National survey data collected by the National Statistical Office of Thailand (NSO) in the first quarter of 2019 was employed. After sorting out irrelevant samples, the dataset contained 167,675 observations. The data was analyzed using logistic regression. The results revealed that all three groups of factors were statistically significant. The users who were more likely to adopt OTT services had higher IT skills, owned smartphones, were able to access to public and broadband Internet, were female, were younger, had received their diploma or had completed basic education, resided in municipal areas, and worked as CEOs, managers, or in other white-collar positions.

The second part was carried out from the perspective of the MNOs. The impacts of OTT were explored from the side of MNOs. The research question for this part is, "What are the impacts of OTT communication services on MNOs in Thailand?" To expand the study, the strategic response of MNOs to OTT was also examined. Additionally, the appropriate strategy to deal with OTT in Thailand was determined by MNOs. The research question for the second part is, "What are the appropriate strategies for dealing with OTT communication services for Thai MNOs?" Semi-structured interviews were conducted in 2020 with corporate strategy managers from five MNOs in Thailand - AIS, TrueMoveH, Dtac, CAT, and TOT. The study of MNOs' perspective is primarily grounded on the theory of firms, profit-maximization, and survival-based theories. The first research question in this section relies on the conceptual framework developed from the concept of environment-driven changes developed by

Ghezzi, Cortimiglia and Frank (2015) and the business model ontology composed by Osterwalder (2004). The results revealed that OTT communications have affected MNOs across four aspects of environment-driven changes: external innovation, regulatory change, consumer change, and competitor strategy change. First, OTT has also affected four components of the business model as defined by Osterwalder (2004), resulting in the consideration that OTT is an external innovation affecting MNOs. Those four components are product (value proposition), customer interface (value delivery), infrastructure management (value creation), and finance (value appropriation). These four components of the business model have affected MNOs, though the level of impact on each is different. It can thus be concluded that OTT has had an impact on MNOs as external innovation. Second, OTT associates with regulatory change, although the impacts of OTT get more severe when regulation remains unchanged. Third, OTT changes consumer behavior in communications services usage, negatively resulting in the use of traditional telecommunication services, especially SMS and international calls. Lastly, competitor strategy change is another area affected by OTT. It is considered an indirect impact; some operators are engaging with OTT, while the rest of the operators in the market have yet to change their strategies, though they are likely to do so eventually. Concerning the second part of the chapter, the appropriate strategy for OTT was explored. By adopting the strategy evaluation of Rumelt (1980), each strategy for OTT gathered from previous studies was estimated. The results indicate that nonaggressive strategies, such embracing OTT and partnering with OTT, are appropriate for Thai MNOs. Moreover, indirect strategies dealing with OTT were found, which include exploring new markets or new sources of revenue and arranging internal reforms within companies.

There are key findings retrieved from both perspectives of the market, users and MNOs, to be addressed in this study. The answer to the overarching research question is that OTT affects the Thai telecommunications sector in various ways. The effects are both positive and negative, depending on the area of the market being looked at. In terms of the responses, the results revealed that the responses from users, in terms of adoption reflecting acceptance of the service, are concentrated in particular groups of users because limitations in using such services remain. For the MNOs, in terms of nonaggressive strategy employed towards OTT, is encouraged as the most appropriate strategy. The results reflect the complexity of the relationship between OTT and stakeholders in the telecommunications sector in Thailand. Apart from the main finding, the results in this study indicate that the concern about substitution between OTT and traditional telecommunications services are somewhat exaggerated at the moment. OTT has partially negative effects on traditional telecommunications services. Moreover, there are differences in services between OTT and traditional services, such as the service stability of traditional services and the richer features of OTT. In addition, there are still limitations in using OTT resulting in usage concentration in certain groups of users, mainly middle to upper class customers residing in urban areas. Consequently, OTT communications are not easily accessible basic communications for Thais. The results from the users' side are consistent with the results from the

MNOs' side, stating that OTT has only partially negative effects on MNOs, for such reasons. In dealing with these negative effects, MNOs are well aware of the situation and have already taken the appropriate steps. MNOs are currently using nonaggressive strategies and utilizing OTT to gain advantages. With the current results from the analyses, it is not necessary for regulators and policymakers to implement new regulations towards OTT regarding the economic impacts of OTT. In other words, governmental authorities are suggested to maintain a light-touch approach.

In terms of the results, there are suggestions for the government authority, including the telecom regulator and the policymakers in Thailand. Firstly, although the necessity to regulate OTT is not compelling, the government authority is required to be active regarding this issue. It needs keep monitoring the situation, as it could change abruptly in the near future. Secondly, there are hindrances in keeping MNOs from competing, including with OTT, such as outdated regulations with which they must comply. As support for domestic entrepreneurs, the government authority is encouraged to assist MNOs, such as revisiting troublesome regulations and helping MNOs find new sources of revenue, which is one of the MNOs' intended plans. Thirdly, concerning the actions to the OTT players, the results in this study indicate that there are no compelling reasons to regulate OTT as much as the traditional telecommunications. Moreover, OTT can somewhat positively benefit the Thai telecommunications sector. Consequently, the government should align itself with OTT, as the MNOs do, in ways that can generate mutual benefits, for OTT players, for Thai people, and for the economy. Lastly, they should apply policies that bridge the digital divide between rural and urban areas by improving infrastructure, as the results suggest that a significant development gap still remains in Thailand. With respect to suggestion to MNOs, they are encouraged to continue their observations of consumer behavior and how it is changing over time. R&D is essential in improving their services and marketing strategies, as users in urban and rural areas have different usage patterns. MNOs would do well to provide different types of packages in order to increase their number of subscribers. Moreover, this will provide opportunities for people who live in remote areas to access communications services.

As for the contributions of this study, it expands the knowledge in the field of telecommunications in a developing country by focusing on OTT communications. It demonstrates results that contradict claims and research that suggests OTT is replacing traditional telecommunications services (e.g., Cecere & Corrocher, 2012; Joshi et al., 2015; Mäkinen et al., 2014) On the other hand, it can provide support to research stating that new services are not necessarily substituting for traditional services (e.g., Arnold et al., 2016; Gerpott & Meinert, 2016; Wellman, 2019). The study revealed that the impacts of OTT are diverse and depend on the area of communication services. In addition, MNOs' strategies dealing with OTT are not limited only to direct strategies, but MNOs are also applying indirect strategies resulting from the rise of OTT. This information is an enhancement from previous studies. Finally, this study provides suggestions for policymakers, regulators, and MNOs in Thailand. Up to this point, and possibly still, information in Thailand has been limited,

and it is hoped that this study may shed some light on the current situation within the country. Nonetheless, there are limitations remaining in this study. For example, there are limitations in datasets resulting in use restrictions of methodology, and exclusion of insight from other players, such as MVNOs. These limitations are expected to be improved in future studies.

LIST OF ACRONYMS AND ABBREVIATIONS

ARPU	Average Revenue Per User
ASEAN	Association of Southeast Asian Nations
ATRC	ASEAN Telecommunication Regulators' Council
AVoD	Ad-supported Video on Demand
BEREC	Body of European Regulators for Electronic Communications
CAGR	Compound Annual Growth Rate
CDN	Content Delivery Network
DPI	Deep Packet Inspection
EC	European Commission
ECS	Electronic Communications Services
EPRS	European Parliamentary Research Service
EU	European Union
FMS	Fixed-to-Mobile
Gbps	Gigabit per second
GDPR	General Data Protection Regulation
GSMA	GSM Association
HHI	Herfindahl-Hirschman Index
IC	Interconnection
IoT	Internet-of-Things
IPTV	Internet Protocol Television
ISP	Internet Service Provider
ITU	International Telecommunication Union
Kbps	Kilobit per second
OTT	Over-the-top
MB	Mobile Broadband
Mbps	Megabit per second
MDES	Ministry of Digital Economy and Society (formerly MICT)
MIC	Ministry of Internal Affairs and Communications of Japan

MICT	Ministry of Information and Communication Technology of Thailand
MNO	Mobile Network Operator
MVNO	Mobile Virtual Network Operator
NBTC	National Broadcasting and Telecommunication Commission of Thailand
NN	Network Neutrality/Net Neutrality
NRA	National Regulatory Authority
NSO	National Statistical Office of Thailand
OFCOM	Office of Communications, United Kingdom
PATS	Public Available Telephone Services
PSTN	Public Switched Telephone Network
QoS	Quality of Service
SMP	Significant Market Power
SSNDQ	Small but Significant and Non-transitory Decrease in Quality
SSNIP	Small but Significant and Non-transitory Increase in Price
SVoD	Subscription Video on Demand
Telcos	Telecommunications and network operators
TRAI	Telecommunication Regulatory Authority of India
UGC	User-Generated Content
USO	Universal Service Obligation
VoIP	Voice over Internet Protocol
WTP	Willingness to pay

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Introduction

Section 1.1 Rationale

Over-the-top (OTT) services - online services provided on the Internet which potentially substitute or complement traditional services, have become a crucial player in the telecommunications market nowadays. Although they are not a completely new player in the market, their rapid growth over the past decade raises concerns from stakeholders in the telecommunications field, including private sectors such as Internet service providers (ISPs) and mobile network operators (MNOs), governmental sectors such as policymakers and telecom regulators, and also scholars and analysts around the world. Each stakeholder has diverse concerns regarding the rise of OTT. Before clarifying the concerns regarding OTT, which are the motivations for this study, it is necessary to give a brief explanation about the term OTT. The term Over-the-top, or OTT, is defined in a variety of ways over many studies. Indeed, OTT is originally online content or services. It provides the services to the end users by delivering their content on the Internet, regardless of any involvement with the Internet providers. Because of this characteristic of OTT, it is named "Over-the-top" (Joshi et al., 2015). However, although OTT is defined as a part of online services, not every online service is OTT (ITU, 2017). The difference is that OTT must be online services with the potential to technically or functionally *substitute* or *complement* traditional telecommunications and audiovisual services, such as fixed-line and mobile voice telephony, SMS, and television (ITU, 2017; ITU, 2019; Lovelock, 2017). Generally, OTT services can be divided into three groups - OTT media/TV, OTT communications, and OTT applications (TIME Consulting, 2017). OTT media or TV mainly provides content, video, and audio streaming, as well as user-generated content (UGC)[1]. Well-known OTT media examples are YouTube, Netflix, and Hulu. OTT communications provides interpersonal communications services, including instant messaging, voice calling, or Voice over Internet Protocol (VoIP)[2] and video calls. OTT communications include applications such as LINE, WhatsApp, and Skype. The last group, OTT applications, are those applications facilitating lifestyle management, such as Airbnb and Uber.

[1] User-generated content (UGC) is any type and form of content created and posted by the users, or consumers, not the official content providers. By uploading the content online, it may or may not be free of charge, depending on the online platforms' policy (Urrutia, 2019).

[2] Voice over Internet Protocol (VoIP) is a communication service utilizing technology that allows users to make voice calls over an IP network. Usually, conventional voice calls, or Public Switched Telephone Network (PSTN), operate by circuit-based switch technology, which requires fixed lines for the communications services. VoIP allows users to make calls over the Internet by sending packets via a packet switch based network (Jalendry & Verma, 2015).

As stated earlier, OTT has grown dramatically over the last decade in terms of subscribers, usage, revenue, development, and business expansion. In 2019, the global OTT market was worth 121.61 billion USD. Moreover, it is anticipated to reach 1,039.03 trillion USD by 2027, a growth rate of 29.4% CAGR from 2020-2027. Furthermore, the OTT market is expected to grow at a faster rate than it was before the COVID-19 pandemic for several reasons, such as increased demand of online entertainment during lockdown and work-from-home (WFH) practices requiring Internet to arrange meetings and connections among workers (Rake & Gaikwad, 2020). Thus, OTT issues cannot be ignored, as their impacts tend to increase along with their growth.

Similar to many other countries in the world, Thailand is one country where OTT is growing. With a supportive environment in Thailand, especially due to its Internet penetration, it is considered a proper place for OTT to cultivate and grow. Thailand now has approximately 52 million Internet users (as of early 2020) among a total population of 69.7 million, and it is expected to continue to increase (Hootesuite & We Are Social, 2020). With such a large number of Internet users, it means that there is a substantial portion of the population who are able to access OTT services. OTT in Thailand started to become a mainstream service around 2014 (Anantho, 2018). Since then, OTT services have become massively successful, with an immense number of users and revenue. Moreover, they are estimated to continue to grow at a rapid rate. For example, the value of expenditure on video streaming in 2018 reached 92.5 million USD, and it is anticipated to grow by twice that amount by 2023 (NBTC, 2019b). Likewise, estimates by the PwC predict that OTT services in Thailand will grow at a faster rate in the next five years, 5.05% CAGR, when compared to other markets in the entertainment and media industry (Positioning, 2019). Not only is there growth in revenue, but the number of users in Thailand is also large. For example, the number of active users of LINE, the most popular OTT communication service Thailand, exceeded 46 million users in 2019, meaning approximately 88% of Internet users have a LINE account (MGR Online, 2020). According to this information, it indicates that OTT in Thailand is successful and is thoroughly permeated into people's lives.

As OTT greatly expands, its impacts are expected to be large as well, bringing with them a myriad of concerns regarding this issue. One of the most prominent concerns regarding the growth of OTT is its potential to replace traditional services, as stated in the general OTT definition: it has the "*potential to substitute"* traditional services such as voice telephony, SMS, and television (Stork et al., 2017). In other words, it can be considered a "disruption" to traditional services (Baldry et al., 2014). According to many statistics displaying the growth of OTT and the decline of traditional services, such as voice calling and SMS, these two kinds of services are going in opposite directions. The claim that OTT is replacing traditional services is persuasive. To illustrate, traditional telecommunications services, specifically mobile telephony and SMS, are suffering from a decline in usage and revenue. According to the GSMA report in 2009, the minutes of use per connection averages 459 minutes, which slightly increased to a peak of 498 minutes in 2010. Afterwards, it continuously declined, to 149 minutes in 2018.

Moreover, OTT services have an advantage in their strategy, such as lower pricing (Steingröver et al., 2019). These are examples of reasons why many scholars are convinced that OTT will replace traditional telecommunications services. This situation leads to claims that MNOs, as the traditional telecommunications services providers, are the victims, while OTT is considered a threat as well as a challenge to mobile telephony service (Chen, 2019). This issue has raised concerns among many stakeholders in the telecommunications field.

As OTT is massively regarded as a substantial threat to traditional services, thus requiring telecommunications and broadcasting regulators to "do something" (Stork et al., 2020). It is therefore a considerable challenge to regulators around the world to establish the appropriate regulatory framework and policy towards each stakeholder regarding the rise of OTT. In Thailand, the National Broadcasting and Telecommunications Commission (NBTC), the Thai telecom regulator, is also confronting this problem. At the moment, any official regulation or plan regarding OTT has not yet been announced. Indeed, the NBTC has been attempting to find the most appropriate and feasible regulatory framework for OTT services since 2017 (Chitranukroh et al., 2019). They have tried many methods, such as requiring content providers on OTT to register themselves to the NBTC, planning to require OTT providers to establish local representatives in Thailand, and imposing a surcharge plan to collect taxes from OTT providers. Those plans have been criticized on the grounds of both advantage and feasibility (Tortermvasana, 2019). The most recent action saw the NBTC arranging an OTT dialogue for ASEAN[3], in June 2021, after two years of attempting to propose a plan to regulate OTT players to the ASEAN Telecommunication Regulators' Council (ATRC)[4]. The prior expectation had been to finish the regulatory framework by the end of 2020 (Post Today, 2021). Nonetheless, they have not reached any type of successful conclusion about this issue as of yet.

While the regulator and policymakers are still in the trial-and-error process, the studies about OTT should be used to consult on the OTT impacts. The studies can help facilitate the policy-making process. Unfortunately, studies regarding OTT are quite limited, especially for OTT communications, and those about OTT specific to Thailand are even scarcer. Among the few studies that do exist, most of the ones looking at OTT in Thailand are focused on OTT media or TV. For example, TIME consulting (2017) narrated the situation of OTT media in Thailand, and proposed a suggestion to regulate OTT media, as well as implementing net neutrality[5] in Thailand. With respect to the study

[3] The Association of Southeast Asian Nations, or ASEAN, is an international organization within the Southeast Asian region. It was established on August 8, 1967. Currently, ASEAN has 10 member states, which include Brunei Darussalam, Cambodia, Indonesia, Laos PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam.

[4] The ASEAN Telecommunication Regulators' Council (ATRC) is a cooperation between the regulators in ASEAN on issues regarding telecommunications and regulations. ATRC is regarded as a platform for member regulators to discuss and establish agreements implemented among ASEAN member states.

[5] Net neutrality is basically a principle originated in the United States to ensure nondiscrimination of data flow on the Internet. When this principle is strictly implemented, the ISPs are prohibited from discriminating against any data or practicing traffic management on their network (Krämer et al., 2013).

about OTT communications, to the best of the author's knowledge, the case for Thailand is absent at this point. However, there are several studies in other case studies. For example, the study of Mäkinen et al. (2014) revealed that users in Finland have tended to replace their traditional telecommunications services, mobile voice calling, and SMS, with Facebook's services. In contrast, the study of Arnold et al. (2016) using the case of Germany suggested that OTT communications are not replacing electronic communications services (ECS)[6], because the users adopted two services as a like-for-like substitution. On the other hand, some studies have found that OTT is not only impossible to substitute, but it is complementary to the traditional telecommunications services, such as the study of Ogidiaka and Ogwueleka (2019), who focused on Nigeria, and the study of Wellman (2019) investigating the situation in Norway. The studies discovered that users cannot rely solely on OTT due to the unstable quality of services, as well as bundling packages offered by MNOs, resulting in complementary usage by consumers. Regarding the study of OTT from the MNOs' perspective, there is even less information to go on. Most of the studies merely demonstrate the results from the user's perspective, although MNOs are widely regarded as one of the most affected actors in this situation. Most of these studies focus on strategy dealing with OTT, rather than the impact of OTT. Among the few focusing on the impact of OTT, a study by Ghezzi et al. (2014) found that OTT is considered to be a disruption for MNOs and leads to a change in strategy. There are studies focusing on the strategic aspects of OTT in many countries, such as those in Latin America (Ganuza & Viecens , 2014), African nations (Stork et al., 2017), and the overall global market (Limbach, 2014). The results generally suggest that nonaggressive strategies, such as embracing and partnering with OTT, are the most recommended. However, each country is shaped by different contexts, and each has different conditions. The results of those studies can be used as supporting guidelines, but they cannot be adopted wholesale and applied directly for use in Thailand. Due to the complex results of OTT studies and insufficient data on OTT in Thailand, research needed to be conducted to understand the specifics of the current situation in Thailand. The results do not only contribute to the field of telecommunications services as an academic contribution, but also provide useful guidelines to the regulator to consult.

To sum up, there are four motivations of this study. First, OTT is increasing massively in Thailand in a number of aspects - usage, revenue, and engagement in users' lives. Second, its impact, especially on traditional telecommunications services, is a concern for stakeholders in the telecommunications market. Third, with these concerns, regulators are confronting the demand to take any action to stop the decline in the use of traditional services. However, the appropriate plan has not been formulated yet. Fourth, the studies, which are supposed to be used to complement the decision to establish the regulatory framework, are insufficient, especially in the case of OTT in Thailand. With

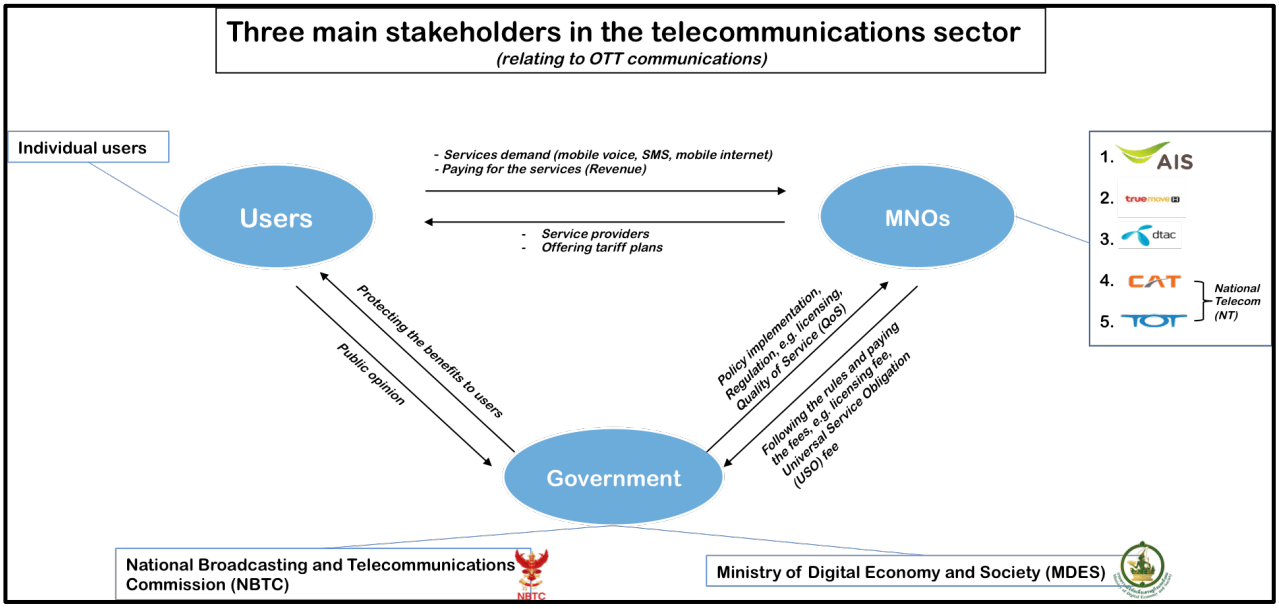
[6] Generally, electronic communications services, or ECS, is defined as communications services consisting entirely or mainly of the conveyance of signals.

these four motivations in mind, this research was conducted to contribute to the field of telecommunications study, especially in Thailand.

Section 1.2 Objective and Research Question

Based on the four motivations mentioned in the last section, this study focuses on OTT communications, of which studies in this area are extremely scarce in Thailand, compared to studies on OTT media. The impacts of OTT communications on the Thai telecommunications sector, including the responses toward the aspect of adoption and strategy dealing with OTT, are examined. The telecommunications sector as it relates to the OTT communications services in this study is comprised of three main stakeholders, which are users, MNOs, and the government. Their relationship to one another is shown in Figure 1-1. As this study is expected to mainly contribute to the government, analyses are carried out on the users and MNOs side. In that sense, the results from the other two perspectives can be consolidated and utilized by the government. Moreover, they are the two ends of the demand and supply sides of traditional telecommunications services. Thus, the overarching research question is posited as, "What are the impacts of OTT communications services on the stakeholders in the telecommunications sector and their responses to OTT in the context of Thailand?"

Figure 1-1: Three Main Stakeholders in the Telecommunications Sector



Source: Mwakatumbula, 2018, adapted by the author

The first section of analyses is performed on the users' side. In this section, the actual usage of Thai users of OTT and traditional telecommunications services, mobile voice calling, and SMS are investigated, in order to observe the impacts of use of OTT on the use of traditional telecommunications services. Moreover, the factors relating to the adoption of OTT is examined in order to further

understand consumer behavior in using the communications services. Thus, the sub-research questions for this part are posited as follows.

RQ 1.1 To what extent does OTT communication services use affect mobile voice calling and SMS use?".

RQ 1.2 To what extent are user characteristics and factors associated with the adoption of OTT communication services, including OTT voice calling and messaging?

These two sub-research questions were examined using quantitative analysis, choice modeling. Probit and logit analysis were performed respectively.

On the other side of the demand and supply relationship, the investigation into the MNOs perspective was carried out. This second section aims to explore the impacts of OTT on the MNOs' perspective. By doing so, the conceptual framework was built on the grounds of business model ontology composed by Osterwalder (2004), as well as disruption factors and environment-driven changes, compiled by Ghezzi et al. (2014). In further study, the strategy dealing with OTT is also examined. Several strategies gathered from previous studies are adopted. Afterwards, the evaluation criteria generated by Rumelt (1980) was used to determine the most appropriate strategy for Thai MNOs. Thus, the sub-research questions for the second section are as follows.

RQ 2.1 What are the impacts of OTT communication services on MNOs in Thailand?

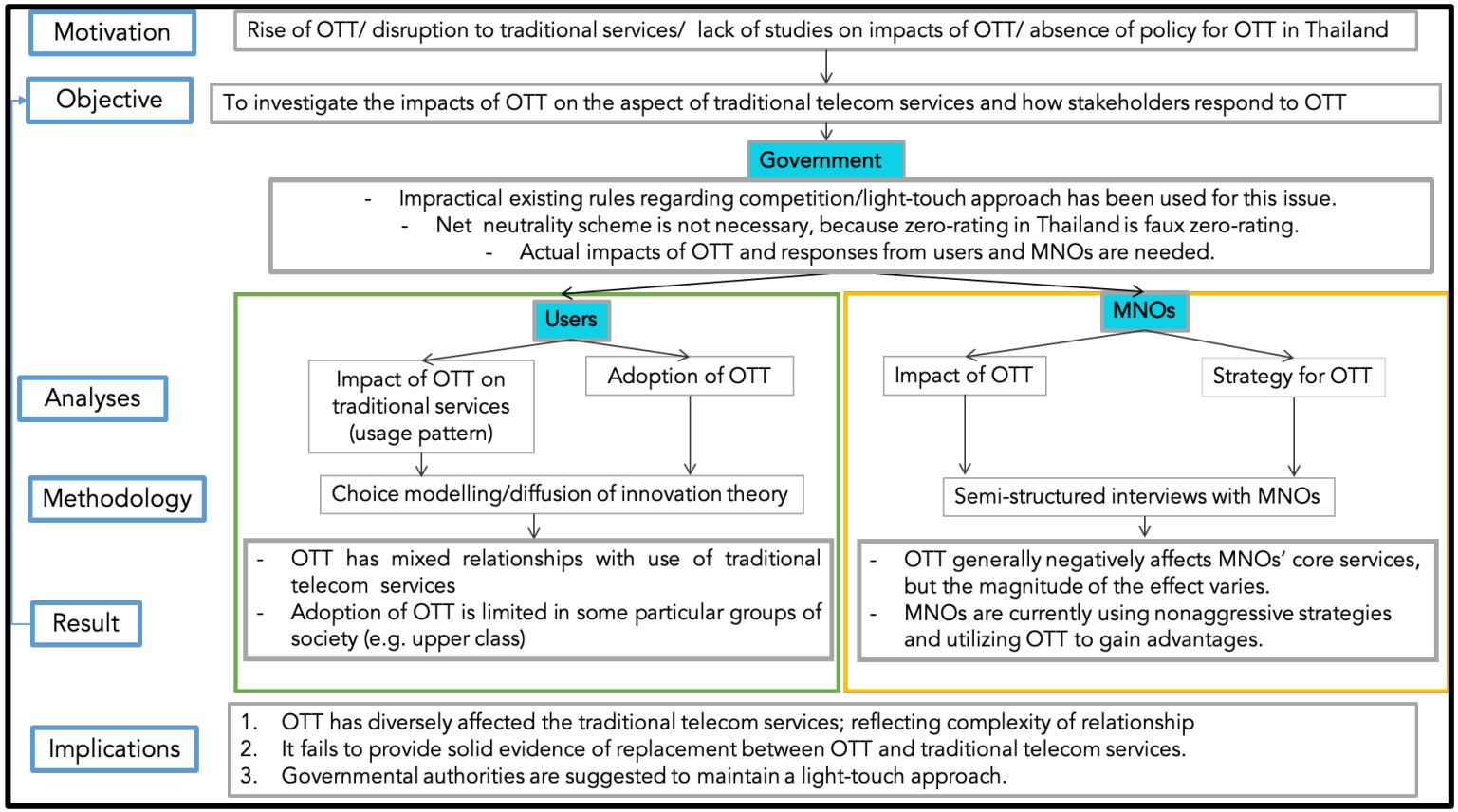
RQ 2.2 What are the appropriate strategies for dealing with OTT communication services for Thai MNOs?

This section used qualitative methodology. Semi-structured interviews were conducted with managers responsible for strategy in five MNOs in Thailand - AIS, TrueMoveH, Dtac, CAT and TOT (CAT and TOT merged to form National Telecom, or NT).

Section 1.3 Significance of the Study

There are three main points of significance of the study. First, the results in this study will extend the understanding of the impacts of OTT on each of the stakeholders in the telecommunications sector and how those stakeholders respond to OTT. This knowledge is very limited, especially in Thailand. Second, the results will contribute to each stakeholder as guidelines to adjust their plans in order to retain the benefits. Third, the results will serve as guidelines for policymakers in Thailand, who need to understand the impacts and then improve policies or the regulatory framework for OTT. The overall framework is summarized in the Figure 1-2.

Figure 1-2: Research Framework



Source: Author

Section 1.4 Structure of Dissertation

This dissertation is comprised of eight chapters. The chapters are organized as follows. This chapter, the first, briefly explains the introduction of the study, including the rationale for the study, the objective of the study, the significance of the study, and the research framework. In addition, this chapter lays out the structure of the thesis as a whole.

Chapter 2 is the background. It illustrates the definition of OTT, its characteristics and monetization, the business model employed by OTT players, especially in the case of OTT communications. The current OTT market in Thailand is also demonstrated; how it's growing, which OTT are popular in Thailand, and their key successes. The factors affecting OTT to be successful in Thailand are also explained. Moreover, the issues of OTT causing concern from stakeholders in the Thai telecommunications market are narrated. These issues are included as the motivation for this research.

Chapter 3 presents the theoretical framework, theories, and models employed in this thesis. Moreover, a brief overview of literature concerning OTT is also given.

Chapter 4 focuses on the government side, namely the regulatory landscape. Incumbent regulation related to online services, as an umbrella term for OTT services, is explored and explained here. The current mechanism used by Thai authorities is described, along with the limitations restricting them from applying rules to OTT. Three aspects of the mechanisms are examined: the regulation regarding the economic impacts, consumer issues, and other issues, such as taxes and politics. Furthermore, the net neutrality principle, which affects the regulation design and traffic management for mobile network operators (MNOs), is investigated. Currently, Thailand has not implemented the net neutrality rule in Thailand. However, this chapter concerns its appropriateness to apply such a rule. Also, the cases of other countries around the world are presented to be compared with that of Thailand.

Chapter 5 concentrates on the study from the users' side - the demand side of traditional telecommunications services. This chapter presents two analyses from the users' perspective. The first one is to find the relationship between usage of OTT, including OTT voice calling and OTT messaging, and traditional telecommunications services, which are mobile voice calling and SMS. In other words, it examines the impact of OTT usage on traditional telecommunications services. This section aims to prove the assumption posited by many scholars that OTT is substituting traditional telecommunications services. The second section analyses the factors relating to OTT adoption. This is included to explain the users' behavior in making use of OTT in order to clearly understand Thai consumer behavior. Relevant factors are found and used to complement the first part in explaining the substitution of two services, OTT and traditional telecommunications services in Thailand.

Chapter 6 elucidates the results from the MNOs' side - the supply side of traditional telecommunications services. The impact of OTT on various dimensions of their business and their appropriate strategies employed to deal with OTT are studied. The results from this chapter are from in-depth interviews with five MNOs in Thailand - AIS, TrueMoveH, Dtac, CAT and TOT (presently NT)

Chapter 7 gives the overall results retrieved from the previous two chapters, the users' side and the MNOs' side. The key findings and discussions are addressed in this chapter. Moreover, the implications and suggestions for the government, including the regulator, policymakers, and MNOs in Thailand are proposed. The contributions and limitations of the study, which are expected to be improved in the future work, are also remarked upon.

Chapter 8 concludes the overall thesis, after which it is presented. The research goals are accomplished.

Chapter 2
Background

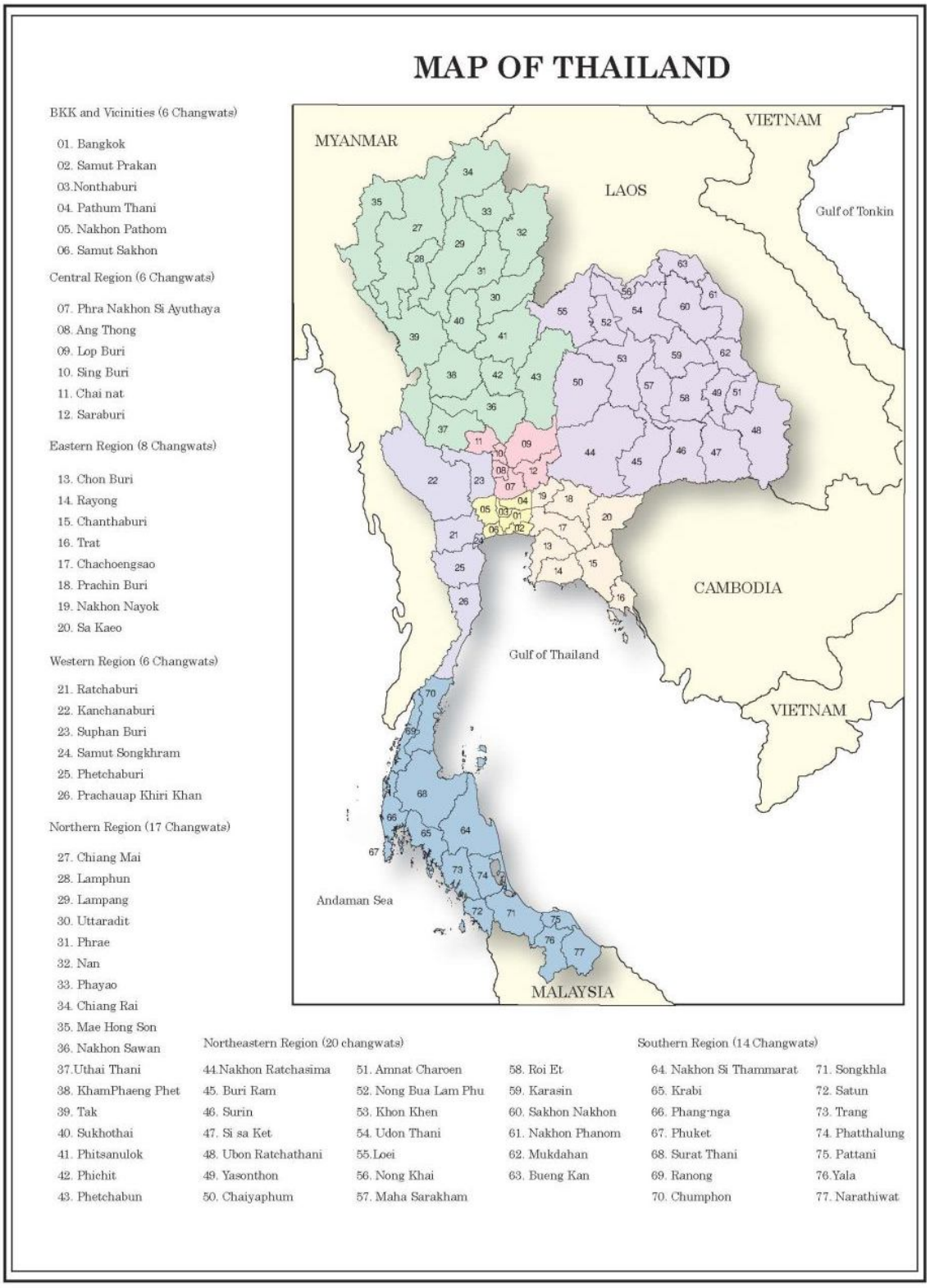
This chapter intends to briefly explain about the taxonomy of Over-the-top (OTT) services, especially OTT communications as the main focus in this thesis. The characteristics and business model, or monetization, of OTT players are described in detail. Furthermore, OTT in Thailand and issues regarding OTT which raise concerns for stakeholders in the telecommunications sector are also elucidated.

Before explaining the taxonomy of OTT, it is necessary to briefly give information about Thailand. The situation regarding OTT and telecommunications can be easier understood with some background information about the country. Thailand, or the Kingdom of Thailand, is a developing country situated in the middle of the Southeast Asian region. Consequently, it is one of the members of the Association of Southeast Asian Nations (ASEAN), the most prominent regional intergovernmental organization in Southeast Asia, which is often compared to the European Union (EU). EU is usually referred, regardless of the leave of the United Kingdom, as the most successful regional organization in the world, while ASEAN is regarded as the second successful (Koh, 2017). Thailand covers 513,119 square kilometers (NSO, 2014). There are 77 provinces, officially separated into seven regions[1], Bangkok and vicinities, Central, Eastern, Western, Northern, Northeastern, and Southern. Bangkok is the capital city and is considered the most developed city in Thailand. Currently, Thailand has a population of 66.19 million, with a growth rate of -0.6% (as of 2020) (BOI, 2021). Approximately 42.79% of the population are male and 57.21% are female. With respect to economic information, Thai GDP in 2020 is 501.8 billion USD and GDP per capita is 7,219.2 USD. GDP in Thailand decreased from the same period last year (Yuda, 2021). Concerning developmental information, the literacy rate[2] indicates that 93% of Thais can read and write the Thai language (BOI, 2021). However, there are differences between urban or municipal areas and rural or nonmunicipal areas. Regarding the information from World Bank in 2020, 49.3% of the Thai population lives in rural areas (World Bank, n.d.). The main big cities, and particularly Bangkok, are well developed, while other parts of the country are underdeveloped. The digital divide in Thailand is problematic to this day, even though it has improved over the last decade (World Bank, 2019). With this information, it is easier to comprehend the situation in Thailand, including the situation relating to OTT.

[1]In the case of research and statistics from the National Statistical Office of Thailand, the data is normally collected from five regions, Bangkok and vicinities, Central, Northern, Northeastern, and Southern region. The Eastern and Western areas are included in the Central region due to the size of the areas and the population.

[2] Literacy rate refers to the percentage of the population who are 6 years and above and are able to write and read (BOI, 2021)

Figure 2-1: Map of Thailand



Source: NSO, 2014

Section 2.1 Definition of OTT Services

Over-the-top (OTT) services have been considered in several discussions in recent years, ranging from their economic to social aspects. However, the official taxonomy of OTT has not yet been established. Although there are attempts to define this term, there is no single definition that has been publicly accepted (Godlovitch, et al., 2015). This term, OTT services, is usually represented in the form of popular applications, such as Skype, YouTube, Netflix, and Facebook. These applications are perceived as OTT services, but the nature of these applications is mostly diverse. It indicates that the term OTT itself is broad and vague. This section aims to clarify the term OTT services, to define the boundary of what is OTT and what is not, its classification, their revenue sources, what constitutes successful factors and concerning issues of OTT. In addition, OTT in Thailand is presented as the background of the research. The meaning of OTT services elucidated in this section will be used as the reference throughout this thesis.

As stated in the European Parliament Research Service (EPRS) briefing report, OTT is defined as the delivery of content, services, or applications over the internet (i.e., 'over the top' of the network) (Davies, 2016), and OTT service providers do not have direct involvement or a business relationship with a network operator or Internet service provider (Madiega, 2019). This is the standard definition of OTT. It focuses on the first characteristics of OTT, relying on the Internet to bring these services to users. The Internet service providers are considered "the third party," in that they are not OTT providers' own managed network (Anantho, 2018). In the past, OTT services did not involve Internet service providers (ISPs) in either their own business or technical aspects, only using ISPs as the platforms to deliver the services to users. This is also the reason why these kinds of services are called "Over-the-top" services (Joshi et al., 2015). In addition, because of the claim stating that OTT services provide service over the Internet without a relationship or contribution to the Internet provider, OTT is considered a "free rider" to the Internet service providers. However, recently the relationship between OTT providers and Internet service providers is getting more complex. They now even collaborate in the form of partnerships (BEREC, 2016). Furthermore, some ISPs develop their own OTT services and provide the service to their Internet subscribers without charge or with special discounts (Santhi, 2019; Stork et al., 2017) As a result, it might no longer be entirely accurate to state that OTT players and ISPs do not have any relationship. Thus, OTT might not solely be free riders to ISPs either (Baldry et al., 2014).

Apart from the provision of delivery used to define OTT, its potential to substitute traditional services is another attribute of OTT. As defined in the International Telecommunications Union (ITU) study paper, OTT services is "an online service that can be regarded as potentially substituting for traditional telecommunications and audiovisual services such as voice telephony, SMS, video on demand and television." (ITU, 2017, p.4). Also stated in the collaborative framework for OTT is a

recommendation paper suggesting that the regulatory bodies or government in each country handle OTT. It is stated that it is "an application accessed and delivered over the public Internet that may be a direct technical/functional substitute for traditional international telecommunications services" (ITU, 2019, p.1)" [3]. Not only do they substitute for traditional services, OTT services can also be complementary with traditional services. Dr. Peter Lovelock, from the Technology Research Project Corporation (TRPC), states "the complementary relationship" with traditional services, which is not commonly regarded in most OTT taxonomy:

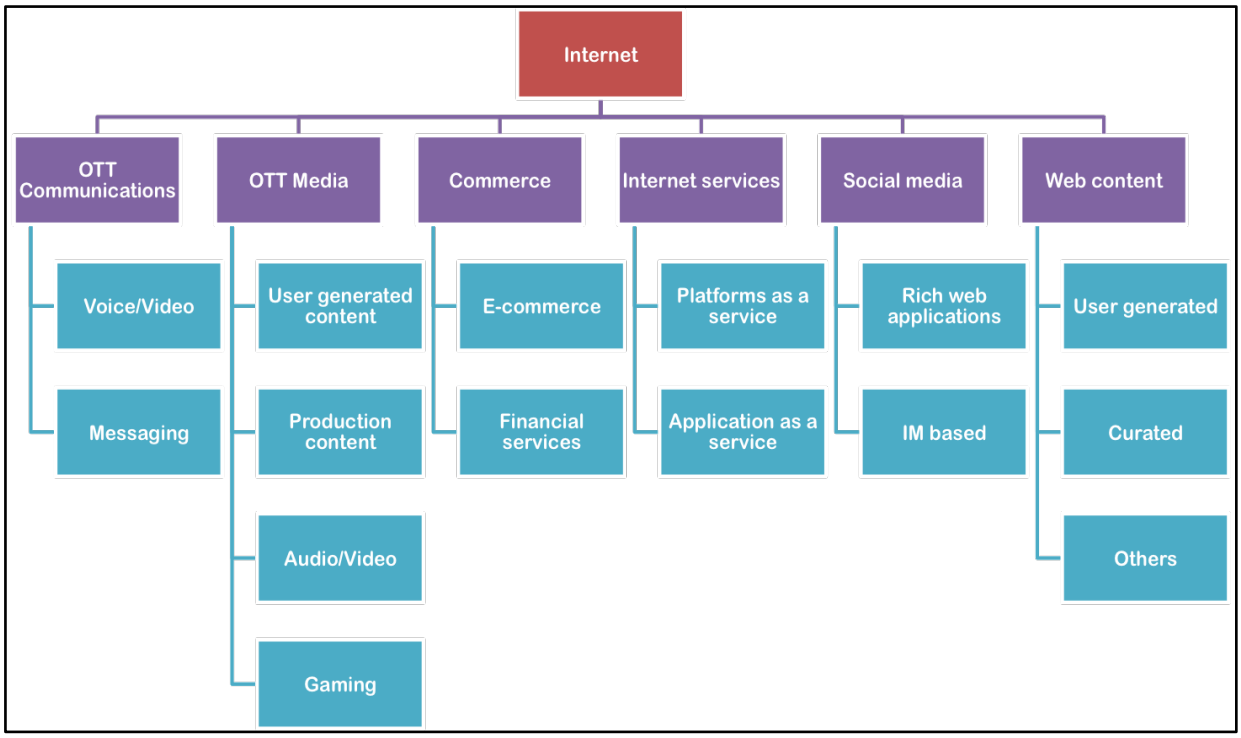
> *Over-the-top (OTT) services can be defined as digital content distributed over the Internet that bypass traditional communications delivery channels to reach end users, and can potentially complement, collaborate or supplant not only traditional telecoms and media services but also a whole range of traditional industries. (Lovelock, 2017)*

Thus, the definition of OTT must represent two properties of OTT: delivering the services on the Internet and having potential to compete with or complement the traditional services. By adopting this definition, it is easy to separate what is OTT and what is not. An online service, which means the service fully or partially relying on the public Internet, falls into the first characteristic of OTT, the delivery of content. Typical online services such as web content can be misunderstood as OTT service. However, in terms of the definition stated, online service is not equal to OTT service. In other words, OTT services can in certain instances be counted as online services, but not every online service is included in OTT. The difference is that OTT must have potential to substitute the traditional services, functionally or technically, while the typical online service does not have this attribute.

There is also the other clear separation of OTT services and typical online services. The study of Baldry et al. (2014) classified all services provided on the Internet into six groups based on use case, as shown in the Figure 2-2: communications, media, commerce, Internet service, social media, and web content. With the definition posited in the first section, OTT services must have potential to replace or complement traditional services. OTT communications are relevant to telecommunications services as they provide identical services, such as voice calling and messaging, while OTT media provides similar services to traditional terrestrial television. Thus, only communications and media services can be counted as OTT services, while the other four groups are not.

[3] However, in this definition, there is a note provided that the definition is a matter of national sovereignty and may vary among member states.

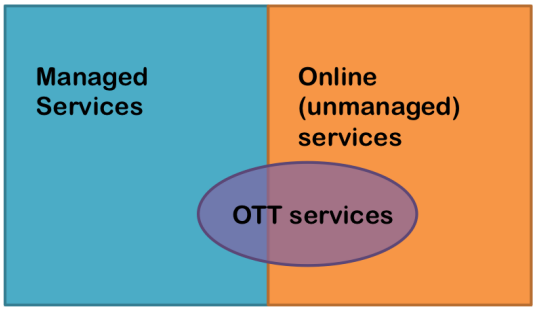
Figure 2-2: Use Case Classification



Source: Baldry, Steingröver, and Hessler, 2014

Internet Protocol Television (IPTV) is another service that is often confused with OTT service. IPTV refers to Internet-based television, which provides TV programming on the Internet instead of using antennas, as conventional television does. Actually, IPTV is clustered into "managed service" (ITU, 2017). Managed service can be provided online, and usually has its own network, or the provision of control over the service distribution. As a result, the quality of service is guaranteed. In contrast to the online service, OTT service provides service to the users without or with little control of the distribution. The quality of service is usually not guaranteed, leaving it dependent upon the network. Because of this reason, OTT service cannot wholly be clustered as a managed service. Managed service also includes services that have their own network, such as fixed and mobile voice calling, which definitely do not qualify as OTT services. Nonetheless, there are some OTT services that guarantee the quality of service and construct their own network, and they are included as managed services as well, yet they are currently not common practice. The character of OTT services, online service, and managed services are displayed in the Venn diagram in Figure 2-3.

Figure 2-3: Boundary of OTT, Managed and Online Services



Source: Markus cited in ITU (2017)

Section 2.2 Classification of Over-the-Top (OTT) Services

Each type of OTT has its own unique characteristics and operational methods, thus the research methodology approaching each type of OTT is different. This section aims to explain the classification of OTT services. There are various kinds of classification in the studies, which are usually dependent on different aspect of the research. In general, OTT services are divided by content and the relationship to traditional services. There are typically three categories: communications, media, and applications (TIME Consulting, 2017; TRAI, 2018). The three categories are explained as follows:

1) OTT communications

OTT communications consist of online services, applications, or websites mainly used for interpersonal communications, messaging, and voice and video telephony (TIME Consulting, 2017). Examples of the services in this group are Skype, Facebook, WhatsApp, and LINE. OTT communications usually provide services that are identical to traditional telecommunications services, such as mobile voice calling and SMS. However, some scholars insist that OTT communications are an enriched version of the traditional telecommunications services by extending features to the service, such as video calls, which are usually not part of traditional services package, or greater interaction and gimmicks, such as stickers and group chats (Arnold et al., 2017). This group sometimes includes social networking, such as Facebook, Twitter, and Instagram, but there are some studies that separate social networking as a different class of OTT (Peitz & Valletti, 2015).

2) OTT media/ OTT TV

OTT media or OTT TV are online services, applications, or websites providing content and video streaming to users. This group also counts subscription-based video on demand (SVoD)[4], ad-based video on demand (AVoD), user-generated content (UGC), and online gaming. Well-known OTT media include YouTube, Netflix, Hulu, and HBO GO. OTT TV is mentioned as having the potential to displace terrestrial television, and even radio. Interestingly, content providers who offer traditional broadcasting services have recently been extending their service to include online broadcasting in response to the changing lifestyles of users (TIME Consulting, 2017).

3) OTT applications

OTT applications are online services, applications, or websites used for productivity and lifestyle management. The OTT in this group is drastically diverse, ranging from e-commerce and financial services to navigation. Uber, Airbnb, Dropbox, Google Maps, and Amazon are examples of OTT in this group. OTT applications are regarded as a replacement for traditional services, such as brick-and-mortar stores. OTT applications are not always included as OTT services. According to a study by Baldry et al. (2014), there are only two kinds of services, OTT communications and OTT media. The other services, including OTT applications, are merely typical Internet services.

Figure 2-4: Sample of OTT Services

Source: Compiled by Author

The classification of OTT can be varied depending on the aspect of research and specific concerns, such as regulatory decisions. The Body of European Regulators for Electronic Communications (BEREC) mainly focuses on regulatory issues (BEREC, 2016). They proposed the classification of OTT regarding its potential to compete with Electronic Communications Services (ECS). ECS refers to the services, which are comprised of three characteristics: principally providing for remuneration, primarily

[4] Subscription-based video on demand (SVoD) and ad-based video on demand (AVoD) are both video streaming services providing videos over the Internet. The difference between these two services is their monetization. In order to gain access to the services, SVoD providers require the users to subscribe by paying a recurring fee, so it is generally ad-free. On the other hand, AVoD puts ads in the services, so users are exempted from payment or granted discounts from the service providers.

for the conveyance of signals, and providers exercising control over content. ECS is subject to regulations, but currently, OTT is not. Consequently, it is being considered whether OTT should be regulated in the same manner as ECS. Thus, BEREC generated the taxonomy to justify this issue. OTT services, which have similar characters to ECS, are clustered as OTT services. An example of the regulatory framework applying to ECS is voice calling terminating at Public Available Telephone Service (PATS) or Public Switched Telephone Network (PSTN). With this criterion, OTT services in BEREC's definition are classified into three groups:

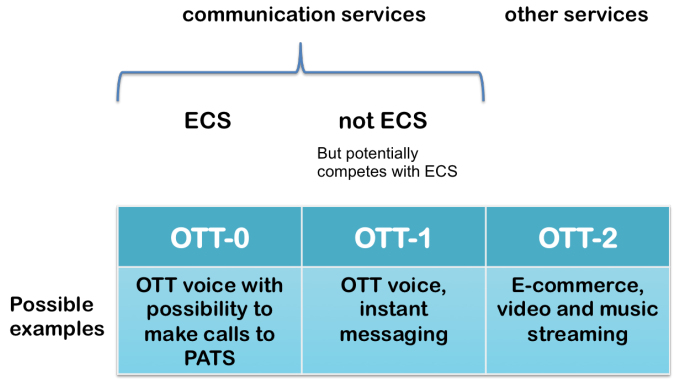
1. OTT-0: an OTT service that qualifies as an ECS. According to the definition of ECS, in the conveyance of signals, OTT providing service online and terminating at PATS are partially responsible for the conveyance of the signal. Thus, the service making a voice call, incoming and outgoing, to PATS is qualified as ECS, such as VoIP terminating to PATS or PSTN. These services have contracts with end users, collect fees from users, and negotiate with the network providers.

2. OTT-1: an OTT service that does not qualify as ECS, but potentially competes with an ECS. OTT in this group cannot connect to PATS or PSTN. It includes voice calls and instant messaging, but it cannot connect to PATS or PSTN. It typically does not guarantee the quality or manage the distribution of the service. Usually, the service in this group is provided at zero cost to the consumer, because it is part of a two-sided business model. The details of this model will be explained in the next section.

3. OTT-2: other OTT services that clearly do not compete with ECS, such as Uber and Airbnb. OTT-2 is the remaining category containing all OTT services that are certainly not an ECS and also do not potentially compete with ECS.

Figure 2-5 illustrates OTT services in BEREC's taxonomy. This taxonomy can be roughly divided into two main categories: communication services and other services. Communication services can be divided into two services: the services that qualify as an ECS, and the ones that do not compete with ECS, but have the potential to. However, this taxonomy was defined in order to discuss regulation, not intentionally to justify it as a legal concept (BEREC, 2016).

Figure 2-5: OTT Services as ECS



Source: BEREC, 2016

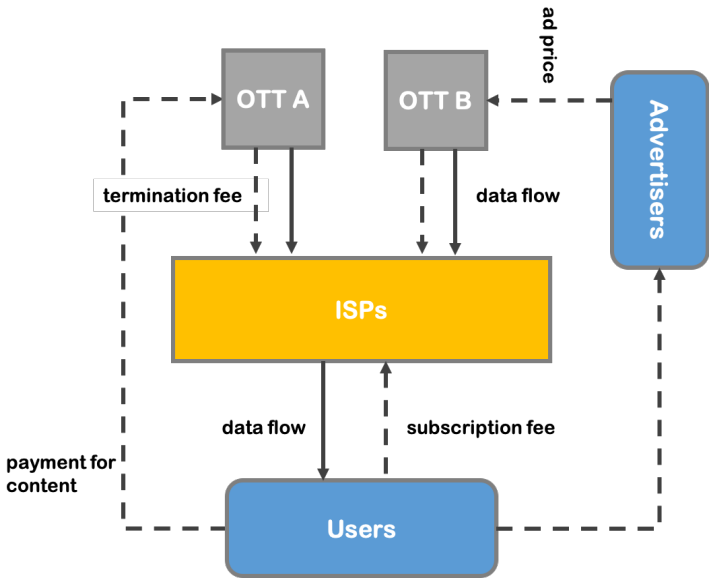
It is not only the taxonomy that is varied among the studies, but also the classification is diverse, depending on the interest of study. In this thesis, the main focus relies on OTT communications. This type of OTT is usually categorized, in all definitions, as a separated group of OTT. However, regarding the taxonomy defined by the BEREC, OTT communications as a whole are comprised of two subgroups; ECS, and those that are not ECS but potentially compete with ECS. In order to clarify the definition of OTT communications in this study, BEREC's definition is elaborated. In this study, the definition of OTT communications does not include the OTT-0, or OTT that can be defined as ECS. The reason is that OTT, which is counted as ECS, is clearly regulated by the National Regulatory Authority (NRA). Thailand follows this approach. VoIP terminating to the PSTN is regulated by the rules enacted by the NBTC, formerly the National Telecommunications Commission (NTC). For this reason, there is no need to further investigate, as the regulatory framework is already established. At the current stage, OTT communications that are not counted as ECS remain a concerning issue requiring further investigation and policy implementation.

Section 2.3 Business Model of OTT/Monetization of OTT

This section aims to summarize the business model or monetization of OTT. In some studies, the business model can be used to classify OTT, apart from the content, and ECS qualification as explained in the last section. The business model of OTT varies depending on the market, consumer segment, and competition. Nowadays OTT services may adopt more than a single model, which continues to evolve. In general, the business model can be divided into two types, one sided or two-sided (multi-sided) market. Nowadays, there is combination of the two models, an example of which is *Freemium*, where basic services are offered without fees and more advanced services require payment (Holm & Günzel-Jensen, 2017). In order to further understand the relationship between each player and OTT's revenue sources, the ecosystem of OTT is illustrated in Figure 2-6, modified from the typical Internet ecosystem. OTT services have their ecosystem, which reflects how they obtain their revenue.

In the ecosystem, OTT services need the Internet service providers (ISPs) to be the medium to bring the service to users as portrayed in the diagram. The main actors in this system are comprised of OTT providers, ISPs (or MNOs, as they provide mobile Internet service), users, and additionally, third parties displayed as advertisements.

Figure 2-6: Internet Ecosystem Business Model



Source: Greenstein, 2016 modified by the author

1. One-sided market

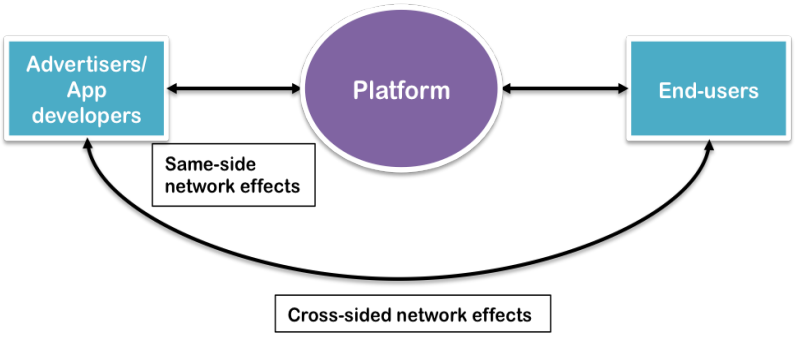
This business model is simple; the users pay directly to the service providers. As shown in Figure 2-6, OTT A represents OTT adopting the one-sided business model. The users pay the subscription fee to the ISPs, and also separately pay for the content access to the content providers, or OTT providers in this case. Users may pay for the usage or subscription, or only the content they consume. Under this scheme, users usually pay periodically – weekly, monthly, or annually - to the service providers. OTT providers employing this business model include Netflix, Hulu, and HBO GO. OTT media or TV typically employs this type of business model. OTT service in this group includes VoIP terminating to PATS which charges the users per minute (or ECS in BEREC's definition), Amazon prime, and some online games. This business model typically has the price proposed to the end users.

2. Two-sided market or multi-sided market

The two-sided market is a common business model for OTT services. It is, however, regarded as one of the most controversial issues about OTT. Employing this business model usually means offering the service to users at zero cost, as the cost is funded by a third party, such as advertisers and application developers. OTT services are considered the intermediary between users and third parties. According

to Figure 2-6, OTT B represents OTT services adopting this business model. By using OTT B, users are required to consume the advertisements, which those companies anticipate will lead to users purchasing their products afterwards. On the other hand, the OTT providers may monetize the personal information of users to advertising agents or application developers. The problem with this business model for traditional communication companies is that it allows OTT services to be offered to users for free, which helps them to compete with the traditional services. To illustrate, voice calling and instant messaging via applications such as WhatsApp and LINE are offered at no cost to the user. They are potentially competing with the traditional fixed-line and mobile telephony and Short Message Service (SMS), which charge for their services. This is considerable cost advantage to consumers. As a result, these applications are expected to cannibalize traditional services even further in the near future. Moreover, regulations are difficult to apply because there is no cost on the user's side. The conventional competitive evaluation or the hypothetical monopolist, such as "Significant Market Power (SMP)" or "Small but Significant and Non-transitory Increase in Price (SSNIP)" cannot apply to OTT services in this group, because these methods require a price for analysis (Graef, 2016). Moreover, the issue of consumer protection is also seriously concerning, because consumers' personal information may be disclosed to third parties, such as advertisers, marketing firms, or application developers.

Figure 2-7: Two-Sided Market/Business Model



Source: Sridhar and Venkatesh, 2012 cited in Sindhar, 2014 modified by the author

In this business model, network effect plays an important role. Network effect means that a network gains or loses value when the number of participants increases. According to the Figure 2-7, the platform represents OTT, or the network engaging the participants from two sides, advertisers/app developers and end-users. On each side, there is a network effect when the number of participants on each side changes. For example, increasing numbers of Facebook users urge more new users to come to Facebook, resulting in rapidly expanding users. This is called the positive – as it increases - same-sided network effect. At the same time, when the number of users becomes larger, it is more attractive to the other side of the platform, advertisers/app developers. As for the advertisers, posting their advertisements to a larger number of end-users means that they can reach more potential customers.

However, too many advertisements might negatively affect the users, resulting in their switching to other platforms or OTT. One side of the platform affecting the other side is denoted as a cross-sided network effect (Graef, 2016). The price offering on each side is justified by both sides of the network.

3. Other methods

Some OTT providers adopt other options, aside from one-side and two-sided business models. One of those options is called "Freemium." This term means the users can enjoy the basic features for free but need to upgrade with payment to access advanced features (Holm & Günzel-Jensen, 2017). Users who choose the "free" package can enjoy standard quality service with a limited number of choices, or they are forced to watch commercials. If the users would like to upgrade to a "premium" variety of service, or be free from viewing advertisements, they have the option to subscribe and pay for the service. For example, the OTT media service YouTube has recently adopted this model. Users can watch videos with advertisements on YouTube, or they can upgrade to "YouTube Premium" by paying recurring fee. YouTube Premium contains a greater number of videos and YouTube original programs. This business model is not popular among OTT communications. So far, Skype is one of the few applications employing this model. Skype offers basic voice and video calls and messaging for free, however users who would like to make calls utilizing traditional telecommunications such as PSTN or VoIP terminating to PSTN, can pay to access this service.

Section 2.4: OTT in Thailand

Similar to other parts of the world, OTT in Thailand is considered a successful business. It is increasing in terms of usage, subscribers, and its engagement with people's daily lives. OTT became mainstream in Thailand around 2014 (Anantho, 2018). All of the three main types of OTT - communications, media, and applications - have gained popularity exponentially in Thailand. The PwC report, Global Entertainment and Media Outlook 2013-2019, states that OTT services are expected to grow even faster than they previously had in all markets in Thailand over the next 5 years, at 5.05% CAGR, or from 502.8 billion THB (15.3 billion USD) in 2018 to 643.2 billion THB (19.5 billion USD) in 2023, due to the utilization of 5G and the demand for online media consumption, especially OTT media in the video on demand market (Kate, 2019). Advertising expenditure on online media has increased over the past five years. Advertising expenditure for OTT services is expected to reach 32.57 billion THB (1.1 billion USD) by 2023 and grow at 13.62% CAGR. Over the same time period, advertising spent on print media has been minimal, decreasing by 3.05% CAGR, while advertising on TV has only increased slightly, by 4.76% (Positioning, 2019). It can be presumed that the OTT market in Thailand is rapidly expanding, as the trend of users has migrated to online service exposure.

In terms of OTT communications, there are several applications that are ubiquitous among users nowadays. LINE is the most prominent OTT communications platform in Thailand (Hootesuite & We Are Social, 2020). Thailand is one of three countries in which LINE is the dominant application. The other two countries are Japan and Taiwan. LINE was created in Japan by the Japanese subsidiary of Korea's Naver Corporation, though recently it has been under the operation of LINE Corporation, Japan (Iqbal, 2021). LINE Corp established its local company in Thailand in 2014 as LINE Thailand (Leesa-nguansuk & Phoosuphanusorn, 2014). Presently, LINE is favored by Thai consumers, with 46 million users in early 2020 (MGR Online, 2020). The number of LINE users is quite close to the number of total Internet users, which stands at 52 million, while the total population of Thailand is approximately 70 million. In other words, 87% of Internet subscribers, or 65% of Thai people use LINE, or at least created an account on the application. Furthermore, Thai users spend an average of 69.29% of their daily online time on the LINE platform, and they use 43 MB data per day via LINE (NBTC, 2019a). Thus, LINE is tremendously successful in both the number of users and the usage aspects in Thailand.

The next application is Facebook messenger, another communications platform that is well-accepted in Thailand. Facebook, as social media, is very popular in Thailand, currently with 48.5 million users, 45 million accounts, including 12.54 million users solely in Bangkok (A., 2019; Manakitsomboon, 2020). Facebook is a well-known social networking application invented in the United States in 2004, and it officially opened its local office as Facebook Thailand in the center of Bangkok in 2018 (Areepermporn, 2018). After situating in Thailand, Facebook Thailand has made great progress, with dramatically increased revenue. The revenue of Facebook Thailand grew from approximately 229,000 USD in 2015 to 11.4 million USD in 2019, an increase of approximately 50 times from the opening of their local office (Thairath online, 2020). Facebook Messenger, as the extension of Facebook, also is favored by Thais, with 26 million users. However, compared to LINE, Thai users spend much less time on Facebook Messenger; with only 4.02% of time spent on the online platform (NBTC, 2019a).

Apart from LINE and Facebook Messenger, there are other applications that have been adopted to a lesser degree by Thai users. Usage on Skype is behind LINE and Facebook Messenger (Hootsuite & Wearesocial, 2020). Skype is an American application owned by Microsoft. It had roughly 14 million subscribers in 2019. Another application is WhatsApp, an American application, which was acquired by Facebook in 2014. WhatsApp is the most widely used OTT communication service, with 2 billion subscribers in 2020 in over 180 countries around the world (Tankovska, 2021). Moreover, it is the leading mobile messaging app in 112 countries (Bannerman, 2020). However, it is not widely used by Thais, with approximately 13 million users in 2019 (Hootesuite & We Are Social, 2020). WeChat is similar to WhatsApp in terms of users and status in the Thai market. WeChat is a Chinese application developed by Tencent, and it is the most used application in China. Although these applications have garnered a fair number of users in Thailand, they are still considered niche applications used by specific

groups. For example, users who have to contact with people in China use WeChat – or WhatsApp for contacts in other countries where LINE and Facebook Messenger are not as popular.

OTT media is an area where many players have entered and left the Thai market over the past five years. Some of them are have been successful and have expanded their businesses to various groups of users. Others have changed their strategies, such as iflix, and some have left the Thai market, such as HOOQ, which left in May 2019 (MGR Online, 2020). The value of expenditure on video streaming in 2018 was 92.5 million USD, and it is expected to double by 2023. Moreover, it is anticipated to grow an average of 16.64% CAGR annually, while the traditional TV market is estimated to grow on average 4.76% CAGR annually (Positioning, 2019). YouTube is an example of player who came into the Thai market early on and has grown tremendously. YouTube, an American user-generated content provider founded in 2005, was acquired by Google in 2006 (Hosch, 2020). YouTube officially established YouTube Thailand in 2014 (Leesa-nguansuk & Kositchotethana, 2014). Afterwards, it has developed its content by partnering with Thai TV channels and professional content producers, while at the same time encouraging the growth of independent content producers. Currently, YouTube has around 40 million users in Thailand, with over 350 channels and more than 1 million subscribers in the country. Moreover, time spent on YouTube has increased significantly, growing approximately 20% from 2019 to 2020 (Mahittivanicha, 2020).

LINE TV is becoming another successful OTT media in Thailand. LINE TV is an extended service from LINE Thailand, provided for the first time in Thailand in 2015 (Leesa-nguansuk, 2015). LINE TV provides the content from various partners, as well as exclusive original content. LINE TV has claimed that they are the number one in video on demand (rebroadcast) platforms in Thailand (LINE for Business, 2019). Only five years after establishment, LINE TV has more than 5,800 million views, accessed by 40 million users who spend an average of 176 minutes watching LINE TV daily (Junkisen, 2019). Additionally, its advertising revenue has increased by 65% from when it was established. Thus, LINE Thailand is successful in taking steps into the Thai market, not only in the OTT communications area, but in OTT media as well.

Netflix, a top ranking in OTT media around the world, was expected to reach 546,000 subscribers in Thailand in 2020 (MGR Online, 2019). Due to expensive price plans and a limited ARPU (Average Revenue Per User) of Thai customers, Netflix is not as successful in Thailand as it is in other parts of the world. Other than the applications mentioned, there are many applications that have a fair number of users and are continuing to expand, such as viu, iflix, Disney+, and WeTV. In addition, there are OTT media services provided by mobile network operators in Thailand, such as TrueID from True, and AISplay by AIS. In addition, TikTok, the Chinese application developed by ByteDance, is a rapidly growing application. It increased 100% from 2018 to 2019 (Marketing Guru, 2020).

OTT applications have been a major success in Thailand, especially ride-hailing applications such as Grab taxi, and food delivery applications like LINE MAN, Grab Food, and Food panda. Grab, after operating for six years in Thailand, has been used over 320 million times in 16 provinces (Positioning, 2019). LINE MAN, another application providing the similar services to Grab, has 1.5 million users monthly, and grew 330% in 2017-2018 (WP, 2019).

As stated, OTT in Thailand is very successful - and growing – as it is not only in Thailand, but also around the world. However, focusing on the Thai market, there are several reasons why OTT is successful in Thailand. These reasons are summarized in the next section.

2.4.1 Key Factors of OTT Success in Thailand

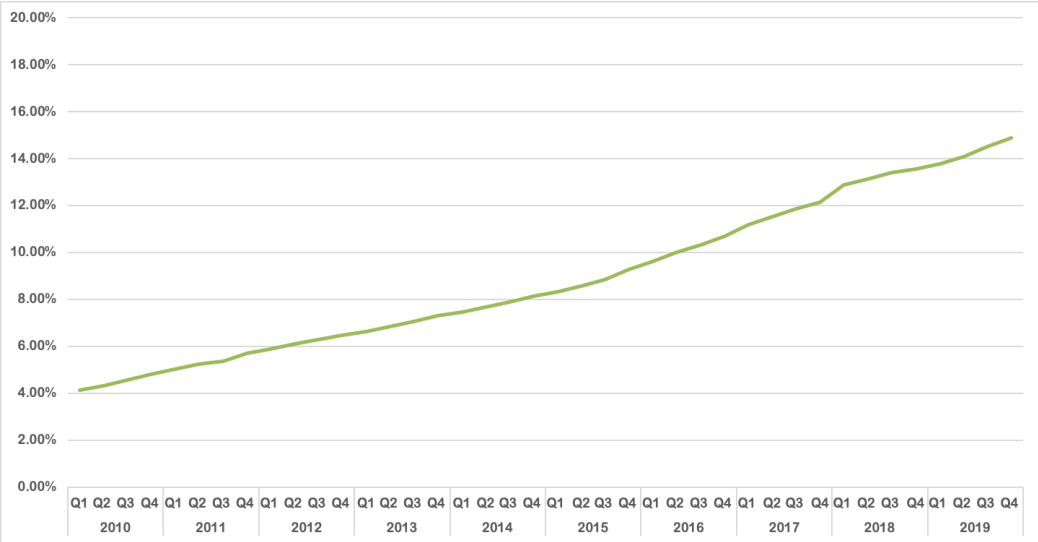
It is undeniable that OTT is very successful in today's market. Apart from development that is rich features resulting from extensive R&D, there are several reasons why OTT is successful. Similar to other countries around the world, OTT in Thailand has achieved its goals for a number of reasons. The key successes of OTT are described as follows.

1) Supportive Internet infrastructure and market

The first factor encouraging the growth of OTT is healthy Internet infrastructure. As a means of service delivery, the Internet plays an important role in the ecosystem. The Internet infrastructure in Thailand is considered to be acceptable. In terms of performance, Thailand ranks 53rd in worldwide broadband speed in 2020, with an average of 30.61 Mbps download speed (Cable, n.d.)[5]. Moreover, according to the Digital Quality of Life Index 2020, researched by Surfshark, the Internet quality of Thailand ranks 47th overall, and is in the first tier (1st -41st) in broadband internet stability. Thailand's penetration rate and number of users shows approximately 52 million Internet users in early 2020 among a total population of 69.7million (Hootesuite & We Are Social, 2020). Mobile Internet is growing considerably faster than a decade ago, up from 14.72 million subscribers in 2010 to 45.38 million in 2019. In addition, the trends of penetration of mobile Internet and broadband Internet are increasing, as shown in the Figures 2-8, 2-9, and 2-10. The area coverage of 4G is 98%, with a 79.61% penetration rate (GSMA, 2020). After the 2.6 GHz spectrum auctions in February 2020, 5G technology is expected to soon be fully implemented. Consequently, mobile Internet will show improved results, increasing opportunities for OTT providers.

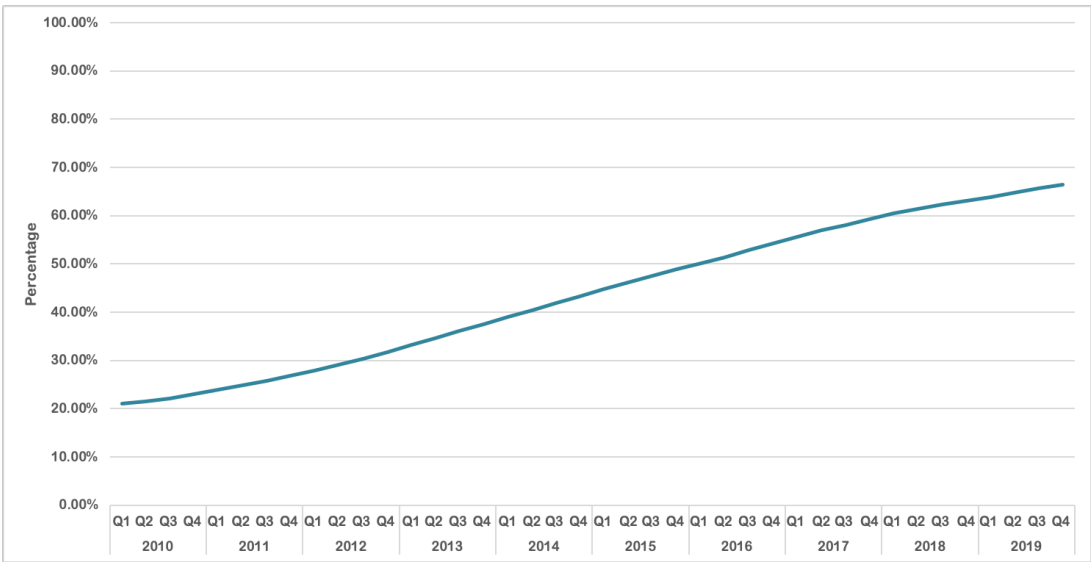
[5] For more information, please visit https://www.cable.co.uk/broadband/speed/worldwide-speed-league/

Figure 2-8: Fixed Broadband Penetration per Population 2010-2019



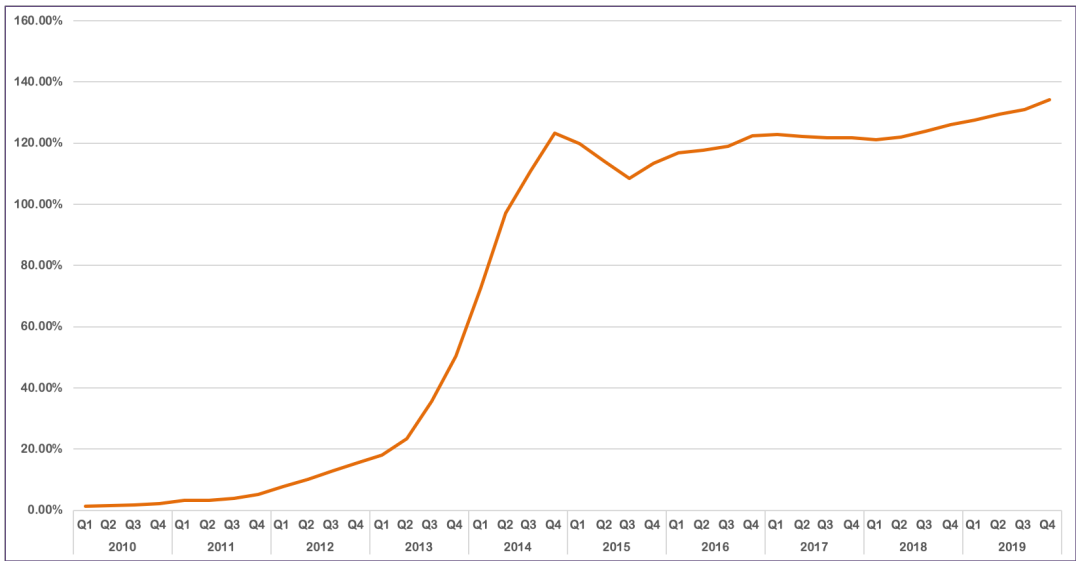
Source: NBTC, n.d.

Figure 2-9: Mobile Internet Penetration per Population 2010-2019



Source: GSMA, 2020 graphed by author

Figure2-10: Mobile Broadband Capable of Market Penetration 2010-2019



Source: GSMA, 2020

Because of the rapid growth of Internet and mobile Internet accessibility, OTT is being quickly adopted into the Thai market. As the quality and accessibility of the Internet improves, there will be greater opportunities for OTT usage and acceptance. OTT needs the Internet to deliver its services, thus faster Internet means mores lanes for delivery and higher quality for users to enjoy.

Thailand is the third fastest growing Internet economy in ASEAN, behind Indonesia and Vietnam (Leesa-nguansuk, 2019). Furthermore, the competition among Internet service providers in Thailand is quite fair. There are four major Internet service providers for fixed-line internet - TOT, True, 3BB, and AWN. For mobile Internet, which is offered by mobile network operators, there are three major operators - AIS, True, and Dtac - and two small, state-owned enterprises - TOT and CAT – which were approved by the Cabinet to merge as a new company, called National Telecom (NT) in January 2020. The merger was expected to be completed in July 2020, however due to the COVID-19 pandemic, the merger was unfortunately delayed. Regarding market share, subscribers, and Herfindahl-Hirschman Index (HHI), the competition of Internet service providers, both fixed-line and mobile, is not highly concentrated. Within the competitive market, it can be expected that service pricing and quality are reasonable. As a result, users have access to good quality Internet at affordable prices.

Table 2-1: Fixed-Line Internet Service Providers (as of Quarter 4, 2019)

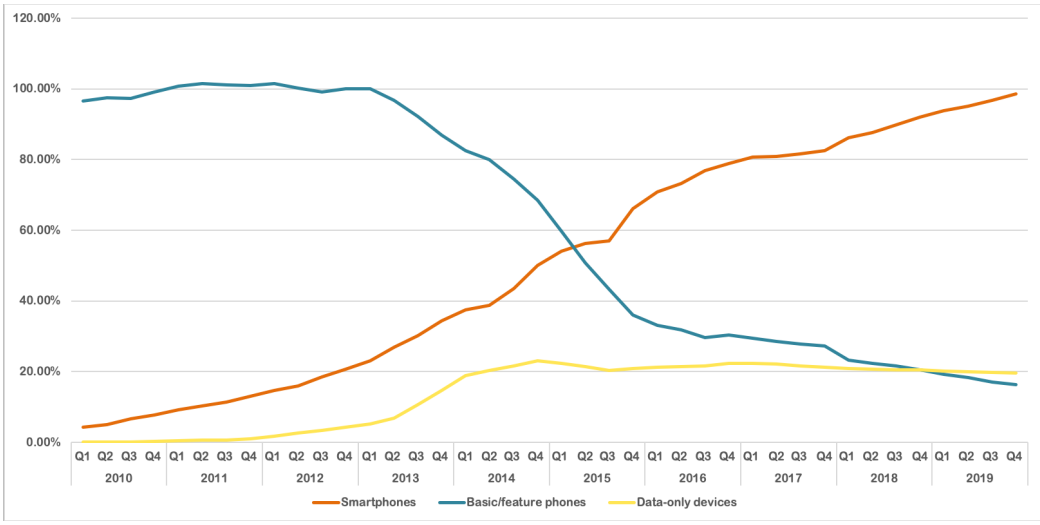
Fixed-line Internet		Mobile Internet	
Operator	Market share (percent)	Operator	Market share (percent)
TICC (True)	37.6%	AIS	44.9%
3BB	31.4%	True	30.2%
TOT	16.2%	Dtac	22.1%
AWN (AIS)	10.3%	CAT	1.5%
Others	4.4%	TOT	0.4%
		Others	0.9%
Herfindahl Hirschman Index (HHI)	2,793	Herfindahl Hirschman Index (HHI)	3,417
Users	10.10 million	Users	46.3 million

Source: NBTC, 2020d

2) Affordable, compatible devices are available.

In order to use OTT, it is essential to own compatible devices, especially smart devices, such as smartphones and tablets. Currently, there are many choices in the smartphone and tablet market, ranging from expensive luxury items to low cost, budget friendly options. Owing to technological development, new devices are offered at affordable prices, with higher performance. Moreover, the overall adoption of smartphones is becoming mainstream. Smartphone users are the majority of mobile phone users nowadays (NSO, 2021). Compared to a decade ago, the proportion of smartphone users is increasing. In 2010, there were 66.74 million connections on basic phones, while there were only 5.28 million connections on smartphones. As of late 2019, those numbers had essentially flipped. There were 68.78 million smartphone connections, with only 11.34 million connections on basic phones (GSMA, 2020). Apart from smartphones, data-only devices (compatible devices for OTT), are also increasing. With only 159,532 connections in 2010, that number has jumped up to 13.64 million connections in late 2019. The increasing number of smartphone and data-only devices is one of the supporting factors encouraging the growth of OTT, concurrent with the rise of Internet access. Inexpensive and acceptable Internet connections, along with affordable smart devices, gives users an expanded environment to utilize OTT services. By obtaining smart devices and Internet connections, users can easily access OTT services anytime and anywhere.

Figure 2-11: Adoption of Handsets per Population



Source: GSMA, 2020

3) Change in users' behavior

Today's users have changed their behaviors to suit their lifestyles, which means that communications, media exposure, and other behaviors no longer necessarily follow the traditional patterns or make use of the standard services. For example, the way in which media is consumed has changed. A survey of consumer behavior and trends on media consumption in Thailand, conducted by Thammasat University cooperating with the NBTC, found that in 2019, Thai consumers used their smartphones to watch motion picture media 27.2% of the time, second only to digital TV, which they used 33.6% of the time (NBTC, 2019c). It seems that the younger generations consume more media online compared to older generations. Younger people usually connect to the Internet and watch content on demand, whereas older people tend to view media content on television. In addition, consumers of communications services have put an increased premium on more personalized customer experience and convenience (Joshi et al., 2015). These behaviors have helped to encourage the growth of OTT media.

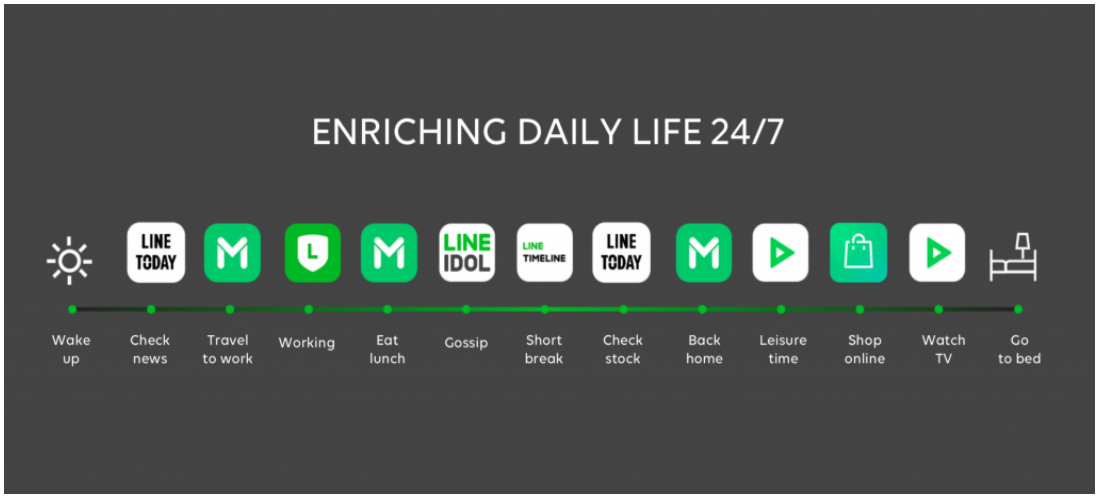
4) Application development

As stated, users nowadays have changed their lifestyles and behavior. OTT services are successful in developing their products and services to suit users' behavior. The quality of services has been improved, both technically and in terms of their business dimensions. Technically, OTT services now offer greater functionality to consumers (Arnold & Schneider, 2017). In other words, OTT is providing richer services than those offered by traditional communication platforms. For example, OTT provides interactive features in chat applications, with special features that are useful to users, such as

group chats and stickers to express emotions, resulting in more natural conversations. These features are considered to be desirable characteristics of OTT when compared to traditional services. Furthermore, OTT developers are active in researching consumer behavior trends. As a result, they are aware of what consumers want and can properly and accurately improve their services to suit their customers' needs.

Many OTT services have vertical and horizontal integration with other online or OTT services (ITU, 2017). To illustrate, LINE Thailand has expanded the service from their chat application to other types of OTT services. LINE has released applications that engage with users' daily lives (Line Today, 2019). LINE has expanded these services to several of their applications across a wide spectrum of interests, including news (LINE today), ride hailing (LINE man), business partners (LINE business connect, LINE official account), food delivery (LINE man), online TV (LINE TV), financial services (LINE pay, Rabbit LINE pay), and job-hunting (LINE jobs). Each application is interconnected through a user's registered account, so it encourages users to explore and make use of other OTT services in the portfolio. These broad developments of OTT services escalate the usage level of OTT.

Figure 2-12: LINE Expansion Service



Source: LINE Thailand, 2019

5) Cost advantage of OTT services

Many OTT services adopt the two-sided business model that is attractive to users because they can offer the services at no cost to the users. For example, communications services are offered at no additional cost. It is perceived as cheaper service when compared to traditional telecommunications, though it is not completely true, because users do have to pay for their Internet connection. It is, however, regarded as "cost advantage" to the users (Joshi et al., 2015).

6) Ability to solve specific problems in Thailand

OTT's ability to solve problems specific to Thailand is considered a key reason for its applications' successes. There are certain conditions in Thailand, such as weather and the poor quality of traditional services, making some OTT successful here. For example, the weather in Thailand plays an important role in the success of food and goods delivery services. As Thailand is an extremely hot and humid country, it is both difficult and inconvenient for many people to leave their homes or offices to buy food – particularly lunch – or pick up packages. Moreover, the traffic situation in Thailand, especially in the capital city Bangkok, is very congested. Thus, food delivery services are very convenient for users. Another example is ride-hailing services. It is well known that transportation in Thailand is inconvenient, especially during peak hours. Moreover, passengers generally have unsatisfactory experiences with traditional taxi services, such as being turned away by drivers, feeling cheated on the cost of the ride, experiencing unsafe driving, and poor service in general (Ackaradejruangsri, 2015). Ride-hailing applications, or alternative services, solve many of these problems. Therefore, the popularity of these applications is increasing.

In conclusion, OTT services are highly successful in Thailand. The success of OTT does not come from one specific factor, but rather from a combination of all factors in the ecosystem together - from the users, from the OTT providers, and from environmental factors. However, while the usage of these services is increasing dramatically, there are issues concerning the rise of OTT services that need to be addressed. The issues of OTT services in Thailand, which are similar to those in other parts of the world, are discussed in the next section. These issues are the motivations of this research.

2.4.2 Issues of OTT

As a rising actor in the ecosystem, OTT services are causing significant changes to the system. These changes are considered positive by some participants, and negative by others. To illustrate, OTT services are regarded as a threat to traditional services, but they offer more alternatives to users, which can be regarded as having a positive impact. This section intends to summarize OTT's issues causing concerns from various actors. These are challenges for policymakers and stakeholders in the market. In this section, the issues are divided into two groups as they affect the stakeholders in the market, the private sectors and the government. The impact felt in the private sector requires the action of the government. The issues relevant to the private sector, such as MNOs and ISPs, are presented first, then the issues relevant to policy and regulation are discussed.

1) Issues regarding the private sector in the ecosystem

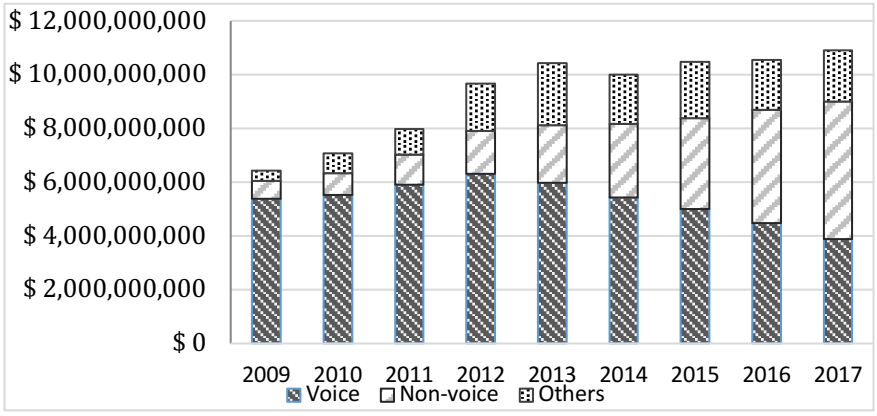
OTT services are defined in the taxonomy as having the potential to substitute traditional services. This is one of the most concerning issues of OTT for traditional service providers, especially

traditional telecommunications services. It is highly possible that OTT communications may replace traditional telecommunications services in the near future. According to many statistics outlining the growth of OTT - as stated in the section about OTT in Thailand, and also the information regarding the decline of traditional telecommunications - it seems that this claim is compelling. Concerning the Thai market, the situation is quite similar to countries in other parts of the world. Traditional telecommunications services, specifically mobile telephony, SMS, and MMS, are suffering from a decline in usage and thus revenue. As shown in Figure 2-13, the total revenue of mobile network operators is increasing gradually, but the contribution to each kind of service has changed; revenue from non-voice, including OTT usage, is increasing instead of voice, which was once the main source of revenue for mobile network operators (MNOs).

Like the decreasing revenue of MNOs, the minutes of use per connection are heading in the same direction. According to the GSMA report in 2009, as shown in figure 2-14, the minutes of use per connection averaged 459 minutes, and slightly increased to a peak of 498 minutes in 2010. Afterward, it continuously declined to 149 minutes in 2018. Regardless of other factors, such as cost and higher competition, minutes of use assure the assumption that customers have changed their behavior in making a call. They might switch to other platforms, OTT communications in particular.

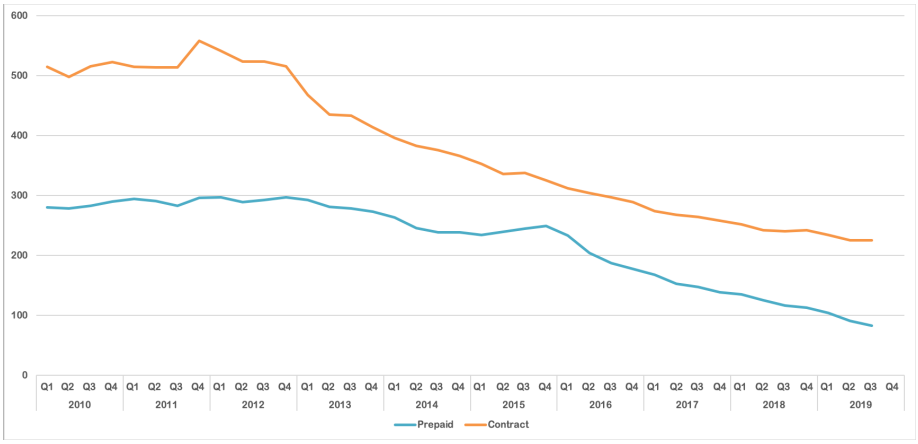
According to Figure 2-13, non-voice revenue has grown over time. Messaging revenue is included in this section, but it cannot be said the revenue is increasing. It is quite difficult to observe messaging revenue in Thailand because the data sets are typically incomplete. However, it is assumed that messaging is on a downward trend, as is the global trend. Available data shows that messaging revenue had been increasing and peaked in 2012–2013 at more than 20 million USD per quarter for each mobile operator. Revenue has decreased to less than 10 million USD since that time. Users are no longer sending text messages via mobile networks at the anywhere near the same rate as they were in the past.

Figure 2-13: Revenue of Mobile Network Operators in Thailand, 2009-2017



Source: GSMA, 2019

Figure 2-14: Minute of Use per Connection (Minute)



Source: GSMA, 2020

The information indicates that in other countries, the claims posited that OTT is replacing traditional telecommunications services, mobile voice calling, and messaging, appears to be persuasive. Thus, the Thai market is expected to experience the same phenomena. Even though the information indicates that OTT may replace the traditional telecommunications services, the actual substitution between OTT and traditional telecommunications services has not been empirically investigated, specifically in Thailand. Thus, in this study, the actual usage pattern of Thai consumers is examined to find the possibility of replacement.

With respect to the OTT media, from the study of Time Consulting (2017) presenting to the NBTC, they stated that OTT TV or media in Thailand is in the beginning stages, decreasing the consumption on traditional media in Thailand. However, many traditional media providers are making their content available on online platforms simultaneously. Thus, it can be said that the relationship between OTT TV and traditional media providers is complex, resulting in difficulty in policy or regulation implementation.

2) Issues regarding policy and regulation

OTT services, as a player rapidly increasing in the market, not only presents threats to traditional service providers, but is a substantial challenge to policymakers and regulators, especially in the field of telecommunications. Apart from the issue addressing whether OTT should or should not be regulated, there are obstacles in establishing an appropriate regulatory framework for OTT services. Thus, the regulatory framework for OTT is still unclear. Not only in Thailand, but other countries in the world are attempting to develop the proper framework for OTT services. Issues regarding policy and regulation implementation are as follows:

Firstly, OTT is providing the services that are identical to the traditional telecommunications services. However, the manner in which it offers the services, and the business model they use, are quite different from traditional telecommunications services. This is one of the reasons why OTT is such a big challenge to the government in trying to determine regulations and applying rules to OTT. The majority of the existing rules and regulations cannot be applied to OTT services due to the nature of those services and the business model they employ (Graef, 2016). For instance, laws of competition do not apply to OTT. According to competition laws, the price of service is required to estimate the level of competition. However, due to OTT's two-sided business model, there is no price to estimate.

Secondly, OTT services are designated as being from a specific country, which is the country of origin, but the services can be provided across borders to other countries, which is the country of consumption or country of destination (ITU, 2017). When the country of origin and the country of consumption are different, which is the country of jurisdiction? This question has been discussed and is a concern. On a national level, authorized agents in the country might prohibit the OTT service provider if their actions are against the law, such as providing illegal content. However, when the providers are not located in the territory, authorized agents on the national level cannot force providers to comply with the laws due to the sovereignty of each country. This restriction is associated with other issues. For example, licensing may not be complied with. Licensing is a type of regulation used for several purposes, such as to promote competition among operators, to maintain the standards of the quality of service, or to enforce the licensee to comply with the specific requirements defined by the licensor. Apart from licensing, taxation is another issue. Corporate and consumption tax may not be properly collected. As a result, losing tax revenue has a negative impact on the economy and social welfare of the country. In addition, consumer protection and privacy issues are of concern. OTT services are not subject to the jurisdiction of the country of consumption. Thus, users' personal data may be transferred across national borders and may not be sufficiently protected. This issue is complex and remains a serious concern for regulators.

Thailand is a country attempting to control OTT services, especially OTT communications and OTT media. The National Broadcasting and Telecommunications Commission (NBTC), a telecom regulator, has attempted to establish the framework to standardize OTT services over the past few years (shown in Table 2-2). The NBTC first planned to regulate OTT services in 2017. For example, they required that Facebook fan page operators register themselves with the regulator and ensure that they do not provide unsuitable content and illegal advertisements. The regulator then declared that they would force foreign OTT service players to establish local offices in Thailand to legally and properly pay cooperate income taxes and abide by local law. However, once those plans were announced, critics began to argue that the measures were neither clear nor concrete (Tortermvasana, 2019). The NBTC decided to postpone the regulation plan.

The NBTC reported their OTT regulation plan at the International Symposium on Converging Technology and Disruptive Communications Moving Forward, held in Bangkok in September of 2018 (Bangkok Post, 2018). It was their first time proposing their plan to collect taxes from OTT players and to enact measurements to protect users' personal data. By doing so, they planned to propose the plan at an upcoming meeting with the ATRC (Bangkok Biz News, 2019). If the ATRC agreed with the plan, there would be similar OTT rules in the Southeast Asian region. However, they mentioned that content regulation was not in their interest, because the context of the content in individual countries was different, thus making it difficult to enforce the same rules across various nations. After the ATRC meeting in August 2019, the NBTC disclosed that the members of the ATRC had yet to respond, as they were still considering the plan (MGR Online, 2019).

According to the NBTC announcement in April 2019, the regulator imposed a surcharge plan for network bandwidth usage to "Big OTT," as determined by data volume, affecting such companies as YouTube, Netflix, Line, and Facebook that stream video through the Internet. The underlying motivation was to charge those OTT services exploiting the infrastructure in which the government invested, with the surcharge expected to contribute to the International Internet Gateway (IIG)[6]. After overwhelming criticism concerning its impracticality, the NBTC decided to backtrack on the plan (Tortermvasana, 2019).

In September 2020, the NBTC announced their latest plan for OTT services. This plan was a continuation of the plan they put forth in 2018, and they expected to finish the regulatory framework by the end of 2020. This framework is under the umbrella of the ATRC (Nation, 2020). It is intended to cover essential areas: the promotion and support of startups and other new businesses in digital era, the effect of OTT related financial services, and the impact on OTT-related telecommunications services, along with other regulatory measures and customer protection.

Table 2-2: NBTC Proposed Plan for OTT Regulations (as of November 2020)

Year	Plan	Progress
2017	The NBTC required the OTTs to register with the NBTC	Postponed
2017	The NBTC was planning bandwidth fee and licensing for OTTs	Postponed
2018-2019	The NBTC proposed tax plan to the ASEAN Telecommunication Regulators' Council (ATRC)	In progress
2019	The NBTC imposed surcharge plan for "Big OTT"	Postponed
2020	The NBTC drafting the regulatory framework for OTT, under the ATRC umbrella	In progress

[6] International Internet Gateway (IIG) is the operator in charge to connect domestic Internet network to foreign Internet networks. With subscription to IIG, the users are allowed to access to the websites or contents provided abroad (Malisuwan et al., 2016)

At this moment, the NBTC has yet to issue official regulations for OTT services, but their announcement reflects an attempt to regulate and control OTT services, providing evidence that OTT services are becoming more crucial as important actors in the telecommunications and media market in Thailand today. Thus, the regulatory framework for OTT in Thailand is still in a process of trial and error. The results of this study are expected to provide guidelines for regulators and policymakers in Thailand to improve their framework to be fair to every stakeholder in the ecosystem.

Chapter 3

Theoretical Background and Literature Review

This chapter explains theories used in the study and methodologies employed for analyses in this study, both quantitative and qualitative. Furthermore, a brief introduction on OTT study is given in order to understand the general field of OTT research today.

Section 3.1 Theoretical Background

3.1.1 Theories Adopted at the Individual Level (User perspective; Consumer behavior)

3.1.1.1 Discrete Choice Models

Discrete choice models are statistical techniques used by many scholars to estimate the probability that an agent, which can be an individual, a household, a firm, or any decision maker, will choose a particular choice from a finite choice set or a relationship between "discrete" dependent variables and a set of independent variables (Hensher & Johnson, 1981). This method is also known as *qualitative choice analysis*. Discrete choice modeling was rapidly developed during the 1970s (Manski, 2001) by a number of scholars, including Heckman (1978, 1979), Dublin, and well-known econometrician McFadden (1984) (Train, 2009). This method has been used in several disciplines, such as telecommunications (e.g. Grzybowski, 2014; Rodini et al., 2003; Srinuan et al., 2012; Ward & Woroch, 2010), and transportation (e.g. Ben-Akiva, 1973; Ben-Akiva & Morikawa, 2002; Weisbroad et al., 1980). It is essential to describe the properties of the discrete choice model, whose conditions must be satisfied in order to apply the model (Train, 2009).

(1) A choice set must be mutually exclusive. An agent can select only one choice in a set of alternatives. When an agent makes a choice, it automatically means that that agent is not selecting the other choices in the set.
(2) All the choices in the set must be exhaustive. All the possible choices are included, and the decision maker chooses only one. Any choice that is not available at the time must be excluded.
(3) The choices included in the set must be finite. The numbers of choices are certain and can be counted. This requirement is quite strict. This is the reason why this model is referred to as "discrete choice." With this characteristic, it differs from typical regression models, which allow an infinite number or continuous number of dependent variables. In that sense, the possible outcome can be any number.

The discrete choice model relies on a prominent theory called the random utility model (RUM). This idea was first appeared in psychology, presented by Thurstone, in 1927 (Ben-Akiva & Lerman, 1985). This theory assumes that the decision maker's choice provides the highest utility over the other choices. Thus, the basic assumption of this model is one of utility-maximizing behavior. The decision maker *n* faces a set of $\mathcal{J}$ finite choices. This assumption can be explained as the decision maker choosing *i*, which is the alternative maximizing the utility. The utility that the decision maker obtains from *j* is $U_{nj}, j = 1, \dots, J$. This utility cannot be observed. However, as it is assumed that the choice gives the greatest utility, the behavioral model explains that as $U_{ni} > U_{nj}\ \forall j \neq i$.

Indeed, it is not possible to observe the entire utility, as stated in the behavioral model, so a part of the utility cannot be detected. When a decision maker chooses, he/she must face the attributes relevant to each alternative and also relevant to himself/herself. These attributes are represented as V_{nj}. This can be observed by the researcher and is referred to as representative utility. Furthermore, because it is impossible to observe the entire utility, the part of utility that cannot be detected remains, so $V_{nj} \neq U_{nj}$. This unknown part is regarded as random, ε_{nj}. It is the difference between true utility, U_{nj}, and representative utility, V_{nj}. Thus, the utility can be written as $U_{nj} = V_{nj} + \varepsilon_{nj}$.

Looking at representative utility V_{nj}, as stated earlier, it represents the attributes that a decision maker faces when they make a choice, and it is observable. This term is comprised of attributes, which are as follows: First, there are the observable characteristics of individuals, such as age, gender, and other socio-demographic characteristics, denoted as s_{nj}. Second, the attributes relating to the choices are denoted as x_{nj}. The function is denoted $V_{nj} = V(x_{nj}, s_{nj})$. Within these backgrounds, the probabilistic formulation can be expressed. The probability that an agent *n* selects choice *i* can be written as follows (Train, 2009):

$$P_{ni} = \text{Prob}\big(U_{ni} > U_{nj} \forall j \neq i\big)$$

$$= \text{Prob}\big(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj} \forall j \neq i\big)$$

$$= \text{Prob}\big(V_{ni} - V_{nj} > \varepsilon_{nj} - \varepsilon_{ni} \forall j \neq i\big)$$

$$P_{ni} = \int I\big(V_{ni} - V_{nj} > \varepsilon_{nj} - \varepsilon_{ni} \forall j \neq i\big)\, f(\varepsilon_n) d\varepsilon_n$$

As stated earlier, the decision maker's choice involves two components - attributes of choice and attributes of the decision maker - which are x_{nj} and s_n, respectively. However, when selecting, the decision maker must consider the preference in the choice, which is varied among the decision makers. These parameters are characterized as β, γ. If the decision maker *n* selects choice *i*, it means that decision

d of decision maker *n* for choice *i* is equal to 1 and 0 if otherwise, then $d_{ni} = 1$. Thus, the probability that decision maker n chooses choice *i* can be formulated as follows (Greene, 2008):

$$P_{ni} = \text{Prob (decision maker n makes choice i|choice set)}, i = 1, \dots J_{ni}$$

$$P_{ni} = Prob\ (d_{ni} = 1|x_{ni}, s_n, \varepsilon_{ni}, \beta, \gamma \dots), i = 1, \dots J_n$$

Discrete choice models are comprised of several sub-models, which are appropriate for each type of dependent variable. Basically, all the types are discrete, but the number of choices available and the nature of the choices require different methods to handle, such as binary logit and probit for two choices or outcomes, and multinomial logit and probit models for more than two alternatives or outcomes. Moreover, $f(\varepsilon_n)$ is needed to specify whether probit or logit is more appropriate, depending on the normal distribution of ε_n assumption. In this study, the choices or outcomes are binary; the choices provided for the respondents are yes/no or 0 and 1. Consequently, binary logit and probit are given in detail.

(1) Binary Logit analysis

Indeed, the logit model is the most popular discrete choice model. It is widely used, because it is in a closed form that is so easy to interpret. The logit model (short for logistic model) was completed by Daniel McFadden (1974), by demonstrating that choice probabilities necessarily imply that unobserved utility, ε_{nj}, is an independent and distributed extreme value. The distribution is also called Gumbel (Generalized Extreme Value Type I) (Train, 2009).

Binary logit has a generic form, as follows (Ben-Akiva, 2008):

$$P_{ni} = \frac{1}{1 + e^{-V_i}} = \frac{e^{V_{ni}}}{e^{V_{ni}} + e^{V_{jn}}}$$

Even though logit is very convenient to use, there are limitations. First, logit can present systematic taste variation relating to the decision makers' characteristics, but it cannot represent random taste variation. Second, logit cannot represent proportional substitution across choices. Third, unobserved factors are independent, and logit can detect this only when the choice situations are repeated over time. Nonetheless, logit cannot be used when unobserved factors are correlated. Thus, probit can be used to relax these restrictions.

(2) Binary Probit analysis

Probit has advantages in terms of being able to relax the restriction of taste variation in logit. The probit model was derived under the assumption of jointly normal unobserved utility components Utility is decomposed into observed and unobserved parts; $U_{nj} = V_{nj} + \varepsilon_{nj} \forall j$. Consider the vector

composed of each ε_{nj}, labeled $\varepsilon'_n = \langle \varepsilon_{n1}, \ldots, \varepsilon_{nJ} \rangle$. In probit, ε_n normal distribution is assumed with a mean vector of zero and covariance matrix Ω. The density of ε_n is:

$$\phi(\varepsilon_n) = \frac{1}{(2\pi)^{J/2}|\Omega|^{1/2}} e^{-\frac{1}{2}\varepsilon' n \Omega^{-1} \varepsilon_n}$$

Thus, the basic formulation of probit can be written as follows (Ben-Akiva, 2008):

$$P_{ni} = \phi(V_{ni}) = \int_{-\infty}^{V_{ni}} \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}\varepsilon_n^2} d\varepsilon_n$$

Concerning parameter estimation, maximum likelihood estimation is used. This method is consistent, asymptotic normal, and efficient (Ben-Akiva, 2008). Furthermore, marginal effects are estimated along with the results from the logit and probit analyses in this study.

(3) Model fit

The discrete choice model cannot use R^2 goodness of fit in the same way as other regressions, such as Ordinary Least Squares (OLS) do, because there are no residuals. Consequently, pseudo R^2 is used instead.

$$pseudo\ R^2 = 1 - lnL/lnL_0$$

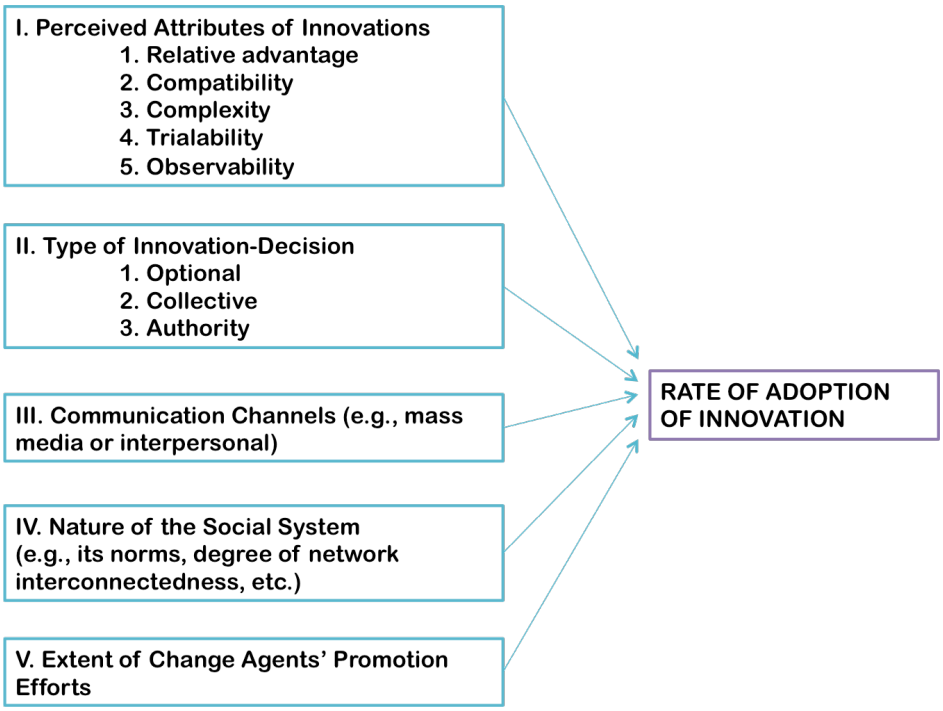
ln*L* refers to the log likelihood for the estimated model without the constant term, and L_0 is the log likelihood function for a model containing only the constant term. This value is between 0-1. However, it tends to increase when more variables are added in the model. The measure of fit depends on the disciplines. As a rule of thumb, 0.2-0.4 indicates a good fit for the model (McFadden, 1977; Xu et al., 2020)

3.1.1.2 Diffusion of Innovations Theory

The Diffusion of Innovations theory was created by Everett Rogers in 1962. It is widely used in studies, especially in the field of telecommunications, to explain how individuals adopt new innovation and diffuse it among others. This theory explains the diffusion process; how the innovation starts diffusing from the first group of adopters, to innovators, early adopters, the early majority, the late majority, and to the last group, the laggards. With respect to adoption, Rogers critically provides five essential perceived attributes of innovations forming their rate of adoption. Rate of adoption is defined as "speed with which an innovation is adopted by members of a social system" (Rogers, 1995, p.206). However, apart from the five perceived attributes, there are other factors relating to rate of adoption,

such as type of innovation-decision and communications channels. As illustrated in Figure 3-1, all of the variables, including the five perceived attributes, are demonstrated.

Figure 3-1: Variables Determining the Rate of Adoption of Innovations



Source: Rogers, 1995

There are five perceived attributes of innovation posited in the theory - relative advantage, compatibility, complexity, trialability, and observability. First, relative advantage is the attribute explaining that potential adopters will adopt new innovations if they feel or perceive that the innovations are better than what they have currently, or that they can offer any aspects of value to them. This attribute usually refers to benefits to adopters such as economic profitability and social prestige. For example, rate of adoption increases when the price of innovations decreases during the diffusion process. Relative advantage is hypothesized to be positively related to rate of adoption. However, this attribute has been criticized by many scholars. To illustrate, it is possible that the individuals may not receive sufficient information, resulting in misperception of advantage and eventually over adoption.

Second, compatibility is the characteristics of innovation belonging to or compatible with the potential adopters. This attribute is basically defined as being compatible with the adopters' life situation. It can be understood in a variety of ways, from cultural values to previously introduced ideas and needs for that specific innovation. As expected, compatibility is positively related to rate of adoption. However, this attribute is considered less important because it is difficult to assess. Third, complexity is the degree to which potential adopters perceive that an innovation is able to be understood and commanded. This

attribute can be regarded as ease of use. It is certain that complexity is negatively related to rate of adoption. Fourth, trialability is the degree to which potential adopters have the opportunity to experiment or try an innovation before actual adoption (Rogers, 1995). This attribute suggests that potential adopters tend to adopt a new innovation if they have a chance to try it or experiment with it before deciding whether to adopt it. Thus, it is positively related to the rate of adoption. Last, observability is the degree to which new innovations are visible to potential adopters. It is claimed that potential adopters increase their rate of adoption if they can see the innovations clearly in real life or in advertisements. Apparently, this attribute is positively related to rate of adoption.

These five attributes are anticipated to be significantly related to the rate of adoption. This thesis employs part of the theory to explain the factors relating to OTT adoption in Thailand. With this result, it can be understood as to what leads users in Thailand to adopt OTT. Consequently, it can be implied from the results what the usage patterns are and who adopts OTT in Thailand. Moreover, the significant factors can affirm the reasons why OTT is successful in Thailand.

3.1.1.3 Tetrachoric Correlation Coefficient in Factor Analysis

Factor analysis (FA) is a useful tool in estimating latent variables underlying observed variables (Jolliffe & Cadima, 2016; Keesookpun, 2014). Generally, it measures the latent variables by Pearson product-moment correlation using continuous data. However, in this thesis, the data was retrieved from the national survey, which was collected in binary yes/no answer form. When the variables are not interval-scaled, using common FA is not appropriate for two reasons (Lorenzo-Seva & Ferrando, 2012). The first reason is that FA assumes that the observed variables have continuous and multivariate normal distributions. It is obvious that dichotomous variables violate this assumption. The second reason is that FA assumes that the variables have linear relations. In that sense, their associations are fully summarized by a covariance or a product-moment correlation matrix. However, when the variables are dichotomous, this assumption is violated. For these reasons, applying the common FA to dichotomous variables may lead to biased conclusions, including the number of factors retained, and biased estimations of factor loadings, especially when the distributions of the observed variables are skewed in opposite directions (Olsson, 1979). Thus, factor analysis for dichotomous data using tetrachoric correlation coefficient is used instead.

Tetrachoric correlation is fundamentally a method to measure latent variables or psychological matters that come with binary data or dichotomous data. The tetrachoric correlation was proposed by Pearson in 1901 in order to specifically deal with binary data (Brown & Benedetti, 1977). It has been widely used in various disciplines, such as psychology, genetics, and medicine (El-Hashash & El-Absy, 2018). Tetrachoric correlation is a product-moment correlation between two latent variables measured on a dichotomous scale. These variables are supposed to be measured on a continuous scale. For some reason, they are presented as dichotomous variables (El-Hashash & El-Absy, 2018). In other words,

tetrachoric correlation assumes that the dichotomous data has underlying continuity (Hinkle et al., 1988, cited in Kay, 2004). It is principally to consider the 2 x 2 contingency table presenting frequency for values of two binary variables, X and Y.

	Y=1	Y=0
X=1	*a*	*b*
X=0	*c*	*d*

The formula of tetrachoric correlation coefficient of variables X and Y, r_t, can be written as follows (Tirakanan, 2015):

$$r_t = cos\left[180°/(1+\sqrt{ad/bc}\right];$$

Regarding the factor analysis of dichotomous data, it can be explained thusly. Assume that *p* response process variables $y = (y_1, \ldots, y_p)$, *m*-dimensional latent variable θ, and $p > m$. Observed variable binary variables x_j takes the value 0 or 1. γ_j is threshold parameter or a value of associated with the item *j*. It can be expressed as (Mislevy, 1986; Muthén, 1989).

$$x_j = \begin{cases} 1, & if\ y_i \geq \gamma_j \\ 0, & if\ y_i < \gamma_j \end{cases}$$

where

$$y_i = \lambda_{j1}\theta_1 + \ldots + \lambda_{jm}\theta_m + v_j$$

λ_j represents the factor loadings. The residual v_j are independent over items or the latent variables θ, and all examinees or the individuals, and follow $N(0, \sigma_j^2)$ distribution, where,

$$\sigma_j^2 = 1 - \sum_k \lambda_{jk}^2$$

The diagonal matrix $(\sigma_1^2, \ldots, \sigma_p^2)$, or the vector of unique variances. The conditional probability of a correct response from the examinee i to item j is written as (Mislevy, 1986):

$$P(x_{ij} = 1|\theta_i) = \frac{1}{\sqrt{2\pi}\sigma_j}\int_{\gamma_j}^{\infty} exp\left[-\frac{1}{2}\left(\frac{v - \sum_k \lambda_{jk}\theta_{ki}}{\sigma_j}\right)^2\right]dv$$

$$= F\left(\frac{\gamma_j - \sum_k \lambda_{jk}\theta_{ki}}{\sigma_j}\right)$$

$$= F_j(\theta_i)$$

where F is the cumulative standard normal distribution. It is further assumed that I_m denotes the identity matrix of order *m*, and Φ represent the covariance matrix of θ, in which $I_m = \Phi$. In addition, $\theta \sim MVN\ (0, I_m)$, from which it follows that $y \sim MVN(0, \Sigma)$ where,

$$\Sigma = \Lambda\Lambda' + \Psi$$

where Σ is the covariance matrix of y, Λ is the matrix of factor loadings, and Ψ is the matrix of residuals. The analysis employs tetrachoric correlations as the index of association for factoring binary data. In this study, the maximum likelihood estimation was adopted as the parameter estimator. As for the factor scores, the correlations matrix is used. The factor scores are obtained from the correlations matrix times the factor loading matrix. After the factor scores are obtained, it is elaborated in logit analysis as one of the variables indicating the IT skills of the respondents.

3.1.2 Methodologies Adopted for Business level (MNOs Perspective)

3.1.2.1 Semi-Structured Interviews

The studies on the perspective of MNOs rely on qualitative methodology, namely semi-structured interviews. Interviews, as one of most widely used methodology, are common yet powerful tools to gather data and understand human beings (Fontana & Prokos, 2016). An interview is basically a conversation between people, interviewee and interviewer. The interviewer seeks information or responses related to a particular purpose from the interviewee(s) (Gillham, 2000). Interviews can be conducted on individuals, agents, and groups in various manners, from face-to-face verbal interchange, which is considered more favorable in terms of quality of responses and appropriateness, to sensitive questions, to conducting through a platform such as telephone and email, which are good for cost-efficiency, timing, and social distance ((Borer & Fontana, 2014). Generally, interviews can be separated into three common types: structured, unstructured, and semi-structured. They all have strengths and weaknesses, with each type of interview being suitable for different purposes of data gathering. Researchers need to carefully select the appropriate type of interview to fulfill their purposes and research questions.

First, a structured interview is a method in which interviewers prepare a set of questions prior to the actual interview. The interviewer asks every respondent these pre-established questions in the same order or sequence. During the interview, the interviewer usually records the conversation, with the transcript to be written out afterwards. This method is simple, standardized, and the interviewer can control the direction of the interview. It is very useful for studies that collect data from a large number of observations. However, this method has its disadvantages. For example, there is little room for any improvisation. The questions are fixed and should not be changed. Thus, deeper insights from

respondents cannot be collected, and errors can happen, such as difficult wording resulting in misinterpretation by respondents.

On the other hand, the second method, an unstructured interview, in contrast to a structured interview, is very flexible. The interviewer is allowed to improvise when asking questions and can converse more freely with the interviewee(s). This method has an advantage in that in-depth information from the interviewee(s) can be obtained. Moreover, the questions can be changed or adjusted to be suitable for each interviewee. However, this method also has negative points. It is comparatively more difficult to control the direction of the interview. Furthermore, it is considered unstandardized, because the questions asked to each interviewee may be different. Consequently, the quality of results from the interviews is questionable.

Third, a semi-structured interview is considered to be a method somewhere between a structured and an unstructured interview. It is very popular, because it improves on the negative aspects of each of the other types of interviews. Semi-structured interviews require pre-established questions, including both closed and open-ended questions, however it allows the interviewer to improvise or ask additional questions during the interview. The questions can be slightly adjusted to suit the ongoing conversation with the interviewee(s), but the interviewer does not lose the direction of the interview. This study relied on semi-structured interviews due to the improved method and appropriateness with the research questions. Every MNO received the same set of interview questions formulated according to the research questions, but additional questions were asked during the interviews. Each MNO in Thailand has different aspects and experiences regarding OTT. Moreover, some in-depth information is desirable in order to improve understanding towards the overall picture of the Thai telecommunications sector situation nowadays. After the interviews were completed, transcripts of the conversations were produced from the voice records. This study follows the postmodern style called polyphony presented by Krieger in 1983 (Borer & Fontana, 2014). It means different points of view reflected in each respondent's dialogue were presented along with analysis from the author to let the readers interpret the given information for themselves

3.1.2.2 Theories

In this study, the theories from the field of firm behavior and strategic management were adopted to develop the hypotheses and analyze the data obtained. The study of firms has been the main focus for a large number of researchers for decades. They have attempted to develop the theory explaining the behavior of firms and the objective of firms in operating their businesses as well as corporate turnarounds in various situations (Abdullah, 2010). One of the most well-known classical theories developed in the early stage of theory development is the profit-maximization theory of the late 1890s. This theory posits that firms mainly aim to maximize profit and increase benefits. It is considered the ultimate goal of firms expand their competencies and resources in order to conduct their business in

such a manner that they can gain revenue and reduce cost (Hornby, 1995). Thus, in order to complete their ultimate objective, various strategies are developed, as stated by Lynch that

> *The strategies will primarily (but not exclusively) be driven by the objective of maximizing the organizations' profitability in the long run (such profits may particularly accrue to the shareholders) by seeking and exploiting opportunities in particular industries… The major argument of the theorists is that the purpose of strategy is to develop sustainable competitive strategy over competitors through choosing the most attractive industry and then resolving how to compete that industry (Lynch, 2015, p.40).*

However, even though this theory is used extensively in many studies, it does have its critics. For example, this theory ignores other factors, such as social responsibility and regulations companies are obligated to follow.

Another theory commonly used in the field of economics is the survival-based theory. This theory states that firms aim to survive as the best and fittest firm in the competition and the environment. The grounded concept of this theory was derived from Charles Darwin's "survival of the fittest." The theory was developed by Herbert Spencer during late 19th and early 20th centuries (Abdullah, 2010). According to this theory in strategy management, it is posited that the strategy was deployed as a practical plan for company survival, allowing for response to changes occurring among the competition and in the environment. Because it was believed that the fittest firms would survive, the firms needed to adapt their strategies and improve their competencies in order to gain competitive advantage. Similar to the profit-maximization theory, some oppose this theory as not being ethical.

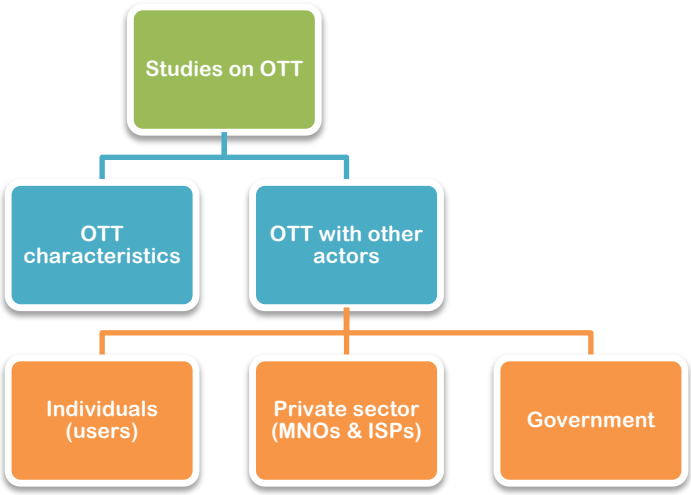
These theories are still useful in providing insights into corporation's main objectives, and they have been used in many studies up to today. This thesis also employed these simple yet straightforward theories to primarily explain the reasons behind the actions of corporate actors, which are different from the perspective of individuals. Keeping these assumptions derived from the theories in mind, the actions of each MNO in this study, such as the decision to adopt particular strategies and their responses to OTT, is clearly understandable. Thus, these theories are very useful and essential to the study.

Section 3.2 Literature Review on OTT

Over-the-top (OTT) services have been studied on multiple occasions, from different points of view. As OTT has emerged within the telecommunications sector in recent years, studies on it have become abundant. This section aims to narrate the overall summary of literature reflecting diverse interests on OTT from each stakeholder in the telecommunications sector. The studies of OTT are roughly separated into two groups in this section, those on OTT characteristics, and relationship between OTT and other actors. Studies on OTT focus on its characteristics, its development, key

successes, and business models. Studies about OTT and its relationship with other actors in the telecommunications sector are dominant. Those actors are individuals or general users, MNOs and ISPs in the private sector, and the government, including regulators and policymakers. However, it is important to note that the literature in this section is only clustered by the main focus of the studies in order to understand the OTT studies as a whole. Actually, these studies cannot be easily separated into single groups, as they are interrelated with other actors and linked to other groups. To illustrate, the studies about OTT successes may imply the responses MNOs should take. Additionally, many studies elaborate more than one perspective of OTT. For this reason, this section only gives a short summary of these studies and is not intended to establish official classification of all OTT studies.

Figure 3-2: Main Focus on OTT Studies



3.2.1 OTT Characteristics

As illustrated in Figure 3-2, the study of OTT itself is the first group of literature. These studies solely focus on OTT. The main interest of these studies is to define the characteristics and provide the information to the readers to understand OTT in today's environment. One of those studies is by Xu (2013), focusing on the two-sided business model adopted by instant messaging (IM), as an extension service of OTT. This study presents the problems of optimal pricing when exercising this business model. The other work was conducted by Joshi et al. (2015). Apart from the main focus on the impact of OTT on telecommunication services providers, it sufficiently lays out the trends OTT accelerates in the telecommunications market. Those trends are personalization and customization, advancement in technology, messaging preferences, content distribution, and social propensity. Another study was conducted by Park (2018). This study focused on the Korean market and found that OTT TV was encouraged by the characteristics of OTT, which is considered an innovation in OTT's ability to disrupt the market, its entrepreneurship, its usage of new business models such as the two-sided market, and its

financial resources. Apart from the study of OTT's characteristics, specific technical studies on OTT were also conducted by several researchers. One example is from Ramadona et al. (2015). They proposed a key performance index (KPI) assessing the quality of services of OTT, specifically Telephony Speech Quality and Telephony Cut-off Call Ratio.

3.2.2 OTT with Other Actors

Although there are many studies dedicated to defining the nature of OTT, there are still not as many as those on OTT and its relationship or impact on other actors. The first perspective is on individuals or users. This group of studies is usually included as part of a user behavior or consumer behavior study. The studies in this group mainly attempt to explain the conditions of adoption and use of OTT in several contexts and environments. The studies in this group are abundant. The first aspect is to investigate the factors affecting users' adoption or use of OTT. One of those studies is, again, that of Joshi et al. (2015). They demonstrated that there are several factors that influence users to adopt OTT, such as cost advantage, convenience, features, and smartphone and mobile Internet penetration. Another study, by Cha and Chan-Olmsted (2012), investigated users' motivations to consume online video platforms or OTT media. They found that perceived substitutability plays an important role in the intention to use such a service. The results from these studies are very useful for other stakeholders in the telecommunications sector. For example, if the government can better understand the use of OTT in the country, they can then formulate appropriate policies aimed at managing OTT.

Apart from the factors affecting adoption and use of OTT, consumer preferences and the attributes of OTT are a main focus in many studies. For example, the study of Shin et al. (2016) found that consumers consider real-time broadcasting to be a priority when they choose between OTT TV and terrestrial television. Another study, conducted by Kim et al. (2017) estimated consumers' willingness to pay for OTT TV in Korea and China. The results in their work revealed that consumers in China were most concerned with picture resolution, followed by the recommendation system and viewing options. The results differ from their Korean consumers, who prioritized the recommendation system, followed by viewing options and picture resolution. Overall, they found that Chinese consumers were willing to pay for OTT to a higher degree than were Korean consumers. The result is similar to a study by Kwon et al. (2020), who also found that the recommendation system is the key factor in continuing subscriptions of OTT. These studies are considered interesting for entrepreneurs to understand consumer preference and to improve their services to meet consumers' needs.

The usage patterns of OTT services and their relationship to other identical services, specifically traditional services, is the main focus in this area. Many studies attempt to find evidence of substitution of OTT for traditional services. This group of studies relies on the users' side, examining the actual usage of the customers. A good example of this is the study by Arnold et al. (2016) examining the substitution of OTT communications and traditional electronic communications services (ECS) in Germany. Their

study failed to prove that OTT is replacing ECS as perceived by many analysts. Another study, this one by Wellman (2020), focused on OTT messaging and SMS in Norway. The studies in this area are increasing as concerns about replacement by OTT are being raised by several stakeholders, especially the policymakers and regulators. The results are beneficial for regulatory framework establishment, as they can be used as evidence for regulations implementation.

The next perspective on OTT is from the private sector, specifically MNOs, terrestrial television broadcasters, and ISPs. This group of studies mainly aims to investigate OTT impacts on the private sector. When the impacts of OTT are revealed, the private sector can adjust its plan towards OTT. Moreover, the government can formulate policies that are suitable to the actual situation. Studies in this group include the work of Antonopoulos et al. (2017), who found that the revenue of OTT and ISPs are positively correlated. This may imply that OTT is not always a threat to ISPs. Another study by Farooq and Raju (2019) emphasized that OTT has both negative and positive impacts on traditional telecommunication service providers. OTT may cause a decline in revenue, though at the same time, it can be an opportunity because OTT can add value to the networks. It is not only the impact of OTT on these companies that is of interest to researchers, the responses from the companies to OTT is also worth investigating. There are several studies suggesting appropriate strategies as responses to OTT. A study by Xu and Chen (2015) recommended a welcoming, cooperative strategy towards OTT rather than non-cooperative one, because the revenue is relatively higher. Similarly, a study by Stork et al. (2017) supports that research. Their study focusing on the African market suggested that embracing OTT is appropriate in order to retain the revenue of mobile operators.

The last perspective on OTT research is from the government's side. OTT appears to have substantial impact, especially negative, on the telecommunications sector. When the issues are raised, it is the duty of the government, including the regulators establishing the rules and regulations for stakeholders, and the policymakers, to determine the direction of the rules and how to take action. This is one of the most scrutinized areas of OTT. Should it be regulated, and if so, what should these regulations look like? Governments around the world, as well as international governmental organizations, are concerned about this issue and have addressed it in several discussions. The regulations mentioned are responses to the economic impacts of OTT, consumer rights and protection, national security, and taxes. Active agents are, for instance, the Telecom Regulatory Authority of India (TRAI), who actively published studies regarding regulatory frameworks for OTT (e.g. TRAI, 2015; TRAI, 2018; TRAI, 2020), the Body of European Regulators for Electronic Communications, and the International Telecommunication Union (ITU), who also assigned a number of researchers to intensively study the OTT impact issue (ITU, 2017; ITU, 2019). These studies currently provide an understanding of OTT and suggest guidelines to establish a regulatory framework for OTT, even though many of the recommendations are ambiguous. Nonetheless, the latest report regarding OTT, published by TRAI in September 2020, firmly recommended that governmental intervention was not necessary

at that time and market forces should be allowed to dictate procedures instead (TRAI, 2020)[1]. With respect to the literature from the researchers, the regulation for OTT is examined. For instance, a study by Brown (2014) assessed whether European ECS regulations were appropriate for OTT. The results indicated that only the regulations regarding the data retention and privacy should be employed. The other regulations were not feasible or appropriate to apply. The NBTC, as the Thai telecom regulator, is also concerned about OTT regulations. They employed a consulting company named TIME Consulting to study on OTT TV issues in Thailand (TIME Consulting, 2017). According to the report, they raised the opportunities and constraints for OTT, which are the keys that the regulator is required to carefully consider. The results are consistent with another study on the situation in Thailand; OTT TV can create both opportunity as well as challenges to the Thai market (Anantho, 2018). Simply put, most of the studies cannot specifically confirm if regulations are recommended because there are conditions to consider before those regulations can be determined. Moreover, each country has different contexts, so there is no single solution effective for all situations.

Regulations are not the only interest of the government. Another focus is on the issue of net neutrality. Net neutrality is simply the principle used to ensure that the data transmitted on the Internet are free from any kind of discrimination. This issue is partly, yet importantly, related to OTT issues. Net neutrality is usually regarded along with its neighbor, the zero-rating issue. The Zero-rating scheme is considered as a type of violation to the net neutrality principal. In general, net neutrality is examined in order to explore its positive and negative impacts on the telecommunications sector, its innovations, and its consumers. However, when the net neutrality principle is applied, it means that OTT cannot be blocked or throttled by any ISPs. Under these circumstances, there might be effects on the stakeholders in the market. A study conducted by Leal (2014) raised a consideration on how EU net neutrality affects the relationship between network operators and OTT providers. The article emphasized the complex relationship between them under the implementation of net neutrality. So far, the issue of net neutrality is not usually officially implemented around the world, including in Thailand. Nonetheless, it is worth exploring how this principle would affect stakeholders so that policymakers can more easily make the decision on whether or not to implement it.

To sum up, OTT has been examined in many ways. This section only gives a brief explanation of the OTT studies so far. Indeed, the study of OTT is not limited to the field of telecommunications but has been explored across several disciplines. However, details about the studies on each perspective will be provided in each chapter.

[1] See https://www.trai.gov.in/notifications/press-release/trai-releases-recommendations-regulatory-framework-over-top-ott

3.2.3 Limitations in Previous Studies

Although previous studies are informative and provide sufficient guidelines for future research, including this study, there are limitations inherent to those studies. This study aims to contribute additional information to the previous research.

Firstly, policy implications for regulators and policymakers are insufficient, or otherwise overly specific. There are few studies tackling the issue of OTT communications that provide useful results. Many studies provide recommendations and policy suggestions to governmental authorities or the NRA, but those recommendations are overly vague. One such example is the study by Baldry et al., (2014), which provides policy recommendations for various scenarios. The limitation is that it requires further study for each country to determine which policy or scenario should be used as an appropriate regulatory framework. Studies from organizations such as BEREC and ITU (BEREC, 2016; ITU, 2017; 2019), aim to provide general information about OTT, such as definitions and the current situation of OTT, and regulatory issues in general. In other words, policy implications may not be their main objective, thus they reference them only vaguely. While those studies suggest policy implications that are far too broad, another group of literature provides overly specific recommendations for particular cases. For instance, there is a study by Brown (2014), which uses the European ECS regulations as a case study in order to give recommendations to the EU. Another study, by Leal (2014), also focuses on the EU approach to net neutrality and its results on OTT. These two conclusions may seem valid in the EU, but they are not necessarily appropriate to be adopted in other countries, including Thailand. The EU and Thailand are very different in many respects, such as the legal system and market competition. Another study was conducted by TRAI (2015; 2020), which presented the results as recommendations for India's NRA. There is no doubt that they base their conclusions on the Indian situation. While this literature provides very useful information and may be complementary to certain national situations, it nevertheless cannot be applied wholesale to the environment within Thailand.

Secondly, other dimensions of OTT, such as its positive effects, are not frequently mentioned in the literature. There are only a few studies describing the positive effects of OTT. One of those is the work of Sudtasan and Mitomo (2016), which emphasizes the fact that OTT increases adoption and willingness to pay (WTP) for optical fiber broadband in Thailand. Other studies include the work of Gerpott et al., (2014), and Gerpott and Meinert (2016). They focused on the effects of mobile Internet (MI) on traditional telecommunications services, which the authors then applied to OTT. The results found that mobile Internet increases the use of traditional telecommunications services, such as mobile voice calling and SMS. These results presented additional dimensions of OTT, other than its negative effects on the ecosystem, resulting in the perception that OTT is a threat to the telecommunications sector. Moreover, they also allege that the relationship between OTT and the telecommunications sector is intertwined, or interdependent. These studies are extremely informative in expanding the

understanding toward the role of OTT in the telecommunications sector. However, the number of studies is quite limited. For this reason, this study aims to provide information demonstrating that OTT may have a crucial positive role in the market and is not simply a threat to the telecommunications sector.

Thirdly, there are a few studies collecting primary data from MNOs through in-depth interviews. Some studies rely on MNOs' data, such as revenue, volume of data traffic, and price from secondary sources (e.g. Stork et al., 2017). This empirical data is considered to be reliable and objective in explaining the real-life situation. However, new insights cannot be investigated from this dataset. It is impossible to obtain new insights from MNOs about the situation of OTT they have encountered, and what is going on from their perspective. Primary data obtained directly through interviews, especially semi-structured interviews, leaves room for unplanned conversations, which may be criticized in terms of biases and reliability, but can equally extend the knowledge of OTT that would not otherwise be retrievable through secondary data. It is considered a tradeoff of using primary data retrieved from interviews. However, it is worthwhile, because this new information can contribute to the field of telecommunications. Indeed, there are some studies adopting interviews as the main method for the collection of primary data, as shown in the study by Ghezzi et al., (2014), and Mahola and Erasmus (2015). In these studies, primary data was collected on the basis of in-depth interviews. By using this methodology, the results expected from the conceptual framework, as well as new information, can be obtained. This new information is considered a valuable contribution of the study.

Fourthly, the explanation of OTT and its relationship with the MNO environment is inadequate. For example, there is limited consideration of competition among MNOs and the regulatory landscape, which may relate to the impacts of OTT as well as the responses of MNOs to OTT. The impact of OTT and its relationship with traditional telecommunications services are of massive concern to many researchers and analysts. As a result, there are a number of studies focusing on this issue. However, these studies merely focus on the direct impact of OTT on the businesses of MNOs and pay little attention to the environment of MNOs, which play an important role on the impact of OTT. There are studies laying out this issue, such as that of Ghezzi et al. (2014) and Stork et al. (2017). However, the explanation surrounding this issue is quite limited. This study proposes a conceptual framework aiming to clarify this issue, which is considered another contribution of this study.

Fifthly, the studies of OTT typically focus on only one or two perspectives. There are some studies attempting to explain OTT across more than two perspectives, such as that by Baldry et al. (2014), ITU (2017), and Joshi et al. (2015), however these studies only briefly explain each perspective. This study aims to more expansively explain OTT from three perspectives: those of the stakeholders in the ecosystem, which are the users, the MNOs, and the government. In other words, this study covers

all of the actors involved in OTT. With this information, the role of OTT in the telecommunications sector can be examined more closely.

Lastly, studies of OTT in Thailand are scarce. Among these limited numbers of OTT studies, most of them focus on OTT media, such as those by Anantho (2018), Chouna & Sonsuphap (2020), TIME Consulting, (2017), and Sudtasan (2018), or they concentrate on OTT as a whole, such as the work of Phansatarn (2020). The study of OTT communications is much scarcer, with only a few delving into that particular area, such as the studies by Jirakasem (2019; 2020). Thailand is a country which is very active in OTT regulations, but research into the situation in Thailand is limited in both number and scope. Without the results from such research, it is relatively more difficult for the policymakers to create appropriate policies for OTT and the Thai telecommunications sector. This is one of the reasons why this study should be conducted.

Although literature provides a significant amount of knowledge regarding OTT, there are several limitations or gaps in the previous studies. For this reason, the results from this study are expected to contribute to the knowledge base surrounding OTT, especially OTT communications, and its role in the telecommunications sector, with particular focus on OTT in Thailand. Additionally, the results obtained in this study can be used as complementary information for both researchers and policymakers in other countries that share similar situations or characteristics with Thailand.

Chapter 4

Regulatory Landscape

(Government's Perspective)

This chapter [1] provides the insights and interests towards OTT from the government's perspective. It begins with the first section explaining the current situation regarding incumbent legislative mechanisms, authority, and restrictions on implementing legal restrictions on OTT providers in Thailand. Once the existing regulations and restrictions are explained, the network neutrality or net neutrality issue is discussed. The circumstances of other countries and their actions towards net neutrality implementation are provided, with Thailand addressed as the main focus in the second section.

Section 4.1 Incumbent Legal Mechanisms and Restrictions

One of the most important issues regarding OTT is that the regulatory framework for OTT is still unclear. Even though there have been attempts made by regulatory bodies, the official regulations have not yet been established. Regardless of the controversy over whether OTT should be regulated or not, this section aims to illustrate the overview of the regulatory landscape in Thailand, mainly for OTT communications, incumbent legal mechanisms employed currently, national regulatory authorities in Thailand, and restrictions in implementing the regulations for OTT services.

4.1.1 National Regulatory Authority (NRA) in Thailand

As introduced in the previous chapters, the National Broadcasting and Telecommunications Commission (NBTC) is the telecommunications and broadcasting regulator in Thailand. The NBTC is an independent regulator officially established in 2011 by virtue of the Act on Organization to Assign Radio Frequency and to Regulate the Broadcasting and Telecommunications Service B.E. 2553 (2010) (NBTC, 2015b). The NBTC was formed from merger of two former independent regulators - the National Telecommunications Commission (NTC) and the National Broadcasting Commission (NBC) (NBTC, 2016). Due to the trend of rapid growth of technological development and convergence of platforms, the NBTC was established as a new independent regulator. The NBTC has the duty to regulate and prescribe the rules for broadcasting and telecommunications businesses. Their mission includes establishing a master plan for telecommunications and broadcasting businesses, allocating the

[1] Part of this chapter is based on the published paper titled "Net Neutrality Regulations in Thailand towards the Basis of Free and Fair Competition: Stick or Carrot?" (Jirakasem & Smerchuar, in press) and the conference paper titled "A Preliminary Assessment of Regulatory Framework for Over-the-top (OTT) Communications Services in Thailand" (Jirakasem, 2019a) by the author.

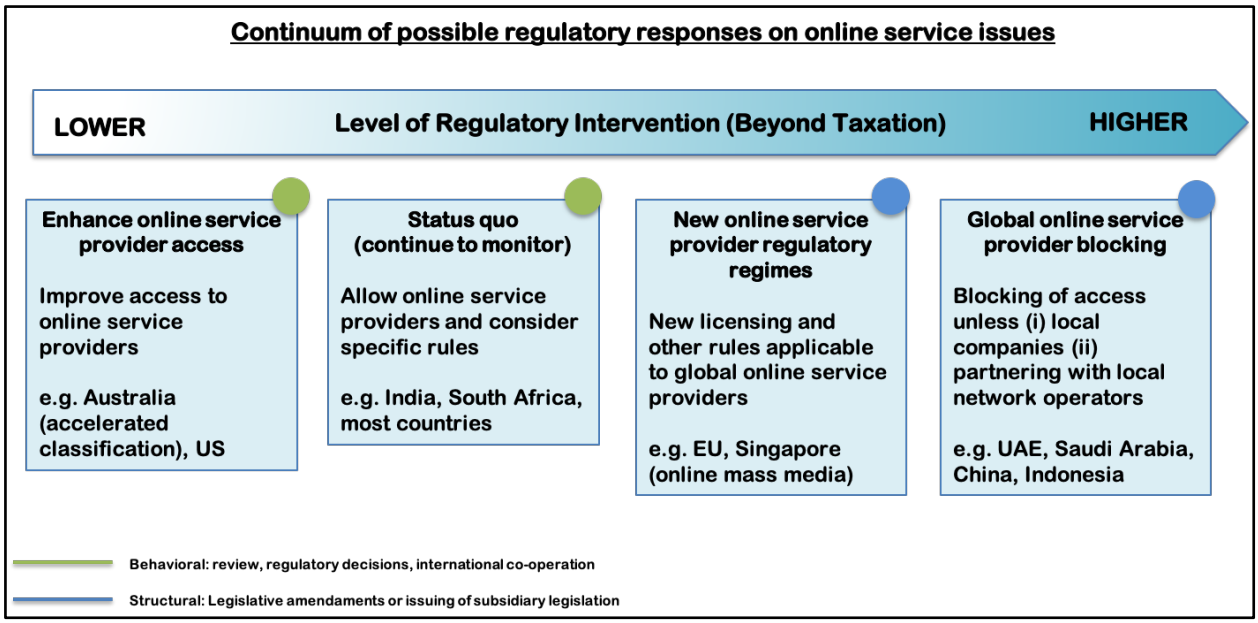
frequencies and spectrum, granting licenses, and setting standards for telecommunications and broadcasting business operations. Their objective is to encourage free and fair competition, along with protecting the national public interest and national security, as well as people's rights and liberty protection (NBTC, 2013).

The Ministry of Digital Economy and Society is another authority overseeing Information Communication Technology (ICT) in Thailand. The Ministry of Digital Economy and Society, or MDES (formerly known as the Ministry of Information and Communications Technology (MICT) was established in 2002 and works closely with the NBTC. The MDES' role is to suggest and implement national policy regarding digital development for the economy and society. Moreover, it has the duty of developing the government's digital presence, maintaining cyber security, and ensuring businesses comply with digital laws. The NBTC and the MDES have similar goals in protecting the national public benefit, though the details of their duties and authority over businesses are designed differently. Usually, they work together and facilitate each other in order to accomplish their goals (MDES, n.d.).

4.1.2 Current Situation Regarding Regulatory Intervention

The ITU's continuum of possible regulatory measures for online service includes four responses, ranging from low to high intervention, as shown in Figure 4-1 (ITU, 2018). Low intervention includes improving online access or behavioral remedies, while high intervention requires legislative amendments and setting specific rules. Thailand has no specific regulations for OTT, services as stated in the previous chapter, but it has attempted to find an appropriate regulatory framework for OTT services. Thus, Thailand falls into the group of "status quo (continue to monitor)" in the regulatory responses. Most of countries are clustered in this group (India is an example). The Telecom Regulatory Authority of India (TRAI) announced in late 2020 that OTT communications services are not required to follow specific regulations for now (TRAI, 2020). However, this needs to be monitored. Notwithstanding, the NBTC is eager to force OTT services to establish a local representative in the country. By doing so, they can control OTT services directly. In addition, the NBTC declared that the regulator and OTT services can collaborate to tackle problems that occur on the platforms together, such as illicit content, fake news, and tax collection. (Tortermvasana, 2019; Tortermvasana & Leesa-nguansuk, 2017). Currently, Thailand is part of the status quo, or behavioral intervention, but it is planning to proceed to structural intervention. Although the NBTC announced that local representative is the appropriate regulatory framework, they did not mention punishment or restrictions, such as blocking of access, if OTT service providers do not comply with those rules. Thus, it cannot yet be determined whether or not regulation for OTT services in Thailand will reach higher levels of intervention.

Figure 4-1: Continuum of Possible Regulatory Responses on Online Service Issues



Source: Windsor Place Consulting, October 2017, cited in ITU, 2018

Although there is no official regulation for OTT services, the Thai authority bodies have mechanisms to control and censor the online services as a whole. Definitely, service or content providers that have established local offices in Thailand must comply with internal jurisdictions. In typical cases, if their actions break Thai laws or violate social norms or public opinions, the internal authorities, such as the Royal Thai Police and the MDES, can use law enforcement, such as the Computer Crime Act 2017, to forbid those actions. However, most OTT services are not located in the country. In that sense, authorities do not have the right to enforce Thai laws with respect to the OTT services. Instead, they implement indirect control over them, because they have the authority to control the ISPs and MNOs. ISPs and MNOs are basically subject to Thai jurisdictions. Specifically, the ISPs and MNOs are licensees in the telecommunications business, so they are obligated to comply with the measures set by the NBTC. With this mechanism, Thai authorities can only block access to OTT services, should they wish to. This is the standard mechanism used for Internet censorship, which is commonly practiced in Thailand (Siriyuvasak, 2007). However, compared to typical web content, OTT services are relatively more complicated to control. There are example cases reflecting that complication of government control. The government's decision to block a Facebook group named "Royalist Marketplace" is one of those cases. Royalist Marketplace is a Facebook group in which members discuss and criticize the monarchy of Thailand. The group was set up by Pavin Chachavalpongpan, a Thai associate professor at Kyoto University, on April 16, 2020 (Chachavalpongpun, 2020). Only months after being set up, membership in the group had increased rapidly, reached one million members. It is considered the most successful Facebook group in Thailand. However, criticizing the monarchy is prohibited in Thailand, both in terms of law and social norms. The *lèse majesté law*, as known as Section 112, is strictly enforced, and the penalty is serious, as stated in the Criminal Code that states, "Whoever defames, insults, or threatens the King,

the Queen, the Heir-apparent, or the Regent, shall be punished with imprisonment of three to fifteen years." (iLaw, n.d.). As a result, there is accusation that the Royalist Marketplace Facebook group is breaking this law, along with the Computer Crime Act 2017. The MDES, led by former Minister Puttipong Punnakan, sent a request to US-based Facebook to restrict the group's access in Thailand. Moreover, the Thai government threatened to pursue criminal proceedings towards Facebook Thailand (Prachatai, 2020). Eventually, Facebook agreed to block access to Royalist Marketplace in August 2020. However, Facebook afterwards announced that they are preparing to sue the Thai government, as they were forced to comply with the Thai government's demand, and the censorship goes against international human rights. Nevertheless, Pavin set up a new group with the same name, which currently has over two million members (as of November 2020). This case reflects the problem of government authority attempting to control OTT services. They have limited power, especially when the providers are not located in the country. Even though Facebook has established a local representative in Thailand, the Thai government's authority is insufficient to absolutely control it. Furthermore, they can only block access to the URL in its entirety, not a specific group or page on the site. Additionally, they must file a request with the OTT service providers to comply with their demand. Service providers are often not willing to grant the request, especially when the request goes against international norms, such as human rights and freedom of speech principles.

4.1.3 Restrictions in Implementing Regulations

This section intends to discuss current issues of regulations relating to OTT services. The situation reflects several restrictions in implementing regulations towards OTT providers. The issues of regulations are divided into three parts: regulations regarding the competitive neutrality or level playing field creation as a part of the economic aspect, regulations regarding consumer issues, and regulations regarding jurisdiction.

4.1.3.1 Regulations Regarding Competitive Neutrality or Level Playing Field

OTT communications are usually regarded as difficult areas in which to apply regulations, especially policies implemented on the grounds of their potential to substitute traditional telecommunications services (ITU, 2017). As OTT is increasing at a significant pace, it is competing with traditional telecommunications services. As a result, there is an argument that regulations should be applied to OTT services as well as traditional services. However, applying regulations is not straightforward. There are three main reasons, as follows:

1) Actual substitution between OTT and traditional telecommunications services are not clear.

Although there is an assumption that OTT is substituting traditional telecommunications services, this assumption has not been empirically investigated yet, specifically as it relates to Thailand.

Thus, it might be overly straightforward to apply the regulations or even establish the regulatory framework regarding competitive neutrality towards OTT services. In reality, it is possible that OTT is not substituting traditional telecommunications services, even though the current information seems to suggest that is the case. Even if OTT can substitute the traditional services, the next questions are, is it a perfect or imperfect substitute, and to what degree are they substituting (ITU, 2017). Because the relationship between OTT and traditional services has not yet been examined, there is the possibility that they are fully substitutable, complementary, or even not relevant at all. It is important to estimate the degree of substitution before applying the regulation. Otherwise, the government will be considered excessively heavy-handed, resulting in negative impacts in the market.

2) Market definition of the OTT and traditional telecommunications markets in Thailand cannot be properly estimated

There are measures to estimate the competitive levels between products or services in the market. Relevant market definition is used to estimate competition law. Prior to issuing the regulation, the market definition and dominant firms are required to be clearly estimated by the authorities using the measures of competition. In Thailand, the latest Trade Competition Act B.E. 2560 (2017) is not effective for the sector-specific market, including the telecommunications industry. Thus, the Notification of the National Broadcasting and Telecommunications Commission RE: Identifying Operators with Significant Market Power in Telecommunications Market B.E. 2557 (2014), generated by virtue of Section 20, in conjunction with Section 27 (11) and (14) of the Act on Organization to Assign Radio Frequency and to Regulate the Broadcasting and Telecommunications Services B.E. 2553 (2010), and Section 21 of the Telecommunications Business Act B.E. 2544 (2001), are considered indicators for the market definition of the telecommunications sector. According to the notification, the relevant markets are identified on the grounds of economic principles. The established primary criteria include their own and the cross-price elasticity of demand, supply substitutability, the hypothetical monopolist test, or the small but significant and non-transitory increase in price (SSNIP), market structure, degree of competition in the relevant markets, and barriers to entry. However, these measures are considered principally incompatible with online services, especially OTT communication services. OTT communications are usually employed in a two-sided or multi- sided market business model, which is typically employed by online services. This kind of service acts as a platform, or intermediary, between at least two groups of consumers, where one group is the users who are provided services free of charge and who are financed by the other group of consumers who are usually advertisers or outside application developers (Armstrong, 2006; Rochet & Tirole, 2003) Even though the first group can pay directly to the OTT services in the form of in-app purchases, this is infrequent among OTT communications. With this type of service, the traditional economic tools defined in the competition law, especially in the above notification, are not effective because the price of the services provided to the general consumers is at

zero cost. As a result, the market definition cannot be estimated regarding the existing legislative framework.

With respect to pricing and the cross-price elasticity of demand, they are all impractical to assess. Although some literature has used the bundling price, which includes the Internet usage allowance and voice over internet protocol (VoIP), instead of the price for platforms (e.g., Lange & Saric, 2016), the Internet subscription fee may not reflect the real price of the OTT. In addition, users perceive OTT to be free of charge and may use the Internet for other purposes, not only for OTT services. Consequently, it is difficult to extract the price of OTT from a bundled price and Internet subscription fee, especially in the case of Thailand, where a flat rate and bundling price are popular among smartphone users.

Apart from the price elasticity of demand, the SSNIP is also difficult to calculate. The lack of a real price is the issue. Furthermore, this test cannot be used to capture the market structure of the OTT (i.e., it cannot be used to estimate competition from advertisers). Therefore, the degree of competition and market structure cannot be estimated. The literature has suggested a modified SSNIP, or other tests, such as the small but significant non-transitory decrease in quality (SSNDQ), as more appropriate methods of estimating the actual price of OTT services (Graef, 2016). Nevertheless, it is not effective to use these due to the unfeasibility of the tests, especially in Thailand.

In addition to the above indicators, the barrier to entry is also a complicated marker. The barrier to entry of OTT is very low compared to traditional telecommunications services, where entry is associated with legal restrictions, technological development, and high investment. OTT may require a research and development fund as investment, but in terms of legal constraints, OTT is expedient. Moreover, the OTT market is multi-home, users can download and subscribe to several OTT services on a single device. On the other hand, users can subscribe to only one or two traditional telecommunications services. Thus, the barrier to entry for new entrants for OTT is relatively low.

Nonetheless, some scholars regard the network effect as one of the barriers to entry. As expressed under Article 102 TFEU, the European Commission mentioned that barrier to entry may include costs and difficulties that users face when changing platforms, especially with the higher numbers of user platforms (Graef, 2016). As the network effect of an application becomes larger, it tends to be more attractive to users. Thus, it would be difficult for new entrants to compete with the applications that have already established large network effects, such as LINE in Thailand.

There is also a factor associated with the barrier to entry called *lock in*. Traditional telecommunications services may lock the users into services by assessing switching costs, both in monetary and other terms, such as time and inconvenience. Switching costs for OTT are usually not related to monetary costs, but it requires some effort to change the service. To illustrate, one user may find that changing an OTT application is burdensome because their list of contacts may not be easily

transferred to another application. Furthermore, his or her contacts may not be active on the new application, and the interconnection is usually unavailable for OTT services.

3) Incumbent regulations for traditional telecommunications services cannot be applied with OTT

In order to create a level playing field, the implementation of incumbent regulators for traditional telecommunications services on OTT services are addressed in some studies (Brown, 2014; ITU, 2017; TRAI, 2016). At the moment, traditional telecommunications services are subject to various regulations, but those regulations are exempted for OTT services, as summarized in Table 4-1. This issue is crucial, because the imbalance creates unfair competition between OTT services and traditional telecommunications services. There are requests from many sectors to apply the same regulations to OTT services as to traditional services (TRAI, 2016). After a review of the prior studies and incumbent regulations for traditional telecommunications services, it can be said that incumbent regulations for traditional telecommunications services cannot be applied to OTT services.

Table 4-1: Regulatory Imbalance between OTT and Traditional Telecommunications Services

Area of Regulation	Mobile Network Operators	OTT players
Licensing	Yes	Usually exempted There are some OTT services required to register licensing, such as VoIP terminating to the PATS
Quality of Services	Yes It is included in the license.	No quality requirements Usually, ISPs are required to retain QoS, while OTT players are not
Interconnection	Yes Due to lock in of service and SMP measurement, interconnection between the operators is required.	No interconnection required
Universal service	Yes It is included in the license.	No
Consumer protection	Yes	No or little enforcement power
Provision of legal interception	Yes It is included in the license.	Yes Required in some cases
Taxation	Yes	Service dependent
Access to emergency services	Required as a license condition for basic service offers (PATS)	Required in some cases. Peer-to-peer providers generally exempted.

Source: Baldry et al.., 2014, modified by the author

The nature of traditional telecommunications services and OTT services is different, resulting in different motivation in applying the regulations. Regarding a previous study, an assessment of Europe's common regulatory framework for electronic communications networks and services was conducted (Brown, 2014). Key regulatory provisions regarding competition are assessed as unfeasible (e.g., interconnection, which is one of the key principles of directive 2002/19/EC). It is considered

unfeasible in implementation. Interconnection aims to connect the networks to protect the market from the situation of monopoly. Users usually own one device, and it requires one (or two) operator or network. When users cannot connect to other users on different networks, they may have to switch their carrier or own additional devices, which may be burdensome or impractical for some consumers. Compared to traditional telecommunications services, interconnection is not necessary for OTT because it is multi-home and uses a different kind of technology from traditional services. Moreover, technical feasibility is also a concern. Therefore, the same framework that is applied to ECS or traditional services may not be appropriate.

Traditional telecommunications services are subject to regulations that are rooted in competitive concern, the reason being that traditional telecommunications services use resources that are limited, such as spectrum and frequencies. In order to fairly allocate those resources, and to encourage a level playing field among operators, licensing is needed. This is different from OTT services, which does not need to own the infrastructure or those resources. Rather, OTT basically relies on the other actors' resources and infrastructure. In addition, the Internet is considered more abundant resource, not scarcer, like the spectrum (Pallero & Chima, 2017). Thus, these kinds of regulations are not necessary for OTT services.

However, there are regulations for traditional telecommunications services that apply to OTT services as well, such as for VoIP, but only VoIP connecting to the PSTN. Thailand's rule for this is defined in the Notification of the National Telecommunications Commission, Re: Service Standard for Voice over Internet Protocol (or Internet Telephony) B.E. 2551 (2008). In the notification, VoIP is subject to a set of regulations, such as licensing, numbering, and quality of services. And it is not only Thailand that implements regulations for VoIP terminating to PSTN. There are many countries requiring this regulation, such as those in the EU, and Singapore. Other countries, such as South Korea, do not restrict Internet telephony with a license, instead allowing network operators to block or charge users for VoIP usage.

To summarize, the regulation regarding competitive neutrality is considered unfeasible under incumbent legislation at the moment, as detailed by the three reasons explained above.

4.1.3.2 Regulation Regarding Consumer Issues

Concerning consumer issues in OTT communications services as the source of income, data are becoming the focus. Advertisers concerns tend to focus on how their advertisements of products and services can reach as many end users as possible. Not surprisingly, an application containing a larger number of users or networks is attractive to them, because it means there are more potential customers. In contrast, consumers are not be pleased with applications displaying numerous advertisements. This can be regarded as a cross-side network effect. However, the issue of advertising is relatively more crucial

on social networking than it is on OTT communications. To develop products that meet consumers' needs, advertisers and application and software developers require the data of users, including personal information, activities on the applications, and sometimes information outside of the applications. Consequently, this issue is profoundly associated with privacy concerns. With respect to this issue, three acts in legislation were reviewed. The latest one is the Personal Data Protection Act (PDPA), which was approved by the Thai government in early 2019. Previously, the Computer Crimes Act (No. 2) B.E. 2560 (2017), was an amendment to the initial, 2007 version, named the Computer Crimes Act B.E. 2550 (2007) or Act on Commission of Offences Relating to Computer. Also in 2007 there was a notification by the Ministry of Information and Communications concerning the principles of traffic data collection B.E. 2550 (2007).

In reference to these three laws, two propositions are discussed in this part. The first one is that a data and privacy protection law were created and was effective in 2020, but the problem is how to implement the legal enforcement of cross-border service providers. The PDPA is the first personal data protection law specifying that the law is subject to data collectors and processors residing outside of the border, as mentioned in Clause 5, to prohibit using, collecting, and disclosing personal data without consent. However, the measures for sentencing for violation of cross-border services are not clearly specified, which may result in ineffective implementation.

The second proposition is that these legislative acts, especially the Computer Crimes Act B.E. 2560 (2017), aim to regulate users who are uploading content online rather than to control the platform. When crimes occur, the authorized agents usually go to the users, which is reasonable, or to the ISPs to block the content or to gain assistance. However, the service providers, especially OTT providers, take little action and rarely assume responsibility in these matters. It is unlikely that a Thai lawsuit would have much impact because the OTT providers are usually not located in Thai territory.

The existing legislative framework in Thailand has progressed recently, especially the PDPA, which can be seen as the very first step. Yet, due to limitations in cross-border enforcement, the framework cannot be sufficiently implemented. However, the most recent law, the General Data Protection Regulation, which was established by the EU in 2018 to replace the Data Protection Directive 95/46/EC, can be implemented across borders within the European Union. Unfortunately, this measure might be not easy to adopt in the Southeast Asian region. The regional organization in this area, namely the Association of Southeast Asian Nations (ASEAN), of which Thailand is a member, is made up of ten extremely diverse nations, especially in terms of telecom regulations, resulting in problematic legislative implementation. Any lawsuit brought against OTT services within the ASEAN Union would be difficult to enforce and would likely not be effective, since most of the OTT providers are based outside the region.

4.1.3.3 Regulation Regarding Jurisdiction and Related Issues

As pointed out in the previous two sections, the main obstacle in approaching OTT is country jurisdiction. Because of this, there are issues in implementing the regulations for OTT, as explained. Tax collection is also issue. With OTT players located outside the territory, corporate and consumption taxes are not properly collected. Mr. Takorn Tantasit, the former secretary of the NBTC, states that, since OTT players gain revenue from Thai users, tax should be collected from those business operators. The taxes are due to the Thai economy and should go towards users' benefits, such as infrastructure improvement (Tortermvasana, 2019). However, collecting taxes directly from the OTT players operating outside the country is unfeasible. Thus, the NBTC is planning to require OTT providers to establish local offices in the country. Not only will this allow Thailand to benefit in terms of tax collection, it also allows for controlling and implementing regulations in the future. To cope with this same situation, other countries have decided to mandate that OTT players establish a local representative. The Indonesian market, for example, is considered large, with a population of 270 million people. Facebook is popular in the country, with approximately 130 million users, as opposed to only 46 million Facebook users in Thailand (Statista, 2019). Prior to 2017, foreign OTTs profited from Indonesian users, but were not required to pay taxes to the country. As a result, Indonesia passed a law in 2017 to force OTT providers to follow their laws.

Currently, some OTT services have established local offices in Thailand, such as LINE Thailand and Facebook Thailand. However, these OTT providers are very large, with vast numbers of users. For small OTT providers, they may not agree to open local offices because it requires them to invest more, and they must comply with the laws of Thailand. Even if the use of OTT communications services in Thailand is relatively high, it does not mean that all OTT players will agree to open offices in the country.

To summarize, there are a number of restrictions in complying with regulations for OTT services. This conclusion was made regarding the existing legislations in the country. However, net neutrality principles play an important role in OTT regulations. So far, net neutrality has not been adopted in Thailand. If it does come into effect, there will be impacts on OTT services and regulations. The next section will discuss net neutrality, its concept, the current situation in other countries, and the rationale towards applying it in Thailand. Then, the overall regulatory landscape in Thailand will be completely illustrated.

Section 4.2 Network Neutrality Issue[2]

When it comes to regulatory issues for OTT services, network neutrality (or net neutrality) is an issue that needs to be addressed. Net neutrality is the principle that ISPs are prohibited from blocking, throttling, or discriminating against data transmitted on their network. In other words, they are required to treat all the data equally. Net neutrality is applied directly to ISPs, but it certainly affects OTT services as a means of content delivered over the Internet. When ISPs are able to control the traffic on their network, they may prioritize or slow down traffic from particular OTT services, resulting in that service's quality suffering in the eyes of its users. Moreover, some OTT services may pay ISPs or partner with ISPs in order to deliver their service at higher speeds or with better quality, or without garnering data usage charges that come with using their competitors' services. This is called *a zero-rating scheme*. Zero-rating can lead to positive or negative issues for users and OTT players. For example, it is considered a benefit for users to use a specific application without data charges. On the other hand, it is unfair to other OTT players who do not collaborate with ISPs, as the speed, quality, or price of their services might require data charges, which would be considered unattractive to their customers. If net neutrality were implemented, all these actions would be prohibited. Thailand is one of the countries in which net neutrality has not officially been adopted. Although there are some discussions and studies regarding net neutrality in Thailand, the conclusions are quite diverse. Clearly, net neutrality is becoming a challenge for policymakers globally, as well as within Thailand, especially as it relates to OTT regulations. This section intends to introduce the basic concept of net neutrality, portray the current situation in Thailand and other countries in the world, preliminarily justify if net neutrality should be implemented in Thailand at the moment, and provide guidelines regarding net neutrality for policymakers in Thailand. In order to accomplish the objectives posited, qualitative content analysis on secondary sources was employed. The documentary method took its evidence from a variety of available sources, including public newspapers, books, government notes, academic papers, the mobile industry database GSMA, relevant incumbent laws, and telecommunications regulations.

4.2.1 Overview of Net Neutrality

The term network neutrality (or net neutrality) was coined in 2003 by law professor Tim Wu. He proposed the word network neutrality in his work named "Network neutrality, broadband discrimination," which examines the idea of a non-discrimination rule on the Internet, and narrates the discriminatory practices enacted by broadband operators in the early 2000s (Wu, 2003). The idea of non-discrimination on the Internet was taken up with the concept of an "end-to-end" approach, which also supported an open and free internet (Audibert & Murray, 2016; Krämer et al., 2013; Reggiani &

[2] Part of this section is based on the published paper titled "Net Neutrality Regulations in Thailand towards the Basis of Free and Fair Competition: Stick or Carrot?" (Jirakasem & Smerchuar, 2021).

Valletti, 2016). Evolving from the originated idea, net neutrality nowadays is regarded as the concept of non-discrimination practices for ISPs on the internet. The general definition asserts that "Net neutrality prohibits Internet service providers from speeding up, slowing down, or blocking Internet traffic based on its source, ownership, or destination" (Krämer et al., 2013, p. 796). This definition is aimed at the ISPs by preventing the practice of traffic management. In other words, ISPs are intended to be only the intermediary delivering the content from content providers, including OTT, to the end users, without any form of discrimination.

Net neutrality not only prohibits ISPs from discriminating for or against data by managing traffic on the network, it also does not permit ISPs collecting financial charges from both the content providers and from the consumers. A definition by Hahn & Wallsten (2006, p.1) stated that net neutrality "usually means that broadband service providers charge consumers only once for Internet access, do not favor one content provider over another, and do not charge content providers for sending information over broadband lines to end users." In a typical case, users pay the ISPs for Internet access in the form of a regular subscription or pay-per-use fee. At the same time, users may pay the content providers for the content access. However, users may be exempted from charges by the ISPs because the content providers cover this fee. Then, users can enjoy the specific content or application without data charges, resulting in gaining popularity for that provider. Alternatively, content providers may pay or collaborate with the ISPs to deliver the content to the users with higher quality or speed, which positively affects the users' experience. These practices are regarded as "zero-rating." Zero-rating is considered a violation to the net neutrality rule, as ISPs favor some content providers, while suppressing others. There is concern about zero-rating, as it might cause unfair competition, consumer protectionism, and innovation hindrance. To illustrate, ISPs may prioritize an OTT that is willing to pay for faster service, bringing that OTT's content to the users on a "fast-lane." On the other hand, OTTs that do not pay for faster services would have their content delivered on a slower "dirt-road," which would be disadvantageous as well as unsatisfactory to customers. Only large and well-financed OTTs would have the resources to pay or partner with ISPs, while small or start-up OTTs would be unable to do so. This would, in theory, be both unfair and might serve to delay innovation, especially from smaller companies.

The FCC determined the practices of ISPs that are categorized as violations of the net neutrality rule. Usually, these actions are prohibited under the net neutrality regime. The actions are as follows:

1) Prioritizing traffic and charging differential prices based on priority status.

2) Imposing congestion-related charges.

3) Adopting business models that offer exclusive content or that establish exclusive relationships with particular content providers.

4) Charging content providers to access the Internet based on factors other than the bandwidth supplied.

(FCC, 2009 cited in Becker et al., 2010, p. 498)

Net neutrality can be explained as the conditions that ensure consumers protected and equal access and use. As stated in the "report on network neutrality," composed by the Ministry of Internal Affairs and Communications, Japan in 2007, there are three principles defined as the basis of net neutrality. Those principles are as follows:

> *Principle 1: Consumers are entitled to use IP-based networks flexibly and access the content/application layer freely.*
>
> *Principle 2: Consumers are entitled to connect to IP-based networks freely through terminals that comply with technical standards provided by laws and regulations and these terminals may connect to each other flexibly.*
>
> *Principle 3: Consumers are entitled to use the communications layer and the platform layer free from discrimination at a reasonable price (MIC, 2007, pp.5-6).*

In general, net neutrality idea is grounded in the principle of non-discrimination on both sides of content providers and consumers. Moreover, the implementation of net neutrality is applied for the benefits of various stakeholders, such as innovators and investors. However, applying net neutrality leads to tradeoffs. It is nearly impossible that in applying or not applying such a rule will lead to a perfect solution for every stakeholder. In the next subsection, studies about net neutrality and its effect on various actors in the ecosystem are discussed.

4.2.2 Net Neutrality Discussions

Simply speaking, net neutrality is grounded on the idea that data transmitted on the Internet must be treated equally, without discrimination. This principle is applied to Internet service providers by preventing them from unequally managing and distributing Internet traffic. Net neutrality originated in the United States as one of the most important issues in diverse areas such as telecommunications, politics, freedom of speech, and the economy. Net neutrality recently returned to the spotlight in the mass media after the Federal Communications Commission (FCC) announced a plan to repeal the net neutrality law in 2017. The cancellation became official in 2018. This abolishment of net neutrality rule ended the Open Internet Order (OIO), which was created during the Barack Obama administration. After the repeal was officially canceled, the FCC started using the new law, called "Restoring Internet Freedom Order," which Ajit Pai, Chairman of the FCC, claimed was enacted on the grounds of free and open internet concepts. This repeal by the FCC raised the question of net neutrality validity around the world: Is it still appropriate to implement it as a regulation in the telecommunications market? Nevertheless, before the abolishment of net neutrality in 2017, it was the topic of several discussions and studies. Basically, these studies examined the aspect of whether net neutrality is appropriate for stakeholders, not only in the telecommunications market, but outside the market as well. Discussion over net neutrality and non-net neutrality regimes is also in the mainstream. However, net neutrality and non-net neutrality are tradeoffs that are considered significant challenges for policymakers. Adopting or

not adopting net neutrality should be based on compelling rationale aimed at the public benefit, consumer welfare, and free and fair competition in the market.

A common assumption about net neutrality is that, under the net neutrality rule, ISP will have decreased incentive to invest in their services, compared to under non-net neutrality regulations (Hahn & Wallsten, 2016). If the ISPs cannot manage the traffic on their network, they lose the benefit of being able to efficiently control the network. Under net neutrality, ISPs are usually just a "dump pipe," only platforms for transferring data, which may occur at a very high volume (also known as exaflood). Furthermore, the ISPs have to bear the cost of infrastructure maintenance. This cost is fundamental to every ISP, especially in the competitive market, in which the consumers have sufficient choices and can easily switch to other ISP providers if they have an unsatisfactory experience with their current Internet provider. Some studies have found that this assumption is true in many cases. For instance, the study of Bourreau et al. (2015), concluded that the incentive for ISPs' to invest is low under net neutrality regulations. A study by Cheng et al. (2011), however, indicated that an ISPs' incentive to expand their infrastructure is higher when net neutrality regulation is applied. However, the work of Njoroge et al. (2014), asserted that the incentive to invest does not depend solely on net neutrality, but rather relies on the tradeoff between the two sides of the platform; the fee for internet access paid by the users, and the benefit they can gain from the content provider's side. Thus, the claim that incentive to invest decreased under net neutrality is not entirely accurate in all cases. By contrast to the ISPs, there is an assumption that the investment incentive of content providers is relatively low under a discriminatory regime. Choi & Kim (2010) and Njoroge et al. (2014) presented in their studies that content providers might not invest significantly when ISPs practice traffic management. They are concerned that ISPs might forfeit investment benefits, resulting in higher prices for consumers.

Innovation is another concern when it comes to the net neutrality regulation debate. Some people argue that innovation will be hindered under discriminatory practices. Net neutrality is supported for the reason that it assures the protection of innovation at the edge (Reggiani & Valletti, 2016), as well as innovation development (Litan & Singer, 2007). Without net neutrality, innovation may be impeded, because discriminatory practices obstruct the competitive capability of small companies or startups (Giles, 2017; Guo et al., 2012). However, the study of Bauer & Knieps (2018) demonstrated that net neutrality can hinder innovation as well. Some Internet-based innovation requires a higher capacity of Internet connection than is typical of ISPs. The study also proposed that differentiated network services might be necessary to ensure the development of certain innovations.

Net neutrality is not only adopted to ensure the development of innovation at the edge, but it is generally used to guarantee free and fair competition. One of the main roles of a national regulatory authority is applying measures encouraging free and fair competition. However, there are counter arguments that net neutrality may not encourage the free and fair of competition it is thought to. Net

neutrality opponents propose that rather than strictly applying such a regulation towards ISPs, a lighter touch would be more preferable (Mcgill, 2017). Hahn and Wallsten (2006) also opposed net neutrality and any kind of price regulation. They suggested that a government should create a competitive environment in the broadband market, such as liberating additional bandwidth and minimizing barriers to entry to the market. Similarly, Kotrous (2016) also disagreed with net neutrality policy, believing deregulation to be a more appropriate method of improving consumer welfare, instead of increasing regulation among broadband providers.

Currently, there is no right answer to the question of whether net neutrality should be adopted, or if it is suitable for every country. Discussions and studies suggest that adopting net neutrality has tradeoffs for stakeholders. Each country has its own conditions; the market situation, competition level, even the political conditions are diverse. The decision on whether or not to adopt net neutrality depends on those factors, and the regulatory authorities have to weigh the tradeoffs, both for the sake of the public benefit and in an attempt to be fair to every actor in the market, as much as is possible. In the next subsection, updated information about the adoption of net neutrality is presented to help make sense of the current situation around the world and to estimate trends as we move forward.

4.2.3 Experiences in the Adoption of Net Neutrality by Country.

Net neutrality is adopted at the national level. As the circumstances in each country are diverse, the intensity level and the objective of adoption are different country-by-country. Currently, there are no countries strictly implementing a net neutrality rule (ITU, 2018). However, many countries have been aware of the rise of net neutrality and have taken it into account. This section aims to summarize the current situation in countries around the world. By doing so, the big picture of net neutrality adoption can be witnessed and easily compared to the progress in Thailand. The categories made by the ITU (2018) are used to clearly see the progress of each country. There are three categories of approaches used by national regulatory bodies.

- **Cautious observation**: those countries that have adopted this approach are cautiously aware of the net neutrality issue. However, they are not taking any specific measures regarding net neutrality.
- **Tentative refinement**: those countries that are clustered into this approach are basically using a light-touch approach, or refinements. They amended some existing regulatory frameworks, but do not take further action, such as prohibiting certain actions.
- **Active reform**: those countries that are in active reform have gone further to issue specific regulations, such as prohibiting ISPs from network management practices. In other words, they adopted net neutrality regulation, though in practice they may not strictly implement it.

A summary of international experiences is exhibited in Table 4-2. The approaches currently being used, relevant legislation, and details are displayed in the table.

Table 4-2: Adoption of Net Neutrality by Country (as of August 2020)

	Country	Approach	Legislation/Guidelines	Details
♦	**Asia**			
1	**India**	Active reform	DoT Letter on Net Neutrality Regulatory Framework, dated 31-07-2018	- The recommendation of TRAI regarding net neutrality has been approved by DoT. It was officially effective from July 12, 2018. - The amendments were made on the licenses granted to the ISPs.
2	**Israel**	Tentative refinement	Israel's Communications Law (amended)	- Net neutrality law for fixed-line services was approved by Israel's parliament in 2011, and for mobile services in 2014. - Zero-rating practices are not identified to be prohibited.
3	**Japan**	Tentative refinement	MIC report 2007 Interim report and announcement, 2019	- MIC Report 2007 stated their awareness of net neutrality principles. However, they determined to not officially implement net neutrality rules due to competition concerns. - There are attempts to establish a net neutrality framework in Japan, but it has not happened yet.
4	**Singapore**	Active reform	IDA's Decision and Explanatory Memorandum for the public consultation on Net Neutrality	- IDA published the decision letter in June 2011 to implement net neutrality. - ISPs are not prohibited from throttling services under specific scenarios, such as managing Internet traffic in order to maintain overall user experience.
5	**South Korea**	Cautious observation	Telecommunications Business Act Korea Communications Commission Guidelines 2011, The Citizen's Coalition for Economic Justice and Open Web 2013, 2018	- The act defines some articles about net neutrality principles. However, the KCC has not officially announced the implementation of net neutrality. - There are only guidelines regarding net neutrality, but implementation has not occurred.
♦	**Africa**			
6	**South Africa**	Cautious observation	ICT White Paper 2016	- The ICT White Paper stating the net neutrality rules was released by DTPS in 2016. - There has been no further progress since the release of the white paper.

	Country	Approach	Legislation/Guidelines	Details
♦ **North America**				
7	**Canada**	Tentative refinement	Telecom Regulatory Policy CRTC 2017-104 (policy 2017-104)	- ISPs are allowed to offer differentiated pricing. However, discrimination of content on the network is not permitted.
8	**Mexico**	Tentative refinement	Federal Telecommunications and Broadcasting Law 2014 (updated in 2018) IFT (Federal Telecommunications Institute)'s draft for Traffic Management and Internet Administration 2017	- The draft released by IFT does not prohibit paid priority or zero-rating, both of which are considered violations to net neutrality principles, even though the draft states the adoption of net neutrality.
9	**USA**	Active reform	Restoring Internet freedom order (present) Open Internet Order 2015 (repealed)	- Open Internet Order 2015 was repealed in 2017, going into effect in 2018. The "Restoring Internet Freedom Order" was adopted in 2018. - State government can independently enact the adoption of net neutrality. Currently, there are four states that have enacted net neutrality regulations: Washington, Oregon, Vermont, and California. Apart from that, there are seven states that have issued executive orders; Colorado, Hawaii, Maine. Montana, New Jersey, New York, and Rhode Island.
♦ **South America**				
10	**Argentina**	Tentative refinement	Argentine Digital Law Decree 764/2000 Resolution 05/2013	- Even though the law states the assurance of net neutrality protection, the law is not strictly implemented. Moreover, zero-rating practices are not prohibited in Argentina.
11	**Brazil**	Active reform	Marco Civil of Internet	- The bill named Marco Civil of Internet was implemented in 2014. - The law ensures net neutrality principles. Discrimination practices by ISPs are not permitted, except for limited technical reasons.

	Country	Approach	Legislation/Guidelines	Details
12	**Chile**	Active reform	Law No. 20.453 The General Telecommunications Law was amended by Bulletin 4915	- The law applying net neutrality was implemented in 2010, and it was updated in 2018. - Chile was the first country to put net neutrality into law. - The new law assures net neutrality principles, such as prohibiting ISPs from blocking, discriminating, or distinguishing the content on the network. However, ISPs can offer tiered pricing and speeds to users.
13	**Colombia**	Tentative refinement	The Act 1450	- The law was implemented in 2011. - Violated by zero-rating practices.
	♦ **Europe**			
14	**European Union**	Varies among members	Regulation 2015/2120	- The regulation was approved in 2015 and implemented in 2016. - There is inconsistency between cross-border and internal legal enforcements. - The implementation of net neutrality is quite different among members, and a zero-rating scheme is commonly practiced in the union. On the other hand, some countries have never violated the net neutrality rule. - Most of the countries adopted tentative refinement, but France and the Netherlands are considered active reformers.

	Country	Approach	Legislation/Guidelines	Details
15	**United Kingdom**	Tentative refinement	EU Regulation 2015/2120 (Until December 31, 2020) Communications Act, 2003 and the Wireless Telegraphy Act 2006 (Amended)	- Currently the UK is obligated to submit reports to the BEREC under EU Regulation 2015/2120 until the end of 2020. Afterwards, Ofcom will be in charge under UK law. - Ofcom amended the existing legislation and is using market structure to ensure the transparency in ISPs and mobile operator practices. Additionally, they basically rely on these mechanisms to protect the users from ISP discrimination.
	♦ **Australia**			
16	**Australia**	Cautious observation	The Competition and Consumer Act 2010 (CCA) provides for access regulation, as well as generic competition law	- The existing law already follows the generic competition law, which can be used to prevent discrimination and harmful practices from ISPs. - Regulated services, including ISPs are subject to non-discrimination and relevant requirements. - There is no specific rule applying net neutrality.
17	**New Zealand**	Cautious observation	The Telecommunications Act 2001 The Commerce Act 1986	- The Telecommunications Act 2001 imposes access regulation for ISPs. Moreover, the Commerce Act 1986 states competition law. - There is no specific provision for net neutrality, but ISPs are subject to general regulatory and competition obligations.

Source: ITU, 2012; Jitsuzumi, 2011; Kline, 2019; Nguyen et al., 2020 (adapted by authors)

4.2.4 Net Neutrality in Thailand Context

Thailand is one of the countries where net neutrality has not been imposed with any legislation or regulation. Similar to other countries in the world, such as the UK, Thailand is relying on the existing legislation, especially that of minimum quality of service. The quality-of-service requirement is imposed by the Notification of the National Telecommunications Broadcasting and Telecommunications Commission Re: Standard of Service Quality for Telecommunications Services B.E. 2562. (2019), in which the standard of quality was adopted from the ITU's ITU-TE.800 framework ("Quality of Service refers to the totality of characteristics of a telecommunications service that bear on its ability to satisfy stated and implied needs of the user of the service.") In the notification, there are two aspects of requirement set for ISPs - technical and non-technical approaches. Non-technical measurements include general and customer service quality, such as service activation time, billing accuracy, response time for accessing customer service call centers, and network availability. Technical parameters require ISPs to preserve quality of service with several technical measurements of services, such as voice, messaging, and data. As it relates to data service, there are several measurements, such as File Transfer Protocol or FTP ratio[1] subject to specified data rate (e.g., 75% success before timeout, download speeds for 4G must be at least 2.5 Mbps, and 500 kbps for uploading), Round Trip Time (RTT)[2], and FTP success ration. The NBTC is the responsible authority to monitor quality of service. Telecommunications service operators are subject to this rule as licensees, who are required to comply with the NBTC's regulation. Basically, the NBTC requires telecommunications service operators to submit reports to the NBTC regularly. Quality of Service is used to ensure the standard of quality that users are experiencing, as well as to bolster consumer protection.

With quality of service ensured, customers do not face unacceptable quality when using services that are not the ISPs' partners. Even though non-partner services may offer degraded service quality, it will still not drop to an unacceptable level. This, however, relies on ISPs to manage data traffic.

Table 4-3: Quality of Service Parameters

	Parameter	Target value
Fixed-line service		
Non-technical parameters		
1	Supply time for initial connection	< 10 working days
2	Percentage of service installation completed on or before the date confirmed	> 90%
3	Number of fault reports per 100 subscribers	≤ 5 times per 100 subscribers
4	Fault repair time	≤ 24 hours
5	Billing inaccuracy	≤ 0.3%
6	Response time for accessing customer-service call center	≤ 60 seconds
Technical parameters (Data-service)		

[1] File Transfer Protocol (FTP) is a network protocol used for transferring files between computer from one location to another on the Internet.

[2] Round Trip Time (RTT) is the duration of time, in milliseconds (ms), it takes for a network request to transmit files from a starting point to a destination and back to the starting point again.

	Parameter	Target value
1	Network unavailability: cumulative Last Mile Node outage time in a month ratio	≤ 1 %
2	Round Trip Time (RTT)	< 50 ms
3	Average speed of FTP transfers	≥ 70%
Mobile services		
Non-technical parameters		
1	Service activation time	- For pre-paid ≤ 3 hours (for 90% of all activation time) - For post-paid ≤ 5 hours (for 90% of all activation time)
2	Billing inaccuracy	≤ 0.3 %
3	Response time for accessing customer service call center	≤ 60 seconds
4	Network unavailability: number of cell outages continuously over 4 hours in a month	≤ 15 times/100 cell per month ≤ 10 times/100 cell per month
5	Network unavailability: number of cell outages continuously over 24 hours in a month	≤ 3%
6	Network unavailability: cumulative cell outage time in a month	≤ 1%
Technical parameters (data service)		
1	Round Trip Time (RTT)	1) 2G: ≤ 1,000 ms (1 second) 2) 3G: ≤ 500 ms 3) 4G and over: ≤ 150 ms
2	FTP success ratio	*For Download* ≥ 80% for 2G and over *For Upload* ≥70% for 2G and over
3	FTP ratio subjected to specified data rate	*1) Download* - 4G and over: ≥ 2.5 Mbps - 3G: ≥ 750 kbps - 2G: ≥ 48 kbps (For 75% of all successful FTP in Timeout) *2) Upload* - 4G and over: ≥ 500 kbps - 3G: ≥ 300 kbps - 2G: ≥ 20 kbps (For 75% of all successful FTP in Timeout)
4	HTTP success ratio	- 4G and over: ≥ 90% (less than 1 minute) - 3G: ≥ 90% (less than 3 minute) - 2G: ≥ 80% (less than 10 minute)
5	Streaming service accessibility	-
6	Streaming reproduction success ratio	-

Apart from the quality of services measurement, Thailand also has an antitrust law for telecommunications services, which was imposed in an effort to support a free and fair competition environment. Anticompetitive practices are monitored by the NBTC under the Notification Regarding the Identifying Operators with Significant Market Power in Each Relevant Market and Measures for the Prevention of Monopoly or Unfair Competition in Telecommunications and Broadcasting Business Act B.E. 2557 (2014). Additionally, the Consumer Protection Act B.E. 2522 (1979) is one of the most effective legal mechanisms to protect consumer welfare.

Although regulation regarding net neutrality is not implemented in Thailand, there have been studies and discussions conducted by academics and the private sector. The discussions are mainly about

whether it is necessary to implement net neutrality in Thailand. The results vary greatly between the scholars and the private sector. Most of the studies recommend the adoption of net neutrality. A study by Jarintipitak (2017) proposed that net neutrality should be implemented in Thailand, as well as other regulations, in order to encourage the production of content by the local industry. There are number of studies recommending net neutrality regulation in Thailand, for various reasons. Sirilim (2014) concluded that net neutrality should be adopted to assure the balance of freedom of use and transparent traffic management practiced by ISPs. Similarly, a study conducted by the TDRI (2016) recommended the application of net neutrality for the sake of freedom of speech protection and to prevent unfair competition. Additionally, Wongprasit (2017) stated that net neutrality is required in the case of Thailand to protect users from the intervention of broadband operators. In contrast to the academic studies, the discussion among the private sector, including ISPs and MNOs in Thailand, does not agree with the net neutrality rule. In discussions held by the Internet Governance Forum (IGF) in 2015 and the NBTC in 2017, operators did not support the idea of net neutrality applied to prohibit traffic management. However, they did support the notion if the motivation for implementation relies on consumer protection. With many suggestions and opinions regarding the adoption of net neutrality in Thailand, it seems that there is no single agreed upon answer. It is considered a significant responsibility for policymakers to carefully consider this issue. The next section will discuss the rationale for potentially enacting a net neutrality rule in Thailand on the grounds of free and fair competition among the stakeholders in the market, which would be intended to eventually result in consumer welfare.

4.2.5 Rationale for Adoption of Net Neutrality in Thailand

It is still a challenge for policymakers and regulators in Thailand to consider the adoption of net neutrality in Thailand. Although pressure has decreased since the abolishment of the net neutrality law in the US, this issue is still at the center of international debates. The rationale to adopt net neutrality in Thailand is preliminarily discussed in this section, relying on the guidelines for policy decisions proposed by the literature (e.g., Bauer, 2006; Becker et al., 2010; Krämer et al., 2013). Whether net neutrality should be adopted or not must be justified on the grounds of fair competition resulting in consumer welfare. Competition between ISPs and zero-rating practices are discussed in this part.

1) Competition among Internet services providers

Net neutrality proponents are concerned about competition among ISPs that tends to occur when discriminatory practices are allowed. In these situations, ISPs exercise monopoly or anticompetitive practices. These actions are considered harmful to users (Hahn & Wallsten, 2006). In the case of Thailand, it seems that such a claim is not entirely accurate. Without net neutrality regulation, competition among ISPs and MNOs in Thailand is not concentrated, which is far from what could be

considered "monopoly" status. As shown in the Table 4-4, the competition level of both fixed-line and mobile Internet services is acceptable. With respect to fixed-line Internet services, there are three major operators in the market (True, 3BB, and TOT) and one operator (AIS) that is gaining in popularity. Competition parameters indicate that the market is not highly concentrated. Regarding the Significant Market Power (SMP) identified in the Notification of the National Telecommunications Broadcasting and Telecommunications Commission Re: Identifying Operators with Significant Market Power in Telecommunications Market B.E. 2557 (2014), the SMP must have market share exceeding 40%. The operators control less than 40% of market share, so none of them is considered a SMP. Moreover, the HHI has continuously decreased, from 2,940 to 2,793 between 2017-2019. This implies that there was an increase in competition and a balance of market share. Although the HHI number was over 1,800, which the NBTC defines as a highly concentrated market, this is quite common in the telecommunications market. Apart from the market share and HHI, the average price per month paid by subscribers is decreasing, which presumably suggests that competition between the operators is gaining in intensity, as the Thai telecommunications market engages in a price competition or price war. As the information illustrates, the fixed-line internet market in Thailand is fairly competitive.

Table 4-4: Fixed-Line and Mobile Internet Market in Thailand 2017-2019

Fixed-line Internet													
Indicator	**Operator**	**2017**				**2018**				**2019**			
		Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Market share	**TICC (True)**	38.1%	38.0%	37.9%	38.4%	37.4%	37.6%	37.8%	37.9%	37.8%	37.7%	37.5%	37.6%
	3BB	33.3%	33.5%	33.7%	33.2%	32.1%	32.2%	32.4%	32.0%	32.1%	32.4%	32.4%	31.4%
	TOT	17.9%	17.3%	17.0%	16.7%	18.9%	18.1%	17.5%	17.2%	16.7%	16.2%	16.1%	16.2%
	AWN (AIS)	4.9%	5.7%	6.0%	6.3%	6.5%	7.0%	7.4%	8.0%	8.5%	8.9%	9.5%	10.3%
	Others	5.7%	5.5%	5.4%	5.3%	5.1%	5.1%	5.0%	4.9%	4.9%	4.7%	4.6%	4.4%
HHI		2,940	2,930	2,929	2,927	2,855	2,854	2,858	2,847	2,838	2,837	2,824	2,793
Monthly Average price per user (Baht)		617	631	642	641	617	619	615	609	596	582	586	588
Users		7.57	7.79	8.02	8.21	8.73	8.91	9.08	9.19	9.36	9.57	9.86	10.10
Revenue (Million Baht)		16,100	16,600	15,300	15,700	16,300	16,700	17,000	16,900	16,900	17,000	17,700	18,100

Mobile Internet													
Indicator	**Operator**	**2017**				**2018**				**2019**			
		Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Market share	**AIS**	45.6%	44.6%	45.0%	46.0%	45.9%	45.8%	46.4%	46.9%	47.6%	47.9%	43.5%	44.9%
	Dtac	28.5%	29.7%	29.8%	29.4%	29.8%	30.3%	30.2%	29.8%	29.3%	28.8%	21.7%	22.1%
	TRUE	23.9%	23.6%	23.0%	22.4%	22.0%	21.6%	21.1%	21.1%	20.9%	21.1%	32.0%	30.2%
	CAT	1.0%	1.1%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.5%	1.5%
	TOT	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%	0.3%	0.3%	0.3%	0.4%	0.4%
	Others	0.7%	0.7%	0.7%	0.7%	0.8%	0.8%	0.7%	0.7%	0.7%	0.7%	0.9%	0.9%
HHI		3,462	3,428	3,442	3,480	3,482	3,486	3,513	3,530	3,560	3,570	3,393	3,417
Average price per user (Baht)		0.19	0.19	0.15	0.14	0.14	0.15	0.15	0.16	0.17	0.17	0.17	0.17
Users		38.5	39.4	40.2	41.0	42.0	42.6	43.3	43.8	44.4	45.1	45.7	46.3
Revenue (Million Baht)		27,529	29,494	30,232	31,593	32,646	34,188	34,511	34,823	35,051	35,332	44,131	46,698

Source: NBTC report on telecommunications market 2017-2019, GSMA, cited in Jirakasem & Smerchuar (2021)

The mobile internet market is one of the steadily growing markets in the telecommunications sector (Srinuan et al., 2012). However, as the mobile internet market is less mature than the fixed-line internet market, the competition level is relatively limited, and fluctuates over time. Considering the growth of mobile internet services, it is growing at a much faster rate than fixed-line usage - four times larger, in fact, with revenue from mobile users double that of fixed-line subscribers. Nevertheless, as the competition level is still not on point, there are mechanisms to prevent anticompetitive practices, such as identifying SMPs and enforcing specific rules aimed at those SMPs. The National Telecommunications Commission identified all of the mobile network providers in Thailand (AIS, True, Dtac, TOT, and CAT) as operators with Significant Market Power (SMP) under the Order of the National Telecommunications Commission No. 32/2553 Re: Identifying Operators with Significant Market Power in Each Relevant Market and the Operators with Significant Market Power to comply with Specific Measures B.E. 2553 (2010). With this notification, the practices of those operators are closely monitored by the regulator. For example, requiring operators to separate accounts by type of service and submit data and information about services charges and rates to the commission for supervision. Furthermore, if there are actions that foreseeably lead to a monopoly, the regulator can impose regulations to avoid those circumstances. Nevertheless, there are several analysts stating that the mobile market in Thailand is "intensely competitive" and in a price war (Bloomberg, 2019; Phoosuphanusorn, 2017). This may be caused by the uncertainty between the standard indicators, such as HHI, and the actual value and price level in the market.

Overall, the competition among ISPs and MNOs in Thailand is considered healthy. Although the level of competition is not high, as determined by law, there are mechanisms to prevent anticompetitive practices. Thus, concern about competition is not a solid assumption motivating net neutrality support in Thailand.

2) Zero-rating practices

Zero-rating is the tariff that mobile networks usually offer to end-users to access particular content without an additional data charge (Krämer & Peitz, 2018). Generally, the content providers or the ISPs subsidize those costs instead of charging the end-users. In a survey collected from 180 countries in 2014, 49% of mobile operators practice zero-rating (Allot, 2014 cited in Somogyi, 2017). Thailand is one of those countries in which operators are utilizing such a scheme, especially those mobile network operators that have their own networks—AIS, True and Dtac (Santhi, 2019). Zero-rating is considered a violation of net neutrality issues, yet it is used as criteria whether or not net neutrality should be implemented. Proponents of net neutrality are concerned that zero-rating can harm users and even forfeit fair competition in the market. Thus, if zero-rating is considered harmful, net neutrality should be applied in order to forbid those practices. Actually, zero-rating can be categorized into at least four types: single-site or service zero-rating, sponsored data, compound zero-rating, and faux (non-selective) zero-rating (Carillo, 2016). Single-site or service zero-rating is a scheme in which a content provider contracts with one or more telecommunications operators to provide service access to the end-users free of charge. In this scheme, unlike sponsored data, the content providers in this group have to pay the telecommunications operator for granting the end-users access to the content free of additional data consumption charges. Compound zero-rating is a scheme wherein the third party or sponsoring company contracts with the telecom providers to allow the end-users to access particular content. The sponsoring company can subsidize the data consumption cost, with consultation with government authorities. For the last group, faux (non-selective) zero-rating, this plan matches content provider partners with one or more telecommunications provider to offer limited amounts of free data to users under certain conditions, such as viewing advertisements. This group is considered not zero-rating, and also not anticompetitive practices. The main goal of this kind of scheme is to attract new users.

The zero-rating practices in Thailand can be summarized as follows:

1) Most of the zero-rating is undertaken by popular mobile applications, such as Facebook, LINE, and YouTube.

2) Exclusive content provided by a particular provider is rarely found. Basically, the applications used by operators in zero-rating programs are also used by other operators.

3) Conditions of use are quite restrictive, and include caps on speed, data, and time.

4) ISPs frequently offer data exemptions on their own applications, such as TrueID by True and AIS Play by AIS, but they still have restricted usage.

5) Compared to fixed-line internet services, zero-rating is usually found in mobile services.

Overall, it can be said that zero-rating service in Thailand conforms primarily to the last type of zero-rating - faux zero-rating, which is used by most of the telecommunications operators as a strategy to attract new users and compete against rival companies. Zero-rating in this group is used as "product differentiation," employed by the operators to differentiate themselves from their rivals. It is a characteristic of competition (Eisenach, 2015; Krämer & Peitz, 2018). Allowing ISPs to offer different packages should positively result in consumer welfare. This ends up being a benefit to users because they can choose the most efficient package, assign personal value to each attribute, and minimize the cost. In addition, these options allow ISPs to observe users' preference in the market and modify their services to make the most of the data they collect, along with innovating new packages and products that better fit their users' lifestyles.

When looking closely at zero-rating practices, it can be concluded that Thailand's faux (non-selective) zero-rating plans are not actually zero-rating, thus they cannot be a compelling rationale to recommend net neutrality in Thailand.

In summary, competition in the Internet market in Thailand is not a concern. The justification motivating a net neutrality system is not sufficient at this point in time. The rationale for net neutrality as a driver of competition and consumer welfare is not considered to be solid enough. Moreover, when weighing other risks, such as decreasing investment incentives, an overly regulated market negatively impacting the free market, and the status quo of the current system, non-net neutrality is more appropriate for the time being. For all of the reasons above, light-touch regulations should remain in place until there is compelling evidence to suggest that net neutrality would be better suited to the situation in Thailand.

4.2.6 Conclusion

After the repeal of the net neutrality rule in the U.S. in 2017-2018, net neutrality became an even more controversial topic of debate, marking an increased challenge for governments and policymakers around the globe, Thailand included. This section aims to tackle the issue and provide guidelines regarding the handling of net neutrality for policymakers in Thailand, assessing the appropriateness of net neutrality within the Thai context in terms of competition associated with consumer welfare. The motivation to implement net neutrality is posited for varied reasons, one of which is competition hindrance resulting in declining consumer welfare. Content analysis on primary and secondary data sources was used. The results indicate that a hindrance in competition was not observed.

Moreover, zero-rating practices, which are considered to be anti- net neutrality, leading to consumer harm, is not as severe as expected by net neutrality proponents. The reason being that zero-rating programs employed by ISPs and MNOs in Thailand are only used to attract new customers, not to hide or obscure cooperation between ISPs and CPs. In addition, the NBTC has established an anti-competition law limiting monopolistic tendencies of ISPs. The NBTC has also established consumer protection regulations requiring ISPs to safeguard user benefits. Through all of these considerations, the compelling rationale to switch to a net neutrality policy is not appropriate for Thailand at the moment. As a recommendation to policymakers, ex-post or light-touch regulation is preferred. The government does not need to intervene into the market to over-regulate the current situation and worsen the terms of the free market. Additionally, antitrust laws are encouraged to be implemented rather than net neutrality regulation until there is solid evidence indicating that net neutrality is needed. If the time comes when net neutrality is necessary, it should be carefully implemented and regulated, with an eye on any changes to the telecommunications industry and their effect on the future.

Section 4.3 Discussion and Conclusion

Regarding the regulatory landscape narrated in the first section, and the discussion concerning net neutrality in Thailand in the second section, there are interesting points to be considered. As previously mentioned, Thailand does not have sufficient authority to regulate OTT. It comes as no surprise, as other countries are confronting the same issue. When domestic authorities cannot reach OTT players situated outside the country, other mechanisms, such as intergovernmental organization, might be necessary. For this reason, it is understandable why the NBTC is attempting to convince ASEAN members to jointly establish rules for OTT. At a meeting of the ATRC in 2019, which took place in Thailand, the NBTC proposed two plans for OTT regulation. First, OTT players would be required to establish an office in Thailand, along with sharing 51% of their local ownership stake. Second, a surcharge would be calculated by the volume of data transmitted over the Internet gateway. Both two methods were opposed by several stakeholders on the grounds of their unfeasibility to implement. Nonetheless, the Ministry of Finance of Thailand, the authority for tax collection, suggested locating the Internet gateway in ASEAN and requiring users to pay fees to OTT by forcing them to go through this gateway. At that point, the revenue obtained from user fees would be distributed to the OTT operators in each country (Bangkok Biz News, 2018). This plan and its procedures are yet to be accepted by the members. One major criticism is that the regulator, including the NBTC, does not comprehend the situation of the ecosystem, especially the real business ecosystem of OTT (Tortermvasana & Leesa-nguansuk, 2019).

It seems that the regulators and policymakers in Thailand are mainly focusing on tax and security issues and paying little interest to other concerns, which are also important and have been scrutinized internationally. The issue of the substitution between OTT and traditional services, especially in the case of OTT communications and traditional telecommunications services, is one of those issues. While statistics indicate that replacement is occurring, the plans and policies for OTT from those authorities are not related to this issue. It is possible that an empirical study regarding this issue in Thailand is not yet available. However, the actions of the regulator should be based on the evidence. Thus, the actual impact of OTT in Thailand needs to be investigated. After this chapter, the analyses on the users and MNOs side are performed. If the results indicate the impacts are expected to negatively affect the telecommunications market in Thailand, the regulator should rush to intervene. With the results, the policy or regulation can be improved in order to maintain a fair market in Thailand.

As discussed in the second section, net neutrality is not appropriate for the Thai situation. This means that without enacting net neutrality, ISPs and MNOs are not required to follow nondiscrimination rules; they can use any means to manage data on their networks. They may prioritize data from specific sources, throttle any sources, or even block media without penalty, as long as there are no complaints from their users. With this condition in place, if ISPs or MNOs find that any OTT is negatively affecting their network, they have the right to manage the data from those OTT service providers. In that sense, governmental intervention to protect the MNOs and ISPs is presumably unnecessary. However, actual experiences from MNOs are needed to justify this claim. This issue will be discussed in greater detail after analyses of the MNOs are completed.

Chapter 5
Consumer Behavior
(Users' Perspective)

This chapter[1] aims to explore the usage patterns of Thai users of OTT communication services. Firstly, it examines the relationship between the use of OTT and traditional telecommunications services, which include mobile voice calling and SMS. This section was motivated by the claim of OTT opponents that OTT is substituting traditional telecommunications services. Secondly, to further understand the usage behavior in using OTT, the factors associating with the use of OTT services are investigated. With all of these results, it will completely illustrate the consumer behavior in using OTT services in Thailand.

Section 5.1 Introduction

Over-the-top (OTT) communication services are one of the most prominent issues in the telecommunications field today. As a rising actor in the market, OTT is considered a disruption affecting the structure of the ecosystem (Baldry et al., 2014). Consequently, OTT is at the center of debates for a variety of reasons, most notably whether it is substituting the traditional telecommunications services. Analysts have stated several reasons causing the displacement. For example, compared with traditional telecommunications services, specifically mobile telephony and SMS, OTT functions identically. Moreover, in users' perceptions, OTT offers a cost advantage, because users can access these services on the Internet at no additional cost. For this reason, there is a claim that OTT presents a threat to traditional telecommunications services as "substitute services" (e.g., Joshi et al., 2015; ITU, 2017; Stork et al., 2017; TRAI, 2015; Wansink, 2014). Furthermore, the number of OTT users or subscribers, along with revenue, are rising quickly, as is the skyrocketing increase of smartphone penetration. All the while, the use of traditional services is declining. This emphasizes the assumption of many analysts stating that OTT is replacing traditional services and is a threat to traditional services.

Nonetheless, there is limited empirical evidence to support this claim, especially in the case of Thailand. Without the results, actual consumer behavior cannot be clearly understood, resulting in difficulty in establishing an appropriate regulatory framework. Thailand is a country where the

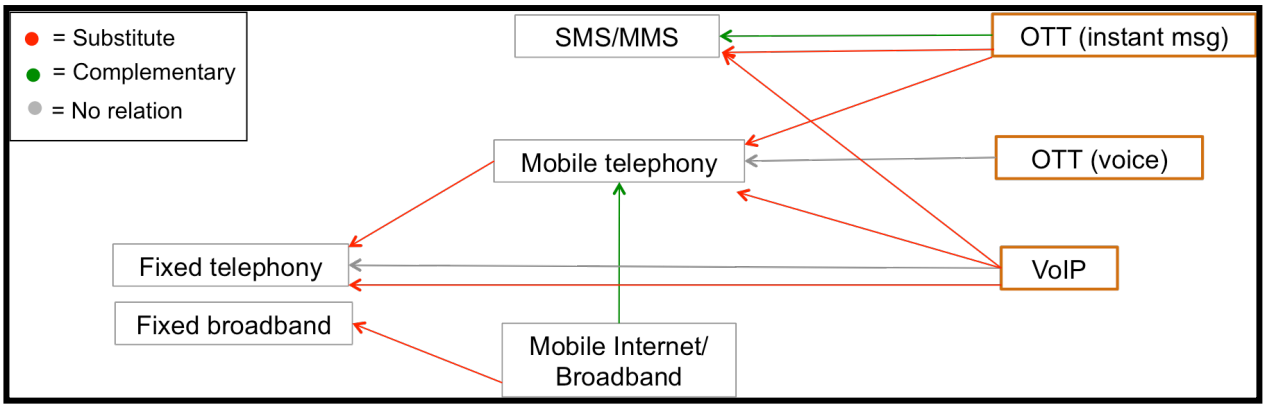
[1] Part of this chapter is based on the conference papers titled "Substitution between mobile telephony and OTT communications services: the case of Thailand?" (Jirakasem & Mitomo, 2018) and "Relationship of Over-the-top (OTT) communications services and traditional telecommunications: the case of Thailand" (Jirakasem, 2019b) by the author.

regulatory framework for OTT has not been concretely created, as illustrated in the last chapter. The regulation must be carefully constructed on the grounds of the actual impact of OTT and consumers' behavior in the market. Consequently, there are two main objectives for this chapter. Firstly, to examine the impacts of OTT communications services on the use of traditional telecommunications services - namely mobile telephony and SMS. In addition, the factors associated with OTT services adoption are investigated. These objectives are expected to contribute to the field of telecommunications because empirical studies on this topic, particularly in Thailand, are scarce. The next step is to create guidelines for players in the telecommunications field, including mobile network operators and policymakers in Thailand.

Section 5.2 Literature Review and Research Questions

5.2.1 Substitution between Old and New Telecommunications Services

Figure 5-1: Literature Review on Substitution of Telecommunications Services



Source: Author

Substitution between older and newer services has been the center of interest among researchers in the field of telecommunications for decades, especially the substitution between fixed-line and mobile telephony, and is well known as Fixed-Mobile Substitution (FMS). Most of the FMS studies revealed that fixed-line telephony was merely substituted by the new service, mobile telephony (e.g., Grzybowski & Verboven, 2016; Rodini et al., 2003; Vogelsang, 2010; Ward & Woroch, 2004). Along with FMS, when the Internet started diffusing among users, especially the Internet on mobile devices, the study of substitution between fixed-line and mobile Internet became more acute. Similar to FMS, the results presented in these studies suggest a substitutable relationship between fixed-line and mobile broadband (e.g., Cardona et al., 2009; Nakamura, 2015; Srinuan et al., 2012) These studies demonstrate that the

era of fixed-line services had come to an end and was being replaced by newer services at the time - mobile services.

In the recent years, online services have been getting more powerful, both in terms of usage and their impact on the economy, owing to technological development and more affordable prices of smartphones and Internet access. OTT communication services are one of those services. OTT communications are a new challenge for the mobile telephony (Chen, 2019). Mobile telephony, as well as fixed-line services, are regarded as the traditional telecommunications services in several studies (e.g., ITU, 2017; Meffert & Mohr, 2017). Recently, the substitution between traditional telecommunications services and a new generation of communication services provided via the Internet are becoming a significant interest in the field of telecommunications studies. With respect to the studies on OTT communications, they are quite limited in number so far, yet they are also significant. Arnold et al. (2016) conducted a survey and semi-structured interviews in Germany to identify the usage pattern of OTT communications and traditional telecommunications services among German consumers. Their research failed to provide sufficient evidence that OTT communication services are replacing electronic communications services (ECS), as they consider OTT a like-for-like substitute. Another study, by Ogidiaka and Ogwueleka (2019), examining consumer behavior in Nigeria, presented a complementary relationship between those two kinds of services. They found that even though the users prefer OTT services over traditional services, they do not rely solely on OTT services, owing to the higher degree of reliability of traditional telecommunications services. Voice service was not the only focus of the study; messaging service was also investigated. The study of Wellman (2019) examining the relationship between OTT messaging and SMS revealed an interrelated relationship between those services in the Norwegian market. These studies oppose the notable claim that OTT services are replacing traditional telecommunications services. However, there are studies that have found that new kinds of services are in fact replacing traditional telecommunications services. One of those is the study of Mäkinen et al. (2014). They studied the usage behavior of Facebook users in Finland. The results indicate that users tend to replace their traditional mobile voice calling and SMS through the use of mobile Facebook services. Thus, studies looking at OTT services are presenting different results depending on the context of the country involved.

Although the studies exclusively focusing on OTT are limited, there is a significant amount of literature analyzing telecommunications services that resemble OTT, such as VoIP, and service reflecting the use of OTT, such as mobile Internet. However, the findings are diverse. Some of these studies, such as that of Cecere and Corrocher (2012), found that VoIP was negatively related with mobile voice calling in Italy. Furthermore, Lange and Saric (2016) found that VoIP substituted fixed-line telephony in the European market. Nevertheless, there are studies suggesting that new services complement traditional services. One of those studies, conducted by Gerpott and Meinert (2016), found that mobile Internet complemented mobile voice calling in German residential postpaid subscribers. On

the other hand, the study of Kwak and Lee (2011) found that the traffic substitution of mobile and VoIP was insignificant in Korea. The study of Lee (2011) also proposed that VoIP in Taiwan only partially displaced the traditional services, such as home landline.

When looking at the function of text messaging, Gerpott (2015) found that the intense use of SMS both complemented and substituted mobile Internet across different timeframes. This finding is consistent with the study of Karikoski and Luukkainen (2011) that posited the relationship between SMS and messaging applications and mobile Internet would be substitutable and complementary in certain situations.

As stated, the results of new generation services are quite diverse, depending on the country. Thus, it is interesting to explore the relationship between OTT communications services and traditional telecommunications services in Thailand. In other words, what are the impacts of OTT use on those of traditional telecommunications services? In light of existing literature, the following research questions are proposed: *To what extent does the use of OTT communications services affect mobile voice calling? And what extent do OTT communications services affect SMS use?*

Prior studies have asserted that OTT are not replacing traditional telecommunications services. Thus, the positive relationship between OTT and traditional telecommunications services is expected in this study.

1) Mobile voice calling

Hypothesis 1: Use of mobile voice calling is significantly positively correlated with use of OTT voice calling.

Hypothesis 2: Use of mobile voice calling is significantly positively correlated with use of OTT messaging.

2) SMS

Hypothesis 3: Use of SMS is significantly positively correlated with use of OTT voice calling.

Hypothesis 4: Use of SMS is significantly positively correlated with use of OTT messaging.

5.2.2 Factors Associated with the Use of New Services

Scholars have not only investigated how the relationship between the use of OTT communications and traditional telecommunications services impacts on those services, but also the factors relating to the adoption and use of OTT communication services. A great deal of the literature has attempted to find the relevant factors leading to OTT, including its new innovations, and the relevant services, such as VoIP and mobile Internet. Basically, the factors examined in prior studies can

be roughly clustered into three groups: the attributes of technology, compatible devices or supportive environment, and the characteristics of adopters (e.g., Arnold et al., 2016; Cecere & Corrocher, 2011; Cecere & Corrocher, 2012; Gerpott, 2010; Gerpott, 2015; Liu & Li, 2010; Rogers, 1995).

The first group contains the attributes of innovations based on the diffusion of innovation theory introduced by Everett Rogers (1995), such as the complexity and compatibility of services. Complexity is an important factor, observed in many studies on internet-based services. Complexity means "the degree to which an innovation is perceived as relatively difficult to understand and use" (Rogers, 1995, p. 242). It is often regarded as ease of use or perceived ease of use in the technology acceptance model. It is asserted that complexity is negatively associated with the rate of adoption of new innovations. In other words, people are more likely to adopt a new innovation as long as they perceive it as easy to use. This attribute was examined in multiple studies. The majority of the results of these studies indicate that complexity negatively influences the adoption of new technology, including OTT communications and relevant services. For example, the study of Cecere and Corrocher (2012), which mainly focuses on the use intensity of VoIP, found that more advanced IT skills of respondents, which was used as a proxy for the complexity variable, positively correlated with the use of VoIP in Italy. Shin (2012), who also focused on VoIP adoption, found similar results; ease of use was positively associated with VoIP adoption in Korea. Apart from VoIP adoption, a study on adoption of WhatsApp in South Africa conducted by Shambare (2014) presented the significance of user-friendly features. Furthermore, Liu and Li (2010), studying Mobile Internet diffusion in China, also found that ease of use was important for mobile Internet adopters. At the same time, this factor was usually included not only in the adoption of OTT services OTT, but also in internet-based services. For instance, the research of the work of Ngai et al. (2007), examining the adoption of Web Course Tools (WebCT), and Leong et al. (2011), examining mobile entertainment adoption, found positive results for ease of use in new innovation adoption.

Nonetheless, there are some studies that have found that adopters may not consider this factor crucial. The study of Al-Jabri and Sohail (2012) focused on the adoption of mobile banking in Saudi Arabia. Surprisingly, they found that complexity was an insignificant factor in mobile banking adoption due to the characteristics of the respondents, which were largely from the younger generations. Overall, and even accounting for some exceptions, it cannot be denied that complexity or ease of use is generally a crucial determinant when it comes to the adoption of new services or innovations.

Another attribute generated from the same theory is compatibility. Compatibility refers to "the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 1995, p. 224). Actually, this factor can be applied to several aspects, such as compatibility with experiences, personal needs, or social norms. It has been hypothesized that potential users are more likely to adopt the innovation if it is considered to be compatible with the adopters' needs, values, beliefs, or experiences (Rogers, 1995). This attribute was included in several

studies, and most of the researchers found that it was consistent with such an assumption. For example, a study by Kai-ming Au and Enderwick (2000) showed that compatibility is positively associated with technology adoption. Similarly, Saaksjarvi (2003) found that the respondents' determination to adopt technological innovations depended on their knowledge and compatibility with the existing values, past experiences, and needs. Furthermore, Ghobakhloo et al. (2011) found that perceived compatibility is a crucial factor influencing e-commerce application adoption among SMEs' CEOs in Iran. A study by Cecere and Corrocher (2012) revealed that experience in using relevant technological programs, such as frequency of Internet usage, led to a positive relationship between Internet usage and VoIP. Compatibility is considered an important factor, as emphasized in the work of Kim et al. (2009), focusing on mobile entertainment service adoption.

The second group is made up of compatible devices and the environment, such as smartphone ownership and high-speed Internet access. This factor is crucial when it comes to OTT communication services studies, as in order to use OTT, it requires supportive devices and the proper environment. A study by Joshi et al. (2015) asserted that smartphone ownership and Internet access are very crucial factors affecting the adoption of OTT services, while a study by Gerpott (2015) proposed that the smartphone is one of the factors associated with the volume of mobile Internet use intensity. Arnold et al. (2016) also found similar results, that smartphones and Internet bandwidth affect the decision to adopt OTT services.

The third and final group of factors associated with the use of new services contains the characteristics of the users. Socio-demographic characteristics of the respondents are included to further understand consumer behavior in adopting and using the services. This group of factors, such as gender, educational level, occupation, and age, is very important in leading to the adopting of new services, including OTT communication services. Arnold et al. (2016) found that younger ages and higher household incomes are positively related with the usage of OTT communications services. Likewise, the study by Gerpott (2015) found that females are more likely to use mobile Internet service, which is a newer innovation, rather than SMS. Cecere and Corrocher (2011) found that users who are employed and housewives and disabled users are more likely to make voice calls over the Internet or VoIP. However, there are some studies that have found inconsistencies in the results of some variables. For example, the study of Cecere and Corrocher (2011) found that younger ages negatively associated with the usage of VoIP, which was in contrast to expectations. Nevertheless, the characteristics of respondents can extend the understanding towards the adoption of new services, especially OTT communication services, of which the literature is scarce at the moment.

There are many potential factors which might be related to the adoption of OTT communications. The second research question posits, *what user characteristics and factors are associated with the adoption of OTT communication services?* Previous studies suggest that there are three groups of

determinants that potentially affect OTT communication services use: the attribute of the technology, the supportive environment, and the socio-demographic characteristics. All three are investigated in this chapter. In order to answer the research question above, based on previous studies, three hypotheses formulated around three groups can be posited, as follows:

Hypothesis 1: IT skills and IT jobs are significantly related with the use of OTT communication services.

Hypothesis 2: A supportive environment is significantly related with the use of OTT communication services.

Hypothesis 3: Socio-demographic characteristics are significantly related with the use of OTT communication services.

Section 5.3 Relationship between OTT Communication Services and Traditional Telecommunications Services

5.3.1 Methodology

5.3.1.1 Survey and Data Collection

This section relies on cross-sectional data collected through face-to-face surveys conducted in April and May 2019 in Thailand. The data was collected by a professional consulting company named IT Survive, located in Bangkok. The dataset contains 1,052 observations from respondents in five regions: the Bangkok metropolitan area, and the central, northern, northeastern, and southern regions. The number of respondents collected in each region was determined by the density of the population. The information on the population was retrieved from the Ministry of Interior, Thailand and compiled by the Fiscal Policy Research Institute Foundation (FPRI) 2017, which made it available at the time of data collection. The data was collected from at least two provinces within each region. The participants had to be at least 18 years old and must own a smartphone to affirm their ability to access all of the choices - both traditional telecommunications services and OTT services. The pilot survey was conducted on 100 respondents in Bangkok before the actual survey was performed in order to check the language and understanding between the respondents and data collection staff.

Table 5-1: Number of Respondents from Five Regions of Thailand

Region	Population	Proportion	Number of Respondents
Bangkok metropolitan area (Bangkok)	10,831,988	0.16	160
Central region	11,869,296	0.18	180
Northern region	12,098,164	0.18	232*
Northeastern region	21,989,477	0.33	330
Southern region	9,399,578	0.15	150
Total	66,188,503	1	1,052

Source: Fiscal Policy Research Institute Foundation (FPRI) adapted by author

* with over determined numbers

The questionnaire was designed and primarily adapted from a previous survey conducted by the NBTC in 2014. It comprised three essential sections:

(a) Socio-demographic characteristics: this part of the questionnaire collected information on the respondents, including gender, age, marital status, educational level, occupation, average monthly income, and region of residence. Details such as address, province, and postal code were asked in order to confirm the accuracy of data collection procedures.

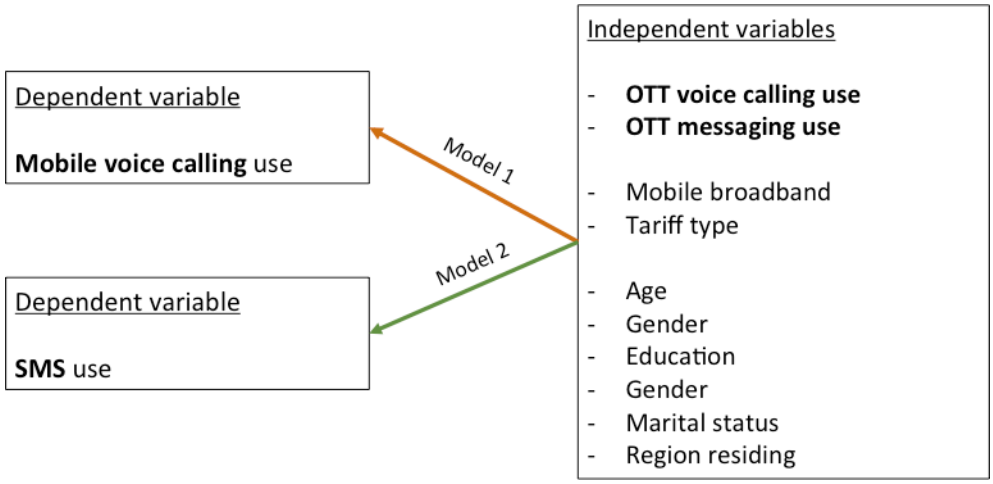
(b) Information related to the usage of traditional telecommunications services: the respondents were asked whether they subscribe to fixed line and/or mobile Internet. They were then asked how frequently they made voice calls and sent SMS on their devices; they were asked to estimate their use intensity. They were also asked about their current internet package and subscription to check the type of mobile Internet they were using. In order to confirm the package or promotion they were subscribed to, the respondents were required to dial *165*1# on their own mobile phone, which would display the subscription information, including their main service and any on-top services, on the screen of their device. This service is provided by the NBTC for all mobile subscribers regardless of which mobile network operator they subscribe to. This process was used to check the recall of respondents, who may have remembered their service plan incorrectly, which could have led to incorrect results.

(c) Information related to the usage of OTT services: the respondents were asked whether they use OTT communications services. A brief definition of OTT communication services was explained to the respondents. Pictures of the logos of popular OTT communication services, which include LINE, Facebook messenger, Skype, WhatsApp, and WeChat were presented, as some of the respondents were more familiar with the logos than the names of the applications. Afterwards, if the respondents did not use any OTT communication services, they were told to skip the questions regarding OTT usage. If they did use those applications, they were asked about the frequency of their use of these applications in

the same manner as they were asked about the frequency of use of their traditional telecommunications services and which features they used - voice calling and messaging, as well as other features.

5.3.1.2 Variable Specification and Analysis

Figure 5-2: Variables Included in the Analysis



1) Actual use of the service

This study aimed to investigate the relationship of OTT and traditional telecommunications services, so the main variables were OTT and mobile telephony use. In general, the substitution effect study used price in the analysis. The cross-price elasticity of demand is typically used as the indicator for the substitution magnitude of services. Because OTT communications services are provided at no cost in the two-sided market business model, some studies use the price of Internet service or the bundling price as a proxy (e.g., Lange & Saric, 2016). However, using internet pricing as a proxy does not always tell the whole story, because customers do not only use OTT services, but also other online services at the same time. Consequently, the price of the Internet alone does not reflect the actual price of OTT communications services. For this reason, the relationship between services in this study relies on the actual use of the services (Cecere & Corrocher, 2011; Cecere & Corrocher, 2012; Gerpott, 2010; Gerpott, 2015; Gerpott et al., 2014; Karikoski & Luukkainen, 2011; Wellman, 2019). In adhering to the existing literature, the respondents will be asked if they use the services over a certain time period.

2) Mobile broadband

Consumers may use OTT services rather than traditional telecommunications services if they have access to high-speed Internet. Mobile Internet leads to a higher prevalence of mobile voice calling (Gerpott et al., 2014) and SMS (Gerpott, 2015), thus these two variables are included in two models, both mobile voice calling and SMS.

3) Tariff type

There are four types of tariff plan in this study. In general, the MNOs in Thailand offer four types of packages to consumers. The first one is a bundling package or flat rate plan. This kind of package is very popular in Thailand. It permits hundreds of free minutes of calls and a sufficient volume of data at a fixed subscription fee. This plan also allows unlimited mobile voice calls, usually in-net calls, and data with a cap on the speed. The three dominant mobile operators provide the services under similar conditions: if the user's call minutes exceed the fixed limit, the customer will be charged at 1.50 THB, or approximately 0.05 USD per minute over the limit. In the case that data usage exceeds allowance, there is no additional charge, but the data speed will be slowed to approximately 128 kbps or 256 kbps, which is generally considered insufficient to make a good quality VoIP call. The second tariff plans have use-dependent rates for mobile voice calling, and a flat rate price for Internet access. The third tariff plan flips the pricing from the second tariff plan, offering a flat rate price for mobile voice calling and a use-dependent package for data usage. Generally, these two groups of subscribers use multiple packages comprising the basic package and add-on packages, which are variously provided by the MNOs nowadays. The last plan is a use-dependent scheme for both mobile voice calling and data usage. This group of users generally does not subscribe to any promotional package. In other words, it is a starter package for new, prepaid users who have not registered with any particular plan. With this plan, mobile voice calling is charged per minute of use, while Internet usage is automatically charged per MB if the users connect to the Internet.

SMS and MMS are generally not included in any of the bundling packages. SMS users are charged approximately 3 THB, or 0.095 USD, per message, and 4–5 THB, or 0.13–0.16 USD, per MMS message. Only use-dependent plans for SMS and MMS are offered.

4) Socio-demographic characteristics

Socio-demographic characteristics were important components in the analysis. Besides being control variables, socio-demographic-related variables might reflect usage patterns (Gerpott & Meinert, 2012; Srinuan et al., 2012). Gender, age, educational level, and marital status are included. Moreover, regions in which respondent reside was put into the model. People living in the Bangkok metropolitan area were more likely to enjoy a better quality of facilities, including Internet connection, compared to other regions. Thus, there might be developmental differences in the telecommunications infrastructure among the regions in Thailand, which could result in differing usages of communications services.

In the analysis, probit was used to retrieve the results, along with the marginal effects. Prior to delineating the results, the description of the variables and descriptive data is presented in the Table 5-2. The total number of respondents was 1,052, comprised of 534 male respondents and 518 female respondents. According to the National Statistical Office (NSO) of Thailand in 2018, the number of

males in the national population was 32,605,100 and the number of females was 33,953,835. This means the Thai population in 2018 was approximately 49% male and 51% female. The dataset was 51% male and 49% female for this study, not exactly the same ratio, but very close. The average age of the respondents was 35.33 years old, and the average monthly income was 23,383 Baht, or around 746 USD.

Table 5-2: Description of Variables

Variable	Definition	Mean	Std. dev.	Min	Max
Dependent variable					
MOBILE VOICE (model 1)	Takes value 1 if individual uses mobile voice calling once per day or several times per week and 0 if otherwise	.683	.465	0	1
SMS (model 2)	Takes value 1 if individual uses SMS once per day or several times per week and 0 if otherwise	.145	.353	0	1
Independent variable					
OTT voice	Takes value 1 if individual uses OTT voice calling once per day or several times per week and 0 if otherwise	.570	.495	0	1
OTT messaging	Takes value 1 if individual uses OTT messaging once per day or several times per week and 0 if otherwise	.880	.325	0	1
Fixed bb	Takes value 1 if individual is subscribed to fixed line broadband and 0 if otherwise	.683	.466	0	1
Mobile bb	Takes value 1 if individual is subscribed to mobile broadband and 0 if otherwise	.946	.226	0	1
Tariff 1	Takes value 1 if individual is subscribed to non-use-dependent plan for both mobile voice calling and Internet and 0 if otherwise	.812	.391	0	1
Tariff 2	Takes value 1 if individual is subscribed to use-dependent package for mobile voice calling and non-use-dependent plan for Internet and 0 if otherwise	.093	.291	0	1
Tariff 3	Takes value 1 if individual is subscribed to non-use-dependent plan for mobile voice calling and use-dependent for Internet and 0 if otherwise	.003	.053	0	1
Tariff 4	Takes value 1 if individual is subscribed to use-dependent for both mobile voice calling and Internet and 0 if otherwise	.092	.289	0	1
Gender	Takes value 1 if individual is male and 0 if female	.508	.500	0	1
Age	Indicates the age of the individual	35.331	10.797	18	74
Marital status	Takes value 1 if individual is married and 0 if otherwise	.632	.482	0	1
College	Takes value 1 if individual graduated from college and 0 if otherwise	.622	.485	0	1
Income	Indicates the average income per month of individual (Thai Baht)	23383.1	14592.18	0	100000

Bangkok	Takes value 1 if individual resides in the Bangkok metropolitan area and 0 if otherwise	.152	.359	0	1
Central	Takes value 1 if individual resides in the central region and 0 if otherwise	.171	.377	0	1
North	Takes value 1 if individual resides in the northern region and 0 if otherwise	.221	.415	0	1
Northeast	Takes value 1 if individual resides in the northeastern region and 0 if otherwise	.314	.464	0	1
South	Takes value 1 if individual resides in the southern region and 0 if otherwise	.143	.350	0	1

* Italic variable is used as the base variable

** Independent variables included in the first model only

Nevertheless, the OTT services variables are comprised of voice calling and messaging. As they are usually included in the same application, the multicollinearity between the variables is doubtful. For this reason, a collinearity check was performed. The results are shown in the Table 5-3. According to the results, there is no VIF or tolerance that exceed value 10.00. The values demonstrated in Table 5-3 show that multicollinearity does not occur in the model.

Table 5-3: Multicollinearity Diagnostics

	Mobile voice calling		**SMS**	
Variable	Tolerance	VIF	Tolerance	VIF
OTT voice	.711	1.406	.722	1.386
OTT messaging	.731	1.369	.732	1.367
Mobile bb	.565	1.770	.757	1.322
Tariff 2	.836	1.195		
Tariff 3	.975	1.026		
Tariff 4	.645	1.550		
Gender	.986	1.015	.988	1.012
Age	.560	1.786	.561	1.783
Marital status	.576	1.736	.576	1.736
College	.704	1.421	.728	1.374
Income	.610	1.640	.615	1.626
Central	.537	1.861	.540	1.850
Northern	.465	2.152	.478	2.091
Northeastern	.401	2.492	.407	2.460
Southern	.518	1.929	.523	1.913
Mean	0.655	1.623	0.636	1.660

5.3.2 Results

5.3.2.1 Mobile Voice Calling Model

After the multicollinearity check was performed, the probit analysis was carried out. The results are presented in full in Table 5-4. The model, excluding the control variables, is declared to confirm the robustness of the model. The complete model shows the value of pseudo R^2 at 0.4365, which indicates an acceptable model fit. After the results yielded by probit, the results calculated by logit are shown in Table 5-5 to check the robustness. The results in both probit and logit methods indicate the correlation of the dependent and independent variables in the same direction. This indicates that the results are robust.

Table 5-4: Results of Mobile Voice Calling Model

MOBILE VOICE	**Model 1**				**Model 2**			
	Coef.		Marginal effects		Coef.		Marginal effects	
OTT Voice	**1.0422*** **	**(.0909)**	**.3496*** **	**(.0300)**	**1.1492*** **	**(.1229)**	**.2722*** **	**(.0303)**
OTT Messaging	**.6955*** **	**(.1339)**	**.2311*** **	**(.0477)**	**.1497**	**(.1862)**	**.0308**	**(.0399)**
Mobile bb					.3059	(.2682)	.0648	(.0604)
Tariff 2					-.1297	(.1746)	-.0262	(.0360)
Tariff 3					-.8870	(.7002)	-.2077	(.1820)
Tariff 4					.4522*	(.2192)	.0815*	(.0358)
Gender					.3502***	(.1061)	.0693***	(.0207)
Age					.0020	(.0061)	.0004	(.0012)
Marital status					.2634	(.1388)	.0526	(.0279)
College					.1822	(.1263)	.0364	(.0254)
Income					4.48e-06	(4.58e-06)	8.85e-07	(9.03e-07)
Central					.3581*	(.1603)	.1128*	(.0504)
North					.5215***	(.1570)	.1596***	(.0482)
Northeast					1.4759***	(.1786)	.3482***	(.0425)
South					-1.639***	(.2297)	-.4630***	(.0519)
_con	-.6502***	(.1204)			-1.5111***	(.3624)		
Number of obs.	1052				1052			
LR chi^2 (13)	225.28				573.31			
Prob > chi^2	0.0000				0.0000			
Pseudo R^2	0.1715				0.4365			

* $p<0.05$

** $p < 0.01$

*** $p < 0.001$

Table 5-5 : Results of Mobile Voice Calling Model from Logit (Robustness Check)

MOBILE VOICE	Model 1		Model 2	
	Coef.		Coef.	
OTT Voice	**1.7514*** **	**(.1560)**	**2.1400*** **	**(.2270)**
OTT Messaging	**.1402*** **	**(.2233)**	**.1777**	**(.3305)**
Mobile bb			.5074	(.0409)
Tariff 2			-.2749	(.3113)
Tariff 3			-1.1830	(1.3837)
Tariff 4			.9182*	(.4345)
Gender			.5907***	(.1927)
Age			.0037	(.0108)
Marital status			.4177	(.2550)
College			.2910	(.2362)
Income			8.30e-06	(8.29e-06)
Central			.6090*	(.2739)
North	.		.9229***	(.2758)
Northeast			2.8006***	(.3499)
South			-2.9176***	(.4569)
_cons	-1.0660***	(.2032)	-2.6367***	(.6460)
Number of obs.	1052		1052	
LR chi^2	225.25		579.88	
Prob > chi^2	0.0000		0.0000	
Pseudo R^2	0.1715		0.4415	

* $p<0.05$

** $p < 0.01$

*** $p < 0.001$

The results of mobile voice calling clearly indicate that it is positively associated with the use of OTT voice calling. The positive association is presented at a significant level $p<0.01$, which means this variable is statistically significant. The marginal effects show us that if use of OTT voice calling changes from irregular use to regular use, the probability for the use of mobile voice calling rises by 27.22%. On the other hand, use of mobile voice calling is not statistically related to OTT messaging use. Although it also shows a positive indicator, its significance level is higher than $p>0.05$, implying that these two services are not statistically significantly correlated.

With respect to the tariff type, only the last group, the use-dependent scheme for both mobile voice calling and data usage, is more likely to be positively associated with mobile voice calling compared to the first tariff type, the non-use-dependent scheme for both voice calling and data. Apart from the first group, there is no other tariff type that is significantly variable. When looking at the marginal effect, consumers subscribing to the use-based scheme on both mobile voice calling and the Internet increases the probability of using mobile voice calling by 8% when compared to bundling tariff-type subscribers.

Of the socio-demographic characteristics, only gender and region are significant at level $p<0.01$. These results demonstrate that being male increases the respondents' probability of using mobile voice

calling by 6.9%. The region of residence also shows a significant level of association. Apart from the southern region, residing in the central, northern, and northeastern regions increases the probability of using mobile voice calling when compared to users residing in the Bangkok metropolitan area, at 11.6%, 21.7%, and 36% respectively. In contrast, respondents living in the southern region seem to use mobile voice calling less than those in the Bangkok area. Living in the southern area decreases the probability of using mobile voice calling by 46%, compared to the respondents residing in the Bangkok metropolitan area. For the other socio-demographic variables, age, marital status, education, and income are not significantly associated with the use of mobile voice calling.

5.3.2.2 Messaging Model

The messaging model was estimated in the same manner as the mobile voice calling model. Similarly, this model excluded the control variables, while the full model including the marginal effects are presented accordingly. For the pseudo R^2 obtained from the full model, it shows 0.3217, indicating that the model fit is acceptable. As well as the first model, the logit was applied to check the robustness. The results from logit indicate that the relationship between dependent and independent variables are identical to the results from probit. This implies that robustness of the results is fairly acceptable.

Table 5-6: Results of Messaging Model

SMS	**Model 1**				**Model 2**			
	Coef.		**Marginal effects**		**Coef.**		**Marginal effects**	
OTT Voice	**-.8587*** **	**(.1068)**	**-.1891**	**(.0239)**	**-.6082*** **	**(.1369)**	**-.1024*** **	**(.0244)**
OTT Messaging	**-.0376**	**(.1405)**	**-.0080**	**(.0301)**	**.3167**	**(.1716)**	**.0446***	**(.0220)**
Mobile bb					.1956	(.3146)	.0283	(.0425)
Gender					-.1991	(.1166)	-.0307	(.0179)
Age					-.0152*	(.0072)	-.0023*	(.0011)
Marital status					.3060	(.1660)	.0469	(.0253)
College					.0508	(.1462)	.0078	(.0224)
Income					-6.19e-06	(4.80e-06)	-9.54e-08	(7.40e-07)
Central					.3206	(.1925)	.0677	(.0397)
North					-0.719	(.1984)	-.0123	(.0282)
Northeast					-1.1925***	(.1941)	-.1024***	(.0282)
South					1.2478***	(.1941)	.3674***	(.0220)
_cons	-.6323***	(.1234)			-.9893***	(.4060)		
Number of obs.	1052				1052			
LR chi^2 (13)	76.68				280.67			
Prob > chi^2	0.0000				0.0000			
Pseudo R^2	0.0879				0.3217			

* $p<0.05$

** $p < 0.01$

*** $p < 0.001$

Table 5-7: Results of Mobile Voice Calling Model from Logit (Robustness Check)

SMS	Model 1		Model 2	
	Coef.		Coef.	
OTT Voice	**-1.6105*** **	**(.2069)**	**-1.1556*** **	**(.2526)**
OTT Messaging	**-.0366*** **	**(.2428)**	**.5905**	**(.3052)**
Mobile bb			.4366	(.6090)
Gender			-.3704	(.2146)
Age			-.0236	(.0130)
Marital status			.6047*	(.3038)
College			.0574	(.2787)
Income			-2.84e-06	(9.38e-06)
Central			.6035	(.3646)
North	.		-.1387	(.3952)
Northeast			-2.5920***	(.6093)
South			-2.0750***	(.3555)
_cons	-1.0477***	(.2115)	-1.8393***	(.7820)
Number of obs.	1052		1052	
LR chi^2	76.63		280.15	
Prob > chi^2	0.0000		0.0000	
Pseudo R^2	0.0878		0.3211	

* $p<0.05$

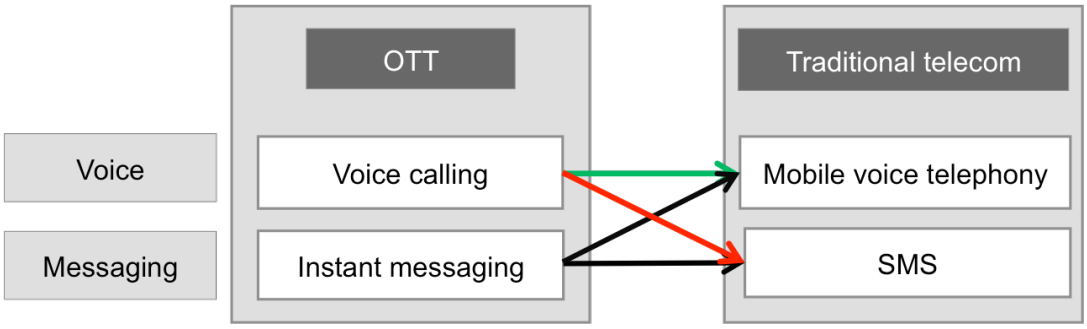
** $p < 0.01$

*** $p < 0.001$

With respect to traditional SMS, the results of OTT voice calling use and SMS use are in contrast to the results of the mobile voice calling model. The marginal effects indicate that if users change their use of OTT voice calling from sporadic use to regular use, the probability of SMS use drops by 10%. The users who are active in using OTT voice calling are less likely to use SMS on their device, compared to users who do not actively use OTT voice services. However, the results of OTT messaging are similar to the mobile voice calling model, showing positive results, though not at a statistically significant number ($p> 0.05$). This implies that OTT messaging is not statistically significantly correlated to traditional telecommunications services, including SMS, in this model.

For the socio-demographic characteristics variables, only age and region of residence are significantly associated with the use of SMS. Age is a significant variable, at level $p<0.05$. Being a younger user decreases the probability of using SMS as a messaging service by 0.2%. Among socio-demographic characteristics, regional variables are also significantly associated with the usage of OTT. Compared to the Bangkok metropolitan area, users residing in the northeastern region decrease the likelihood of using SMS, at 9.9%. By contrast, residents in the southern region increase the likelihood of using SMS, at 34.9%. However, gender, marital status, education, and income are not statistically significant determinants explaining the usage of SMS. The main results are summarized and presented in Figure 5-3, and the tests of the hypotheses are presented in Table 5-8.

Figure 5-3: Summary of Results



5.3.2.3 Summary of Results

Table 5-8 : Summary of Results Compared to Hypotheses

Variable	Hypothesis	Result
Voice Calling Model (Dependent variable: MOBILEVOICE)		
OTT Voice	H1: Use of mobile voice calling is significantly positively related with use of OTT voice calling	Accepted
OTT Messaging	H2: Use of mobile voice calling is significantly positively related with use of OTT messaging	Rejected
Messaging Model (Dependent variable: SMS)		
OTT Voice	H3: Use of SMS is significantly positively related with use of OTT voice calling.	Rejected
OTT Messaging	H4: Use of SMS is significantly positively related with use of OTT messaging.	Rejected

To sum up, the two research questions posited were, "To what extent does the use of OTT communication services affect mobile voice calling," and "To what extent does the use of OTT communication services affect SMS?" The results suggest that the use of OTT voice calling is positively related with the use of mobile voice calling, but negatively associated with the use of SMS. On the other hand, OTT messaging use is not associated with the use of either mobile voice calling or SMS. In other words, the use of OTT voice calling and mobile voice calling have a positive, or complementary relationship. At the same time, the use of OTT voice calling and SMS have a negative, or substitute relationship. The use of OTT messaging is independent from mobile voice calling and SMS.

Because there are claims that OTT services are replacing traditional telecommunications services, this research was conducted to empirically examine the impacts of OTT on traditional telecommunications services, or the relationship between these two communications services. The results

of mobile voice calling and OTT voice calling presented are positively related, or complementary, rather than substituting, as claimed by OTT opponents. The results are surprisingly in contrast to the assumption claimed by many OTT opponents. There are four explanations for why OTT voice calling and mobile voice calling may be positively associated in Thailand.

The first explanation is the tariff type offered in Thailand. MNOs in Thailand usually offer bundled packages or flat rate plans for subscribers. With these packages, users are permitted a specified number of minutes of call time, or even free minutes for on-net[2] usage, as well as an amount of data traffic under a relatively inexpensive fixed-price. In many cases, depending on the price, unlimited minutes of call time or Internet traffic is included in the packages. With this kind of package, users can use two services, mobile voice calling and OTT services, without additional costs, unless their usage exceeds the limit. These types of packages are very popular in Thailand - every operator provides them as one of their main products at a wide range of price points. Moreover, many of them collaborate with specific OTT services, such as popular online games, video and music streaming, and social media to offer special discounts or free data usage to attract more users. This type of package was produced to retain revenue as call minutes decreased, and it has worked to keep consumers using mobile telephony as their means of communication. Some consumers may use voice calling to feel that they are getting value out of a service that they have already paid for in advance. As a result, call minutes of use increase along with OTT usage.

The second possibility is unequal service quality. The quality of OTT and mobile telephony are still different at the moment. Even though the quality of Internet connection in Thailand has improved dramatically and continues to improve, it is still not as stable as mobile telephony, especially in rural areas. Moreover, the quality of the Internet depends on the package a consumer has purchased. Less expensive packages tend to have slower Internet speeds, resulting in poorer OTT service quality. Thus, those consumers cannot rely solely on OTT, especially in situations requiring stable Internet quality, such as in an emergency or in formal calling contexts. This assumption is consistent with literature focusing on user behavior in making voice calls in different contexts in Thailand (Jirakasem, 2020). The results from that study found that users prioritize the quality of services the most, especially in formal situations requiring greater stability of service. Thus, it is compelling that users in Thailand are relying on services with both better and more consistent quality. That is why OTT services are not able to replace mobile voice calling at the moment.

The third possibility is the lack of interoperability between OTT and mobile voice calling services. Basically, mobile voice calling, as a type of traditional ECS, is obligated to interoperate between operators due to the multi-homing exemption (Arnold et al., 2020). On the other hand, OTT

[2] On-net call describes a call made with the same operators. In other words, caller and receiver are use the same operator. In contrast, Off-net refers to a caller and receiver who are using different operators.

communication services are not interoperable, because of an absence of regulation along with technological restrictions. A caller on an OTT service cannot currently call a traditional mobile telephony user (with the exception of VoIP terminating to PSTN, which allows calls across platforms). In other words, a caller can only connect with another user on the same platform, choosing to use either the same OTT service as the person with whom they wish to connect, or they can use a traditional mobile telephone number. Because both parties must use the same platform, there is a high probability that users will need to use both OTT and traditional mobile voice calling at different times due to the lack of interoperability of the services.

The last possibility is the personal habits of some users. This positive relationship may well be the result of personal user behavior. Users who love to talk tend to talk more than less talkative users on every platform. This factor cannot be properly observed in this study, and as such is considered one of the limitations of the study.

Other than the OTT services and mobile voice calling variables, the use-dependent tariff type variable is shown to be significantly associated with the use of mobile voice calling. Compared to flat-rate or bundling package subscribers, customers on the use-dependent scheme of both mobile voice calling and the Internet are more likely to make voice calls with mobile telephony. It may be that users in this group usually do not specifically subscribe to the Internet, but instead subscribe to mobile telephony, which is the most basic plan. In this case, users may have mobile Internet access, including OTT services, but are charged based on the data volume they use, which can be expensive. Thus, users in this group, more than users of other tariff types, prefer to make voice calls using mobile telephony.

The results in this study are consistent with previous studies. To illustrate, a study by Gerpott and Weichert (2016) examined the relationship between mobile Internet, which the authors implied included the use of OTT as well, and mobile voice calling, found a complementary relationship. They used the activation theory to support these results. The activation theory asserts that the use of a service may spill over to other comparable services, in the way that mobile Internet and mobile voice calling do. A study by Wellman (2019) found a positive relationship as well between OTT messaging and SMS, which this study also examined. However, the author suspected that the positive relationship might be the result of the bundling package, which included SMS in the plan. Similarly, a positive relationship between OTT voice calling and mobile telephony in this study can be expected for a similar reason - the packages offered by the MNOs. Nevertheless, there are several studies that found different results. For example, a study by Arnold et al., (2016) found that OTT communication services did not replace traditional services. A study by Cecere and Corrocher (2012) investigated the relationship between VoIP usage and other communications services, including mobile telephony. They found that those services were negatively associated. A study by Kwak and Lee (2016) found that the two services were not related. Furthermore, the study of Mäkinen et al. (2014) found that Facebook users tended to replace mobile

voice calling and SMS with Facebook. It can be concluded that the results may vary depending on the country and the context within each country.

The relationship between OTT voice calling and SMS was discovered to be negative. It is possible that the users of OTT voice calling are less likely to type their communication. Many users do not want to type messages and wait for a response. Voice calling provides faster access to the receiver. Moreover, SMS requires an additional fee, as SMS is generally not included in mobile service packages. Thus, it is understandable that consumers do not want to use SMS, especially when they have other options for communication, many of which are free of charge.

Regarding messaging services, OTT and SMS are not significantly associated. In other words, they are independent. There are two possibilities for this may be the case. First, from the users' perspective, these two services are not comparable, and consumers use them differently. OTT messaging are richly featured applications. They provide a greater number of options than traditional services and contain features that are beyond the scope of traditional telecommunications services, such as stickers, emotional expression, group chats, and file saving systems. Second, the number of SMS users in the dataset is limited, so the actual effect of substitution cannot be captured. This reason is considered to be a limitation of the study.

Regions are also interesting factors affecting users' adoption of OTT services. Compared with the Bangkok metropolitan region (the capital city area of Thailand), other regions seem more negatively correlated with OTT usage, with the exception of messaging. This points to a digital divide among various regions in Thailand. There are still a large number of rural areas in Thailand, which is home to approximately 49% of the total population. Bangkok is the most developed city in Thailand. Consequently, the results reveal that regions outside the Bangkok metropolitan area have a lower proportion of internet users, as the users in Bangkok enjoy a higher quality of Internet access compared with other regions. Furthermore, it may be related to other factors, such as income, as the Bangkok metropolitan region has a higher income due to a relatively higher cost of living. With a higher income, better quality mobile packages and devices are more affordable. Lastly, it may relate to the lifestyle in urban areas. People who live in urban areas tend to possess more sophisticated devices and newer technology due to social values. In other words, social factor is probably also important and deserves further investigation to understand the phenomenon.

The results of the messaging model are quite similar when compared to those of previous studies. There are several studies indicating that OTT messaging is negatively associated with the use of SMS, such as that by Gerpott (2010), examining the usage of mobile Internet and the demand for SMS, even though the effect is small. However, there were limited studies regarding OTT services and SMS. One of those is a study by Wellman (2019), who found a complementary relationship between OTT messaging and SMS use. The result of this study is in contrast to the work of Wellman, because the

packages offered in Norway are different from those offered in Thailand - SMS is not included in packages offered in Thailand, while it is in Norway.

There is another point that needs to be discussed. It is the correlation between the dependent variables from two models - the use of mobile voice calling and SMS. By performing a correlation test between them, the results show that they are correlated, with a coefficient of -0.4729. This implies that they have a negative relationship, and might indicate another reason as to why the results in the first model show the use of OTT voice calling increases the use of mobile telephony but decreases the use of SMS. The results are quite consistent with some previous studies investigating the relationship between voice calling and SMS, such as that of Kim et al. (2020), who found that mobile voice calling and SMS have a substitutable relationship. In addition, it is notable that users of mobile voice calling are less likely to use SMS. This is likely due to the habits of the respondents. Some people prefer to talk rather than text, while people who choose texting are less likely to make a voice call. Another possibility is the package offered to the users. As explained earlier, SMS is usually not included in the bundling packages, quite possibly explaining why users prefer making voice calls rather than texting through SMS.

Nevertheless, it is important to investigate the factors related to the adoption of OTT services. Unfortunately, the data employed in this section provides limited insights in terms of factors. Thus, the dataset offered by the National Statistical Office of Thailand, which contains various relevant factors, will be used. The factors, both technical and demographic, are examined in the next section. By retrieving both sets of information, the policy suggestion can be precisely proposed.

Section 5.4 Factors associated with OTT communications adoption

This section aims to investigate the factors affecting the adoption of OTT services. With respect to the diffusion of innovation theory formulated by Everett Rogers (1995), the main factors - the attributes of technology and the users - are examined in this analysis. The results of this section help us further understand the behavior of Thai consumers and the future trends of OTT services usage, along with being able to better estimate its potential to substitute traditional telecommunications services.

5.4.1 Methodology

5.4.1.1 Survey and Data Collection

This section employed the survey data collected by the National Statistical Office of Thailand. The dataset is comprised of 178,000 samples collected from 83,880 households in five regions of

Thailand – the Bangkok metropolitan area and the Central, North, Northeastern, and Southern regions. The data collection procedures were performed in the 4th quarter of 2019 (October-December). As a national survey, the number of samples was stratified by the total population. Moreover, Stratified Two Stage sampling, provinces and municipal areas were additionally used to determine the number of households. However, this study only analyzed the data from respondents 15 years old or older. After sorting out irrelevant respondents, a total of 167,675 samples were included in the analysis.

Table 5-9: Number of Respondents from Five Regions of Thailand

	Entire kingdom			Municipal area			Non-municipal area		
Region	Total	Male	Female	Total	Male	Female	Total	Male	Female
Bangkok metropolitan area	8,824.6	4,272.3	4,552.3	8,824.6	4,272.3	4,552.3	-	-	-
Central region	20,071.1	9,808.3	10,262.9	9,227.5	4,462.5	4,765.0	-	-	-
Northern region	11,281.7	5,482.2	5,799.5	3,921.9	1,867.1	2,054.8	7,359.8	3,615.1	3,744.7
Northeastern region	18,476.6	8,977.8	9,498.8	5,404.9	2,599.4	2,805.5	13,071.7	6,378.4	6,693.2
Southern region	9,367.1	4,605.0	4,762.0	3,136.3	1,509.1	1,627.3	6,230.7	3,096.0	3,134.8
Total	68,021.0	33,145.5	34,875.5	30,515.2	14,710.3	15,804.9	37,505.8	18,435.3	19,070.5

Unit: in thousands

Source: NSO, 2019

5.4.1.2 Variable Clarification

In this section, three groups of factors are examined: attributes of the technology, compatible devices and supportive environment, and lastly, socio-demographic characteristics. The data was selected from the complete set of questionnaires, as follows:

1) Complexity of the technology in relation to individual skills

The diffusion of innovations theory developed by Everett Rogers perceived five attributes of technology that determine the rate of innovation adoption: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 1995). In this study, complexity and compatibility are examined. The other attributes cannot be measured due to the limitation of the research design. The first attribute, the complexity of the innovation - also known as ease of use - is associated with the ability to learn how to understand and command the innovation (Rogers, 1995). It is usually perceived that the difficulty of the innovation might lead to less adoption of the innovation. However, this depends on each individual to understand and learn how to use the innovation. Cecere and Corrocher (2012) asserted that if the individuals have IT skill, they might find that learning how to use new technology is easier. This assumption is somewhat consistent to some previous studies (e.g. Al-Jabri & Sohail, 2012; Attewell, 1992; Oliveira et al., 2014). Thus, IT skill is used in the study as a proxy representing the perceived ease of use by the individuals. Questions about IT skills were asked in binary patterns - are they capable of performing the following skills. Those questions are shown in Table 5-10.

Table 5-10: Questions Regarding IT Skills

	Question
1	Copying or moving a file or folder
2	Using copy and paste tools to duplicate or move information within a document
3	Sending e-mails with attached files (e.g., documents, pictures, and videos)
4	Using basic arithmetic formulas in a spreadsheet
5	Connecting and installing new devices (e.g., modem, camera, printer)
6	Finding, downloading, installing, and configuring software
7	Creating electronic presentations with presentation software (including images, sound, video, or charts)
8	Transferring files between a computer and other devices (e.g., mobile phone)
9	Writing a computer program using a specialized programming language

Source: NSO, 2019, p.27

Several binary questions can be included in the model as a single variable. Consequently, the factor analysis was performed to find the factor scores of the IT skills variable. However, as they are binary or dichotomous variables, it is not possible to perform general factor analysis using the Pearson coefficient correlation. As a result, factor analysis using *tetrachoric correlation* was used instead (Brown & Benedetti, 1977; Uebersax, 2015). After the analysis, the factor scores were included in the model as variables representing the IT skills. However, the ability to create the presentations caused non positive definite, so it was dropped from the analysis. In total, eight items were used to extract the factor scores for IT skills. An internal consistency reliability test was performed on these eight items by Kuder-Richardson 20 (KR20). The KR20 test is generally used to measure reliability for binary data. The results show that the KR20 coefficient is 0.9. The coefficient indicates excellent internal consistency. In addition, Kaiser-Meyer-Olkin test was performed to evaluate how data is suitable for factor analysis. The results show that KMO=0.78, which is acceptable value.

After factor analysis was performed, the eigenvalues were obtained. The results showed only one eigenvalue greater than 1. In addition, the scree plot suggests that one factor is well represented. For these reasons, only a single factor was extracted and titled "IT skills." As shown in Table 5-12, a total of eight variables load the factor. They are all higher than 0.6. The uniqueness of all the items is less than 0.6, which means that all the variables are well explained by the factor.

Figure 5-4: Scree Plot

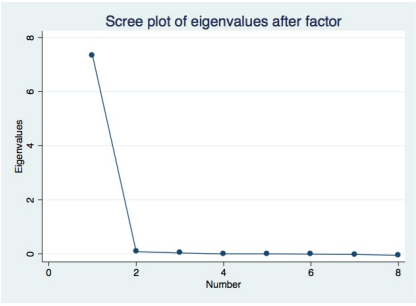


Table 5-11: Factor Analysis for IT Skills

Variable	**IT Skills**
Copying or moving a file or folder	0.9979
Using copy and paste tools to duplicate or move information within a document	0.9984
Sending e-mails with attached files (e.g., documents, pictures, and videos)	0.9847
Using basic arithmetic formulas in a spreadsheet	0.9733
Connecting and installing new devices (e.g., modem, camera, printer)	0.9600
Finding, downloading, installing, and configuring software	0.9434
Transferring files between a computer and other devices (e.g., mobile phone)	0.9609
Writing a computer program using a specialized programming language	0.8344

Apart from IT skills, another variable called IT job was added to the analysis. The IT job variable represents respondents who work in the IT or communications industry. This variable is expected to be positively correlated with the adoption of OTT services, as the individuals who work in this industry may be proficient in using technological devices. Additionally, they may have opportunities to access the latest information on new technology and try it before others, which may apply to the trialability in the diffusion of innovation theory. Trialability means the capability to experiment with a service before actual adoption. This attribute is important to potential adopters, especially early adopters (Gross, 1942; Ryan, 1948 cited in Rogers, 1995).

2) Compatibility with experiences and supportive environments

Apart from IT skills, there are aspects of compatibility that cause potential adopters concern, such as compatibility with their needs, social values, past experiences, and familiarity (Rogers, 1995). Rogers refers to this as technology cluster, wherein the adoption of one technology may trigger to adoption of several others (Rogers, 1995). This is also known as the spill-over effect (Gerpott, 2014). For example, smartphone use can trigger the use of other services provided on the same or similar devices, including OTT services. While it is important to have compatible devices to use OTT, it does not guarantee that smartphone users will automatically adopt OTT services. However, other studies (e.g., Arnold et al., 2016; Gerpott, 2014) have shown that compatible devices are considered one of determinants of new technology adoption. Thus, smartphone ownership is included in the analysis, and it is expected to be positively associated with OTT adoption.

A supportive environment is asserted to be one of the determinants of OTT adoption compatibility. It is highly possible that users are more likely to adopt OTT services if they have a supportive environment, such as high-speed Internet or accessible public Internet services, which are generally free of charge. Thus, questions asking if the respondent is able to access high-speed Internet or public Internet were included in the analysis. Similar to the previous studies, these variables were expected to show positive signs OTT adoption.

3) Socio-demographic characteristics

The characteristics of the users are important to the decision to adopt the service. The first variable in this group is the gender of the respondents. Gender is usually included in the analysis as the control variable. As shown in several prior studies, gender makes a difference in the decision to adopt a new service. Thus, this variable is used. The second variable is marital status. Because users who are married may change their behavior, it is used as one of the determinants. The third factor is the age of the respondents. Younger respondents tend to be more likely to adopt new services. The fourth variable in this group is education. It can be expected that higher education is positively associated with new technology adoption. Higher education can imply the ability to learn new things as well as greater opportunity to access the technology. Next is the municipal area. Even for respondents who live in regions other than Bangkok, those that live in more developed areas or bigger cities, such as Chiang Mai and Phuket, are also more likely to adopt newer technologies. Thus, municipal areas, which are considered better developed than non-municipal areas, are included as a determinant of new technology adoption. The last variable in this group is the occupation of respondents. Jobs are separated into five groups: student, manager or CEO, white collar, blue collar, and unemployed. However, for this study, the unemployed group is excluded, because the reasons for unemployment are too varied to yield clear results.

5.4.1.3 Description of Variable and Multicollinearity Check

In this study, there are variables that may not correlate, causing a violation of the logistic regression assumption. For this reason, a multicollinearity check was performed. The results show all of the tolerances less than 1.00. Moreover, the VIF of all the variables range from 1.021 - 2.026. These values confirm no to little correlation between variables. Thus, the assumption of multicollinearity is not violated. However, there is a variable expressing a VIF value of more than 2.00, which might require some caution, even if it is a generally acceptable value. The following is descriptive information for each variable and their multicollinearity diagnostic details.

Table 5-12: Description of Variables

Variable	Definition	Mean	Std. dev.	Min	Max
Dependent variable					
OTT	Take value 1 if individual uses OTT services and 0 if otherwise	.5563	.4968	0	1
Independent variable					
Complexity of the technology in relation to the individual skills					
IT skills	Factor scores of IT skills	.3107	1.0234	-6.2400	7.5121
IT job	Take value 1 if individual's job is in technological and communications industry	.0015	.0381	0	1
Compatibility with experience and supportive environment					
Smartphone	Take value 1 if individual's mobile phone is smartphone and 0 if otherwise	.8453	.3616	0	1
Net access	Take value 1 if individual is able to access public internet in their daily life and 0 if otherwise	.3108	.4628	0	1
Broadband	Take value 1 if individual has broadband internet access at home and 0 if otherwise	.2990	.4578	0	1
Socio-demographic characteristics					
Male	Take value 1 if individual is male and 0 if otherwise	.4644	.4987	0	1
Marital status	Take value 1 if individual is married and 0 if otherwise	.6350	.4814		
Age	Indicates the actual age of the individual	48.1964	17.7887	15	98
Diploma	Take value 1 if individual obtained at least diploma from basic education (equivalent to secondary school) and 0 if otherwise	.9541	.2092	0	1
Location	Take value 1 if individual resides in municipal area and 0 if otherwise	.5563	.4968	0	
Student	Take value 1 if individual is student and 0 of otherwise	.0618	.2408	0	1
Manager	Take value 1 if the individual is manager or CEO and 0 if otherwise	.0207	.1425	0	1
White collar	Take value 1 if the individual's job is considered white collar and 0 if otherwise	.0578	.2334	0	1
Blue collar	Take value 1 if the individual's job is considered blue collar and 0 if otherwise	.5843	.4928	0	1

Table 5-0-13: Multicollinearity Diagnostics

Variable	Tolerance	VIF
IT skills	.698	1.434
IT job	.975	1.026
Smartphone	.750	1.333
Net access	.634	1.578
Broadband	.913	1.096
Male	.936	1.069
Marital status	.848	1.180
Age	.529	1.891
Diploma	.948	1.055
Location	.979	1.021
Student	.494	2.026
Manager	.873	1.145
White collar	.645	1.550
Blue collar	.576	1.736
Mean	.771	1.367

5.4.2 Results

After the binary logistic regression was performed, the results were obtained. Pseudo R^2, Model 4, is the complete model and the most accurate predictor of the association of OTT service adoption and its factors. The results, both coefficient and marginal effects, are shown in Tables 5-14 and 5-15 respectively. Moreover, similar to the first section, the probit analysis was performed as a robustness check. The results yielded by probit are presented in Table 5-16. They indicate the same direction as the results yielded by logit, which means they also respond to the hypotheses identical to the logit model. Thus, robustness is acceptable.

Table 5-14: Results

Dependent variable: OTT

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err	Coef.	Std.Err.
Complexity of the technology in relation to the individual skills								
IT skills	.3342***	(.0106)			.3380***	(.0104)	.1398***	(.0121)
IT job	.0833	(.3574)			1.1925***	(.3646)	-.1354	(.3704)
Compatibility with experiences and supportive environment								
Smartphone			6.1312***	(.1769)	6.4558***	(.1754)	6.1792***	(.1781)
Net access			2.1640***	(.0210)	2.7694***	(.0193)	2.1278***	(.0212)
Broadband			.9553***	(.0018)	.4019***	(.0138)	.9548***	(.0165)
Socio-demographic characteristics								
Male	-.1168***	(.0130)	-.1844***	(.0152)			-.1831***	(.0153)
Marital status	.1945***	(.0146)	.1341***	(.0170)			.1360***	(.0170)
Age	-.0912***	(.0005)	-.0893***	(.0006)			-.0889***	(.0006)
Diploma	1.9008***	(.0408)	1.3134***	(.0468)			1.3037***	(.0467)
Location	.5270***	(.0129)	.4534***	(.0148)			.4486***	(.0148)
Student	-.0014	(.0534)	-.9594***	(.0614)			-1.1435***	(.0632)
Manager	2.027***	(.0546)	.8333***	(.0623)			.7868***	(.0628)
White collar	2.2576***	(.0493)	.8426***	(.0539)			.7155***	(.0556)
Blue collar	.1469***	(.0164)	-.3691***	(.0190)			-.3678***	(.0190)
_cons	1.9900***	(.0484)	-3.6192***	(.1843)	-6.9125***	(.1754)	-3.6761***	(.0467)
Number of obs.	167675		167675		167675		167675	
LR chi^2	80437.45		115391.02		86214.56		115532.96	
Prob>chi^2	0.0000		0.0000		0.0000		0.0000	
Pseudo R^2	0.3463		0.4968		0.3712		0.4974	

Table 5-15: Marginal Effects

Dependent variable: OTT

	Model 1		Model 2		Model 3		Model 4	
Variable	dy/dx	Std.Err.	dy/dx	Std.Err.	dy/dx	Std.Err	dy/dx	Std.Err.
Complexity of the technology in relation to the individual skills								
IT skills	.0494***	(.0016)			.0499***	(.0015)	.0156***	(.0014)
IT job	.0123	(.0528)			.1649***	(.0429)	-.0152	(.0416)
Compatibility with experiences and supportive environment								
Smartphone			.5235***	(.0039)	.5699***	(.0020)	.5235***	(.0039)
Net access			.2700***	(.0024)	.4053***	(.0020)	.2648***	(.0415)
Broadband			.1068***	(.0018)	.0597***	(.0020)	.1067***	(.0018)
Socio-demographic characteristics								
Male	-.0172***	(.0019)	-.0206***	(.0017)			-.0204***	(.0017)
Marital status	.0286***	(.0021)	.0150***	(.0019)			.0152***	(.0019)
Age	-.0135***	(.00005)	-.0100***	(.00005)			-.0100***	(.0001)
Diploma	.2642***	(.0049)	.1471***	(.0051)			.1457***	(.0051)
Location	.0782***	(.0019)	.0511***	(.0017)			.0505***	(.0017)
Student	-.0002	(.0079)	-.1056***	(.0065)			-.1249***	(.0065)
Manager	.2777***	(.0061)	.0917***	(.0067)			.0867***	(.0067)
White collar	.3083***	(.0052)	.0933***	(.0058)			.0794***	(.0060)
Blue collar	.0218***	(.0024)	-.0411***	(.0021)			-.1457***	(.0051)

Table 5-16: Results from Probit (Robustness Check)

Dependent variable: OTT

	Model 1		Model 2		Model 3		Model 4	
Variable	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
Complexity of the technology in relation to the individual skills								
IT skills	.1563***	(.0052)			.1572***	(.0051)	.0531***	(.0057)
IT job	-.0226	(.1600)			.5596***	(.1695)	-.1069	(.1670)
Compatibility with experiences and supportive environment								
Smartphone			3.0702***	(.0747)	3.0145***	(.0665)	3.0842***	(.0757)
Net access			1.1794***	(.0110)	1.5948***	(.0099)	1.1640***	(.0111)
Broadband			.5446***	(.0094)	.2284***	(.0082)	.5448***	(.0094)
Socio-demographic characteristics								
Male	-.0679***	(.0075)	-.1038***	(.0086)			-.1027***	(.0087)
Marital status	.1185***	(.0084)	.0874***	(.0096)			.0884***	(.0096)
Age	-.0532***	(.0003)	-.0508***	(.0003)			-.0507***	(.0003)
Diploma	1.0678***	(.0225)	.7403***	(.0265)			.7370***	(.0264)
Location	.306***	(.0075)	.2576***	(.0084)			.2556***	(.0084)
Student	-.0658	(.0261)	-.6199***	(.0289)			-.7000***	(.0300)
Manager	1.1811***	(.0297)	.4489***	(.0330)			.4245***	(.0332)
White collar	1.2440***	(.0245)	.4006***	(.0263)			.3465***	(.0272)
Blue collar	.0944***	(.0094)	-.1986***	(.0108)			-.1985***	(.0108)
_cons	1.1864***	(.0273)	-1.6598***	(.0800)	-3.2899***	(.0664)	-1.6771***	(.0809)
Number of obs.	167675		167675		167675		167675	
LR chi^2	79889.53		114327.59		85989.57		114416.52	
Prob>chi^2	0.0000		0.0000		0.0000		0.0000	
Pseudo R^2	0.3439		0.4922		0.3702		0.4926	

The results indicate that all of the groups of determinants were statistically significant in OTT adoption, even though the effects were different in terms of size and direction. The first group looked at

the complexity of the technology in relation to IT skills and IT jobs as the representatives. Only IT skills were significantly positively associated with OTT adoption. The results revealed that an increase in IT skill increased the possibility of adopting OTT by 1.56%, as expected. Concerning IT jobs, it was not significantly associated with the adoption of OTT. It can be said that working in IT and the communications industry did not affect the respondents to adopt such a service.

The second group of factors that have the most significant effects include three variables - smartphone ownership, public Internet access, and high speed or broadband Internet access - are all significant factors to adopt OTT. Among these three variables, smartphone ownership has the largest effect. Owning smartphone increases the chance of adopting OTT by 52.35%, a much larger percentage than either of the other two determinants. The ability to connect to public Internet increases adoption of OTT by 26.48%, while the smallest effect in this group is broadband Internet access, which increases adoption rates by 10.67% - the smallest effect, though still significant.

The last group of determinants, socio-demographic characteristics of the users, are all statistically significant, though the effects are varied. Firstly, female respondents are more likely than male respondents to adopt OTT. Secondly, married individuals are more likely to adopt OTT than respondents in other marital status groups. Thirdly, as expected, there is higher possibility that younger users will adopt OTT services. Fourthly, higher education leads to a higher possibility of adopting OTT services. Fifthly, users who reside in municipal areas are more likely to adopt OTT services, compared to users who live in non-municipal areas. And lastly, the occupation of the respondents plays an important role in OTT adoption. While students and users who work in blue-collar jobs are negatively associated with OTT adoption, CEOs, managers, and respondents who work in white collar positions are more likely to adopt the services. The following is the table showing the hypothesis and the results of each variable.

Table 5-17: Results Regarding Hypotheses

Hypothesis	**Result**	**Significant determinants**	
		Positive	**Negative**
H1: Complexity of the technology in relation to the individual's skills is significantly correlated to the use of OTT	Accepted	*IT skills*	
H2: Compatibility to experiences or supportive environment is significantly correlated to the use of OTT	Accepted	*Smartphone* *Net access* *Broadband*	
H3: Socio-demographic characteristics are significantly correlated to the use of OTT	Accepted	*Married* *Diploma* *Municipal* *Manager* *White collar*	*Male* *Age* *Student* *Blue collar*

With regards to the research question posited above - What are the user characteristics and factors associated with the adoption of OTT communication services, including OTT voice calling and messaging? - the answer to this question is revealed by the analysis. The user characteristics and factors associated with the adoption of OTT communication services are the IT skills of users, ownership of a smartphone, the ability to access broadband internet and public internet, gender, marital status, age, education, living area, and the current job of the respondents. Users who are more likely to adopt OTT services have higher IT skills, own a smartphone, are able to connect to broadband internet and public internet in their daily life, are married, are younger, have higher levels of education, live in municipal areas, and work as managers, CEOs, or in white collar jobs.

Some of the results confirm the hypotheses, while there are also variables that diverge from expectations. The IT job variable turned out to be statistically insignificant. Additionally, it has negative coefficient, which is in contrast to the hypothesis. In other words, working in the IT and communications industry simply does not affect an individual's adoption of OTT services. As for the reasons why this might be true, it seems that workers in the industry are not more likely to adopt OTT services than those in other industries. It may be that, in reality, IT workers do not necessarily have any greater access to OTT services information than employees in other industries, and it is also possible that some of them may have tried the services and found they did not fulfill their needs.

Being a student is another variable that does not follow the hypothesis. The general perception is that younger people tend to more quickly adopt new services, compared to older people. Students, who are presumably young, should adopt OTT services more easily. Surprisingly, the results indicate that being student is negatively associated with the adoption of OTT. Moreover, the results of the age variable support the assumption that younger users are more likely to adopt the services. Nonetheless, it appears that the student variable came out differently than expected. Firstly, students in Thailand may not be using OTT communication services intensively. They may not find the services necessary, even though they are very active in using other online services, especially social media. Secondly, the dataset sets the age of users from 15 years old. At this young age, because they are not permitted to work under Thailand's child labor laws[3]), they are likely relying on their parents to cover their expenses and as such may not be able to afford a smartphone or mobile Internet on their own, especially for students living in rural areas where the income is relatively low. This variable is in contrast to previous studies, such as that by Cecere and Corrocher (2012), which was conducted in Italy and is considered to be a developed country. Even though the telecommunications infrastructure in Thailand is rapidly and steadily growing, the developmental gap still remains serious problem, especially in urban and rural areas.

[3] See child labors provisions under the Labour Protection Act, B.E. 2541(1998) and Labour Protection Act (No.5) B.E. 2560 (2017)(Amendments)

There are interesting points to be discussed regarding other elements of the results. Firstly, even though IT skills are positively related to OTT adoption and statistically significant, the effects are small, especially when compared to the other groups of variables. It is possible that using OTT nowadays does not require highly technological skills. The services are easy to use. As stated in the diffusion of innovation theory and other innovation acceptance models, perceived ease of use is a crucial factor and positively related to service acceptance and adoption. This certainly can be considered a success for OTT services developers, the fact that very little IT skill is required to make use of the services, which are have been designed and developed well.

Secondly, a supportive environment is a crucial factor in service adoption. According to the results, it has the largest effect when compared to the other groups of variables, with smartphone adoption having the single greatest effect on OTT adoption. Actually, it is not a surprising result, as smartphone ownership is necessary in order to use OTT services. Additionally, there is evidence to support the claims that OTT services are becoming prominent communication services due to the increase in smartphone penetration. It is interesting to note that even users who are not initially interested in OTT services might end up using them if they have a smartphone. While this issue needs further investigation, it can be presumed that if smartphone use continues to increase, with pricing remaining affordable and internet access available, then usage of OTT services is likely to also increase. And if that is case, then claims predicting that OTT services could replace traditional telecommunications services are farfetched. Apart from the smartphone, the ability to connect to the public Internet, which is perceived as free of charge, and access to high-speed Internet at home, play very important roles. Nowadays, there are available Internet or Wi-Fi hotspots provided by both the private sector and the government in many cities. Although Wi-Fi hotspots are currently limited in rural areas, there is a government project, created in 2016 and overseen by the MDES and the NBTC, called "The Village Broadband Internet Project" or "Net Pracharat." This project aims to provide broadband Internet for people living in rural areas by installing fiber cable networks and equipping Wi-Fi hotspots at speeds of 30/10 Mbps[4] ((TOT, 2018). The project is still in progress. When it is completed, it can be anticipated that the use of OTT services will increase.

Thirdly, as noted in the first section of the chapter, OTT services do not substitute traditional telecommunications services at the moment. It seems that OTT is not adopted by every group of users. As shown in the results, users working in blue-collar jobs are negatively engaged in OTT usage. It is possible that using OTT requires skill, education, and the cost of purchasing a smartphone and Internet service. Generally, blue-collar workers in Thailand receive very low wages. Even though the government has tried to set the minimum wage, workers often do not get paid enough to cover their living costs (Charoensuthipan, 2020). For this reason, smartphone ownership and Internet service, especially high-

[4] For more information about the project, see https://npcr.netpracharat.com/Netpracharat_EN/one-page/

speed Internet, is considered unaffordable to many blue-collar workers, resulting in fewer of them adopting OTT services.

There is a gap in development reflected in the use of OTT and municipal areas. Thailand has a problem of development. Similar to previous studies (e.g., Cecere & Corrocher, 2012), the results from different regions reveal a developmental gap. In Thailand, it seems that the developmental gap is quite wide, not only between municipal and non-municipal areas, but also regions, as shown in the results of the first section.

The results are mostly similar to previous studies. However, their contribution extends the knowledge from previous studies. Firstly, it is the first study focusing on OTT communications services, although there are several studies focusing on online services. Secondly, it employs a very large dataset, so the results are basically reliable. Thirdly, it uses the variables of environment for compatibility. Fourthly, it focuses on Thailand, which is considered a developing country. On the other hand, the characteristics of Thailand are unique. The big cities and municipal areas are well developed, especially in the area of telecommunications services, giving it similarities to the situation in developed countries. However, in the rural areas, the dynamics are similar to a developing country. The results represent similar cases.

Section 5.5 Discussion

According to the results from the two sections of this chapter, the discussion is addressed as follows. Firstly, from the results indicated in the first section, it is not entirely true that OTT communication services are replacing traditional telecommunications services, as claimed by many analysts. Only the relationship between SMS and OTT voice calling present significantly negative. The other relationships present neither positive nor independent. Secondly, there are several reasons why those relationships are not negative in all cases. As the results in the second section revealed, the most important factors are the supportive environment. This can be considered as support to adopt OTT services. However, it can also represent obstacles to many users in Thailand, which is a developing country where a progress gap remains, such as that between urban and rural areas, shown in the second section's results. Moreover, OTT services rely on Internet connections, which are unstable in some areas, and are not yet fully developed, especially in Thailand. Users may experience some struggles using OTT, which can impede them from switching from traditional telecommunications services to OTT. Once the Internet connection in Thailand is more developed in terms of stability and coverage, OTT may increase their influence over customers' communications services usage.

The results presented in this chapter are retrieved from the users and can provide useful information to the MNOs to understand their customers better. Moreover, the regulator can analyze the results to better understand the developmental gap in Thailand and figure out what issues still remain in the Thai telecommunications market. Nonetheless, the MNOs perspective is essential. The reason is that there are uncertain areas that only MNOs can clarify, such as the actual impact of OTT on MNOs, as well as the usage patterns of users today and whether or not they are the result of the strategy adopted by MNOs. An analysis from the MNOs' perspective will be conducted in the next section. Afterwards, the overall picture of the Thai telecommunications market regarding OTT communications can be better understood.

Chapter 6
Mobile Network Operators (MNOs)' Perspective

When it comes to the topic of OTT communication services, it is important to regard the MNOs as one of the most affected players in the ecosystem. In this chapter, the impact of OTT from the Thai MNOs' perspective is investigated. Furthermore, the strategies that those MNOs are currently using are explored in order to illustrate a complete picture of the role of OTT in the ecosystem. It is expected to contribute to policymakers, as the perspective of MNOs may require precise action on the part of the policymakers in order to retain benefits for the overall players in the Thai telecommunications market.

Section 6.1 Introduction

As perceived by many analysts, OTT communications are considered to be a threat to MNOs. They provide identical services to the MNOs, but at a potentially lower price. Even though it is still controversial if OTT is in fact less expensive, since in order to use OTT services, users are required to have compatible devices and an Internet connection, it seems that generally users think of OTT as being free of charge. With the rise of OTT usage nowadays, the MNOs are suffering from a decline in usage and revenue in core services or traditional telecommunications services, namely mobile voice calling, and SMS. This decline is suspected to be a direct result of the rise of OTT (Joshi et al., 2015). Nonetheless, there are also studies suggesting that MNOs may not be the victim of OTT usage. OTT services can escalate the demand for Internet service, especially broadband Internet (Sudtasan & Mitomo, 2016). This assumption is quite manipulative, because Internet usage and revenue from data usage are increasing dramatically. MNOs nowadays are offering packages in partnership with OTT. Moreover, it seems that MNOs in Thailand are using non-aggressive strategies towards OTT. However, as far as the author knows, the knowledge about the actual impact of OTT on MNOs in Thailand is limited. Furthermore, whether non-aggressive strategies are the intended and appropriate MNO strategy to curtail the effects of OTT services remains to be determined. If so, what are the reasons why MNOs have employed such a strategy. To sum up, there are two research questions posited in this chapter: *What are the impacts of OTT communication services on MNOs in Thailand?* And *What are the appropriate strategies for dealing with OTT communication services for Thai MNOs?* This chapter utilizes related theories, such as the Theory of Profit-maximization, the Business Model Ontology of Osterwalder (2004), and Rumelt's Strategy Evaluation (1980). The results in this chapter are expected to contribute to the previous chapter, consumer behavior, by enhancing the insight of OTT's role from the MNOs perspective. With the results, policymakers in Thailand can clearly see the role of OTT, how it affects

the Thai telecommunications ecosystem, and how the MNOs in Thailand respond to these impacts. Subsequently, policymakers can precisely enact the appropriate policies to maintain fairness in the market.

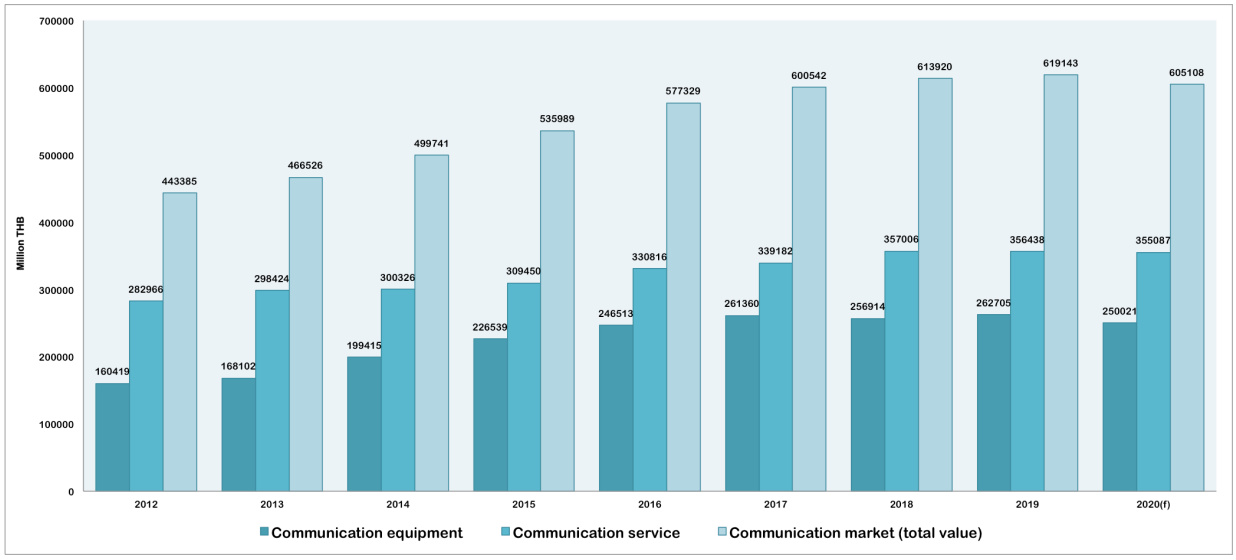
This chapter is organized as follows. It begins with an introductory section explaining the rationale behind the study in this chapter and the research questions for the two analyses. Moreover, in this section, the situation of Thai MNOs is described to elucidate the current situation in Thailand and to provide background on the players in the market. In the next section, the literature review is presented covering the previous studies regarding the impacts of OTT on MNOs, as well as appropriate strategies to deal with OTT. The limitations of previous studies are discussed in this section. These limitations are considered to be the gap that this study aims to fill. After the literature reviews, the methodologies used for the two analyses in this chapter are explained. This section begins by explaining where the studies exist in the field of study of firms' behavior and strategy. Afterwards, this section explains the conceptual framework used for the first analysis - the impacts of OTT on MNOs. The conceptual framework for this analysis was developed from two concepts, namely disruptive change factors focusing on environment-driven changes (Ghezzi et al., 2014), and business model ontology (Osterwalder, 2004). The conceptual framework explains the impacts of OTT on four aspects of MNOs, namely external innovation, regulatory change, consumer change, and change in competitor strategy. In addition, to clearly demonstrate how OTT affects the businesses of MNOs as an external innovation, the first aspect, the area of business affected by OTT, was proposed, which includes product (value proposition), customer interface (value delivery), infrastructure management (value creation) and financial aspects (value appropriation). As for the second analysis, it examines the appropriate strategies for MNOs to deal with the impacts of OTT. Potential strategies were gathered from previous studies, ranging from an aggressive strategy such as blocking, to a nonaggressive strategy such as partnering with OTT players. These strategies were assessed using Rumelt's strategy evaluation. The evaluation comprises four criteria, which are consistency, consonance, advantage, and feasibility (Rumelt, 1980). The data in this chapter, for both analyses, was collected using semi-structured interviews with five MNOs in Thailand. After the section on methodology, the results are presented. The results from the first analysis are discussed first. Subsequently, the results from the second analysis are presented. The last two sections explain the results of the research questions and discuss the underlying results, which are further interpreted from the results.

6.1.1 Mobile Network Operators in Thailand

Thailand is one of the countries in which the telecommunications market is dramatically increasing, especially in the mobile segment. In 2019, the total value of the Thai communications industry was 619,143 million THB (19,921 million USD), which slightly increased from 2018, by 0.9%,

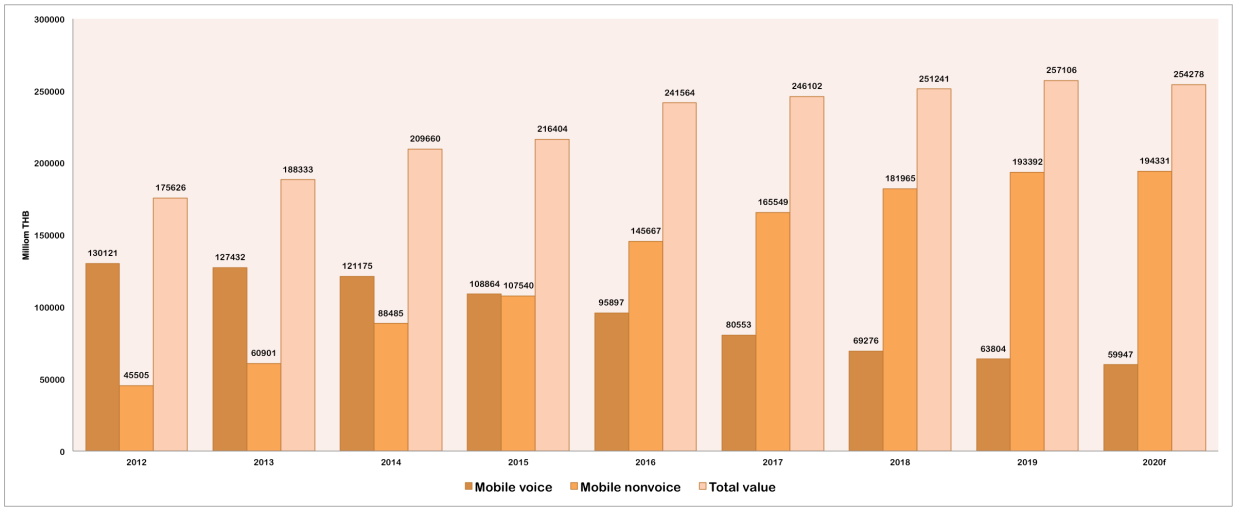
while the total value of the communications market was 356,438 Million THB (11,468 million USD) (NBTC, 2020a). Mobile services accounted for 257,106 million THB (8,272 million USD) of the communications market, or more than half of the total value. Figure 6-1 and 6-2 show the total value of both the telecommunications and mobile markets has been increasing for years. Moreover, estimates suggest it will continue to grow, even though the growth rate is anticipated to slightly decrease in 2020 due to the COVID-19 pandemic, resulting in an economic recession. However, the value of mobile non-voice is anticipated to be growing because many of the companies have changed their work structures to include "work from home," requiring higher consumption of mobile data (NBTC, 2020a).

Figure 6-1: Communications Market in Thailand 2012-2019 and Outlook for 2020



Source: NBTC, 2012-2019 compiled by the author

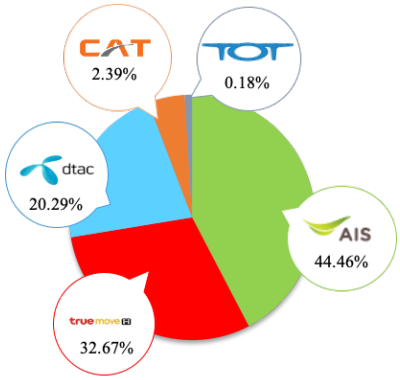
Figure 6-2: Mobile Service Market in Thailand 2012-2019 and Outlook for 2020



Source: NBTC, 2012-2019 compiled by the author

Currently, there are four major operators in Thailand: AIS, TrueMoveH, Dtac, and National Telecom (NT). However, the data was collected in June 2020, at which time NT was still in its transition period, merging between CAT and TOT. Thus, there is information on five telecommunications operators in this chapter.

Figure 6-3: Market Share of Thai MNO in 2020 (3rd Quarter)



Note: Total subscribers in Thailand is 119.17 millions
Source: NBTC, 2020e

Among these five MNOs, Advanced Info Service, known as AIS, under the Advanced Wireless Network Co., Ltd., is the largest in terms of subscribers and revenue. In the 3rd quarter of 2019, AIS had 40.9 million subscribers, or a 44.46% market share (which rose to 46% as of 2nd Q of 2020). The revenue in 2019 was 183,432 million THB (5,902 million USD), which increased from 169,856 million THB[1] (5,465 million USD) the previous year, with approximately 82% of the revenue coming from the mobile section. AIS is an advanced operator in the market. Apart from mobile services, they offer other services, including fixed-line broadband utilizing optical fiber, digital service such as online content provided via an application named AIS Play, and cloud computing service products for business customers.

The next MNO is TrueMoveH, from True Corporation. TruemoveH is the second largest MNO in Thailand, with 30.6 million subscribers (as of 4Q 2020) and 107.2 billion THB (3,449 million USD) revenue in 2020, a slight increased from 105.8 billion THB (3,404 million USD) in 2019. True Corporation also provides a variety of services, such as fixed-line Internet, both fiber and ADSL under the brand True Online, which is currently number 1 in the broadband market based on revenue and subscribers. True also provides pay TV service under the brand True Visions, the number one nationwide pay TV provider in Thailand. Lastly, they offer other digital services, such as OTT media

[1] For more details, see https://investor.ais.co.th/misc/factsheet/20201119-advanc-factsheet-3q2020-en.pdf

called TrueID, digital analytics, digital solutions, and Internet of Things (IoT)[2]. Similar to AIS, the main revenue of True is also from the mobile segment.

The third largest MNO is Dtac, from Total Access Communications. Dtac had 18.9 million users in 2020, a decrease from 20.6 million users in 2019. Dtac recorded 79,213 million THB (2,549 million USD) in revenue in 2020, also a slight decrease from 81,228 million THB (2,614 million USD) in 2019[3]. According to the Dtac annual report, the loss of revenue resulted from the decrease in the numbers of tourists and foreign laborers, which are important consumers for the company. Indeed, the revenue of Dtac has fluctuated in the past five years. Dtac is the MNO that provides only mobile service, while the other MNOs provide fixed-line Internet and other digital services simultaneously.

The two smallest MNOs, CAT and TOT, were state-owned enterprises (SOEs). After 18 years of attempting to merge CAT and TOT, the cabinet finally approved the merger in 2020, creating the new state-owned enterprise known as National Telecom (NT). The new company now operates under the control of MDES, whereas formerly CAT and TOT were under the Ministry of Transport and Communications (MOTC) (Blasko, 1998). The two previous SOEs had been formed from different organizations; CAT was created under the Communications Authority of Thailand (CAT), which also operated the postal services at that time. After privatization in 2003, two new enterprises were established - CAT and Thailand Post. At the time of the merger with TOT in 2020, CAT had a small number of subscribers in the mobile segment. However, CAT operated many other services in the telecommunications market, including fixed-line telephone and Internet, satellite, and radio. In total, CAT generated 87,531 million THB (2,816 million USD) in revenue in 2019, up from 63,445 million THB (2.041 million USD) the previous year [4].

TOT was restructured from the Telephone Organization of Thailand. After restructuring, it became TOT Corporation Public Company Limited in 2002 and then TOT Public Company Limited in 2005. Similar to CAT, TOT provided many services in the telecommunications market, including core networks, cloud business, fixed-line and mobile telephony, and Internet services[5]. According to the annual report TOT published in 2020, TOT had 186,048 mobile subscribers in 2019, an increased from 2018, in which it had 131,883 mobile users.

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[2] For more details, see http://investor.truecorp.co.th/misc/PRESN/20210326-true-glance-4q2020.pdf

[3] For more details, see https://dtac.listedcompany.com/misc/flipbook/index.html?id=142320

[4] For more details, see http://ww1.cattelecom.com/annual2019_v2/TH/#p=1

[5] For more details, see https://www.tot.co.th/docs/default-source/default-document-library/annual-report-th/tot-annualreport-2562.pdf?sfvrsn=3bbd837f_4

Table 6-1: The Results of the 5G Auction

MNO	700 MHz	2600 MHz	26 GHz
AIS	1 license	10 licenses	12 licenses
TrueMoveH	-	9 licenses	8 licenses
Dtac	-	-	2 licenses
CAT	2 licenses	-	-
TOT	-	-	4 licenses

Source: NBTC, 2020b

Nevertheless, the trend of these companies may change in the near future. Due to the spectrum allocation utilized for 5G in February 2020, there might be a dramatic shift in development and competition in the telecommunications market in Thailand. With the 5G spectrums, new services such as the IoT, cloud computing, and other digital services can be increasingly supported. The growth of these new services may reshape the landscape of the telecommunications market nowadays.

Section 6.2 Prior Studies

OTT has impacts, both positive and negative, on stakeholders in the digital ecosystem, including telecommunications operators. OTT media has been portrayed as negatively affecting Internet service providers and mobile network providers offering mobile Internet, because the providers are utilized as service intermediaries for OTT and users. On the other hand, OTT also has negative impacts on traditional content providers, such as terrestrial and digital TV providers, since they offer similar services. OTT communications, as the main focus in this study, are often regarded as a threat to MNOs. There is a great deal of literature emphasizing the impact of OTT services on MNOs (e.g., Farooq & Raju, 2019; ITU, 2017; Joshi et al., 2015; Ogidiaka & Ogwueleka, 2019). However, the impacts mentioned in those studies have both positive and negative sides, even though negative impacts are dominant. Apart from the impact on core services of MNOs (e.g., voice calling, SMS, mobile Internet) other aspects of the impacts of OTT have been emphasized in several studies. One of those studies is the work of Ghezzi, Cortimiglia, and Frank (2014). They found that OTT, as value-added services and a disruptive change in technology, affected the decision-making of MNOs' strategy in Italy. Moreover, as it pertains to that study, OTT was also considered as one of the environment-driven factors influencing strategy change.

Indeed, besides the study of the impacts of OTT, the response to OTT in terms of strategy adopted by MNOs is also a prominent area among OTT studies, both in the field of telecommunications and business. Several studies focus on potential and justify appropriate MNO strategies for coping with OTT. Generally, the study of MNO strategies for OTT mainly focuses on current and future possible

responsive strategies, which were illustrated in the last section, as they relate to specific countries or contexts, and the relevant factors associated with the adoption of certain strategies (e.g., Heuermann, 2019; Limbach, 2014; Murri, 2013; Park, 2018; Stork et al., 2017). The study of Ganuza and Viecens (2014) is one of those studies. The research focuses on the strategies of traditional telecommunications operators in Latin America (LATAM). In their study, they found that there are two general patterns of strategy employed in LATAM. The first pattern is bundling services; the operators combine services, including core services such as fixed and mobile telephony, into a package. However, the package basically includes satellite TV, rather than IPTV, because of limitations in the regulations. The second pattern is the development of proprietary OTT products. However, in this study, they found that employing strategy towards OTT is not an operators' priority. There are limitations in using OTT in LATAM, such as cost, limited network coverage, and a developmental gap, so OTT users are mostly concentrated among those with higher purchasing power.

The next study was carried out by Limbach (2014). This research employed several cases from many countries to investigate the taxonomy and impact of cooperative strategies of telecommunications operators on OTT. By using Osterwalder's business model concept, the research found that different cooperative strategies yield different amounts of value to consumers. The study identified seven types of cooperative strategies, which can be clustered into three groups based on value creation patterns. The first group is local consultant, which helps solve specific consumer problems. The second group, promotion, bundling, and special OTT tariff cooperation, creates unique and exclusive value to the users. The last group is access to customer data, access to core services, and technology integration, which attracts large numbers of subscribers in order to present new innovations to the users. Overall, this study presented the positive effects from corporative strategy with OTT. However, the study suggested that the operator should carefully choose the strategies based on their low operational cost and process efficiency. In addition, operators should adapt the strategy to their own core competencies.

Besides the study of the general strategy of MNOs towards OTT, there are studies suggesting the appropriate strategy for MNOs to deal with OTT. The study of Stork, Esselaar, and Chair (2017) focuses on the strategies of MNOs coping with OTT in 44 countries in the African region. The authors examined the patterns of strategies used by African MNOs, ranging from aggressive strategies like blocking to friendly strategies such as partnering with OTT. Furthermore, the study intensively analyzed the data from dominant MNOs in South Africa, Kenya, and Namibia to find the most successful strategy. The results indicate that embracing OTT and providing flat-rate pricing are the most successful in order to maintain revenue. Thus, the suggestion from the authors is that regulators should assist the MNOs in providing such a plan. Additionally, the results revealed that a zero-rating scheme is beneficial for new entrants to gain market share. This result is more evidence showing the benefit of a zero-rating scheme in the African region. Similarly, the study of Krämer and Jalajel (2019) also recommended operators to align with OTT. Their study suggested MNOs should follow partner with OTT in the first

stage. The partnership should be in the area of added-value services, such as music, video, and game streaming. The reasons are that these areas are capable of contributing to the operators and can be managed by partnering. Similarly, the study of Xu and Chen (2015) also supports a cooperative strategy, rather than a non-cooperative one. Under a cooperative strategy, they suggest, the total profit is higher, even though a non-cooperative strategy, such as charging OTT providers for mobile Internet access, can also earn profits for the MNOs. Likewise, a study by Ross and Erasmus (2013) suggested that a defensive strategy such as traffic differentiation, specifically using deep packet inspection (DPI), is not suitable because it is not accepted by the Internet community.

According to the literature reviews, even though they are highly informative and provide essential results, there are limitations. This study aims to contribute to those studies. Firstly, this study's focus on OTT communication services is limited. Most of study focuses on OTT services as whole, including all types of OTT. Even though it covers some aspects of OTT communications, such as the strategy of OTT on services provided on the network, each OTT is quite different in terms of characteristics and monetization. For instance, OTT communications affects the core network of MNOs, while OTT media focuses on the bandwidth and capacity of the networks. As presented in a study by Park (2014), which focused on OTT media, a strategy of partnering can be done on both OTT media and OTT communications, though with OTT media it includes discounting subscription fees and monitoring traffic management to a higher degree than OTT communications. Thus, this study focuses on OTT communications employing a two-sided market business model. Secondly, prior studies conducted research in particular countries or regions, which can be quite diverse. Thus, the results cannot be expected to be the same. The context of each country or region is different, including capacity of MNOs, consumer behavior, and legal restrictions. As shown in the work of Ganuza and Viecens (2014) studying the Latin American region, they emphasized that MNO strategy to OTT is not important in the MNOs' perspective due to a large digital divide in the region, resulting in a small effect to OTT. The results differ in other developing countries. For example, the study by Mahola and Erasmus (2015), focusing on Sub-Saharan Africa, found that OTT has a revenue structure similar to network operators, so the study suggested that MNOs cannot be reluctant to carefully plan their strategy for OTT. Those studies show inconsistent results. The context of each country or region likely play a crucial role in the responsive action of MNOs. For this reason, the results in Thailand may be different from other countries. In order to provide the most accurate pattern of the Thai market for each stakeholder in the telecommunications field, it is necessary to concentrate on the Thai market, using the data from Thai MNOs. Apart from being to the benefit of Thai stakeholders, the data contributes to prior studies by providing more cases, which eventually may help future studies to find patterns of MNOs and consumers around the world. Thirdly, the previous studies usually encourage the use of a collaborative strategy with OTT players. This study will be another examination for this postulation. Lastly, the previous studies did not have theories to determine the best strategy. This study employs the

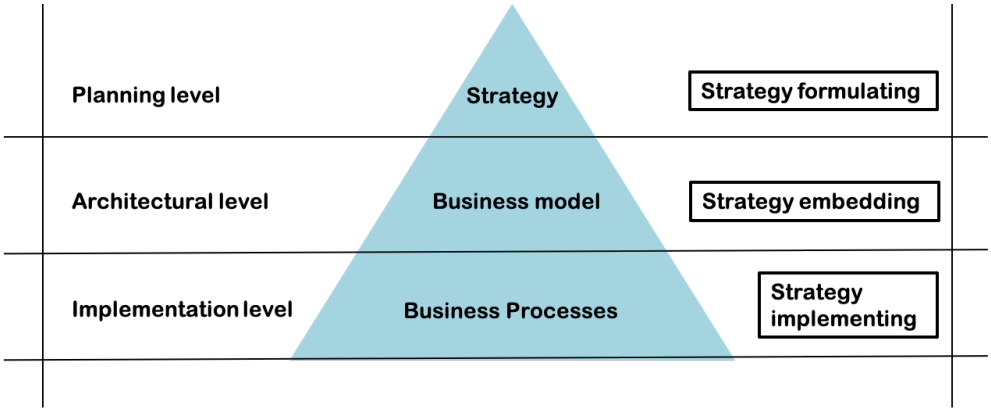
business model of Osterwalder (2004) and Rumelt's strategy evaluation (1980) to help explain the best response for Thai MNOs.

Section 6.3 Methodology

6.3.1 Conceptual Framework

The conceptual framework of this study was primarily based on the concept of business architecture embedded with the theory of firms and strategy management. As explained in Chapter 3: Theoretical background and literature review, profit-maximization and survival-based theory are used in clarifying that firms refers to MNOs in this chapter. With these theories, it is assumed that the MNOs are seeking to maximize their revenue and survive in the market. With respect to the conceptual framework, the concept of business architecture is used to illustrate the structure of each element and their relationship to one another within that architecture. The term business architecture is defined as a blueprint, or a general description of a business system. It captures and explains the relationship of a firms' elements, ranging from its strategic goals to its business models, and how they are implemented (Simon, 2015; Verteeg & Bouwman, 2006). Business architecture is slightly different, depending on the area of the firm, but fundamentally it is comprised of three parts, as shown in the Figure 6-4.

Figure 6-4: Business Architecture



Source: Osterwalder, 2004; Versteeg & Bouwman, 2006 adapted by the author

Firstly, positioned on the top of pyramid, it is the business strategy. In this domain, the organization is formulating their strategy as the main objectives of operating the business. Strategy, as stated in the previous section, is regarded as the general course of action defining the objectives of the

firm. The motivation of strategic formation is regarded as the direction of the business. There are several types of strategies, such as corporate strategy used to explain the general market definition, competitive strategy for a specific market, and functional strategy (Simon et al., 2014). The business influences, both the internal and external factors, motivate the strategy formulation. There are numerous theories defining those influences, for example, a PEST scheme (political, economic, social, and technological), Porter's five forces model for external influences analysis, research and development (R&D) of the firm, and value chain analysis (VCA) for internal drives.

Secondly, the middle tier of the structure is a business model. Business strategy and business model are quite close, but they have different roles in the structure. Strategy is considered the objective, while business model is the plan of how to achieve the goal. In other words, the strategy can be achieved by the business model - one or many models depending on the firm (Seddon et al., 2004 cited in Ghezzi et al., 2014). Business model is generally comprised of how the enterprises create their values, products, or services, how to deliver those values, who the values are delivered to, and what profits can be made from the model (Osterwalder, 2004; Simon, 2015; Simon et al., 2014).

Thirdly, the bottom layer of the pyramid is the business process. In this tier, it covers all the actors/organizations taking a role in the implementation of the business models created in the second layer. This layer does not only relate to people, it covers the monetary constraints and capability of the business. Business capability is the ability for an enterprise to perform its activities in order to achieve its goals. Additionally, this layer includes all of the factors relating to the administration, such as the organizational and cultural environment (Simon et al., 2014).

This study is focused on the *strategy formulating level*, as the part of responsive strategy to OTT, and the tier of *business models*, as the part of impacts of OTT. The bottom layer, business implementation, is not included, because the rising phenomenon of OTT is quite new. It is highly possible that strategy implementation has not yet started, or that it is still in the early stages. In that case, the results might not be accurately estimated. Moreover, it includes several actors, which were not available from which to retrieve data. For these reasons, the last block of structure is excluded from the study.

6.3.1.1 Disruptive Change Factors

In order to maintain the accomplishment of the main objectives stated above, the strategy is often adjusted to respond to changes occurring in both the internal and external environment, especially in a highly competitive market. MNOs in Thailand are also in a competitive, dynamic environment. In a dynamic environment of competition, it is undeniable that there are changes, specifically changes affecting the strategy of firms. According to the framework proposed and used in the work of Ghezzi, Cortimiglia, and Frank (2014), there are four external influences, or environment-driven changes, which are the main focus of this study. These changes are regarded as affecting the

strategy of firms. The first change is *external innovation,* or technological change. This change refers to the emergence or discontinuities of innovation. Innovation is, even though there is no single acceptable one, the first appearance of an idea for a new product or process, the creation and marketing of the new product, and an improvement in instruments or methods of doing the innovating (Fagerberg, 2003; Kline & Rosenberg, 2009). Basically, technological change is considered to be one of the crucial factors driving competition (Porter, 1985). For example, the emergence of the App store, tablets, and smartphones tremendously affected the strategy of business and marketing. The second change is *regulatory change*. The regulations are newly established following the emergence of new innovation and technology. These new regulations might affect the firms either directly or indirectly. For example, the rules related to consumer data protection were established following the emergence of applications collecting the personal information of consumers. In this case, the companies operating in the field of telecommunications have to carefully handle the information of users or may have to be closely monitored by the national regulator. The third change is *customer change*. Users can change their habits and preferences for any number of reasons, ranging from the overall economic conditions to a temporary fad. However, it is important for firms to closely observe the behavior of consumers and change their strategy accordingly. The last change is the *competitor strategy change*. This change covers the change within a company or the change in relationship to firms with which they are in competition. Change in a company might affect the others in a number of ways, such as market share, revenue, or even reputation. For this reason, companies are required to revisit their current strategy and eventually change it. Although there is only a change in one company, it may lead to a change in all the players in competition with one another.

Internal influences, or enterprise-driven changes, although not the focus of the study, are worth explaining briefly in order to comprehend the bigger picture of the framework. Generally, there are internal drives - R&D efforts and emerging resources and competences. R&D efforts may affect the company in a number of ways. For example, they might increase the quality of a company's products, leading to a unique value proposition. These improved products can be considered as disrupters or change agents of competition strategy to rivals. For the latter influence, emerging resources and competencies, they may be from either tangible or intangible resources. The changes in this area can affect the company in the operating process. For example, increasing human resources may lead to an increasingly productive working process resulting in a more efficient operation.

6.3.1.2 Business Model Ontology

Strategy is the way in which a firm can identify and achieve such a position (Porter, 1980). In order to achieve their goal and implement the strategy, a business model is developed. This section describes the concept of business model ontology. It is used to explain the areas in which MNOs are affected by OTT communications. Referencing the work of Osterwalder (2004), a firm needs to specify

its strategy, as well as its business model. One definition of a business model, proposed by Osterwalder et al. (2005) stated that:

"*A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams." (Osterwalder et al., 2005, p.10)*

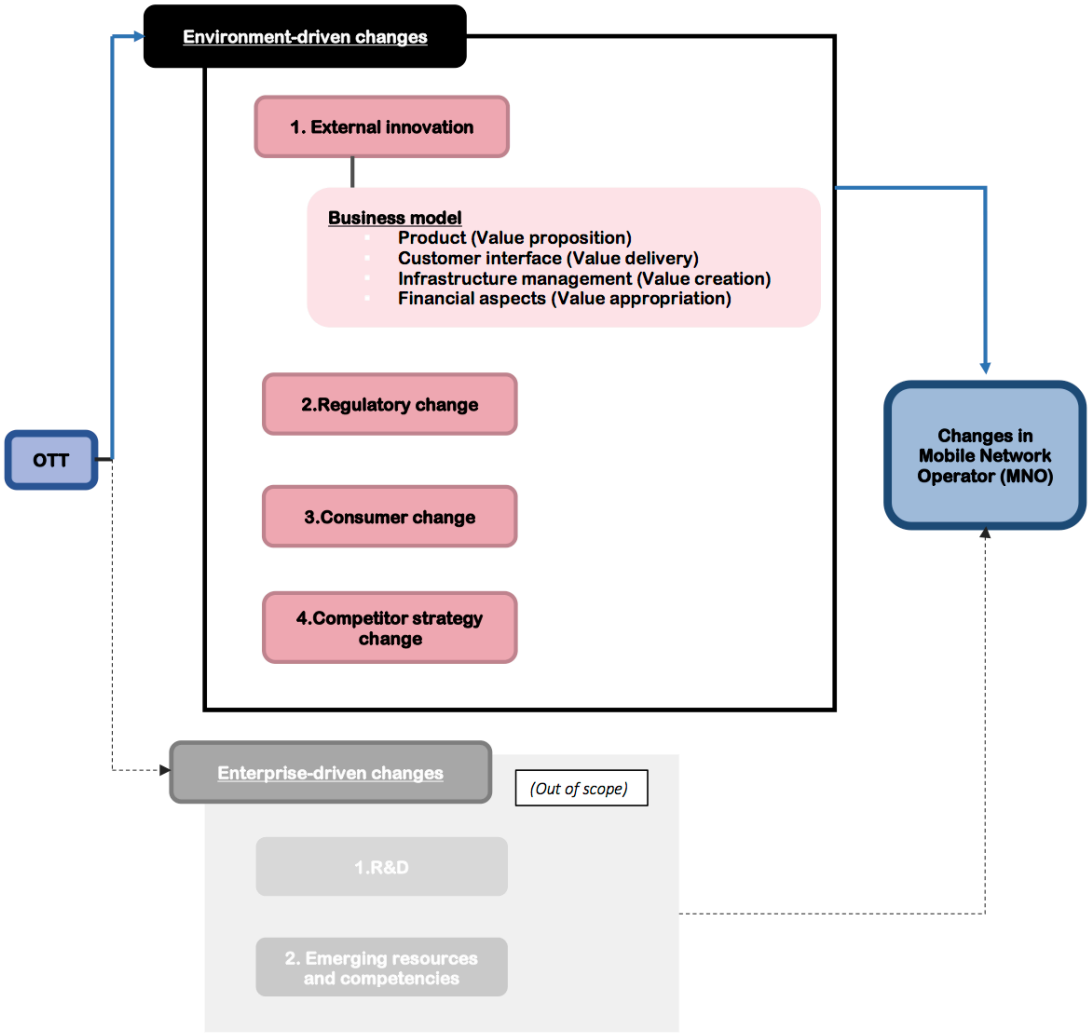
Business model ontology is comprised of four pillars: product innovation, customer relationship, infrastructure management, and financial aspects. The four pillars are rearranged in the study of Ghezzi, et al. (2014) as value proposition, value delivery, value creation, and value appropriation, respectively. Product innovation is identified as *value proposition*. The main purpose of a company is the creation of value that customers are willing to pay for. This refers to what business the company is in and what bundle of products and services it offers on the market. Customer relationship is the pillar covering all customer issues, ranging from identifying target customers to establishing relationships with those customers. In other words, this pillar defines *value delivery*. It can be said that this pillar is to identify who the firms want to deliver their value proposition to. Infrastructure management is about the capabilities. It is also possible to partner with other actors in order to increase their value proposition. It is about *value creation*. Financial aspects are about how to make the profits. All value proposition has to make incoming revenue.

The business model, as well as strategy, can also be changed. The study of Saebi, Lien, and Foss (2017) posited that a firms' propensity to adapt their business model depends on whether an event in the environment is perceived as a threat or as an opportunity, and what type of strategic orientation the firm pursues. They found that the more severe the external threat, the more likely that firms engage in business model adaptation. In contrast, they found that the more firms perceive opportunity, the more likely they are to remain status quo and the less likely they are to adapt their business model.

6.3.1.3 Conceptual Framework for the Impact of OTT on MNOs Part

After explaining the general concepts of each element grounded in the conceptual framework, disruptive change factors, and the business model ontology, the relationship of elements and the hypothesis of the study can be defined. As shown in the Figure 6-5, the conceptual framework of the study, OTT is proposed as a potential disruption affecting change in the MNOs' strategy.

Figure 6-5: Conceptual Framework - Potential Disruption Affecting Change in Firms



Source: Ghezzi et al., 2014; Osterwalder, 2004; adapted by the author

By affecting the MNOs, OTT is considered a disrupter, or external factor. In previous study, the authors found diffusion of OTT associates in two areas from four environment-driven changes, external innovation, and competitor strategy change (Ghezzi et al., 2014). In this study, those four elements of environment-driven changes are included as a proposal. The results in each country are more likely to be different and varied depending on the domestic context. Looking closer at the first element, external innovation, it adopts the concept of the business model put forth by Osterwalder (2004) to explain how external innovation affects business. In addition, this element is considered the one to be most directly affected by OTT on MNOs' businesses. OTT, as an external innovation, is expected to affect MNOs' business model across four components. The first component is product (value proposition), which is defined as the core services of MNOs - voice calling, SMS, and mobile Internet.

The second is the customer interface (value delivery), which is MNOs' value network positioning in the market. The third component is infrastructure management (value creation), which means the infrastructure, resources, and capabilities that MNOs own, both tangible and intangible. The last is the financial aspect (value appropriation). This component refers to the revenue of MNOs. It is expected that OTT communications services affect the four components of business models of MNOs as an external innovation. As concerns environment-driven change, it is also expected that OTT communications have such an impact on it. The remaining three changes are identified as regulatory change, consumer change, and competitor strategy change. These four changes are anticipated to be associated with OTT, resulting in change to MNOs, specifically in their strategies. These are the hypotheses for the first research question in this chapter: *What are the impacts of OTT communications services on MNOs in Thailand?*

6.3.1.4 Criteria for Strategy Evaluation

As explained in the early portion of this chapter, MNOs usually have several strategy alternatives for dealing with OTT. The second research question, *what are the appropriate strategies for dealing with OTT communications services for Thai MNOs,* is based on the strategy evaluation formulated by Richard Rumelt (1980), which was used to identify successful strategy for Thai MNOs. In terms of the evaluation, the strategy must meet all of the criteria. If it fails even one criterion, it is considered an inappropriate strategy. Each criterion is as follows:

- ***Consistency****: The strategy must not present mutually inconsistent goals and policies.*
- ***Consonance****: The strategy must represent an adaptive response to the external environment and to the critical changes occurring within it.*
- ***Advantage****: The strategy must provide for the creation and/or maintenance of a competitive advantage in the selected area of activity.*
- ***Feasibility****: The strategy must neither overtax available resources nor create unsolvable sub-problems*

(Rumelt, 1993, p.2)

Rumelt's strategy evaluation has been adopted by several companies to identify their best opportunity for success. It is one of a limited number of strategy evaluations formulated in the field of strategic management. Indeed, strategy evaluation has not been extensively studied within strategic management (Forsell, 2012). Rather, the main focus in this field has mostly been on how strategies are formulated and how they have changed over a certain period of time (e.g., Mintzberg, 1978; Porter, 1997; Shapiro, 1989; Teece, 2010). Basically, when it comes to evaluation and strategy, SWOT analysis is one of the most well-known techniques. SWOT analysis, developed in the 1960s, is the strategic planning and management technique to consider potential factors affecting a business, including internal and external forces. SWOT stands for Strengths, Weakness, Opportunities, and Threats (Namugenyi et

al., 2019). Principally, the Strengths and Weakness are the internal capabilities and constraints of the firms, while Opportunities and Threats are the external environment of the firms. SWOT analysis has been widely used by many marketing researchers, strategists, and practitioners (Helms & Nixon, 2010). However, SWOT analysis is not appropriate for this study. The reason for this is that it is not specific for strategy assessment. SWOT analysis can be used nebulously and incompletely for any situation that a firm is facing. It is superficial and can be easily misused and misinterpreted (Teoli et al., 2019). Moreover, studies have criticized SWOT analysis on the grounds that it is predominantly concentrated on environmental factors (Ekmekçioglu et al., 2011).

SWOT analysis has been scorned for several reasons, including its superficiality, as mentioned. However, there are alternatives to SWOT. For example, DOE, SOAR, PESTEL and Porter's Five Forces all offer alternative means of analysis. These models have expanded the axis from the four criteria comprised in SWOT. DOE (Defensive/Offensive Evaluation) is one of the alternatives to SWOT (Valentin, 2005). The Defensive evaluation in the analysis estimates the extant venture's vulnerability and strengths. The Offensive evaluation focuses on potential pioneering ventures and gaining market shares from rivals. DOE analyzes internal and external factors equally as well as SWOT but is claimed to be more focused. Apart from DOE, SOAR (Strengths, Opportunities, Aspirations, Results) is also hailed as a popular alternative to SWOT (Zarestky & Cole, 2017). It extends the focus on the Aspirations of the stakeholders and the Results used to estimate goal accomplishment. However, DOE and SOAR are considered to be methods more suitable for strategy planning than evaluation, even though they contain some criteria relevant to strategy evaluation, such as the Results portion of SOAR, while PESTEL, which stands for Political, Economic, Social, Technological, Environmental, and Legal analysis, is geared towards firms assessing the macro-economic factors affecting their organizations. This, however, is not main interest of analysis in this study. Porter's Five Forces comprises the Competition in the industry, the Potential of new entrants into the market, the Power of suppliers, the Power of customers, and the Threat of substitute products. It is clear that this analysis is suitable for estimating the competition in the market, not the strategy. Even though each of these analytic tools has been regarded as alternatives to SWOT, their usage is quite different. They are apposite to a firm's assessment of the diverse factors affecting the organization and beneficial in terms of strategy planning, though not specific for evaluating the strategies formulated by the firms. For this reason, this group of evaluation tools cannot be used in this study. Thus, Rumelt's strategy evaluation is to be considered.

The work of Mintzberg, Ahlstrand, and Lampell (1998), suggested that Rumelt's strategy evaluation was, in fact, "the best one." Along with Rumelt's evaluation having been designed to exclusively deal with strategy evaluation, there are three other reasons why Rumelt's strategy evaluation was adopted in this study, as opposed to other similar evaluation models, such as those of Seymour Tilles (1986) and Tavana and Banerjee (1995). Firstly, Rumelt's strategy evaluation can help explain the appropriateness of the strategies before it is actually implemented. In other words, this assessment can

be used in the decision-making process of choosing the right strategy for the firms. Strategy evaluation is a process that should be done before it is implemented, not only after it has been used (Hastings, 1996). In this study, before the interviewees estimate each strategy, it is assumed that those strategies not have been used by MNOs. On the other hand, many strategy assessments are applied to assess the success or failure of strategy implementation. They are generally comprised of criteria requiring the results of strategy implementation. One of the strategy evaluations comprises the measurement of results is the work of Lee, Chen and Chang (2008). Their assessment includes the increase in the performance of the company and its profit.

Secondly, this strategy evaluation is comprised of criteria covering the internal issues, such as consistency with the company's objective, and external issues, such as consonance with the environment, including the legal system and competition in the market. There are strategy assessments proposing similar methods, including internal and external factors. For instance, the strategy evaluation proposed by Seymour Tilles (1963) covers both internal and external factors, namely internal consistency, consistency with the environment, appropriateness in the light of available resources, satisfactory degree of risk, appropriateness time horizon, and workability. Although this evaluation has more criteria than Rumelt's, all of the criteria can be explained by Rumelt's strategy evaluation, which is simplified version of assessment. Consequently, it is both easier to use and easier for readers to comprehend.

Thirdly, it is well suited to qualitative methodology. There are strategy evaluations used in quantitative analysis. For instance, the strategy evaluation model (SAM), proposed by Tavana and Banerjee (1995), is comprised of three environments - internal environment, task environment, and general environment. This method should be applied using quantitative analysis, because it calculates the utility associated with each potential strategy. Moreover, in order to apply this method, it requires detailed data, which is not accessible in the case of Thailand.

Using this evaluation methodology, each strategy will be assessed to justify suitability for dealing with OTT in Thailand.

6.3.1.5 Responsive Strategy

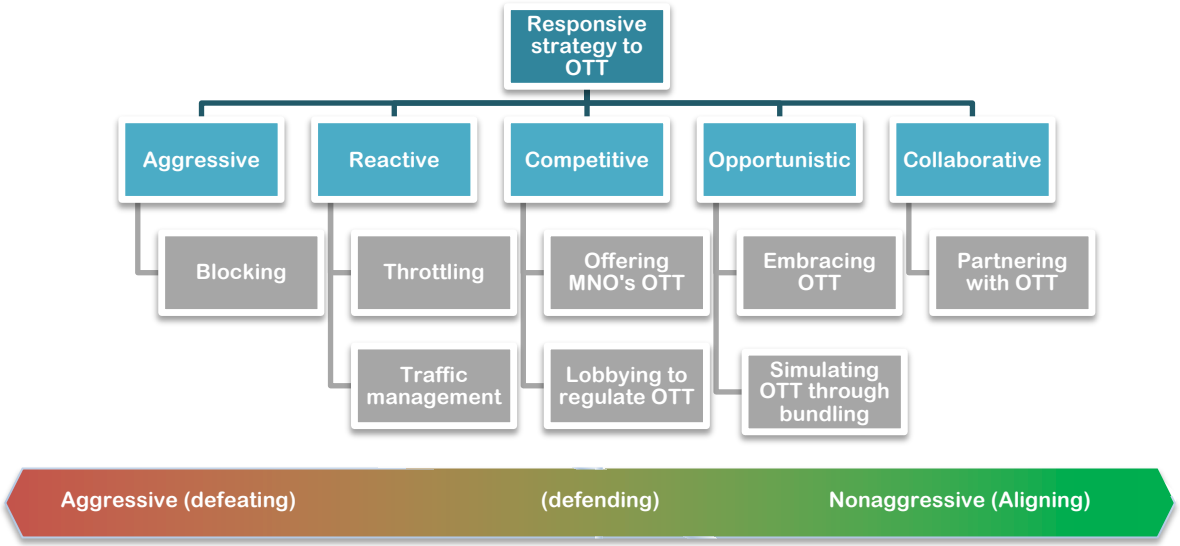
The impact of OTTs forces MNOs to develop responsive strategies. Indeed, MNOs usually choose to employ strategies that respond to the impact they receive from OTTs. Before moving forward to the alternative strategies that MNOs can pursue, it is essential to briefly explain the definition of "strategy." Generally, strategy refers to

> *"…the means by which individuals or organizations achieve their objectives… strategy is focused on achieving certain goals; that the critical actions that make up a strategy involve allocation of resources; and that strategy implies some consistency, integration, or cohesiveness of decisions and actions" (Grant, 2010, p.16).*

In the work of Henry Mintzberg (1987), he described the concept of strategy using five Ps: Plan, Ploy, Pattern, Position, and Perspective. Firstly, a strategy is a *plan*. It means a "consciously intended" course of action or a guideline to deal with a situation. Secondly, strategy can be defined as a *ploy* used to maneuver the competitors. Thirdly, strategy has a *pattern* in action, or a consistency of behavior, whether intended or not. Fourthly, strategy is a *position*; how the organizations place themselves in the environment, or external context. Lastly, strategy is *perspective*. In contrast to position, which focuses on the external environment, perspective focuses on internal intention to design and set characters, such as being the pacesetters by developing new technology in the market. These five Ps are interrelated across various possible directions, such as formulating from the concept of *perspective* to be a *plan* (or *ploy*) as the *position* in the market, which then becomes the *pattern* of an organizations' behavior. This is a basic understanding towards strategy pursued by corporations or businesses nowadays.

There have been several strategies proposed for ways in which MNOs can deal with OTT operators and services. Some of those strategies are appropriate over the long term, even though they may not be considered ideal choices for the short term. All possible strategies collected from prior studies are illustrated in this section, as shown in the Figure 6-6. Generally, the strategies for OTT range from aggressive, on the left side of the scale, to nonaggressive or friendly, on the right side of the scale. In addition, there is some literature defining the strategy in three clusters: defeating, defending, and aligning (e.g., Heuermann, 2019). Defeating is somewhat of an aggressive strategy, while aligning is close to nonaggressive. Defending is a strategy in-between the two; it is not aggressive, but it does not collaborate with OTT services. Defending is only pursued to protect the revenue and market share of the incumbent operators but does not try to eliminate its rivals.

Figure 6-6: Responsive Strategy to OTT



Source: Murri, 2013; Stork et al., 2017 adapted by the author

The chart illustrated in Figure 6-6 displays five sub-group examples of strategies pursued by MNOs in many countries. The details of each group are explained, as follows.

1) Aggressive strategy

Aggressive strategy is positioned on the left side as the most defeating to OTT. The strategy in this group aims to prevent the growth of OTT by blocking OTT access or advertising, which is the revenue source of OTT. This strategy is very effective in eliminating the threat from the competition, resulting in MNOs' core services' protection (Murri, 2013). However, it is controversial because it has negative impacts on various dimensions. Firstly, it affects the reputation of the MNOs (Kramer et al., 2013). User feedback is important for the operator, especially in a competitive market. Users can easily switch to other MNOs that do not block OTT access, especially if those users are looking for popular OTT services. The other option is for all MNOs to unite in blocking the same OTT, yet doing so is difficult, unless the MNOs are forced by governmental authorities. Typically, blocking is a practice exercised by more repressive governments, such as those of China and The United Arab Emirates. Nevertheless, this strategy is restricted by the net neutrality principle. In other words, blocking is not allowed if net neutrality is implemented in the country (Heuermann, 2019).

2) Reactive strategy

Reactive strategy basically comprises internal practices such traffic management and throttling (Murri, 2013). With this strategy, MNOs may slow down the data transmitted over particular OTT. This strategy is similar to aggressive strategy, but it is not quite as severe as aggressive strategy. The users can still use the particular OTT, but the use experience is distorted. This strategy is positive for MNOs, as they can control the traffic on their networks, especially traffic on the data hungry OTTs, such as OTT TV. Moreover, reactive strategy is relatively cost efficient, as MNOs do not have to considerably increase their investment for network maintenance and infrastructure upgrades. Nonetheless, the targeted OTT users may be frustrated with slow or lower quality services, even though other users may be satisfied with the Internet services due to the traffic management of the operators. Consistent with aggressive strategy, users who experience poor connections to particular OTTs may complain and switch to other operators. Indeed, users tend to blame the operators rather than the OTT providers when they experience poor quality of services. Like the aggressive strategy, whether or not this strategy can be applied depends on the net neutrality implementation in the country.

3) Competitive strategy

Strategy in this group is employed by the MNOs to compete with OTTs in order to gain market share. One practice employed as a competitive strategy includes MNOs developing their own OTT services to compete with the OTT services of other providers. This strategy is frequently engaged in

Thailand for OTT media or TV, not OTT communications. Examples of this strategy include AIS Play by AIS and TrueID by TrueMoveH. This strategy requires a sufficient investment budget and extensive research and development (R&D). However, if it is successful, the MNOs reap substantial benefits, such as revenue, market share, and business expansion. Apart from offering their own OTT services, lobbying the responsible agents, such as regulators or the government, for regulatory intervention is another strategy. This practice usually aims to create a level playing field. By doing so, it is not difficult for the MNOs to enter into discussions with the regulator, but it is a difficult task for the regulator to establish the necessary rulings. Creating a regulatory framework for OTT is a controversial and complex task among the stakeholders in the telecommunications market nowadays.

4) Opportunistic strategy

Opportunistic strategy, as defined by Murri (2013), means the practice of MNOs that exclusively discriminate data for OTT for users, such as offering the use of OTT with some packages, charging consumers extra for using particular OTT, and prioritizing OTT over the network, resulting in a better user experience. This strategy has been applied in Thailand, but in a slightly different form than that described in the literature (Aidi et al., 2012; Murri, 2013). Basically, MNOs allow users in their network to enjoy particular OTT services without charging data usage fees, as well as providing exclusive content for their users. This can be considered a zero-rating scheme (Santhi, 2019). Moreover, they may bundle particular OTT in the package. These strategies do not require official cooperation with the OTT operators. MNOs may advertise OTT in their subscription packages in order to attract customers, especially new users from other operators. Even though this kind of strategy is cost efficient and attractive for users, there are some downsides. For example, users may not be satisfied if the MNOs prioritize OTT that are not included in the package they sign up for. In addition, this strategy does not retain the loss of revenue from the core services of MNOs. Lastly, if all the MNOs employed the same strategy, its effectiveness would decline. Users would find that there is no difference among MNOs regarding their OTT offers.

5) Collaborative strategy

This strategy is the friendliest towards OTT, so it is positioned on the right side of the scale. MNOs adopt this strategy in order to build relationships with OTT providers in a variety of ways, from short-term partnerships to joint ventures. In general, they collaborate and share revenue and other benefits. Some aspects of this group are similar to an opportunistic strategy, such as the MNOs may prioritize data transmitted on particular OTTs. The difference is that this strategy includes formal collaboration and mutual interest. Examples of partnering include providing exclusive content and jointly developing new services, such as online payment platforms. This strategy structure not only positively affects MNOs in terms of revenue, but they can also use it to attract users by collaborating with popular OTT. However, this strategy does not promote the use of traditional services. Moreover,

similar to an opportunistic strategy, the partnership is often not limited to only one MNO. OTT can build identical alignments with a number of MNOs, which eventually diminishes the effectiveness of the strategy.

6.3.2 Data Collection

The data collection of this study relies on qualitative methodology. Semi-structured interviews with five MNOs - AIS, TrueMoveH, Dtac, CAT and TOT - were conducted from April to June 2020 in Thailand. However, due the limitations caused by the COVID-19 pandemic, while some interviews were conducted in person, others were done through telephone and video calls. The seven interviewees were corporate strategy managers, responsible for company strategy and policy formulation. The average duration of the interviews was 45 minutes. The questions were open-ended. There were three essential sections of questions in the interview. Firstly, the impact of OTT was asked in every aspect, such as the impact on core services, relationship with consumers, and financial repercussions. Secondly, potential strategies were presented to the interviewees, and their opinion to each one was asked. Afterwards, they were required to specify the appropriate strategy for them, including the strategy that they were currently using or were planning to use, in both the short and long term. Lastly, questions about the regulations and other opinions were asked in order to further understand the situation from the MNO's perspective.

The interviews were conducted in Thai. All of interviews were recorded and transcripts were provided by the author. However, the secondary data resources, such as the company's annual reports and the NBTC's reports were also used in order to complement the information provided by the interviewees. Nonetheless, in adherence to research ethics standards, information identifying specific interviewees' names or characteristics of MNOs that could potentially affect their business in any aspect was concealed, as was any sensitive information.

Section 6.4 Results

After the interviews were conducted, the voice records were transcribed. As they relate to the framework proposed in the last section, the results are presented accordingly.

6.4.1 Impact of OTT

1. External Innovation

OTT is considered to be an external innovation. As explained in the previous section, OTT is a "disruptive technology" to MNOs. The growth of the OTT phenomenon is not only occurring in Thailand, but it is taking place in many countries around the world. Moreover, because OTT operates

across borders, it can be said that it is actually a global issue. Many countries are dealing with this problem together. Nonetheless, from the MNOs' perspective, they cannot deny its existence and have to adapt themselves to it, changing their strategies to suit their needs. For instance, one operator stated that the emergence of OTT is inevitable:

> *"At the end of the day, we have to accept that [new] technology is replacing [old technology]. We have to accept that it is a kind of disruptive technology developing over time. Therefore, no matter if we like it or not, we cannot avoid it."*

From the interviews conducted, most of the interviewees felt similarly and agreed that OTT has the potential to be a disruptive technology affecting the business of MNOs. In this study, it is regarded as "external innovation." The first section presents the impact of OTT on MNOs' business model as an external innovation, including the aspects of product (value proposition), consumer interface (value delivery), infrastructure (value creation), and finance (value appropriation). The assumption posited that OTT affects all four areas of the business model. After the interviews were completed, the results indicate that OTT literally does in fact impact all four elements of the business model, even though the intensity of effects varies across the elements.

1) Product (value proposition)

This area, the product of MNOs including voice calling, SMS, and mobile Internet, is considered the most affected from the perspective of all interviewees. However, the impact on each service varies. Firstly, OTT has an impact on voice calling. The interviewees pointed out that voice calling usage has constantly decreased, owing to the rise of OTT, but the effect is not large. Some interviewees insisted that the decrease in voice calling is not significant because voice calling is considered to be an essential communications service, especially for customers residing in rural areas and corporate users:

> *"It [Decreasing in voice segment] is approximately 20-30%, because we [a MNO's name] covers every customer base, including consumers residing in urban areas and rural areas. Non-urban users still like to make [traditional] voice calls. Thus, the revenue in the voice segment does not decrease that much"*

Moreover, the quality of traditional voice calling and OTT are not comparable; traditional voice calling is considered better and more reliable at the moment:

> *"In the case of voice calling, they [revenue and usage of voice calling before and after the emergence of OTT] are not so different. Actually, I have to say that traditional [voice calls], in terms of stability, is better than using OTT, because using OTT requires good quality Internet. If the Internet connection fails or there is time lag, the sound will be jittery, but in the case of voice calling on cellular networks, it transmits kind of more stable. Therefore, users use both services."*

Secondly, international calls are also affected by OTT. Compared to domestic calling, the impact of OTT on international calls is significantly larger. In Thailand, like elsewhere, international calls are charged at different price depending on telecom providers and the destination country. Basically, when users make international calls, they are required to dial a specific code provided by each MNO before dialing the destination number, such as dialing 003 for AIS, 009 for NT, and 006 for TrueMoveH. Currently, the prices for international calls are more affordable than they were in the past. Additionally, there are promotions offering special discounts. For example, NT provides international calls start at 1.5 baht per minute[6] to 5 destination countries. This price is quite similar to that of domestic calls. However, it is considered expensive when compared to making a voice call via OTT. With more reasonable pricing, many customers use OTT services for international calling. Currently, international calls through MNOs are mostly made by corporate users who are rely on a more stable quality of call and prioritizing the formality of the communications method. Individuals who are subsidized for the cost of the calls by their organizations may also use MNO international voice calling services. However, at this point, most individual users have switched to OTT when making international calls.

> *"... but in the case of the voice calls segment, the voice affected a lot is only international calls...It is obvious that the minutes of [international] calls have decreased due to cost... [current users are] the first is business users, it is like... in general they prefer using traditional [international] voice calls because they still prioritize the stability of communications. The second is users who are subsidized for the cost of calling… In the case of individual users, mostly they adopt OTT. Do you observe that when we plan to go abroad, we buy the [mobile] data package and take it with us? It means people certainly intend to communicate with people residing in Thailand via OTT."*

Thirdly, SMS/MMS seems to be the MNO service most severely affected by OTT. According to the interviews, the revenue of SMS increased to its peak in 2013-2014, then dropped. They suspect that the decline of SMS was caused by OTT. The decline of SMS was clearly observable during the New Year period. During this time, people usually like to send messages to their friends and family via SMS. After the rise of OTT, which began in 2013-2014, users no longer sent SMS messages anymore. Instead, they sent their messages through OTT applications, such as LINE, Facebook Messenger, and WhatsApp. An interviewee heatedly responded to this issue:

> *"Before the rise of OTT, [SMS] traffic during New Year period was like... off the charts! 30-40 million messages (were sent). After the social media boom, apparently, it dropped off dramatically. SMS and MMS have diminished 70%... Lots of users switched to OTT. This business [SMS] almost collapsed. All that is left is content marketers relating to SMS."*

There are reasons why SMS was affected dramatically by OTT compared to other core services of MNOs. As suspected by the interviewees, the first reason is that SMS is not included in the packages

[6] The promotion was offered from 12-14 February 2021 and limited to only five destination countries: China, Hong Kong, Singapore, Malaysia, and Taiwan.

provided by MNOs. Users who want to send SMS are required to pay additional charges, which are generally 3 Baht per message for SMS, and 4 Baht for MMS[7]. For this reason, users avoid paying extra fees by using other services that are already included in the package, specifically OTT services via data allowance. Another reason is that OTT is well-developed. It is richer in terms of features and extras compared to SMS and MMS. Thus, it is more attractive than SMS/MMS from the users' perspective.

"But SMS is an add-on service (excluded from the general package). It may be a psychological effect. One more thing is a message sent using LINE has more gimmicks, such as sending pictures or voice. It may make the [OTT's] features seem better than SMS."

SMS is anticipated to survive in the market, however, even though its usage has decreased dramatically. Similar to the case of international calls, the user base has changed from individuals to corporate users. An interviewee anticipated that SMS will still be an active service in the market:

"SMS has demand from other groups of users, helping sustain SMS service, such as OTP [one-time password] service. OTP sent from a bank for financial transactions help sustain the revenue of SMS. Another source of revenue is from the communications services of retail stores, such as Tesco, Makro, etc. However, while the revenue from corporate users helps [sustain the business], it does not compensate for the loss from the individual users' side. These users have changed to messaging via OTT. Therefore, if we look back to the revenue around 2013-2014, we can see that revenue from SMS increased, then dropped. It dropped, even though there was revenue from other sources supporting it, such as corporate users."

Fourthly, mobile Internet is the area expected to increase, due to the rise of OTT, resulting in higher demand for Internet service. Many users have adopted mobile Internet as they've purchased more technological devices, i.e., smartphones, while at the same time, users with devices such as iPads and tablets are also using mobile Internet, resulting in increasing number of subscribers. For this reason, many MNOs have found that their revenue from mobile Internet is increasing. An interviewee provided insightful information about the increase of mobile Internet that:

"We have two factors, first of which is that our customer base has expanded. They probably, how do you say it, are the users who never before owned a second device, they are starting to own a second device now. Secondly, our customer group, who started using new devices like iPads, is increasing... mainly from our expanded customer base, so the Internet segment is growing. Previously, customers who did not use the Internet, currently they started using it."

However, many operators stated that the increase in demand, and also the usage of Internet, do not generate significant income for MNOs. The MNOs are required to maintain good quality services, so they have to invest more in their infrastructure. Moreover, users seem unwilling to pay more for

[7] Excluded the value-added tax (VAT)

Internet. They usually have a limited budget for Internet. In addition, due to competition, MNOs cannot increase the price for providing Internet service as they would like to do. If they did, users would switch to other operators. Internet is considered sensitive to the price point because users do not find any significant difference among providers. Furthermore, MNOs compete in terms of quantity of data allowance instead of price. Thus, the net income they receive does not significantly change. The next reason stated by the interviewees is that the Internet market in Thailand is somewhat saturated. They do not think that the market can grow much bigger than it already is right now. The last reason is that users subscribe to more than one service at a time. For example, users subscribe to fixed-line broadband and also mobile Internet. In this case, users are more likely to be active on online activities consuming a high volume of data when they are connecting to their home Wi-Fi, as this service is offered at a fixed price. When they are connected to mobile Internet, they are less likely to use services consuming large amounts of data to avoid exceeding the limit of their subscription package, resulting in additional cost. An interviewee interestingly narrated the current situation of the mobile Internet market:

"When the bandwidth increased by OTT, umm, it, it increased, then the cost of network investment has gradually increased as well. When [we] invest more, it seems good for us that we can sell more Internet. Yet, the problem is that the consumers are not willing to pay more (laugh). The consumers demand more bandwidth [data] allowance, but they do not want to pay more, because they would like to pay for what they consider that it is "valuable." They may want to pay for Netflix, 100-200 Baht, they would pay, but they do not want to pay for Internet. How do you say, another thing is because of the competition? The products [Internet] are all the same."

Another reason from the users' side is that the MNOs noticed that the users' selection in Internet usage. Because of this reason, the revenue from the Internet does not generate income as much as expected:

"Presently, some users use two services simultaneously, data on mobile and Wi-Fi at home. The users know really well what activities should be done on which service. What time they should use Wi-Fi and what activity should use mobile data."

Apart from what some customers see as problems from their side of the equation, other interviewees mentioned problems from the MNOs' side, which is a highly competitive level among the MNOs:

"Umm…in this case, it [OTT] does not affect the operators, because the competition in the telecommunications market nowadays, in terms of price and usage are quite saturated, by the circumstances of the Thai telecommunications market…"

"[Our] income does not increase the same as the actual usage does. Currently, the operators are competing on data packages. Thus, data packages prefer to increase the quantity of GB allowance to the users [instead of decreasing the price]"

In addition, many users tend to consume more data as they become more familiar with using the Internet. Initially, they may purchase a package for OTT communications. However, after they get more comfortable on the Internet, they tend to expand their usage to other services that consume a high volume of bandwidth. Thus, MNOs have to bear this cost of infrastructure investment, which is likely to increase over time.

"Surely, people start using a data package for a reason. If they want to use OTT, they have to purchase a data package. As the Internet provider, we have more revenue from this service. OTT makes the users stick to OTT communications. This leads to other activities consuming data. Users may start from a data package for the sake of the communications services. When they have a data package, they use other activities on the Internet, such as watching YouTube. These activities consume lots of bandwidth."

To sum up, the product area greatly affected by OTT is voice calling, international calls, and SMS though international calls and SMS are affected to a higher degree than voice calling. With respect to mobile Internet, there is a slight increase, but it does not compensate for the loss from the other core services. Thus, OTT negatively affects the product (value proposition) of MNOs, as stated in the hypothesis.

2) Customer interface (value delivery)

The second area affected by OTT is the relationship with users. OTT affects the customer interface in two aspects. Firstly, it blurs the understanding of MNOs towards users. OTT is considered a layer between MNOs and users, resulting in an unclear understanding of MNOs by its users. Secondly, OTT has damaged the relationship between MNOs and users. When users encounter problems while using OTT services, they tend to blame the MNOs, rather than OTT providers. An interviewee described the situation that his/her company is facing as such:

"From the past, it can be said that mobile operators are gradually being in trouble. In the past, we built our relationship with the consumers directly. When OTT came [into the market], OTT inserted itself as a middle layer [between MNOs and users]. They [OTT] have managed the relationship with users. The information of users is in the hand of OTT. Data on users that we have now is not sufficient. We don't know exactly who our consumers are. We don't know consumers' behavior, because what we collect is only how much data they consume, what application they use, but we don't know what attributes they prefer, and actual behavior. This important data is in the hand of OTT players. Therefore, OTT is getting more powerful, more important. As a mobile operator, we are trying to manage the relationship with users, to get to know our consumers better, through various methods."

In addition, MNOs are suffering from complains sent from their own consumers. As a result, MNOs try to invest and maintain the quality of service by any means, such as allowing OTT providers to construct a Content Delivery Network (CDN) in the site of the MNOs. CDN is a server group or network distributing content. If the CDN is located sufficiently close to the network of MNOs, the

content transmitted to the users is smoother and faster, resulting in a satisfactory quality of services from the users' perspective. This situation was explained by interviewees thusly:

"Another thing is that, concerning OTT, LINE, YouTube, the users never think that the problem is from them. They never take a look at YouTube. Why don't the users ever complain about YouTube? They would rather blame the operator, like "Internet from this operator is slow." This is one point why OTT is a threat for us. The income goes to them, but maintenance duty, supporting the speed, is on us. We carry this duty. There is a server called 'CDN' ... They [OTT providers] located their CDN in our sites. Locating these CDNs is free of charge. In the past, we charged them for locating CDN, but now it is free."

3) Infrastructure (value creation)

It is important to look at the impact of OTT on the infrastructure of MNOs. As the owner of the networks, MNOs suffer from the high volume of data transmitted on the network. Actually, OTT communications do not affect the infrastructure as much as OTT media does. From the MNOs' perspective, it may be difficult for them to distinguish the type of OTT. They mentioned the impact of OTT on their infrastructure as a whole as follows:

"As the mobile operators, when the trend goes that way, we do not have other choices but to invest in the infrastructure to support the traffic that has changed from over the traditional services to be on the Internet."

However, the cost invested in the infrastructure is not as large as perceived. An operator stated that the suppliers usually offer the devices at almost the same price, but the capacity of the device is enhanced. Therefore, the cost per unit is increased slightly. An interviewee explained this situation in detail:

"Actually, about the cost, when the bandwidth increases, the cost per unit gets cheaper for the operators. It is the nature of suppliers that are selling the devices at the same price, but they increase the capacity of the device, for example, from 10GB to 100GB at almost the same price. It is not entirely true that our cost increases that much, and our income is static... it [the cost] might be slightly increasing. The suppliers offer us the devices at cheap prices. It is the nature of them."

4) Financial aspects (value appropriation)

The overall impact of OTT on product, customer interface, and infrastructure means that the financial returns are negatively affected. The usage of core services, including voice calling, international calls, and SMS is decreasing. Although mobile Internet is increasing due to the higher demand for Internet service, it cannot compensate for the loss of revenue from the other core services of MNOs. Moreover, with the circumstances of the market, it cannot be expected that revenue from this area will increase to the degree they would like. The obstacles were described by an interviewee as:

"The revenue from voice calling will diminish. Only revenue from Internet will be left. When there is only the revenue from Internet, as I said, there is no difference among the operators, except there is an operator claiming they have more Internet towers or something special. It will soon eventually be saturated. When it comes to saturation, it is the end."

In conclusion, OTT negatively affects four components of the business model of MNOs. However, the degree to which they are affected varies among the components and core services of the MNOs. Some of the MNOs' products will earn a profit, specifically mobile Internet, but it cannot compensate for the diminishing revenue in other core services. Thus, the hypothesis proposed that OTT affects the business model of MNOs is acceptable.

2. Regulatory Change

OTT not only affects four elements of the business model, it is also expected to associate with the environment affecting the change of MNOs. In theory, regulatory change occurs when there is new innovation. This innovation leads to new regulations, and these regulations act as obstacles to the incumbent operators. However, in the case of OTT, the "unchanged" regulations are more of a problem to MNOs. MNOs are obligated to follow a myriad of rules enacted by the regulator. These rules sometimes hinder the competitive advantage of MNOs. On the other hand, OTT services are exempted from most of the regulations. This is known as an uneven level playing field. An example was given by an interviewee:

"The users switched to OTT because of the price of voice calling. The package provided by the MNOs already includes a termination charge between the operators. … It is the base fare constraining us. The IC [interconnection charge] is around 0.1 Baht. For this reason, [the price offered to the consumers] cannot be lower than it is now. Lower than this, we will go bankrupt… As long as the NBTC controls the IC, the price is still unchanged."

Another interviewee also raised a similar issue regarding the IC in Thailand, as stated:

"…Our revenue has to be partially paid to the NBTC. There are several types of payment to the NBTC, such as the [license] fee deducted from the total revenue, and USO [Universal Service Obligation] charge. Apart from the auctions cost, we have to pay for the license sold to the operators. We have lots of burdens. Concerning fees, like the USO fee, they have never been reduced. They were generated on the grounds of 10-year-ago assumptions…They are not okay. They remain the same… Some regulations are outdated, such as on-net and off-net… We are under the regulation of the IC…, with charges on fixed-lines more expensive than on mobile. They are paradoxical and inconsistent…"

Concerning the interconnection charge (IC), the reference rate issued by the NBTC is shown in Table 6-2. These rates were confirmed at the time of the interviews (April-June, 2020). The rate was slightly reduced in 2021. These charges are applied to MNOs, which stated in interviews that the IC is an obstacle to them. In addition, these rates do not apply to OTT services unless they connect to the PSTN.

Table 6-2: Reference Rate for Interconnection Charge

Services	Interconnection	Reference Rate (Effective January 1st – December 31st, 2020)
Mobile telephony	Call Origination	0.12 Baht/Minute
	Call Termination	0.12 Baht/Minute
	Call Transit	0.02 Baht/Minute
Fixed-line telephony	Call Origination	0.19 Baht/Minute
	Call Termination	0.19 Baht/Minute
	Call Transit	0.11 Baht/Minute
	Call Termination for Local Call	0.40 Baht/Minute

Source: NBTC, 2021

Because of the problem of regulations, MNOs all agreed that the NBTC should revise the rules that are applied to MNOs. To them, it seems that implementation of some regulations caused them problem hindering their competitiveness. An interviewee passionately complained about this issue:

> *"I think we should not regulate OTT, but from our side, as mobile [operator], or network owner... I discussed with them [NBTC] that domestically, MNOs are strictly regulated. Sometimes, we are overly regulated, exceeding the authority that the NBTC has. From our side, we comply with those regulations. As we rely on them [NBTC], when we can comply, we always do. We used to raise the issue regarding strict regulation with the NBTC. This problem will make us collapse. On the other hand, you [NBTC] don't have any means to regulate OTT, and never support us to compete with OTT. The NBTC should change their role from controlling us to instead being the partner supporting domestic entrepreneurs to gain a competitive advantage."*

In addition, as stated by the interviewees, they actually do not agree with OTT regulations. However, they think that they are lacking in competitive advantage compared to OTT because of the strict regulations implemented by the NBTC. Indeed, the factors are not only limited to the new service regulation constraining the incumbent corporations, but it is becoming a problem when the regulations are overly static. Moreover, technology and innovation can be developed in a very short time. Oftentimes, however, the regulations, especially those from governmental organizations dealing with red tape, cannot move swiftly enough to keep up. The issue occurring in OTT and MNOs is one of the examples demonstrating regulatory problems.

With respect to the regulations applying to MNOs, there are three issues that should be addressed. Firstly, it should be remembered that MNOs are in the private sector. They are the stakeholders in the ecosystem. It is natural that the firms should maximize their profit. There is a

common belief that "the company has a legal duty to maximize the profit for the company." When the regulations hinder them from doing so, they may perceive that themselves to be overly regulated, more so than they actually are. It is basically a kind of bias which is common in the firms. Secondly, it is possible that the regulatory framework imposed on MNOs is overly strict, as they believe. A convincing argument can be made to this effect, that the regulations are quite strict for Thai MNOs. Thirdly, it is possible that the regulations for MNOs in Thailand are necessarily strict because they are identified as a "significant market power (SMP)." Under the anti-monopoly law, when a company is identified as an SMP, it is obligated to comply with extended measures. Currently, all MNOs are identified as SMPs, under the Order of the National Telecommunications Commission No.32/2553 Re: Identifying Operators with Significant Market Power in Each Relevant Market and the Operators with Significant Market Power to Comply with Specific Measures.

The regulatory framework of Thailand currently has several rules that apply to MNOs. One of these prominent regulations is licensing. Presently, there are three types of licenses granted to telecommunications operators. The first type, a Type I license, is for operators providing telecommunications services without operating the network. The second type, a Type II license, is for operators providing telecommunications services for specific limited groups of customers with or without operating the network or leasing out the network to other operators to provide those services. Basically, the services in this group do not significantly affect fair competition or general consumers because they aim to provide the services exclusively to other operators or companies. The third type, a Type III license, is for operators who operate the network for services to the general public. The services provided in this group are considered to have significant impact on both fair competition and users. Consequently, the MNOs providing traditional telecommunications services are granted this type of license.

According to the Notification of the National Broadcasting and Telecommunications Commission on Licensing Criteria and Procedures for Telecommunications Services B.E. 2563 (2020), there are several requirements stated in the licenses, which the licensees have to abide by. For example, before licenses are granted, the licensees have to meet specific requirements and submit the details of their businesses for the NBTC's consideration. These may include financial statements, market analysis, and competitive strategies. After licenses are granted, the licensees are required to pay annual fees along with annual funding support for the Broadcasting and Telecommunications Business Research and Development Fund. Moreover, there are a number of duties that apply to the licensees, including opposition to unfair competition practices and customer protection, such as setting up interconnection systems, maintaining quality of services, and providing free services in the event of emergency.

The level of regulation of MNOs in Thailand, compared to that in other countries of the world, is marginally above average. Statistics from the global ICT regulatory outlook of 2020, published by the ITU, shows Thailand situated in the third generation (G3) of maturity of regulatory frameworks for ICT

sectors and the digital economy (ITU, 2020). There are a total of five generations in the ITU study. More than half of the world is concentrated in the second and third generation (G2 and G3), while the fifth generation (G5) is the highest rank, indicating high regulatory maturity. The regulations in G5 are considered appropriate and support the growth of ICT in those countries. Looking more closely at the details, the ITU uses their criteria to estimate the maturity of the regulatory frameworks. The estimation is called the ICT regulatory tracker, and comprises 50 indicators divided into four pillars, namely regulatory authority, regulatory mandate, regulatory regime, and competition framework. The sum of Thailand's scores for each pillar is 20/20, 19.5/22, 22/30, and19.8/28, respectively, for a total score of 81.3 out of 100. The global average score is 73.7, while within the Asia-Pacific region it is 64.8. These indicators imply that the regulatory framework in Thailand is acceptable, slightly higher than the global average, though it has not yet reached the upper two tiers of regulatory framework maturity.

3. Consumer Change

It is important to regard consumer behavior as one of the factors encouraging the growth of OTT. It is not limited only to saving costs, but OTT is also successful in developing their services to accurately fulfill consumers' needs. We know that many users have switched to OTT. When customers use OTT regularly, they get more familiar with the services, at which point they are less likely to go back to traditional services. This issue was stated disapprovingly by interviewees as such:

> *"...it may be difficult to us. When consumers become accustomed to OTT services, they stick to the OTT services. We don't know what to do then… On the consumers' side, if they are satisfied with the services, they found them better, they will stay with those services. They won't come back to traditional services."*

> *"It seems like everyone has accepted that OTT services have been improved tremendously. They can respond to the users' needs better. It is an easy comparison between SMS and [OTT] messaging from LINE or Facebook, it is totally different."*

It is interesting that all of the MNOs stated that consumers have actually changed their behavior. There are special characteristics of OTT that users like. In other words, OTT can solve users' problems very precisely, and they understand their users well. This supports the notion that one of OTT's key successes is that it has used substantial amounts of R&D to create products that are popular with users, who find that OTT is better than the services they had been using. It is therefore understandable that they would switch to new services. As stated by the interviewees, the users are unlikely to revert back to using traditional services.

Moreover, an interviewee stated that the current situation of COVID-19 leads to a higher usage of OTT:

"I think, from the number of subscribers [to OTT] nowadays, we can see that consumers tend to consume the data more. They have changed their behavior. For instance, during the COVID-10 pandemic, it is clear that the users have changed their behavior to a "new normal." People who used to reject the technology have changed their mind to adopt technological devices. Thus, I truly believe that in the future, it will stay with people. It cannot be rejected…concerning the telecommunications and OTT, it will be accepted, including OTT expecting to enter [the market] in the future."

This issue is also mentioned in the report by the NBTC regarding the regulatory situation in Thailand, published in 2021. The lockdown from the COVID-19 pandemic has been a major factor in increasing the use of communications services. A large number of users have changed their working environments from in the office to work-from-home (WFH), requiring them to use communications services far more frequently than they did prior to the pandemic. Not only has the use of OTT increased, which is reflected in an increase in data traffic, but traditional telecommunications services have increased as well, especially in the second quarter of 2021, as shown in Table 6-3. The NBTC suspects that these increases are due to a greater number of people who now work from home (NBTC, 2021). Moreover, users who reside in areas where Internet connectivity and its stability are poor, are forced to rely largely on traditional telecommunications services. This is another reason why the use of traditional telecommunications services has increased in recent years.

Table 6-3: Communications Services Connection

Service	2Q2020	3Q2020	4Q2020	1Q2021	2Q2021	% change YoY	% change QoQ
Mobile-telephone traffic (Millions of minutes)	8,168.40	7,967.50	7,819.60	7,166.40	7,528.60	-7.83%	5.05%
Outgoing mobile traffic to fixed networks (Millions of minutes)	299.90	266.20	263.90	275.80	278.60	-7.10%	1.02%
Domestic fixed-to-fixed telephone traffic (Millions of minutes)	2.70	2.80	2.70	2.50	2.10	-22.22%	-16.00%
Fixed-to-Mobile telephone (Millions of minutes)	148.20	141.70	141.40	146.80	144.90	-2.23%	-1.29%
SMS sent (Millions of files sent)	2,890.50	3,035.10	3,357.00	3,291.60	3,798.10	31.40%	15.39%
MMS sent (Millions of files sent)	2.90	3.10	3.90	3.80	3.60	24.14%	-5.26%
International outgoing telephone traffic (Millions of minutes)	12.60	10.20	9.60	8.90	19.10	51.59%	114.61%

Service	2Q2020	3Q2020	4Q2020	1Q2021	2Q2021	% change YoY	% change QoQ
International incoming telephone traffic (Millions of minutes)	9.50	6.50	8.70	8.70	18.80	97.89%	116.09%

Source: NBTC, 2021

As mentioned in the first aspect, external innovation, there are still some groups of users who are *not* changing their usage of traditional telecommunications services. Even though OTT can be considered a new and attractive alternative, they still rely on traditional services. These groups of users are corporate users. For this reason, some interviewees stated that OTT cannot replace traditional telecommunications services.

"As we predict, the situation will not change dramatically from what it is now. Because we have predicted, predicted from the status of voice [calling] and SMS 4-5 years ago, what it is right now is similar to our prediction. It is that voice calling would decrease in terms of revenue from the increase of use in Internet [access] and data [usage]. It [data usage] substituted SMS. It [SMS] has been decreasing continuously from 6-7 years ago. It will not decrease much from where it is now, because many users have to use it, which are organizations such as banks or stores. They have to rely on SMS, and the current usage level is their normal level. It has currently been in a saturated thread … So I think they [the traditional telecommunications services] will not be completely substituted by OTT."

4. Competitor Strategy Change

The telecommunications market in Thailand is quite competitive. As stated in the theory, a change of strategy from one operator can lead to a change from all the players in the market. MNOs as well have changed their strategy to cope with the changing dynamics of OTT. It seems true in Thailand, too, as an interviewee explained:

"Currently, we have partnerships with OTT services, because it is the trend in the market. Every player partners with OTT providers so no one is at a disadvantage. It is a must. If we don't, we may not survive."

This is consistent with the promotion and packages offered by MNOs over the past five years. The assumption that MNOs tend to provide similar promotions following trends seems compelling. In general, MNOs provide bundling packages consisting of voice minutes and a specific amount of data allowance. These kinds of packages are offered by every operator. However, MNOs frequently offer extra or bonus packages to attract users, or to satisfy existing customers in an attempt to prevent them from switching to other operators. These packages change frequently over time. There are two possible

rationales why MNOs feel the need to regularly change their promotional package offerings. The first reason is to follow and keep up with current trends, including consumer behavior. This issue has been discussed in a previous section, consumer change. A clear example is the WFH pattern resulting from the COVID-19 pandemic. Companies released several packages exempting data charges for MS Team, Zoom, and VLEARN applications in an effort to support customers making use of online working and learning platforms. Moreover, the three MNOs in Thailand offer "COVID-19 insurance" for consumers (NBTC, 2020c). This reflects how the promotions offered by the MNOs has changed to fit users' needs.

The second point is an alteration of approach following competitors' change in strategy. Over the past five years, we have seen MNOs tend to change their strategies to follow their competitors. To illustrate, in the third quarter of 2017, Dtac had to reduce the price for 1 Mbps and 4 Mbps packages to the same level as the packages offered by other operators (NBTC, 2017a). However, OTT has played an important role in the strategy changes among MNOs, which follow similar patterns of offering promotions, including the most popular OTT in their packages. For instance, in April 2015, AIS and Dtac offered promotions allowing consumers to use Facebook, LINE, and WhatsApp with no charge to their data plan. In September of the same year, TrueMoveH also offered free usage on Facebook. Another example was in the second quarter of 2018, when every MNO offered packages allowing their consumers to use additional services without being charged for the data. All of them utilized popular OTT communications and media, such as Facebook, LINE, WhatsApp, and YouTube. Some of them provided the packages at a fixed-price. Although the details and pricing of the packages are varied, the concepts of the packages are virtually identical. It is understandable that MNOs released these packages in response to the growing trend of customer use of OTT services. It is undeniable that each of the MNOs could not sit idly by while the rest of the MNOs were following trends, especially among the three biggest MNOs - AIS, TrueMoveH, and Dtac. This is considered one of the characteristics of a highly competitive market.

Table 6-4: Outstanding Promotions from MNOs in the 2nd Quarter of 2018

MNO	Tariff Type	Name of Promotion	Price (Baht)	Application
AIS	Post-paid	On-Top Social	17/ 1 day	FB, LINE, WhatsApp
			59/ 7 days	FB, LINE, WhatsApp
		Social Pack	5/ 1 day	FB or LINE or WhatsApp
			29/ 7 days	FB
			19/ 7 days	Line or WhatsApp
			116/30 days	FB
			49/30 days	Line or WhatsApp
		On-Top VDO Clip	29/ 1 day	YouTube
			99/ 7 days	YouTube
	Pre-paid	Social & Entertainment Apps	7/ 1 day	FB, LINE, WhatsApp
			49/ 7 days	FB, LINE, WhatsApp
		Social & Entertainment Apps	5/ 1 day	FB or LINE or WhatsApp
			29/ 7 days	FB
			19/ 7 days	Line or WhatsApp
		On-Top VDO Clip	29/ 1 day	YouTube
			99/ 7 days	YouTube

MNO	Tariff Type	Name of Promotion	Price (Baht)	Application
dtac	Post-paid	Unlimited App Use	116/ 30 days	FB
			70/30 days	Line or WhatsApp
		YouTube and LINE TV	69/ 5 days	YouTube, LINE TV
			169/ 15 days	YouTube, LINE TV
	Pre-paid	Unlimited Use on 5 Apps	7/ 1 day	FB, Messenger, LINE, Twitter, IG
		Facebook, LINE, WhatsApp Mini	5/ 1 day	FB
			19/ 7 days	LINE or WhatsApp
		Unlimited VDO streaming on YouTube, Unlimited TV-series watching on LINE TV	9/ 1 hour	YouTube or LINE TV
True	Post-paid	Social Unlimited	15/ 1 day	FB, LINE, WhatsApp, IG
			69/ 7 days	FB, LINE, WhatsApp, IG
			179/ 30 days	FB, LINE, WhatsApp, IG
		Unlimited Facebook/ Unlimited WhatsApp / Unlimited Twitter/ Unlimited LINE/ Unlimited Instagram	5/ 1 day	FB or WhatsApp or Twitter or LINE or IG
			19/ 7 days	FB or WhatsApp or Twitter or LINE or IG
			49/ 30 days	FB or WhatsApp or Twitter or LINE or IG
		YouTube	29/ 1 day	YouTube, LINE TV
			99/ 7 days	YouTube, LINE TV
	Pre-paid	Social Unlimited	15/ 1 day	FB, LINE, WhatsApp, IG
			69/ 7 days	FB, LINE, WhatsApp, IG
			179/ 30 days	FB, LINE, WhatsApp, IG
		Unlimited Facebook/ Unlimited WhatsApp / Unlimited Twitter/ Unlimited LINE/ Unlimited Instagram	5/ 1 day	FB or WhatsApp or Twitter or LINE or IG
			19/ 7 days	FB or WhatsApp or Twitter or LINE or IG
			49/ 30 days	FB or WhatsApp or Twitter or LINE or IG
		YouTube	29/ 1 day	YouTube
			99/ 7 days	YouTube

Source: NBTC, 2018

The first section of this chapter examined the impact of OTT as externally driven changes. The results revealed that OTT impacts and has associations with four factors of those environment-driven changes, even though there are some factors presenting different results. Firstly, it affects four components of MNOs' business model as an external innovation, which are products, customer interface, infrastructure management, and financial aspects. Moreover, OTT is associated with a change in regulations, consumer changes, and competitor strategy changes. The results found here are slightly different from those of a previous study (Ghezzi et al., 2014), who found that diffusion of OTT had nothing to do with aspects of regulatory change or consumer change. Since the context of each country is different, the results can be different.

Indeed, it is interesting that each component is interrelated to one another. For example, the fact that usage in the core services of MNOs is declining is the result of a change in user behavior. When the usage declines, it follows that revenue also decreases. When MNOs tried to raise the price of their services as one of their strategies, they found that the regulations prevented them from doing so. Moreover, as some MNOs changed their strategy due to the rise of OTT, it meant that they risked losing market share. In this circumstance, it is important to note that even though the study aimed to examine

the impact of OTT in each element, it does not mean that those elements do not have any effect on each other.

To sum up for this section, it is clear that OTT has various impacts on MNOs, both negative and positive and to different degrees. With these impacts, MNOs are concerned about changing their business and environment. Thus, considered strategy dealing with these impacts is necessary. The next section discusses the issue of this strategy. An appropriate strategy for OTT is also evaluated regarding its impact on OTT.

6.4.2 Strategy against OTT

It is clear that OTT actually affects MNOs in various ways. One of those changes is in the strategy coping with OTT. In this section, the main objective is to find the most appropriate strategy towards OTT from the Thai MNOs' perspective. Each strategy was presented to the MNOs, their opinion was asked, and whether they had implemented these strategies was recorded. Utilizing the theories of firms, the main purpose of the corporations is to maximize revenue and survive in the market. However, these theories merely explain the overall objectives which typical corporates adopt. In this section, the objective regarding OTT was elaborated. Before discussing each strategy, the interviewees were asked about their company's general attitude towards OTT services and their main goal to deal with OTT. Mostly, they admitted that they have to be friendly towards OTT services. OTT services are a reality they cannot deny. Instead of being the enemy of OTT operators, they choose to be friends with OTT players. This is considered as a sub-objective for dealing with OTT. Thus, the opinions expressed in each strategy is under the assumption that MNOs in Thailand will act as partners with OTT services. It is expected that the use of the most appropriate strategy means that it can help them accomplish this goal. In previous studies, it was demonstrated that nonaggressive strategies are commonly used in other countries (Stork et al., 2017). Thus, it is hypothesized that this group of strategies is in the interest of Thai MNOs as well.

Regarding the interviews pertaining to each strategy, the results are presented with assessment using Rumelt's strategy evaluation (1980) to determine if each strategy is appropriate in the Thai context. The assessment is comprised of four criteria, the first of which is consistency. Good strategy must be consistent with the goals and policies set by the company. The second is consonance. The strategy must be compatible with the external environment, such as legal systems and market competition, and can be adaptive to the changes that occur within dynamic competition. The third criterion is advantage. The strategy must encourage the competitive advantage of the firms. The last is feasibility. It means that the strategy must be feasible in terms of resources and legal restrictions and able to operate the strategy.

1. Aggressive Strategy (Blocking)

For MNOs, blocking is considered an inappropriate strategy. Firstly, blocking can be fruitfully implemented only on the condition that every operator blocks the same OTT at the same time. Otherwise, users would simply switch to the operators that are not blocking the OTT that they want to use, especially in a highly competitive market where users have alternatives and can change operators easily. An interviewee insisted that there is a low possibility of blocking adoption:

> *"It is impossible [to use a blocking strategy], because there is competition in the layer of mobile operators. If we block, it must be done on the condition that every operator simultaneously blocks [the same OTT]. I also think this situation is impossible to happen because we are actively in competition. If Dtac blocks, True blocks, but AIS does not block, the users would all go to AIS. Recently, switching the operator process is so easy. In the layer of MNOs, it is quite difficult to negotiate with OTT, or to do anything to OTT players, such as blocking or slowing down the traffic on OTT applications. As far as I know, there is no operator practicing that kind of thing. Even though Thailand has not implemented net neutrality regulation, there is no operator adopting such a strategy."*

Apart from competition between MNOs, another reason why a blocking strategy is not appropriate for MNOs is the dissatisfaction of users. Currently, users tend to blame the operators when they encounter difficulties using any online service, including OTT services. If MNOs adopted a blocking strategy, it would escalate the negative impact on the relationship between MNOs and users. For this reason, MNOs are not willing to block any OTT, especially those that are popular. The concern over the users was stated thusly:

> *"Concerning blocking or something like that, we do not use this strategy. The reason is that when the consumers use OTT, sometimes that OTT player does not provide an adequate quality of service and the users experience problems. When the users have problems, they complain to us, or their internet providers. This is what is happening nowadays. If we had a blocking policy, the negative impact would turn on us."*

According to the interviews, a blocking strategy is not common practice in Thailand, even though the law allows for it. Nonetheless, blocking practice can be exercised under two conditions. Firstly, if a particular OTT is consuming too much bandwidth, resulting in other users' quality of services experience suffering, such as customers using BitTorrent. Secondly, if there is an order from the government. As explained in the chapter on the regulatory landscape, there is strict internet censorship in Thailand, especially content related to national security, the royal family, and inappropriate content such as explicit nudity. In that sense, blocking is applied to all operators under orders from the government. This issue was discussed accordingly:

> *"When there is blocking, [the users] cannot blame any specific operator when they have to block [by itself]. …The Ministry of Digital Economy, Ministry of ICT, or DESP cannot blame us that the operators are capable of blocking. [We can't block] because of the competition and our consumers. Go to the NBTC instead! The operators*

are not under the control of the ministry. We are under the NBTC, so the NBTC [can use their authority] to [force the operators to] block the [online] content, block the access to IP address or URL."

However, the quotes above seem to suggest that blocking online content in Thailand is a bit tricky, in terms of authority and the responsible organizations. Simply put, it is not an appropriate strategy for MNOs, even though they are sometimes required to utilize blocking.

From the overall information obtained from the interviewees, blocking is not considered a beneficial strategy as assessed by Rumelt's evaluation. It fails in the consistency aspect, because it does not help MNOs to reach the goal that the strategy must lead toward substantial profits for the company. Users tend to switch to other operators when their current operator blocks a particular application, resulting in a decline of subscribers and revenue. In addition, it contradicts to the sub-objective posited that MNOs aim to be partner with OTT. As well as the consistency aspect, MNOs blocking OTT appears to be unacceptable by users and competitive environment. In this circumstance, it also fails the advantage aspect, because it does not encourage a competitive advantage for MNOs. The last aspect is feasibility. It is technically feasible, through legislation and practice, though it is not acceptable by the community. Blocking does not require special techniques or resources to employ. Consequently, only the aspect of feasibility is viable, regarding to the evaluation.

2. Reactive Strategy (Throttling and Traffic Management)

Similar to the aggressive strategy, reactive strategy is not common practice among MNOs in Thailand either. However, there are operators exercising throttling or traffic management on some OTT consuming the data. As OTT communications generally does not require high bandwidth, MNOs does not find it necessary to implement this strategy. An interviewee discussed this issue:

"With respect to blocking, we never block OTT communications, but we used to block others [e.g., OTT media], such as [name of OTT media]. And we have throttled it. [OTT communications] such as LINE, in terms of usage, it does not consume bandwidth. It is not harmful to the network."

Concerning a reactive strategy, it also fails as an appropriate strategy. Most of the reasons why are quite similar to those of a blocking strategy. However, the feedback from users is relatively less harsh, because consumers still use the services, though at slower Internet speeds or with lower quality of service. Yet, the use of this strategy remains untenable for MNOs, because there is no reason to manage the traffic on OTT communications in the first place. This kind of strategy is more suitable for managing applications consuming higher data bandwidth. In addition, this strategy is somewhat related to other groups of strategies, especially partnering with OTT. By cooperating with OTT, or considered as a zero-rating scheme, MNOs may be required to manage traffic for partnered OTT. In that sense, it can be said that traffic management is suitable for the MNOs.

3. Competitive Strategy (**Offering MNOs' OTT, Lobbying to Regulate OTT**)

The interviewees revealed that offering MNOs' OTT, in other words, developing their own OTT, is not an uncommon practice among MNOs, but mostly on OTT media. However, the purpose of offering OTT is different depending on the type of OTT. Mostly, they have developed and offered OTT media to users, as the content distributors or online platform from video on demand. Some operators, such as AIS and TrueMoveH, have their own OTT media application to offer content, such as movies, foreign series, and exclusive content. The purpose of offering such an OTT is to, firstly, find a new source of revenue. This market in Thailand is growing dramatically. As stated in the chapter on background, Thai OTT TV online content in the form of video on demand is very successful in Thailand. Apparently, there is space left for new entrants in the market of OTT media/TV in Thailand. Some interviewees insisted that the declining revenue from their core services forced them to find other sources of revenue to compensate for the loss. When the MNOs decided to enter the market of OTT media/TV, it was undeniable that they would have to compete with the incumbent OTT media/TV. These included players that are not MNOs, such YouTube and LINE TV and the OTT offered by other MNOs. On the other hand, in the case of OTT communications, there is only one MNO developing OTT communications, which is G-Chat from CAT. G-Chat is an application that functions similar to LINE (CAT, N.D.)[8]. It aims to be a platform for communicating between governmental organizations. Currently, G-Chat is under the operation of the Electronic Government Agency (EGA). However, the purpose of developing such an application is not to compete with incumbent OTT communications, but rather G-Chat was developed by demand of the government, which is not looking for the profits. Moreover, G-Chat is aimed at new and different target users, those who work in Thai governmental organizations. To sum up, offering MNOs' OTT communications is also not an appropriate strategy for MNOs in Thailand. There are several reasons why Thai MNOs are not interested in creating their own OTT communications. One of the reasons is that they believe that they are not qualified to create products for OTT communications, stated as follows:

> *"We understand that OTT [communications] has been highly developed in terms of data and operations. They have their own data. We are not specialized like that. We are not going to the area where we are not proficient."*

Another reason is that OTT communications have the characteristic of network effects, which is considered a barrier to entry for new entrants, including MNOs who are interested in entering into the OTT communications market as explained by two interviewees that:

> *"We had an idea [of developing our own OTT] …, but we cannot compete with the mainstream [OTT communications] … It is considered as social network, right? If it is a one-to-one effect, it is okay. If it is many to many, our effect [from limited users] is too little. When we offer the service to users, the users have to talk across the*

[8] For more details, see https://www.catebusiness.com/Newsactivity/Detail/H00040

platform or use different platforms simultaneously. Eventually, it [MNOs' OTT] will be deleted from the screen of the mobile phone. You [MNOs] cannot compete with them [mainstream OTT]."

"The problem is when we regularly use LINE, it is easy to share things across the group. When we use other applications, in order to share pictures, we must save the pictures and then share them. It is burdensome. Thus, there is a barrier to entry. The chance for new entrants is limited. It is troublesome, because the incumbent [OTT communications] has been developed to be operate smoothly; sharing pictures or anything is so easy."

Concerning the strategy evaluation, MNOs' offering OTT, specifically OTT communications, is another somewhat inappropriate strategy for Thai MNOs. As stated by the interviewees, MNOs should be developing their own OTT services; it would be exactly within their skill set and has the potential to generate profits as well as to increase the number of subscribers to the MNOs. Thus, the main objective is consistent with the goals of the firms. In terms of consistency, this strategy seems to be fine; the trend for OTT usage is upwards. Offering OTT services is a promising way to respond to users' needs. The next is advantage. With their own OTT, MNOs can better compete against their rivals by attracting new subscribers. However, this strategy does fail in the last criterion - feasibility. Most of the interviewees mentioned difficulties in developing their own OTT, especially OTT communications. Doing so requires resources, information about their users, and R&D. Moreover, being successful is more difficult, as they have to compete with incumbent OTT, who have large numbers of existing subscribers and strong quality of service. As mentioned by the interviewees, network effects play a crucial role in communications services. For these reasons, developing OTT communications is rare, as opposed to OTT media, which most of the MNOs have already done.

Another competitive strategy is to lobby towards regulating OTT in order to create a level playing field, resulting in fair competition between OTT and MNOs. The results indicate that there is discussion with the regulator (the NBTC). However, the discussion is not based on demands for regulation of OTT, as stated:

"Concerning this issue [OTT], we had some discussions regarding the regulatory framework. However, the NBTC regulating these players, like Facebook or LINE, is difficult. The reason is that these players are providing service globally, so in reality, it is quite difficult for the NBTC to regulate them, enact the rules, or force them to comply with Thai regulations. When I talked to the NBTC, we discussed taxation. When these players collect revenue from Thais, not only for the NBTC, but also in the level of government, how can we collect tax from those players and use it to develop our country? In terms of regulation, as they are telecom licensees, we have no clue how to do it. Indeed, they [the OTT players] are so big compared to Thailand. With mobile operators, we can negotiate, but with them [OTT], it is very difficult."

MNOs do not agree with the idea of regulating OTT. Instead, they prefer that the NBTC adjust some of the rules that apply to incumbent MNOs. Some of those regulations are considered obstacles to competition. This suggestion was stated that:

> *"As I can see, it is a global trend. Regulating might lead to distorted circumstances. I think we should not do it.... Some regulations [for domestic MNOs] are outdated, such as operators having to follow on-net and off-net regulation. You know that? It is about calling in the operator and off the operator. In addition, we are regulated again with the IC. To illustrate, if an AIS number dials a True number, AIS will be charged by the IC. Also, fixed lines are charged more than mobile phones. It is so paradoxical. It is not unity in regulation. As I said, the NBTC is a good regulator, they must support the operators in gaining more competitive advantage."*

However, not every MNO agrees with the non-regulation scheme for OTT. Some operators are in favor of the idea of OTT regulations, such as licensing. An interviewee expressed his/her opinion that:

> *"Around two years ago, we discussed this with the NBTC. The NBTC also had a plan to regulate OTT as well. However, after that, there was no progress. Actually, we pushed the NBTC to regulate OTT by licensing…There were 2-3 reasons. Firstly, as I mentioned, the NBTC would be able to control the quality of OTT services if OTT were under licensing regulation. When the quality of OTT content is poor, consumers always complain to us. Secondly, it is about the fee charged from licenses and tax. We proposed all of these things to the NBTC."*

As for lobbying strategy, it is considered feasible. MNOs can discuss this with the NBTC, but the results cannot be guaranteed. Even though most of the interviewees do not agree with the idea of regulating OTT, there are some MNOs that believe OTT regulations would be beneficial to them. However, concerning compatibility, lobbying is still considered inappropriate because it belongs to an environment where the regulator is currently unable to regulate OTT.

In conclusion, competitive strategy is another strategy that MNOs considered to be inappropriate for most of the MNOs. Even though they have applied elements of this strategy unintentionally, they do not find it suitable and yield some positive results to them. Instead, they find that lobbying the regulator to adjust current regulations is more preferable.

4. Opportunistic Strategy (Embracing OTT, Simulating OTT through Bundling)

For MNOs, embracing OTT currently means utilizing OTT services in any way they choose, without official cooperation from OTT providers. In order to do so, there are several methods, such as exempting the data consumption charges for particular OTT services. In interviews, many operators

admitted they are using this strategy. However, there are some problems from unofficial utilization of those OTT services they are offering to the consumers. For example:

> *"We did not partner [with OTT players]. We did not ask for official cooperation. We did it by ourselves. We launched a promotion called "Social Sim" [exempting the data charge for some OTTs] or something like that. But the problem is that they [the OTT providers] extended the server without informing us. The users [device] might connect to an [unregistered] IP. Then, the users complain to us. Actually, every time they [the OTT providers] extend the server, they are supposed to inform us. We mainly set the [system] to not charge when the users access a specific IP address, which the OTT providers informed us of in advance. It worked. But when the users go to different IP apart from what we have, the users are charged. It is out of our control. Thus, the data is syncing all the time... We put our effort to do it for our consumers without demanding any help from them [the OTT providers]. We just want to satisfy our consumers in this highly competitive market."*

Even though there are technical difficulties in employing this strategy for some MNOs, it is considered a worthwhile strategy, which can yield the results that are consistent with the goals of the operators. The second criterion is compatibility. This strategy was basically generated from the trend among users who are active on OTT. One advantage of this strategy is that it helps the MNOs increase the number of subscribers and prevents users from switching to other operators. A larger number of subscribers is considered a competitive advantage to the company. Lastly, it is feasible. Generally, MNOs embrace or include the usage of OTT in their promotion without an official relationship established with OTT players. Thus, embracing OTT is also another good strategy in dealing with OTT for Thai MNOs.

Concerning the simulating OTT through bundling, interestingly, in Thailand, bundling packages do not actually include OTT communications. In general, the MNOs are using OTT in the packages as data charge exemptions, which as was explained in the embracing OTT strategy. Every MNO in Thailand has at least one type of bundling package, which usually includes voice calling and data (mobile Internet). Sometimes SMS/MMS is included, but not often. The details vary depending on the promotion, price, and the policy of the MNOs. Some packages offer limited numbers of voice call minutes and data traffic. Other packages provide unlimited minutes for voice calls and data, with or without a speed cap. However, users who subscribe to bundling packages also have to subscribe to mobile Internet. When they have mobile Internet, they are able to use OTT as well. Simply put, OTT communications are included in the bundling unintentionally. This case is different in Thailand than in other countries, where OTT services are included in the package. In Thailand, it is very rare to find a package including OTT communication services in the package. There are more cases for OTT media, for example including specially priced Netflix subscriptions in the package. Due to this situation, stimulating OTT through bundling is not used for OTT communications. Thus, the evaluation cannot be performed.

5. Collaborative Strategy (Partnering with OTT)

Partnering with OTT in this study means an official collaboration with OTT players. Only a limited number of MNOs stated official partnerships with OTT players. Mostly, they include OTT in their packages without any official agreement with OTT providers, which is considered embracing OTT strategy. Although there are some partnerships with OTT, the interviewee revealed that it is not easy to do so. A case was raised by an interviewee that:

> *"There was a campaign our company started. We are partners with OTT players and share the revenue with OTT providers. For example, our partner now is Netflix. However, in practice, we cannot be partners with every OTT and share the benefits in every aspect. For instance, with LINE, we tried to find an opportunity to be a partner with them and share revenue, but it is still unclear. Currently, we can only sell LINE stickers and things like that."*

There are also partnerships with OTT communications company LINE. They established a new service featuring a LINE application called LINE payment, embedded in the LINE application. Apart from this partnership, there is stock sharing, which is not considered to be a partnership. In conclusion, although cooperation with OTT players was expected in the hypothesis, it surprisingly is not common practice in Thailand. However, in terms of strategy evaluation, partnering strategy is counted as a beneficial strategy. Actually, this strategy is quite close to the estimation for the embracing strategy, the only difference being the official partnership establishment with OTT providers. Its feasibility is relatively lower than embracing OTT, but it is still possible to implement such a strategy. Thus, this strategy is concluded as another suitable strategy for Thai MNOs.

6. New Strategies

After the interviews were carried out, two more strategies were discovered in this study - finding a new source of revenue and reorganizing the internal environment. They are not direct strategies of OTT; however, they are strategies generated as a result of the impact of OTT. These strategies are naturally beneficial for MNOs. As explained in the section of the results of the impact of OTT, the effects on the revenue of MNOs from OTT are considerable. As a result, MNOs are forced to find new sources of revenue in order to survive in the market. Due to research ethics, the details of the new sources of revenue for each operator cannot be disclosed. Basically, new sources of revenue are in the telecommunications field, utilizing new technologies, such as 5G, fiber optic fixed-line Internet, and IoT (Internet of Things), and even in other areas, such as broadcasting and insurance.

Another new strategy is internal reform. Similar to the situation of exploring new sources of revenue, internal reform is not a direct response to OTT, but it is the result of the impact from OTT. Not only are they looking for new sources of revenue, some MNOs are trying their best to save costs by

improving their internal management. According to the interviews, this strategy yielded quite satisfying results:

> *"We were back to internal management to save costs. We removed what we considered to be unnecessary to cut costs. We employed a consulting company to specifically operate this job, as we see that we have to do two sides simultaneously. One side is to explore the future business. On the other hand, we have to reorganize our home… for example managing our inventory. We improved our inventory to be as lean as we can. Moreover, we also changed the way we negotiate with vendors. Previously, we stocked too many items. We have changed to be 'grasp in time.' We have changed so much."*

Not surprisingly, this strategy is considered appropriate. Apart from being adopted by MNOs, looking at each criterion of evaluation seems fine. Although not being directly employed by OTT, it has met or surpassed all of the criteria. Firstly, it is consistent with the company's goals. For example, it helps the firm save costs, bettering the chances of the firm's survival in the business. In addition, regarding exploring a new market strategy, it is a promising strategy, boosting revenue for the MNOs. Also, they do not oppose any OTT. Secondly, it is consistent with the environment, where competition is evolving and the traditional telecommunications market is somewhat saturated. Thirdly, it seems to enhance the competitive advantage of the MNOs. Moreover, in the case of exploring new markets, if it is successful, MNOs will have more products to provide to users, and may well have larger groups of subscribers. Lastly, these strategies are feasible. The interviewees mentioned that they are investing in a market that they know well. Consequently, feasibility is not their problem. To sum up, this strategy is appropriate for Thai MNOs.

6.4.2.1 Discussion

Regarding the summary of results in table 6-5, it shows that the lower group of strategies is considered appropriate for MNOs, which are both opportunistic and collaborative. These strategies are considered nonaggressive to OTT. The results are mostly consistent with the literature. The details of the results and discussions are as follows:

Table 6-5: Summary of Results

Responsive strategy			**Strategy assessment**			
	Type	**Practice**	**Consistency**	**Consonance**	**Advantage**	**Feasibility**
Direct to OTT	Aggressive	Blocking	×	×	×	✓
	Reactive	Throttling	×	×	✓	✓
		Traffic management	×	×	✓	✓
	Competitive	Offering MNO's OTT	✓	✓	✓	×
		Lobbying to regulate OTT	✓	×	✓	✓
	Opportunistic	Embracing OTT	✓	✓	✓	✓

Responsive strategy			Strategy assessment			
		Simulating OTT though bundling	Cannot be evaluated			
	Collaborative	Partnering with OTT	✓	✓	✓	✓
Indirect to OTT	New strategy	Exploring new sources of revenue	✓	✓	✓	✓
		Internal reform	✓	✓	✓	✓

Firstly, as mentioned, the appropriate strategies regarding Rumelt's strategy evaluation are embracing OTT, partnering with OTT, and exploring new sources of revenue and internal reform. All of them have been adopted by Thai MNOs. This implies that Thai MNOs are well aware of the situation and may well have chosen the right path for their businesses. In addition, because MNOs are currently using appropriate strategies, it implies that they have already passed the process of trial-and-error in experimenting with various strategies and have found what works best for their businesses in the context of the Thai market.

Secondly, there are unsuccessful strategies that MNOs have used, or are using currently, and probably will continue to use in the future, such as blocking some applications or throttling data on the network. This issue raises two points. The first is that firms do not always use smart strategies. It is possible that an appropriate strategy may be defined by the situation and the choices available at the time. For example, throttling some applications may cause the users to complain and switch to other providers eventually, but it might be the best practice that MNOs can employ at the time to prevent overburdening the network.

Thirdly, MNOs do not use only one strategy; they combine several, as much as their competencies allow. Moreover, adopting one strategy requires the use of another strategy. To illustrate, traffic management, one of reactive strategies, need not be enacted on OTT communications unless the MNOs have a zero-rating scheme, or are in partnership with an OTT provider. Consequently, MNOs have to practice traffic management on their network. Without such a partnership, traffic management for OTT communications is pointless.

Fourthly, even though MNOs use several strategies, the intensity of use for each strategy is different. For example, as stated by one interviewee, using an official partnership strategy with OTT is not typical when compared to embracing OTT. This implies that the level of difficulty for each strategy varies. Moreover, approaching OTT operators is regarded as difficult. MNOs seem not to attempt to approach OTT operators, and focus more on other strategies that do not require cooperation from OTT.

Lastly, adopting these strategies is further proof that OTT literally affects MNOs in Thailand. And that the effects of OTT must be curtailed in the future. Additionally, it is also the evidence that MNOs are trying to survive in the business, as evidenced by the survival-based theory.

Section 6.5 Summary of Results According to the RQ

RQ 1: What are the impacts of OTT communication services on MNOs in Thailand?

The results revealed that first, OTT has a negative impact on four elements of the business model of MNOs as external innovation: product, customer interface, infrastructure, and financial aspects. First, OTT affects the core services - the product - of MNOs. It decreases the usage and revenue of voice calling, international calling, and SMS. Among these three core services, voice calling is the service that is least affected by OTT. On the other hand, it slightly increases usage and revenue for mobile Internet. However, the increased revenue cannot compensate for the loss of usage and revenue from the other core services. Secondly, it affects the relationship between the MNOs and their users. OTT is considered a middle layer, squeezing itself between MNOs and users. Consequently, MNOs do not properly understand how their customers make use of OTT services. Moreover, the image of MNOs in the eyes of users is declining. Users tend to blame MNOs for poor quality service when using OTT, even though the problems are not coming from MNOs. Thirdly, OTT affects the infrastructure of MNOs. However, the effects are very small, because OTT communications do not use as much Internet bandwidth as OTT media/TV does. Lastly, OTT affects the financial statement of MNOs. As stated, the usage of core services is rapidly decreasing. Additionally, MNOs need to invest more in their infrastructure, causing them financial losses. Overall, those four elements of the business model are affected by OTT, but the intensity of the impact varies. Apart from being an external innovation affecting the business model of MNOs, OTT is associated with other external environmental factors enabling the impact of OTT on MNOs. Second, it is related to the aspect of unchanged regulations. This is in contrast to the theory positing that the regulations formulated for new innovations tend to be obstacles to businesses. Results revealed that the regulations for MNOs are considered burden to the MNOs. They tend to block the competitiveness of MNOs, resulting in greater advantages for OTT players. With OTT surrounded by the current regulatory landscape, it has more power to affect MNOs. Third, consumer behavior is changing. It is undeniable that users are more interested in using OTT services due to the richer features and advancements of OTT. Once users become familiar and comfortable with OTT, it is difficult for them to go back to using traditional services. Lastly, there is a change in the competition's strategy. The MNOs are changing their strategy to partner with OTT because other MNOs are doing the same, and no one wants to be left behind. In order to survive in the competition, MNOs decided to change their strategy. However, many of those strategies result in increasing the effect of OTT on MNOs.

RQ2: What are the appropriate strategies for dealing with OTT communication services for Thai MNOs?

As the results revealed in the first research question, MNOs have to change their strategy according to the impact of OTT and changing of environment. From the interviews and evaluation of strategy under the criteria comprised by Rumelt (1980), the results revealed that nonaggressive strategies are considered appropriate for use in Thailand. Even though there are actual implementations of all the strategies, the nonaggressive strategies, such as embracing and partnering with OTT, are the most suitable for the current telecommunications ecosystem, as well as passing all four criteria of evaluation. Apart from the direct strategies to OTT proposed before the interviews, the study also found that indirect strategies resulting from OTT are widely used in Thailand. Those strategies are exploring new sources of revenue and internal reform. Moreover, they are appropriate in terms of strategy evaluation. To sum up, the MNOs are encouraged to use two sides of the services. The first side is a direct, nonaggressive strategy with OTT. The other side is an indirect strategy, exploring new markets and internal reforms. This result is consistent with the recommendation suggested in the work of Meffert and Mohr (2017). With these two attempts at strategy, it can be expected that MNOs will survive while maximizing their profit, as posited in the theories of profit-maximization.

Section 6.6 Discussion

According to the results, OTT has impacted MNOs in a variety of ways. Moreover, the appropriate strategy for coping with OTT in Thailand is a nonaggressive strategy, such as embracing and partnering with OTT. The results are similar to the previous studies, which examined diverse countries and environments. Nonetheless, there are several issues to be discussed in this section.

Firstly, the results are consistent with the last section on consumer behavior. As was discovered in the last section, voice calling is not replacing OTT; they have a positive relationship. In this section it was found that OTT has decreased the usage and revenue of voice calling, yet the effect is small. Moreover, some MNOs stated that voice calling is not decreasing in the amount it was expected. This result can be used as supporting evidence that the substitution between mobile voice calling and OTT has not finished in this area, at least not yet. Nonetheless, it illustrates the bigger picture of the current Thai telecommunications market.

Secondly, the package provided to the users plays an important role in retaining revenue. As seen with SMS, there has been a drastic decrease since the emergence of OTT. The reason that OTT affects SMS, apart from the richer features of OTT, is that SMS is generally not included in bundling mobile packages, which are very popular in Thailand. Thus, when users want to send SMS or MMS,

they are required to pay additional costs, while messaging on OTT is included in the package price. As one of the interviewees suspected, there is probably a psychological effect. Indeed, it can be explained by the "taxi meter" effect. Simply put, this effect basically states that users tend to choose a flat-rate tariff type rather than a pay per use option, even though they may end up paying more than they expect (Lambrecht & Skiera, 2006). In other words, users tend to avoid pay-per-use situations and prefer flat-rate schemes, or bundling packages, that they pay at a fixed price. People generally do not want to pay more. If they already have a data allowance in their flat-rate package, they use OTT instead of SMS, unless that is not possible because the person they wish to message does not use the same OTT platform. In addition, by this logic, it is possible that voice calling is not decreasing to the same degree as SMS because it is already included in the package. As a result, users can enjoy it without being concerned about additional costs.

Thirdly, even though Thailand is not implementing net neutrality, the MNOs have nonetheless chosen to essentially abide by their principles. The actions they are refraining from implementing include traffic management, throttling, and blocking. It is interesting that the bargaining power of users can essentially force MNOs to tolerate net neutrality, whether they want to or not. Furthermore, it reflects the competition among MNOs in Thailand. If one operator were to employ restrictive measures, users have other choices of providers to switch to. As a result, MNOs are trying their best to avoid enacting those strategies.

Fourthly, it seems that MNOs are not interested in approaching OTT players, or doing anything to OTT in the long term. As cited by the interviewees, OTT is very powerful, and doing anything, even establishing corporative agreement with OTT, is difficult. Another reason is that they might be uncertain about what role OTT may play in the future. It is difficult to predict what direction OTT might take. Rather, MNOs are relying more on other areas of businesses that they can retrieve sufficient information and control more easily.

Lastly, as a recommendation, the regulators and policymakers in Thailand should provide greater assistance to the MNOs. The regulator has the power to protect the benefits of the people, specifically the users, while at the same time they should support MNOs in two areas. Firstly, the regulator can assist MNOs in gaining a competitive advantage by giving more them information and removing unnecessary regulations that hinder their competitiveness. Secondly, the regulator should promote MNOs to explore new sources of revenue. It is important to help domestic companies survive against outside competition, as the revenue from MNOs contributes to the Thai economy. Thirdly, they should encourage MNOs in developing new and improved infrastructure. By improving it, not only can MNOs gain competitiveness, but it also benefits Thai users, because infrastructure is a fundamental facility affecting the development of the country (ITU, 2019).

Chapter 7

Key Findings, Discussion, and Implications

This chapter presents the key findings retrieved from the analyses. With these findings, the overarching research question is answered. Moreover, there are interesting points to be discussed in this chapter. Afterwards, the contributions in terms of academic implications and recommendations to each player in the market are provided. Finally, even though this study attempted to erase drawbacks as much as it could, limitations remain. These limitations are pointed out and suggestions for improvements in future studies are included.

Section 7.1 Key Findings and Discussion

This study aims to investigate the role of OTT communications, specifically the impact of OTT communications and its relationship with the telecommunications sector, particularly as it pertains to the customers of mobile network operators (MNOs) as the traditional telecommunications services providers. This research was conducted because OTT has significantly increased in terms of subscriptions, users, and power in the market, resulting in concern among analysts, entrepreneurs, and policymakers. The actual impact of OTT, however, is still unclear due to a dearth of studies focusing on the impact of OTT in Thailand, especially the impact of OTT communications. For this reason, it is difficult in establish the appropriate regulations and policies towards OTT and other stakeholders in the ecosystem. Thus, the overarching research question is posited: *What are the impacts of OTT communication services on the stakeholders in the telecommunications sector and their responses to OTT in the context of Thailand?* In order to answer the question, analyses from two perspectives of the traditional telecommunications market - users on the demand side and MNOs on the supply side - were conducted. After the examinations were completely carried out, the answer to the overarching research question is that OTT affects Thai telecommunications sector in various ways. The effects are both positive and negative, depending on the area in the market. The results indicate that the response from users, in the sense that adoption reflects acceptance of the service, is concentrated in particular groups of users. For the MNOs, a nonaggressive strategy towards OTT is the most appropriate. The details of each result are discussed, as follows.

7.1.1 Key Findings from the Consumers' Perspective

OTT communications have affected consumer behavior in using communications services. In other words, it has changed the patterns of consumers using traditional telecommunications services, mobile voice calling, SMS, and OTT communications. However, the impact varies depending on the service. OTT voice calling is positively related with mobile voice calling, but it has a negative relationship

with SMS. On the other hand, OTT messaging is not statistically related to all of the traditional telecommunications services. Understanding this, it becomes clear that it is not entirely accurate to say that OTT communication services are substituting traditional telecommunications services at the moment. In addition, further study of the adoption of OTT was conducted to better understand consumer behavior in using OTT communications. This analysis aimed to examine three groups of factors affecting the adoption of OTT communications - technological attributes concerning complexity or ease of use of the technology, a supportive environment, such as smartphone ownership and broadband Internet access, and socio-demographic characteristics of the users. The results of the analysis indicate that there are significant factors affecting the adoption of OTT, which cover three groups of variables. The factors that are positively associated with OTT adoption are basic IT skills, smartphone ownership, capability of accessing public Internet and broadband service, gender, age, education, employment type and position, and residence location. These factors reveal that OTT adopters are more likely to be in middle to upper class, both socially and economically. In that sense, OTT is not considered a basic communications service for low opportunity users in the same that traditional telecommunications services are. Thus, the results complement the first analysis that OTT is not, as originally thought, substituting the traditional telecommunications services. Nevertheless, it can be roughly estimated that the situation of OTT and traditional telecommunications services in the near future are likely to change. The most important factors in the second analysis are in the supportive environment group, comprising smartphone ownership, public Internet access, and broadband access. With the trend nowadays, it is highly possible that the adoption rate of OTT will increase along with the adoption of smartphone use and penetration of the Internet, including free Internet access provided by government projects, such as Net Pracharat, and improved broadband Internet from more developed infrastructure and technology. When the users are in this supportive environment, they are likely to adopt OTT services. Moreover, as the Internet improves due to the implementation of 5G, the quality of services of OTT will improve as well, resulting in less difference between OTT and traditional telecom services, specifically mobile voice calling.

7.1.2 Key Findings from the MNOs' Perspective

The perspective of users alone is not sufficient, thus the perspective of MNOs was further investigated. The results from in-depth interviews with five MNOs in Thailand revealed that OTT can be defined as disruptive change for MNOs as it associates with four aspects of environment-driven factors, leading to the change in the business. The framework implemented in the work of Ghezzi et al. (2014), described those four factors as: (1) external innovation, (2) regulatory change, (3) customer change, and (4) competitor strategy change. In their study, OTT is a factor of external innovation as it affects all four components of the MNO business model. This study also found similar results. OTT communications, as external innovation, affects four components of the business model, which is the concept first proposed by Osterwalder (2004). (1) It decreases the core services of MNOs, mobile voice

calling, international calls, and SMS. This impact is included in the component of products (value proposition). Among these services, mobile voice calling does not decrease significantly, while international calls and SMS have been drastically affected. On the other hand, OTT increases the usage of mobile Internet, but it does not equally generate profits, due to the competition among MNOs and the increased investment for infrastructure improvement. (2) OTT affects the consumer relationship (value delivery) between MNOs and consumers. MNOs are blamed by users for unsatisfactory experiences when using OTT services. In order to satisfy the users and build good relationships with users, MNOs have to let OTT exploit their capabilities, such as establishing the CDN in MNO sites without charge. Moreover, MNOs are unable to access the information of users because OTT is inserted in the middle layer between MNOs and users, resulting in an unclear understanding about users' behaviors and preferences. (3) OTT affects MNOs' infrastructure management (value creation). It is certain that when OTT takes advantage of the infrastructure or networks of MNOs, it must directly affect the infrastructure. Even though net neutrality principles are not implemented in Thailand and MNOs can legally manage the traffic on their networks, they choose not to do so due to negative feedbacks from users. For this reason, MNOs have no choice but to invest in the networks to maintain the quality of services. Nonetheless, this impact is relatively small, compared to other components, because OTT communications don't consume bandwidth to the same degree that OTT media does. (4) Certainly, OTT affects the financial aspect of MNOs (value appropriation). With decreased usage, income, and increasing investment, revenue is decreasing, or profits are lower than expected.

The results in this study expanded on those from the previous study. In the previous study, it was discovered that diffusion of OTT affected the MNOs as external innovation and was associated with competitor strategy changes. This study found that OTT is associated with all factors of disruptive change, which include external innovation, as explained above, regulatory change, customer change, and competitor strategy changes. With respect to regulatory change, it was proposed that new innovation leads to new regulations, which can be burdensome to the existing operators. In this study, the results from interviews showed that regulations are problematic issues for MNOs in two ways. The first is the lack of regulation for OTT, which encourages OTT to be more powerful and enhance its competitiveness. This issue is regarded as an "uneven level playing field." However, the regulatory framework for OTT has not yet been established, so the effects of the regulations are currently unknown. It may or may not trouble the MNOs, as the framework postulated. The second aspect, incumbent regulations, are more troublesome when applied to MNOs, which have to comply with multiple regulations that hinder their competitiveness with OTT. To illustrate, they cannot drop the price of voice calling to the same level as OTT because they must pay interconnection fees. In other words, MNOs cannot use the price strategy in this case. As concerns the consumer change aspect, the next disruptive change, many users have changed their behavior in how they communicate, especially in messaging. With greater potential to adopt new services, users can easily switch to new kinds of services.

When users switch, it is unlikely that they will return to using traditional telecommunications services. Lastly, the competitor change in strategy is considered a significant factor. Several MNOs have changed their strategy towards OTT services, resulting in other operators being forced to change as well. To sum up, OTT is associated with a number of disruptive change factors for MNOs. For this reason, the strategy dealing with OTT was investigated to understand the Thai reaction to OTT services.

In terms of the second part of the MNOs' perspective analysis, the appropriate strategy to deal with OTT was examined. As looked at through the strategy evaluation criteria proposed by Rumelt (1980), the results indicated that a nonaggressive strategy, such as embracing OTT and partnering with OTT, is the most appropriate for MNOs, even though those MNOs have previously adopted different types of strategies, ranging from aggressive, such as blocking or throttling, to nonaggressive. In addition, the study also found that MNOs do not only have direct strategies towards OTT but also have indirect strategies they have adopted because of OTT. Those strategies include exploring new markets by utilizing new technologies such as 5G and IoT, and also reforming the internal management in the organization. These strategies were used in order to limit the impact of OTT, resulting in higher profits in the market for MNOs.

The results from the MNOs are mostly consistent with the results from the users' side. The interviewees revealed that the revenue and usage of voice calling has not decreased substantially; some MNOs insisted that their revenue and usage has not decreased at all, while others said it has decreased somewhat. However, statistics show that voice calling is gradually declining, which could be caused by other factors, such as market saturation and users changing their calling behavior. It is consistent with the results from the users' perspective that using OTT increases the use of mobile voice calling. They are not substitutable as many OTT opponents stated. SMS usage, on the other hand, has been diminishing since the rise of OTT. This result is consistent with the results from the users' side that SMS has a negative relationship with traditional telecommunications services. When looking at OTT messaging, they are independent. Possible causes are that OTT messaging has already finished replacing all traditional telecommunications services. Another reason is that using OTT messaging is not related to the usage of traditional telecommunications services. As stated by the interviewees, OTT messaging is very different from traditional telecom services, and it might be considered a totally different kind of communications services.

7.1.3 Discussion

One of the main motivations in this study is to examine the impacts of OTT on traditional telecommunications services. The results turned out to be different from many analysts' expectations. There are several reasons why the impact of OTT on traditional telecommunications services are varied and different. Firstly, the difference might be the outcome of the bundling packages offered by MNOs in Thailand. Usually, bundling packages include only voice calling and data, which means customers

can use OTT from their data allowance and voice calling services at no additional cost. On the other hand, SMS are charged per each message sent or received. When voice calling is already included in the package, customers can use it freely, and if users do not make calls, MNOs still receive the revenue from the bundling package purchase. For this reason, voice calling services are not drastically declining. Secondly, there can be a substantial difference in quality between services. Mobile voice calling and OTT voice calling do not always offer the same quality of services, with mobile voice calling often offering superior sound and connection quality. This gap is generally reduced when users are connecting to OTT via high-speed Internet, but many users in Thailand are not always, or ever, able to do so. Thirdly, SMS and OTT messaging are different in terms of quality, features, gimmicks, and other functions embedded in OTT services. These differences make OTT messaging and SMS incomparable, resulting in different usage pattern of users.

The impact of OTT is both crucial and observable, with the results reflecting that limitations in using OTT. As stated previously, OTT users tend to be mainly in middle to upper-class society. There are requirements in using OTT, which are not always available for many users in Thailand. Those requirements include smartphone ownership, Internet connectivity, and basic IT skills. These variables are examined in the study and demonstrate significant effects on OTT adoption. Similarly, the variables reflecting the development between municipal and non-municipal areas were proven to be significant in OTT adoption. Overall, in this circumstance, smartphone ownership, Internet connectivity, basic IT skills, and a minimum level of education are considered limitations for many Thais. Moreover, OTT usage is concentrated in urban areas, where Internet connections are more readily available and of relatively high quality. In these areas, the cost of living is higher, as is workers' income. With the current minimum wage ranging from 313 to 336 Baht per day (10 to 10.73 USD) depending on the province[1], it is difficult for many low-wage workers to afford sophisticated devices like smartphones or tablets as well as Internet subscription fees. Moreover, they must have at least a basic level of education to have the skills required to use the service. These are interrelated problems; when users do not have the opportunity to enroll in school for basic education, they are more likely to wind up working in blue-collar jobs, with low wages, even in Thailand where the cost of living is relatively low. Thus, the results demonstrate that OTT adopters are not blue-collar workers, which can help to explain why OTT is still far from being a basic tool for communicating among Thais and has yet to replace traditional telecommunications services, especially mobile voice calling. In addition, this result implies that traditional telecommunications services, even though they are not as popular as they were in the last decade, are still an important means of communication in Thailand, particularly in remote and rural

[1] Information is from the official website of ministry of labour (MOL). The latest information was announced in the National Wage Committee's Notification on Minimum Wage Rate (No.10), to be effective on January 1, 2020.
More detailed information available at https://www.mol.go.th/en/minimum-wage/

areas. The government needs to maintain these essential services for people living in remote areas along with the developing the infrastructure to bridge the digital divide.

With the current resources, both tangible and intangible, and the competency of Thai entrepreneurs, being partners with and taking advantage of OTT opportunities is considered the most appropriate strategy. From the MNOs' perspective, other strategies, such as blocking or MNOs' developing their own OTT communication platforms, is considered unfeasible and impractical to implement. Interviewees agreed that it is not possible to do so. Even though MNOs are likely capable of developing their own OTT communication services, they would require a large amount of research and development (R&D), and interviewees stated that Thai users would not be interested in using Thai OTT. Additionally, it is suspected that OTT communications rely on network effects. This is different from OTT media, which does not rely on network effects as much as OTT communications do. Furthermore, the MNOs probably realize that it might not be profitable to invest in developing such an application because it is unpredictable whether users will adopt it or not, especially in the moderately-sized Thai market. This is one of the problems that many developing countries may have experienced. For these reasons, a nonaggressive strategy, such as embracing and partnering with OTT, is supported over an aggressive or competing strategy. These factors were not properly investigated in this study, but they are worth exploring in a future study.

As the last remark, this study gives an insight that two services, OTT and traditional telecommunications services, are providing similar services. They are identical in some respects, but that does not mean they are always interchangeable. OTT providers and MNOs are not necessarily competitors as shown in the results. Moreover, they can partner with one another in various configurations to contribute product differentiation to users. OTT negatively affects MNOs in some respects, but it can be of benefit to them in other aspects. It is important for MNOs to take the opportunity from the rise of OTT to gain advantages. In that sense, it depends on the ability of MNOs to manage their businesses, regardless of the help from governmental authorities. With the results found in this study, there are no compelling reasons to attempt to regulate OTT, specifically in the area of the economic impacts of OTT.

Section 7.2 Implications

This study aims to provide useful suggestions for stakeholders in the ecosystem of telecommunications, specifically the government's regulators and policymakers, along with mobile network operators (MNOs) in Thailand. Based on the implications of the results, the suggestions are as follows:

1) Recommendations to the Governmental Authorities

With respect to the government, and referring to the regulators and policymakers in Thailand, there are four recommendations regarding the results. Firstly, intervention from the government as it affects OTT and traditional telecommunications services, specifically MNOs, is not suggested at the moment. Apart from feasibility, which should be discussed separately, the situation in Thailand indicates that intervention, such as establishing regulations in the same manner as traditional telecommunications services, is not appropriate. The reason is that it does not hold true in every case that OTT is harmful to traditional services, such with mobile voice calling service. Moreover, MNOs are aware of the issue and they have their own way to handle it by enacting various strategies. This is the beauty of a free and competitive market. Intervention from the government is mandatory in some situations, but it can alter standard market mechanisms. However, at the moment, the government should closely monitor the situation, which change rapidly in the near future.

Secondly, even though intervention from the government is not recommended, it does not mean the government should be reluctant to be involved in this issue. The government is encouraged to extend their role as a supporter of MNOs and domestic businesses in Thailand and not only as the regulator, whose obligation is more likely to act as controller or rule keeper. MNOs revealed that the struggles hindering them from competitiveness is the burdensome and outdated regulations from the NBTC. In that sense, the NBTC should revisit and modify the current rules applied to MNOs. By doing so, MNOs can enhance their competitiveness, resulting in higher income, which can compensate for the loss they suffer from OTT. Furthermore, this will eventually contribute to the Thai economy. Moreover, when MNOs benefit, they are able to invest and improve the infrastructure. This is an advantage that the regulator should support, because infrastructure is known to be a basic yet crucial necessity affecting the development of the country in several ways. For example, infrastructure can help bridge the digital divide, which is a serious problem in Thailand. In addition, as a supporter, the regulator should assist the MNOs in implementing new strategies, exploring new sources of revenue, and assisting in research and development (R&D). Many MNOs have stated that they plan to offer new products to users utilizing new technology, such as 5G and IoT. This is a good strategy that not only reflects positively on the MNOs but also helps users enjoy better service, which in turn results in a better quality of life. Moreover, new technology can be utilized by corporate users as well as other businesses, which eventually benefits the entire economy and development of Thailand.

Thirdly, as the recommendations to government to deal with OTT providers, it is important to note that OTT services are not always the threat to any aspects to the country, as shown in the results of this study. Blocking or any aggressive actions might turn the situation into worse. In that sense, closely corporation and agreement in the way that supports both government- and Thai people, and OTT providers are preferable. In this study, some users are not able to intensively use OTT as the main

communications services, but there are lots of users are using it. In other words, OTT can positively benefit many users in Thailand. With this reason, encouraging OTT is considered an alternative approach to OTT providers. Instead of attempting to suppress OTT, encouraging both OTT and MNOs can benefit all of the stakeholder, especially Thai people and economy.

Lastly, it is observable from the results that the problem of the digital divide in Thailand remains serious. Apart from encouraging MNOs or ISPs to invest in infrastructure, it should be a priority policy for the government and its policymakers. OTT services can be used in areas where the Internet is available and stable. The results show that users residing in non-municipal areas are less likely to use OTT compared to users residing in municipal areas, which are relatively more developed. Even though users in rural areas can use traditional services, such as mobile voice calling, instead of OTT, it is better to have more choices. In addition, people can utilize it for other benefits, not only for using OTT.

2) Recommendations for the MNOs

MNOs are encouraged to continue using nonaggressive strategies with OTT. As shown in the chapter on consumer behavior, many users are enjoying OTT services. Even though it is difficult to predict the future of OTT, it can be roughly seen that smartphone ownership and Internet accessibility are the keys to using OTT. MNOs will certainly be forced to confront higher usage of OTT. Thus, instead of using aggressive strategies, which actually can be used under the incumbent legislations and regulations in Thailand, MNOs should view OTT as an opportunity. MNOs can use OTT as value added to their service. Furthermore, bundling packages are quite successful in terms of constraining the impact of OTT. As seen in the results, voice calling is not dropping as much as SMS is. One of the reasons is that voice calling is included in bundling packages. The lesson to be learned is that users have a tendency to change their behavior regularly. It is important to keep innovating to respond to consumers' needs. OTT has been successful in penetrating the market because of its potential to perfectly respond to users' needs and behaviors as they change. OTT knows its consumers very well. Thus, it would make sense for MNOs to closely observe consumer behavior and keep innovating. R&D is very important, as always.

In addition, there are gaps between users in urban and rural areas. MNOs need to closely observe each customer base and provide appropriate packages for users in each area. Moreover, they have different usage behavior, with many customers still relying on traditional telecommunications services. MNOs would do well to offer traditional telecom services to those users along with some data allowance at an affordable price for those who want it, in order to maximize the benefits and efficiently utilize the infrastructure they have. Furthermore, providing packages at different price points depending on the area of residence is one of the suggested strategies. As stated, the users in in remote and rural area have different preferences and expense capacity from users residing in urban areas. This strategy has benefits for MNOs, users, and the overall development of the country as it will serve to increase the

number of subscribers as well as market share. Moreover, it will provide the opportunity for the people who live in remote areas to access both communications services and the Internet. This project should not be undertaken by MNOs alone; the government should assist them in order to help reduce the digital divide in Thailand.

Section 7.3 Contributions of the Study

This study adds significant knowledge to previous studies and to the field of telecommunications in several dimensions. Firstly, it focuses on OTT communications. This study illustrates the impact of OTT communications and consumer behavior using OTT communications. Indeed, there are abundant studies that focus on various aspects of OTT services, and yet there are a limited number of studies exclusively studying OTT communications. As stated in the background chapter, OTT is clustered into groups based on its characteristics and business model. Even though OTT communications shares the features of providing content on the Internet as well as typical OTT, its features and business model are quite unique. For this reason, its impact is relatively different from other types of OTT. This study should help policymakers and telecommunications service providers to clearly see the impact of OTT on communications services.

Secondly, this study confirms, with empirical data, that OTT is not replacing traditional services in every facet. While results from prior studies varied across country, region, and context, this study affirms the previous studies that OTT does in fact affect traditional services, though the level of impact quite different.

Thirdly, this study focuses on Thailand as the case study. Thailand is a country that has characteristics of both well-developed ICT in the urban and municipal areas, and underdeveloped ICT in non-municipal and rural areas (Malisuwan et al., 2016; Srinuan, 2012). In other words, the developmental gap, or digital divide, is massive. It is different from previous studies that have focused on developed countries with smaller digital divides. There are several countries that share this same situation with Thailand, but the research concerning the gap is scarce. A contribution of this study is to illustrate the consumer behavior and market characteristics in the group of countries that fall into this category. The results of the study not only benefit the policymakers in Thailand but can be used as one of the case studies for policymakers in other countries, especially those sharing the same or similar problems as Thailand.

Fourthly, another academic contribution is this study's extending of the understanding of OTT impact on MNOs. It shows that OTT not only directly affects MNOs on the foundations of its business model, but it indirectly affects MNOs by associating with the surrounding environment, such as

regulatory issues and competition among MNOs. It emphasizes how the impact of new players can affect the existing players in the market in multiple ways.

Lastly, this study conducted research concerning OTT communications from three main stakeholders in the ecosystem: users, the government and its regulators, and mobile network operators (MNOs). By doing so, the role and impact of OTT can be clearly seen across the entire ecosystem. From these results, the policymakers and all the stakeholders in the ecosystem can comprehensively understand the role OTT plays and its impact on each stakeholder. It also emphasizes the ways in which OTT affects not only one or specific stakeholders but relates to other stakeholders in the same ecosystem. Thus, when there are changes from the impact of OTT, other players are required to make adjustments themselves, including the government.

Section 7.4 Limitation and Future Study

Although this study tried its best to accomplish its goals and remove all possible flaws, there are limitations, and these limitations were inevitable. They are expected to be improved upon in future studies.

Firstly, the methodology is one of the limitations. In the section on consumer behavior, in order to accurately examine the substitution between the services, cross-price elasticity of demand is a well-known method that has been used in several studies (e.g., the substitution between fixed and mobile telephony and fixed and mobile broadband). When using this method, "price" is the key variable in the analysis. Unfortunately, with OTT communication services, price is impossible to properly obtain at the moment. For this reason, the usage by consumers between OTT and traditional telecommunications services was looked at instead. However, this only shows the usage of the two services, which may or may not related. Without the cross-price elasticity of demand, it is controversial to state that the two services are substitutable or complementary from an economic perspective. This limitation is expected to be eliminated in future studies by separating out the actual price of OTT or finding an appropriate proxy in place of the price. Otherwise, alternative methodologies should be analyzed instead. For example, the hedonic pricing model is a promising methodology in coping with this issue. The hedonic pricing model is generally used to estimate the price of a product as determined by its characteristics or attributes (Sirmans et al., 2005). For example, the price of housing is determined by surrounding environment such as urban green areas (Saphores & Li, 2012). However, the hedonic pricing model could not be employed in this study due to limitations in the dataset.

Secondly, this study used two different datasets in the first and second sections of the consumer behavior chapter. Due to the limitations of the survey, all of the information could not be collected at

the same time. The respondents tended to have limited time and tolerance when responding to the questions. If the length of the questionnaires was too long, the respondents would lose interest and answer the questions without scrutiny. This issue negatively affected the quality of answers they provided (Burchell & March, 1992). Thus, the first section of the chapter employed a survey conducted specifically for this study, but it could not include certain factors, such as IT skills, which was included as a crucial variable. The second section employs data from a national survey containing a very large sample, but it does not contain information about the usage of mobile voice telephony, an important service included as one of the traditional telecommunications services. For both of these reasons, two datasets were used. More insightful results would be available if the same dataset collected from the same respondents could have been used. Moreover, the datasets are all cross-sectional data and cannot provide the results of changes occurring over time. Panel data is more appropriate, but this type of data was not available.

Thirdly, the survey of all data used in this study relies on self-reported questionnaires. Although this kind of questionnaire has been routinely used in an abundance of studies, and they are convenient to collect, there are disadvantages in using the data collected from this method. Respondents may not always answer accurately or truthfully. For example, some respondents do not remember their actual usage of particular services or misperceive their own behaviors. Respondents may also choose to answer questions in ways they believe to be pleasing to the researcher; they think they know what the researcher wants from the survey and they respond in that way, even though their answers may not be as honest as they would be otherwise. Even worse, some respondents answer the questions carelessly, especially when there are too many questions for them to respond to. These problems are considered typical in self-reported questionnaires. Nevertheless, it would be better if objective data were used. Some previous studies employed data collected from actual usage retrieved through the billing system of MNOs. This data is more reliable, but it is not available in Thailand. If possible, it is suggested that future studies use objective datasets instead of subjective datasets.

Fourthly, in the chapter on the perspective of mobile network operators (MNOs), it does not include the insight of mobile virtual network operators (MVNO) and other new, smaller operators, who have small number of subscribers, and offer a limited number of products. Moreover, many operators are new entrants to the market with limited budgets, resources, and capabilities to invest. Furthermore, they do not own their own infrastructure or networks as the big five MNOs do. Because of these limitations, the attitude they have towards OTT, the impact of OTT on them, and the strategies they use towards OTT are likely different from those of the large MNOs. It would be interesting and beneficial if they can be included in the analysis. Future study can contribute to this study by comparing them to the large MNOs. In that sense, policymakers can establish more precise policies for the Thai telecommunications market.

Fifthly, this study focuses mainly on the aspect of economics and cannot comment on other aspects of regulation, such as consumer rights, data protection, and tax collection. Future study is suggested to examine these issues, not only the internal legal legislations, but also international agreements, such as the case of GDPR, which deserves to be investigated as well.

Lastly, there is sensitive information that could not be accessed, especially information regarding national security, the Thai monarchy, and related background intelligence. This information is highly restricted and cannot be accessed by any means. Likewise, any information of a sensitive nature the researcher may have access to cannot be exposed, even if it is used for academic purposes. Although Thailand claims to be under a democratic regime, there are several restrictions that seem contradict the basic principles of democracy, such as limited freedom of speech, Internet content blocking, and media censorship. This issue constrains intensive research involving the government in related areas of study.

Chapter 8
Conclusion

This study aims to investigate the impact of Over-the-top (OTT) communication services on the telecommunications sector in Thailand. OTT communications in this study refers to online applications distributed on the Internet, and contains identical features to traditional telecommunications services, which include mobile voice calling and SMS. OTT in Thailand is similar to that in the rest of the world and has been expanding, in terms of revenue, usage, influences on people's lives, and business expansion. There are several reasons why OTT is successful in Thailand. For example, OTT is employing a business model called two-sided market; OTT providers offer the services to users at no cost, and the cost is covered by a third-party, namely advertisers or app developers in exchange for user access or information. With this business model, the users generally perceive that using the services are free of charge, resulting in a cost advantage compared to traditional telecommunications services (Joshi et al., 2015). While OTT is enjoying their success, traditional services, namely mobile network operators (MNOs), are suffering from a decline of traditional telecommunications services in both mobile voice calling and SMS. OTT is regarded as the cause of MNOs' loss due to the suspicion that lots of users have switched to OTT and reduced their usage on traditional telecommunications services. Because of this issue, telecommunications regulators and the government have been demanded to take action or apply rules to OTT providers in order to create a level playing field. Although the National Broadcasting and Telecommunications Commission (NBTC), which is the Thai telecom regulator, is attempting to establish a regulatory framework for OTT, the official regulations for OTT services have not yet been created and implemented. There are limitations for the NBTC to create and apply the rules to OTT. One of those is that studies regarding OTT in Thailand, especially empirical studies on OTT communications, are scarce. Currently, most of the studies on OTT in Thailand focuses on OTT media or OTT TV, another type of OTT, which is quite different from OTT communications in terms of content and monetization (e.g., Anantho, 2018; Chouna & Sonsuphap, 2020; TIME Consulting, 2017). Moreover, the studies regarding OTT communications in the academic area are generally limited. Basically, the impacts of OTT usage on traditional telecommunications services were investigated, but the results were diverse depending on the context of the country and the specific service usage (e.g., Arnold et al., 2016; Mäkinen et al., 2014; Wellman, 2019). With these same issues occurring in Thailand, this study was conducted in order to examine the impacts of OTT on the Thai telecommunications sector. Furthermore, in order to paint a clearer picture of the Thai market, the responses to OTT were also investigated. With this main focus, the overarching research question was posited to be, "What are the impacts of OTT communication services on the stakeholders in the telecommunications sector and what are their responses to OTT in the context of Thailand?"

There are three main implications of the study. First, the results in this study will extend the understanding of the impact of OTT on each of the stakeholders in the telecommunications sector and how those stakeholders respond to OTT. This knowledge is very limited, especially in Thailand. Second, the results will contribute to each stakeholder as guidelines to adjust their plans in order to retain their benefits. And third, the results will serve as guidelines for policymakers in Thailand, who need to understand the impacts and then improve policy or the regulatory framework for OTT.

The telecommunications sector relating to OTT communications in this study is comprised of three stakeholders - users, MNOs, and the government. As this study mainly aims to contribute to the government side, the investigations are carried out from the side of users and MNOs. Moreover, they are interrelated with the demand and supply sides of traditional telecommunications services, one of the areas most affected by the rise of OTT. The first part, investigation of the users' side, focuses on individual users in Thailand. In this section, usage behavior of OTT and traditional telecommunications services are examined in order to find the impacts of OTT on traditional telecommunications services. Thus, the research questions are posited as to what extent does OTT communication services use affect mobile voice calling? And to what extent does OTT communications services use affect SMS? The study relies on quantitative methodology, keeping in mind choice modeling based on the random utility theory. The data was collected from five regions in Thailand during April and May 2019 and comprised 1,052 observations. Following the previous study (Cecere & Corrocher, 2012), probit analysis was performed. The results revealed that use of OTT voice calling is positively related with use of mobile voice calling. On the other hand, it is negatively associated with use of SMS. However, OTT messaging is not statistically associated with both mobile voice calling and SMS. In studying the response of users to OTT, the adoption of OTT was of interest. By elaborating the diffusion of innovation theory espoused by Everett Roger (1995), three factors relating to the adoption of OTT were examined: complexity of the technology in relation to the individual skills, supportive environment, and socio-demographic characteristics. The data was collected from a national survey by the National Statistical Office of Thailand (NSO) in the first quarter of 2019. After sorting out irrelevant samples, the dataset contains 167,675 samples. The data was analyzed using logistic regression. The results revealed that all three groups of factors are statistically significant. The users who are more likely to adopt OTT services have higher IT skills, own smartphones, are able to access both public and broadband Internet, are female, are younger, completed their diploma or basic education, reside in municipal areas, and work as CEOs, managers, or in white-collar professions.

The second part was carried out from the MNOs' perspective. The impacts of OTT were explored from the side of MNOs. The research question for this part was, "What are the impacts of OTT communication services on MNOs in Thailand?" For further study, the response to OTT in relation to strategy dealing with OTT was also examined. The appropriate strategy to deal with OTT Thailand was determined by MNOs. The research question asked was, "What are the appropriate

strategies for dealing with OTT communication services for Thai MNOs?" Semi-structured interviews were conducted with the strategy managers from five MNOs in Thailand - AIS, TrueMoveH, Dtac, CAT, and TOT, from April to June 2020. The first research question in this part relies on the conceptual framework developed from the study of Osterwalder's business model ontology (2003) and environment-driven changes developed by Ghezzi, Cortimiglia, and Frank (2014). The results revealed that OTT communications have affected MNOs in four ways as one of the environment-driven changes; external innovation, regulatory change, consumer change, and competitor strategy change. First, OTT has affected four components of the business model defined by Osterwalder (2003), resulting in consideration that OTT is an external innovation affecting MNOs. Those four components are (1) product (value proposition) - OTT is offering nearly identical services to the core services of MNOs, so the usage of core services, which are mobile voice calling, international calling, and SMS are decreasing, even though the degree of decline varies among these services. The only service increasing is mobile Internet, however it does not generate much revenue and does not compensate for the losses in other core services of MNOs. (2) Customer interface (value delivery) - OTT is considered a layer squeezing itself between the MNOs and the users. Consequently, MNOs are not as accessible to their users as they were previously. Moreover, users tend to blame MNOs for any problems they face while using online services, so the relationship between MNOs and users is strained. (3) Infrastructure management (value creation) - As OTTs increase their bandwidth usage, MNOs have to maintain the quality of their services by investing more in infrastructure. This area has little impact, however because OTT communications do not consume much bandwidth. It is OTT media or OTT TV that does. (4) Financial aspects (value appropriation) - With core services drastically declining due to OTT, MNOs have to increasingly invest in their infrastructure, which affects MNOs financial returns. These four components of business model have been affected by MNOs, even though the level of impact is different. It can be concluded that OTT has some impact on MNOs as external innovation. Second, OTT is associated with regulatory change, but the impact of OTT increases when regulation remains unchanged. Third, OTT changes consumer communications services usage behavior, resulting in a decrease in the use of traditional telecommunications services. Last, OTT has forced competitors to change their strategies. Because some operators are engaging with OTT, other operators in the market have to change their strategies as well. Concerning the second section of the chapter, the appropriate strategy for OTT was explored. By adopting the strategy evaluation of Rumelt (1980), each strategy for OTT was estimated. The results indicate that a nonaggressive strategy, such as embracing OTT and partnering with OTT, are appropriate for Thai MNOs. Moreover, indirect strategies of dealing with OTT were found, exploring new markets or new sources of revenue and arranging internal reforms in the company.

With respect to the key findings retrieved from both two perspectives of the market, users and MNOs, there are findings to be addressed in this study. The answer to the overarching research question is that OTT affects the Thai telecommunications sector in a variety of ways. The effects are both positive

and negative, depending on the area in the market. With respect to the response, the results revealed that the response from users, in terms of adoption reflecting the acceptance of the service, is concentrated in particular groups of users. For the MNOs, the response to OTT is to take a nonaggressive strategy with OTT as the most appropriate way forward. The results in this study suggest that the concern about substitution of OTT for traditional telecommunications services is a bit exaggerated at the moment, the reasons being that some services have positive relationships, and only OTT voice calling and SMS have negative relationships. Moreover, there are differences between OTT and traditional services, such as the service stability of traditional services and the richer features of OTT, resulting in consumers using the services for different purposes. In addition, there are still limitations to using OTT, such that usage concentrates in certain groups of users, mainly those residing in urban areas and being in the middle to upper classes of society. As for MNOs, although they are indeed affected by the rise of OTT, they are well aware of the situation and have already employed the appropriate strategies. However, there are some obstacles hindering them from competitiveness with OTT, such as the outdated regulations forced on them by the NBTC.

The implications are revealed by the main findings. For the regulators and policymakers, intervention such implementing new regulations regarding the economic impact of OTT is not necessary at the moment. However, they should keep monitoring the situation, as they changes may occur in the near future. Moreover, the regulators and policymakers should change their role from strict rule-keeper to one of assistance to MNOs, revisiting troublesome regulations and helping MNOs find new sources of revenue by providing sufficient information. At the same time, they should apply policies to bridge the digital divide in rural areas by improving infrastructure and thus reducing the developmental gap that still remains in Thailand. In addition, because users in urban and rural areas have different usage patterns, MNOs are recommended to provide different service packages or tariff types. This will increase the number of subscribers, adding to market share, and will provide opportunities for people who live in remote areas to access communications services. As an additional suggestion, MNOs are encouraged to continue observing consumer behavior, as it remains dynamic. R&D is essential in improving their services and marketing strategy.

The contribution of this study is that it adds to the knowledge in the field of telecommunications. It focuses on OTT communications in a developing country, where studies of this type are limited. Moreover, it demonstrates results that are in contrast to the claims and research that says OTT is replacing traditional services (Cecere & Corrocher, 2012; Joshi et al., 2015; Mäkinen et al., 2014). At the same time, it offers support to the research stating that OTT has not substituted traditional services (e.g., Arnold et al., 2016; Gerpott, 2014; Wellman, 2019). Moreover, the study revealed that the impacts of OTT are diverse, not only directly to stakeholders in the market, but that it can indirectly affect other areas, such as association with the environment in the ecosystem. In addition, direct strategies are not the only way to deal with OTT; MNOs are applying indirect strategies as well, which are the result of

the rise of OTT. Finally, it provides suggestions for the policymakers, the regulators, and the MNOs in Thailand. This information has never been mentioned in any studies, especially in the case of Thailand.

Nonetheless, limitations remain in this study. A lack of pricing information, which is essential to the cross-price elasticity of demand, and the use of two different data sets resulting in separate analyses, meant the methodology was unable to calculate certain indicators. Moreover, the study has a limited insight in that it did not collect data from MVNO providers, who may have a different perspective on OTT and might implement different types of strategy. These limitations are expected to be improved in future studies.

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