

MULTIDIMENSIONAL PERSPECTIVE OVER THE TOP AND MOBILE NETWORK OPERATOR: COMPETE AND COINCIDE

WIDYA GRANITA^{1*} and ZAIRIL²

^{1, 2}Bina Nusantara University, Jakarta-Indonesia and Mercu Buana University, Jakarta-Indonesia.

*Corresponding Author Email : widya.granita@binus.ac.id

Abstract

Mobile telecommunication is a developing technology, made possible by internet technology based on digital platforms and sophisticated devices to enable users to access various media content without time or space limits. The emergence of over-the-top OTT service platforms has revolutionized the telecommunications industry, requiring operators to upgrade their networks with cutting-edge technology to provide high-speed data access, broad coverage, and consistent network quality. This study aims to identify OTT services and determine their effect on reducing ARPU. This research seeks to find a solution to the challenge of reducing operator ARPU in the emergence of OTT services, while at the same time realizing the need to monetize services by OTT players. The Regulatory Impact Analysis model is used to show that regulation is needed for OTT that combines MNO business with commercial OTT such as e-commerce. OTT, which has a social and non-commercial focus, should not be treated the same. The government has given permission for OTT to set up a representative office in Indonesia, it requires an agreement and procedures for the relationship between MNO and application, content and platform providers, and MNO rates must be differentiated based on the type of data accessed. Network administrators should create tools to identify data and URLs to prevent MNOs from being harmed by international OTT services.

Keywords: Over The Top, Online Consumer Behavior, Cellular Operator, Regulatory

INTRODUCTION

Internet technology based on digital platforms is growing dynamically and creating various innovations in various fields, especially cellular telecommunication technology. It is accompanied by the high penetration of mobile internet users (54.68%) of the total population of Indonesia (APJII and MASTEL 2018) and followed by rapid changes in technology and features on devices that can meet the needs of cellular service users. The survey results (Ministry of Communication and Informatics 2018) show that more than half of Indonesia's population (66.31%) already have smartphones or smartphones connected to the internet to the highest usage to meet communication needs (93.46%).

Shin, Park, and Lee (2016) said that with the deployment of 'smart' devices with internet connectivity and digitization of media content, consumers enjoy a variety of content applications without the constraints of space, place and time. The emergence of service platforms that provide media content via the open internet has caused a paradigm shift away from the traditional telecommunication industry. The phenomenon of user behavior to always be connected to a cellular network, wanting a fast and real-time exchange of information for social, business and other personal needs (Nandhiosa and Haryadi 2015) through an 'ABC' (Always Best Connection) cellular network. The need to always be well connected for internet user also mean connected through the best available technology devices and access at all times

(Gustafsson and Jonsson 2003). The fast growing digital platform in the telecommunications industry has placed mobile operators in the middle of a paradox. On the one hand, digital thinking has firmly entrenched in its business model, where cellular operators were not only provide their own digital products and services, but also enable other parties to access the network through cellular technology infrastructure. Furthermore, these other parties participate in growing on the digital economy (Mohr 2017), where there is a possibility of a negative impact on customers if operators are allowed to charge additional prices for content providers. Under conditions where network externalities dominate the internet, network value influenced by two elements namely the number of subscribers and the number of content creators. Thus, subscribers and content creators have an importance role that operators cannot ignore.

In contrast, OTT relies on net neutrality in providing internet service innovations. Based on net neutrality, operators should have no control over network data services. If the opposite happens, it will be detrimental to new players (start-ups) and lead to the transformation of the internet from an innovation-based market to a market controlled by deal makers (Baldry, Steingover, and Hessler 2014). Mobile operators as one Internet Service Providers (ISP) oppose network neutrality based on two basics arguments claiming that:

1. OTT has conflicting interests by providing similar services thereby threatening the growth of cellular operators.
2. OTT is a free rider that exploits operators' networks, thus requiring infrastructure investment and modernization of the network.

Operators propose a solution by charging additional fees to OTT players to prioritize OTT network traffic. Then use additional revenue for network expansion and increased broadband access to more consumers.

Internet use in Indonesia expected to be dominated by OTT video services. The problem that arises from OTT services is the use of these services consumes services consumes high bandwidth in telecommunication networks and has not been regulated, resulting in unhealthy competition (Sujata et al. 2015). In line with findings (Esselaar, Song, and Stork 2017), OTT traffic has dominated the operator cellular networks. Data service usage is increasing rapidly, but voice and SMS revenues are declining rapidly. Revenue from data services has the potential to become prime source of revenues for MNOs, requiring new mechanisms to drive demand and revenue. Cellular operators have required to continue deploying cellular networks with the latest technology to provide high data access speeds, wides coverage, and reliable network quality. Cellular operators strive to provide voice, data, and multimedia services that are seamless and of high quality and interoperability across multiple cellular devices (Sujata et al. 2015). Cellular operators react very quickly in response to developments in technology and market changes in the telecommunication industry such as mobile internet services, which are now trapped in the midst of new challenges to increasing revenue, namely Over The Top (OTT) service providers. Traditionally, cellular operators' revenue streams have been from voice and messaging (SMS) services, data services as the new generation is internet-based. OTT service providers send audio, video, and other media over the internet and use mobile operators'

networks. Although OTT accessed through cellular operator networks and infrastructure that requires continuous capital investment, OTT does not contribute directly to operator revenue. OTT users need a data service package expected to boost cellular operator data revenue. Another challenge is that OTT offers the same services as cellular operators, thereby threatening significant and measurable revenues (Sujata, et al., 2015). A variety of OTT applications and services lure users further away from cellular operator whose prices are relatively pricey with limited variety of services. The existence of OTT has impacted on voice, and SMS revenue is a necessity. Besides, mass density of cellular data network traffic is a critical point to consider. In fact, according to Price Waterhouse Coopers (2017), the OTT market is growing rapidly and market size of OTT in the US expected to reach US\$ 16.54 billion in 2019 with a CAGR of 14.6%.

According to (Stephen Esselaar and Stork 2018), operators are of the opinion that OTT has cannibalized voice and SMS revenues resulting in a decrease in overall revenue resulting in a lower ability to invest in network infrastructure; declining service quality; decreased state tax revenue and lower licenses. Facebook (2017) reports that over 1.86 billion monthly active users are on Facebook, 1.2 billion on WhatsApp, and 1 billion on Facebook Messenger. OTT services that rely on internet connectivity to access them have gained high popularity around the world. In several countries, changes in consumer behavior have been observed in the cellular telecommunications market, which has tended to see a significant reduction in the use and revenue of text messaging services in recent years.

From a global perspective, the production of new models of gadgets and OTT services with enhanced capabilities should drive new constellations of data services and mobile applications, but in general, it has not driven rapid ARPU growth (Ahmad 2012). On the other hand, regulators and operators have claimed that OTT has a negative impact on the industry (Council of Africa Regulators, 2017) and that telecommunication operators' revenues are not growing due to declining voice and SMS revenues and stagnant or slow data revenues (WATRA, 2017). In general, revenue depends on many factors including the number of customers, customer profiles, product design, retail prices, level of competition in the industry, and regulations (Esselar & Stork, 2018). These factors can be grouped into three categories:

- a) Economic factors: population, GDP per capita, exchange rate;
- b) Regulatory environment: number of MNOs, fairness of competition, transparency, and predictability of regulatory interventions; Operators: product design, response to other operators, and business models.

This study aims to identify OTT services and study their effects on cellular operators' ARPU reduction from various perspectives. In particular, OTT services have raised the following question: What is the concept for operators in Indonesia to overcome the eroded revenue caused by OTT services on a customer-oriented basis? In addition, how does the role of regulation balance the telecommunications industry in Indonesia to manage the OTT business, mobile operators, and users? This research focuses on cellular operator data services and OTT applications from the perspective of consumer preferences and behavior which are believed to

influence consumption decisions on cellular usage; OTT services that have an impact on increasing cellular data service traffic; as well as regulations that affect the business model of cellular operators in dealing with OTT. The next section reviews existing and relevant literature on the impact of OTT on cellular operators, online user behavior, and the role of regulation in the health of the mobile telecommunication industry. Then, data collection explains the evolution of cellular services, and the growth of OTT applications and analyzes the business models of mobile operators that combine OTT from a regulatory perspective. Then followed by discussion and discussion. Finally, the research conclusions and suggestions for theoretical and managerial implications.

THEORITICAL REVIEW

1. Inter-relationships in the Ecosystem Device Network Application (DNA)

Technology at affordable prices, the internet and information flowing massively, an occurrence of globalization have transformed the economy, community, and personal life. The trend of rapid information exchange creates business opportunities for content and application developers (Nandhiasa and Haryadi, 2016). The new generation of mobile internet-based telecommunication services has gained worldwide popularity because internet technology has been known worldwide for more than a decade.

The pressure on cellular businesses and regulators to provide consumer-oriented services and real-time information is intensifying. Governments and businesses must change and move fast. Economic actors and the telecommunication industry must be more innovative and competitive (ATSI 2016). Openness, which is a synthesis of collaborative creativity, connectivity, access, and transparency, has revolutionized the way we communicate, relate, and compete. This is reshaping digital ecosystems, and enabling governments to re-engineer, and rewrite business models and services provided. Players in digital business have complex relationships, consisting of Devices, networks, and Applications (ATSI, 2016). The main players in the digital ecosystem are Devices (manufacturers of devices, including manufacturers of components used in mobile devices and operating system developers); Networks (cellular operators, internet service providers, and network infrastructure vendors); Applications (application developers). These three elements had integrated to provide mobile internet services for end users. End users determine the choice of device use, and cellular operators, use the application according to their needs and desires. Figure 1 shows the inter-relationships between elements in the digital ecosystem.

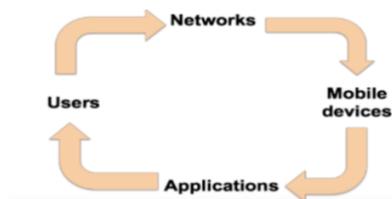


Figure 1: Mobile Broadband Ecosystem

Source: Openness in the mobile Broadband Ecosystem (FCC-2013)

2. Cellular Network

Users pay mobile operators to get network access either through a monthly postpaid subscription mechanism or prepaid purchases. Apart from that, operators also set prices, for example, unlimited bandwidth, bandwidth caps, or based on usage (billing), as well as restrictions on initial fee contracts until termination, as well as restrictions on tethering and others. Of course, the role of network equipment vendors in the development of cellular network infrastructure is very important (ATSI, 2016). Cellular operators rely on Base Transceiver Stations (BTS), packet gateways and services, and mobility control software to build and manage cellular network infrastructure.

2.1. Application Developers

Application developers are one element of the digital ecosystem that creates applications for various platforms such as Apple iOS and Google Android. Applications range from network and device utilities to mobile access to online content, mobile games, and location-based (geolocation) applications. Creating a successful application is a challenge and requires the creation of separate versions for each operating system platform by relying on the application programming interface or Application Protocol Interface (API) prepared by operating system developers and device manufacturers (IAB 2017).

Various business models based on application development design and consumer experience are carried out to find the appropriate monetization pattern. One of them, the initial purchase price is a freemium or free download with limited functionality and exposure to advertisements. Second, the download is free (or paid) with an application purchase for additional services or a subscription. Developers distribute an application product through the App Store which is the largest application store operated by Apple and Google (Mohr, 2017).

Having many applications available means that users have many choices. This condition forces developers to maintain price stability so they can compete by offering free or cheap applications. Therefore the revenue from the application depends on advertising and word of mouth to promote the application. On the other hand, application developers depend on cellular service providers who have quality network coverage and performance and are subject to the terms and conditions of the operator and end-user service contracts which may limit the use of certain applications.

2.2. Device manufacturers

A smartphone is defined as a mobile phone that incorporates a general-purpose operating system, where users are free to add applications, extend functionality or customize (MCPC, 201). Various devices such as smartphones, tablets, and smart meters are connected to the mobile internet network. Users prefer to choose the uses of devices that continue to offer types and features with the latest technology. Meanwhile, many gadget manufacturers rely on cellular operators by offering discounts or collaborating to provide bundling programs.

Most carriers "lock" these devices to their network, restricting customers from using them with other operators. In addition, device manufacturers rely heavily on component manufacturers for a regular supply of components (radio chipsets and processors that govern radio network operation and compatibility, features, and performance). Relationships with the component manufacturer are complicated when these companies also sell their own devices. For example, Samsung is a leading smartphone manufacturer but also a major supplier of screens to its main competitor Apple devices.

In addition, (ATSI 2016) states that operating system developers (OS) on devices provide platforms for applications. Some operating systems are provided by device manufacturers, for example, Apple iOS, and operating systems are provided separately, for example, Google Android and Microsoft Windows Mobile. Some operating system developers try to limit the fragmentation of OS software to ensure interoperability, where applications run on one device but also other devices. Each OS platform also has a very different philosophy toward openness both in terms of the OS itself and the application environment.

Historically, mobile carriers have been influenced by the devices and services available to users. But the ecosystem has evolved in such a way that operating system developers, device manufacturers, and application developers have more control over the user experience and consumption of network resources. User preferences for their cellular devices influence the decision to switch operators that have been used. The type and variety of applications also affect network bandwidth consumption and radio access signaling can reduce network performance in cells with heavy traffic.

Cellular network management is becoming more challenging for operators with the rapid emergence of new applications. Operators must be able to influence the choice of application users or the efficiency of application developers in using network resources through various forms of usage-based pricing. If data usage continues to grow, operators will incur significance costs to expand network capacity. Operators' technical options for managing network resources are limited by optimization of the underlying network infrastructure and mobile devices.

2.3. Over The Top (OTT) Services

OTT is a content service in the form of data, information, or multimedia that operates via the internet network. It can be said that OTT services "hitch a ride" on the internet network belonging to cellular operators. Greene and Lancaster (2007) define Over-The-Top Services as Services accessed via the internet network from operators that provide added value to customers. However, operators are excluded from planning, selling, and providing services. Of course, this does not directly increase telecommunications operator revenue from OTT service providers.

The Ministry of Communication and Informatics through the Ministry of Communication and Informatics Circular Letter (2016), defines OTT as an application or content service by utilizing internet protocol-based telecommunication services. OTT services refer to online services that have the potential to replace traditional telecommunication and audio-visual services such as voice telephony, SMS, video on demand, and television (ITU, 2017).

OTT services are separated into three categories concerning the main features: media, communication, and applications. OTT service providers include Facebook, Twitter, Youtube, Viber, and others. OTT service providers generally do not have an official form of cooperation with telecommunication operators (ATSI, 2016). OTT-based services and applications cannot stand alone but require an interconnected OTT World and Telco World. Telco World is the realm of communication and internet network service providers consisting of ISPs (Internet Service Providers), cellular operators, and other telecommunications service providers and internet access.

Telcos provide infrastructure, connections, and communication lines that support the functionality of OTT-based applications and services. Telkom, Telkomsel, XL Axiata, Indosat Ooredoo, and others are examples of companies that are in the Telco World or OTT world, where OTT-based business and application developers are located. OTT services are defined as all forms of service products in the digital world (internet) in the form of OTT technology-based applications that utilize internet connections and internet infrastructure provided by Telco World.

Various types of services are provided in online OTT, including streaming, audio and video services, social networking services, instant messaging services, and others. OTT applications are mostly accessed by mobile (Smartphones, Tablets) so OTT applications are more synonymous with online-based mobile applications. However, not all mobile-based applications are OTT-based applications. Only mobile applications absolutely require an internet connection from an internet access provider, in this case, telcos, cellular operators, and ISPs to be able to operate OTT application functionality properly.

The OTT application and service categories that are commonly used daily include (1) Social Networks and social media: social connection, multimedia sharing, professional, informational, educational, hobbies, and academic; (2) Chatting and Messaging, OTT-based applications that emphasize sending and receiving messages quickly (instant messaging). The existence of this online short message application makes it easy to communicate both in two directions and en masse (in an online public space).

Some examples of instant messaging OTT-based services and applications are WhatsApp, Line, Telegram, Kakao Talk, WeChat, and others. (3) Audio-Video Streaming, emphasizing the types of streaming audio and video multimedia file services online to users. Users can use both mobile and desktop applications. Included in this category are video streaming (Netflix, Vevo), video chatting, and video calling (skype, face time, line, Whatsapp, and video game streaming (twitch)).

3. OTT Relations and Mobile Operators

OTT services such as Skype, WeChat, KakaoTalk, and WhatsApp have grown dramatically and are increasingly displacing voice and SMS services from mobile operators (OECD, 2013). Cellular revenue has stagnated or decreased, and cellular operators have suggested slowing down or blocking traffic using OTT services, OTT owned by the operator as well, or submitting

regulations regarding OTT traffic service fees. This proposal becomes a conflict related to access, interconnection, and discrimination.

OTT providers offer value-added services for both paid and unpaid customers. OTT directly or indirectly competes with mobile operator's services that provide connectivity to users. OTT is a service provided by a third party that is not affiliated but utilizes the operator's network to access it. Basically, OTT services reduce operator connectivity services which are their commodities (Jayakar and Park 2018). According to (Sujata et al. 2015), OTT impacts are not limited only to voice and SMS services but also cause an exponential increase in data traffic. It causes high cellular network traffic, so the network quality decreases significantly.

The main contributor to the increase in data traffic is the consumer appetite for using videos more. In response to increasing data traffic, operators must continue to invest in building and modernizing network infrastructure to ensure network stability that meets the quality of service (QoS) and quality of experience (QoE) (Shin, Choi, and Lee 2016). According to (Bilbil 2018), the International Telecommunication Union (ITU) telecommunication trend report, with machine-to-machine communication, cloud systems, and OTT services, mobile traffic is expected to grow by 61% from 2013 to 2018.

OTT players offer core services such as voice or messaging, and media space is the operator's domain. The dynamic growth of internet technology companies such as space and cloud services is becoming a competitor to operators in terms of customer base and revenue. These services tie customers to specific ecosystems while creating dependencies and turning mobile operators into dump pipes. With operator-neutral connectivity (E-SIM) allows seamless network access changes between operators. Therefore, digital business players are systematically attacking mobile operators' revenues and margins.

4. Digital User Behavior

Maslow (1970) stated that the hierarchy of needs found what factors motivate a particular need at different times. The needs are categorized as physiological needs, safety needs, and social or belonging needs, esteem needs, and self-actualization needs. Maslow's theory provides a clear basis for actualizing consumer motives and behavior. The need for communication is related to social needs at the top of the hierarchy. The digital era has driven the need for mobility and mobile phones to become part of individual lives because they can meet user needs for more than just social interaction. And the core feature of cellular service is communication. Previous empirical studies have highlighted that consumption motives are categorized as product-oriented (utilitarian) or experience-oriented (hedonic) uses (Holbrook and Hirschman 1982). The decision to adopt a new product or service varies according to individual needs, motivation, socio-cultural context, or even shopping environment (Woodruffe-burton, Eccles, and Elliott 2008).

Consumption is becoming more than mere adoption of mobile products and services. Furthermore, consumption motives carried out by (Okada 2005) and (Chitturi et al. 2008) state that benefits are utilitarian, usually referring to the functional, instrumental, and practical benefits of offering use and considered closer to usability. Hedonic benefits are aesthetic,

experience, and enjoyment because these are considered closer to luxury or desire. In general, the type of product or service and consumer involvement also influence the degree to which the utilitarian or hedonic aspects play a more dominant role in decision-making.

Despite the many advanced feature developments, mobile operators must pay attention to mobile users as important decision-makers. In special conditions, some users stick to innovations that present new service features even though they do not need these services (Ahmad 2012). Attributes and usage motivations provide a clear picture for classifying different types of cellular services and update the current understanding of social (communication) needs regarding the theory of the hierarchy of needs.

The mobile user experience has tangible and intelligible aspects referred to as a product and service hybrid (Ahmad 2012). In fact, currently, users of data services are in a position closely related to market mechanisms and the cellular industry constantly changing. In terms of advancements in mobile technology accompanied by the rapid development of various gadget features, users will have more and more choices. These various choices are very similar and offer competitive cellular services, so users find it difficult to decide on the use of cellular services and their devices (Verma 2017).

(Mohr 2017) states that globally there are 2.5 billion digital users under 25 years old. The characteristics of this group are always on behavior and different usage behavior compared to traditional consumers. On average, these young digital users spend 315 minutes online every day, while users over 25 years old spend just 126 minutes. More than two-thirds of the cohort access YouTube daily, and 41 percent of 18 to 32-year-olds use the video messaging service Snapchat for 25 to 30 minutes per day.

According to (Sujata et al. 2015), it is very relevant to understand how requests for cellular and OTT services are related to online user behavior. Cellular service users are increasingly prioritizing a more personalized experience and access that can be tailored to the service of their choice. The availability of various and large amounts of content causes users to demand correct and relevant information and content that is available at any time. Consumer demand for convenience has become important for digital businesses to identify individual preferences and provide content according to user needs and wants. By nature, the user wants a unique and one-of-a-kind experience.

The factors that determine the cellular operator's revenue are the intensity of time and the variety of usage by consumers. The perspective of the user's personality can change from time to time and from one place to another, greatly influencing buying behavior. User behavior reflects the totality of usage under different circumstances. According to (Verma 2017), lifestyle is another factor that influences buying behavior. Lifestyle refers to the way of life of an individual in society and is expressed by the things around him. This can be seen from the interests, opinions, and other activities that shape behavior and interactions an innovation, relative advantage, reflect the features of the technology itself (Shaw, Ellis, and Ziegler 2018), where these features can provide a variety of services and data services with more advanced technology.

(Arnold and Schneider 2016) stated that the behavior of using cellular services has high complexity. The number of variables involved with the tendency to interact and influence each other. The variables identified play a major role in influencing online user behavior, consisting of the external environment, culture and sub-culture, social class and social groups, family, and between individuals and others, such as economics, geography, religion, politics, and economy. Most users use both cellular and OTT services simultaneously. The usage pattern that appears is based on the type of service.

OTT is used more for fun than for communication. On the other hand, the perception of the user is that the price of voice communication is higher, so they choose OTT, especially for international conversations. Price is one of the reasons mobile users switch to OTT. In addition, using OTT shows that someone is socially up to date with the latest technological developments and does not exclude from social contact. For example, WhatsApp is used to communicate, establish relationships, and socialize.

Consumers use OTT communication services because of additional functions compared to operator services, such as text, voice, and video messages. Images and videos used to reveal and express emotions to others so that communication becomes more natural. In addition, psychologically can judge not only by words but also by facial expressions and gestures. Overall, it adds a new quality of experience or communication.

RESEARCH METHODS

This research was conducted using a qualitative method, using literature studies, survey results of competent institutions, financial reports of telecommunications companies, whitepapers, newspaper excerpts, and various other research reports as well as analysis of the influence of regulations to answer the formulated research questions.

RESULTS AND DISCUSSION

OTT and Mobile Operators in Indonesia

Consumer preferences for voice calls via cell phones are defined using two methods, namely OTT communication services via the internet and traditional services using cellular networks. The OTT communication business model offers free-of-charge services to users, thereby competing with cellular operator services. However, there are drawbacks to OTT service like the service quality is not satisfactory compared to cellular operators. In addition, using OTT requires an internet connection, and data service fees (Jirkasem and Mitomo 2019).

Cellular operators believe that OTT has cannibalized voice and SMS service revenue leading to a decrease in overall revenue. It leaves operators less able to invest in network infrastructure; cellular operator service quality has fallen below standard; lower government revenue from taxes and license fees (Stephen Esselaar and Stork 2018). Naturally, OTT provides communication services replacing traditional voice and SMS services. OTT also provides services that are not related to communication but use the cellular network as a platform for services such as digital money, smart-electricity meters, and transportation services (fleet

management). OTT services are often referred to as Rich Interactive Services (Arnold and Schneider 2016) to differentiate internet-based services from cellular network services.

Several previous studies have shown that OTT is an opportunity for cellular operators to encourage the growth of data service usage. Operators sometimes ignore OTT as the main driving factor for cellular broadband adoption to increase revenue from data services (Stork, Esselaar, and Chair 2017). Stephen Esselaar and Stork (2018) argue that adopting a flat access pricing model for OTT data services can increase profitability.

Antonopoulos et al. (2017) found an econometric model to prove that OTT and cellular operator revenue are significantly positively related. On the telecommunications market side, cellular telephone services, SMS, and MMS experienced declining usage and revenue levels. According to The Ministry of Communication and Informatics 2018, the total revenue of mobile network operators has increased gradually, but the contribution for each type of service has changed. Non-voice revenue, including OTT usage, increased more than voice, which was once the primary source of revenue for mobile network operators (MNOs).

The development of OTT services in the form of content that can be accessed anytime, anywhere, and on any device has attracted consumers to continue using OTT (Sung et al. 2016). OTT growth globally has increased from \$4.2 billion in 2010 to \$21 billion in 2014, expected to reach \$51.1 billion in 2020 (Digital TV Research, 2015).

Recent technological advances in the telecommunications world require the involvement of cellular operators and over-the-top (OTT) providers who offer services through cellular operators' networks. The entry of these new players has changed the dynamics of the ecosystem's digital equilibrium (Antonopoulos et al. 2017). On the one hand, OTT providers benefit from a net neutrality policy that does not discriminate against any application or content to transfer data free of charge, whereas network providers want to take advantage of business opportunities and create revenue by supporting prioritized ones.

The influx of OTT with conflicting goals further complicates the borderless multi-tenant structure of the internet. More specifically, mobile operators argue that OTT uses its network to transfer large amounts of data traffic without contributing to direct revenue. On the other hand, OTT service providers apply network neutrality rules. (Tu, 2003) considers network providers as operators who do not have the right to prioritize network data traffic.

The interplay of OTT and mobile operators intersect by offering similar so-called cellular communication services. It leads to direct competition and conflicting or complementary interests between mobile operators and OTT. Such services include social networking and content distribution that add value to mobile internet connectivity. Regardless of the role of the OTT provider, OTT applications have different quality of service (QoS) demands such as bandwidth, delay, jitter, and other requirements for network resources.

These boundaries, and the multi-tenant nature of the internet, imply complex and correlated relationships among stakeholders in digital ecosystems (Antonopoulos et al. 2017). The business relationship between players in the digital ecosystem refers to the price mechanism

between service providers (cellular operators and OTT providers) and end users. For cellular operators, the widespread use of broadband technology tends to set a flat rate for voice services. On the other hand, OTT, as a new player in the market, has adopted a more attractive and targeted business model (Baldry, Steingover, and Hessler 2014) such as periodic or regular subscriptions, payments on a per-transaction basis, and freemium services i.e. free usage rates but get features Paid advanced features. Alternative OTT revenue is through advertising, donations, and monetization of data services.

In short, Antonopoulos et al. (2017) stated several important facts regarding the relationship between mobile operators and OTT providers, namely the possibility of changing the mobile internet operational mechanism by considering the shared right to access the internet safely and a high-quality experience. One of them is prioritizing real-time services and not favoring the interests of certain parties, such as prioritizing video service traffic from one party which can lead to a monopoly situation. The research results of Jirkasem et.al (2019) showed the claim that OTT substitutes traditional telecommunication services. Empirical studies result in a relationship between these two communication services. In terms of service packages, cellular operators offer connectivity with flat-rate packages which are not completely without limitations. However, the minutes and data quota is sufficient to make calls and access the internet without restrictions. The flat rates combined for both services, so users don't count minutes or bytes with the scheme compared to the usage-based scheme. Moreover, without worrying about fees, users are free to choose certain services for every situation and purpose.

The result of the flat rate plan is positive, meaning that the relationship between the two types of services is complementary. In contrast, a usage-based scheme, OTT replaces cellular operator voice and SMS services. Mobile operators charge users for every minute of use, so users will turn to OTT to reduce costs due to flat-rate internet usage. There is no risk of the user paying additional fees, so use OTT instead of regular mobile voice calls. Meanwhile, for messaging services, OTT, SMS, and MMS are independent. From a user perspective, the two services are not comparable and end up using them differently. On the other hand, the number of SMS and MMS users is small and not distributed well, so the true substitution effect cannot be captured.

Motivation of Data and OTT Service Users

Mobile phones are no longer just voice communication devices but have become multipurpose personal communication devices in less than three decades. Users are now switching to web-based applications covering a variety of information, entertainment, financial and educational services. The experience of using cellular services consists of tangible and intangible aspects so it is considered a product and service hybrid (Ahmad, 2012). The meaning of mobile phones is becoming increasingly diverse, especially in age groups, lifestyles, and motivations for use. Young people are adopting innovations from mobile products and services such as multimedia messaging services (MMS), streaming music, web browsing, video cameras, and so on.

The older generation mostly used the phone for voice calling and texting. Responding to a saturated market, device manufacturers and cellular service providers continue to introduce

new types of services. Users are faced with a variety of unnecessary services and are generally not technologically ready for more advanced services that are high in complexity. Ahmad (2012) adds that this explains the failure of cellular operators to provide a substantial increase in average revenue per user or Average Rate per Unit (ARPU) through the data services offered.

Mazzoni, Castaldi, and Addeo (2007) examined various aspects of mobile services as technology, value creation, product or service development, and lifestyle. However, understanding specific consumer behaviors as usage motivation is critical to provide insight into segmentation strategies that can lead to increased ARPU. The use of cellular services is based on different consumption motives and values. The different types of consumer motivation are categorized into hedonic and utilitarian values (Babin, Darden, and Griffin 1994; Chitturi et al. 2008).

Previous literature has also highlighted that consumption motives can be categorized as either product-oriented (utilitarian) or experience-oriented (hedonic) pleasure (Holbrook and Hirschman 1982). Currently almost everyone, especially in urban areas, has the 'expertise' to use technology products. Urban youth are creating a modern lifestyle driven by new technologies. Likewise in rural areas, people have various types of information to meet their needs according to their functions, responsibilities, and duties (Bristy 2014). The availability of various internet-based services makes a significant positive change in business by providing inexpensive communication services for roamers, researchers, information transfer, advertising, celebrity promotion, and others. The younger generation has created a new social class and is using mobile services as an effective channel for career development and exposure to creativity globally. Along with the growth of cellular and OTT services, the use of social networks is very familiar in everyday life.

Social media is even used as an alternative to the telephone (voice) to communicate, find old friends, share life updates by uploading pictures and videos, share comments, share likes and dislikes, give good impressions and wishes, take notes, and blogging. Users also join groups created by specific organizations or groups to connect with fans and learn about new events and activities of those groups. Additionally, follow pages related to music, recreation areas, educational institutions, social issues, TV shows, dramas, famous people, clubs, and more.

Mobile Operator Strategy with OTT

The telecommunications market is changing rapidly, and mobile operators and OTT players have their own challenges in the market mechanism.

The things that are very significant from the point of view of mobile operators are

1. The exponential growth of OTT services.
2. Data service priority, where customers want to access more data, thus expecting cellular operators to provide superior service by providing additional bandwidth.
3. Despite having high investment rates and strong data traffic growth, revenue growth has slowed for operators worldwide due to intense competition, decreased ARPU voice, and regulatory rates.

4. Costs: Operators have invested heavily to expand network coverage, increase network capacity to handle connectivity and data traffic growth, and using a high-speed mobile broadband network (ATSI, 2014). From the OTT side, it is important to play its business role in the digital world through:
 - a) Quality of Service: Unstable bandwidth for OTT can lead to unwanted buffering, audio and visual dropouts, and poor video quality.
 - b) The Need for Monetization: the biggest challenge that OTT providers face is the monetization of their services. Most the players have not yet monetized their large user base, because the conversion rate to paid users is still low. Currently OTT players have implemented various revenue models such as advertising, post-paid prepaid to freemium.

Sujata, et.al (2016) state that from an OTT point of view, the challenges faced are: better service quality if OTT providers and mobile operators partner to provide quality services at lower bandwidth costs. The Open Connect model adopted between Netflix and the operator is one of its successes. Netflix moved its content delivery network (CDN) edge servers to carrier data centers (DCs) to speed up content delivery. In addition, mobile operators' opportunities for OTT communications will increase. Of course, this will be a mutually beneficial partnership for both operators and OTT players. In addition to reducing costs and revenues, telecom operators and OTT can collaborate for service innovation.

Accessing OTT services requires greater bandwidth and capacity than basic telecommunication services. The telecommunications industry, there is a significant reduction in revenue, increased cellular network traffic, and higher costs (Nandhiosa, 2015). According to Mascot (2013); Farouq and Raju (2019), strategies have been proposed and implemented by mobile operators to overcome this threat:

Block OTT. Obstructing OTT services and slowing data service connectivity by operators to control the proliferation of OTT services.

1. Price based on value. Operators can develop access pricing and are not limited by regulations regarding bundling or price restrictions on rebalancing. Operators need to develop innovative pricing models for new services.
2. Mobile Apps. Namely a new messaging or voice application service launched by operators to face competition with OTT services. For example, the Orange "Libbon" app from Orange, T-Mobile "Bobsled", "YiChat" from China Telecom, "iO" from Swisscom, and others. Most of these services offer free voice and text with strategies to limit OTT usage.
3. Partnership with OTT services. More and more operators are exploring partnership opportunities with OTT such as 3 and Verizon with Skype, Reliance with Whatsapp, Airtel with Facebook, and others to benefit from operator network traffic. This partnership illustrates that OTT is also an opportunity for operators to monetize popular applications by providing them to customers as value-added services.

Regulatory Impact Analysis

OTT players offer services via the internet without involvement with internet service providers or telecommunications operators or are called free-riding OTT (Jirkasem and Mitomo, 2019). It seems clear that cellular operators play an important role in this relationship. Apart from being an intermediary, mobile operators can partner with OTT. In this scheme, OTT offers services to end users at no charge for data traffic associated with these services but must pay fees for using the operator's network. This business model allows operators to block, slow down, and limit access speeds to OTT that do not belong to these operators. It is considered unfair for some OTT players, new innovators, and even users. Many countries adhere to the principle of net neutrality, but this has not implemented in Indonesia.

OTT services serve as a platform that connects the two sides of the market (Peitz & Valletti, 2015). Facebook is a platform that provides social networking services free of charge to users and uses this application for advertisers from other companies. As a result, there are requests from two distinct groups that is users and advertisers interdependent. Facebook functions as an intermediary that reconciles the interests of advertisers and their target users. Users might be attracted by low access costs and less advertising. However, advertisers want a large target audience at low advertising costs. This interdependence does not affect demand and profits but also influences pricing decisions by mobile operators (Wellmann, 2019).

Data service access fees for Facebook users not only reduce application usage but can also reduce advertiser demand due to a smaller target audience. However, according to Jirkasem (2019), the quality of OTT services is less than satisfactory compared to voice services from cellular operators. In addition, OTT requires internet connectivity potentially leading to additional costs for its users. The implications of OTT services are regulatory policies because parts of the mobile telecommunication market are under the scrutiny of regulatory authorities, i.g. roaming fees, termination rates, and data privacy (Berec, 2018; European Union 2002, 2016). In general, regulations are implemented to prevent companies from abusing their market power. Therefore, the competition between cellular operators and OTT service providers, regulation is needed for the cellular telecommunication market. Besides that, it is necessary to limit the extent to which regulations need to be adapted so that with similar market conditions, they are bound at the same regulatory level.

Responding to the development of OTT, BRTI (Indonesian Telecommunications Regulatory Body) considers that telecommunications operators are not united in overcoming OTT polemics that occur in Indonesia due to different policies adopted by each operator. Operators burdened with several obligations can be seen in Table 1.

Operators in Indonesia through the ATSI (Association of Indonesian Telecommunications Operators) also reject the implementation of net-neutrality in Indonesia because they want equal benefits on the use of network infrastructure (Indotelko, 2014). Net neutrality means that all content, regardless of source and form, must be treated equally by infrastructure providers. To overcome the OTT versus operator polemic, business synergy can be a solution for cellular operator survival, with various forms of collaboration that can be applied between operators

and OTT providers (Kamiruddin, 2014). BRTI also calls for fair cooperation between OTT providers and operators in the form of an appropriate business model (Iqbal, 2015).

Table 1: Obligations of Telecommunications Operators According to the Law

Item	Deskripsi	Pengaruh pada Regulasi	Insentif Operator Seluler
Reduce cost of Univesal Service Fund (USF)	Mobile operators are asked to contribute to USF. This USF fee can be reduced or waived for operators who offer Freemium Internet.	USF income becomes lower, it may be difficult to implement if it is not based on regulations.	Operators hoard spectrum to prevent other operators from using it. At the same time, the shift to 4G and 5G means that carriers need new spectrum ranges, which will leave them open to dialogue about new spectrum regimes.
Specific Spectrum	Improvements in spectrum management so that 4G spectrum is available can be used to drive Freemium Internet.	Improved spectrum allocation reduces the opportunity cost of inefficient use of spectrum without significant cost to regulators.	Operators hoard spectrum to prevent other operators from using it. At the same time, the shift to 4G and 5G means that carriers need new spectrum ranges, which will leave them open to dialogue about new spectrum regimes.
Reduce Licensing Cost	Operators offering Freemium Internet may apply for a lower service license fee	Regulators are unlikely to go down this route as it reduces their budgets and therefore power and influence.	Immediate monetary benefits for mobile operators
Internet Freemium License	A separate license including spectrum and launch obligations may be granted subject to the condition that the new operator offers Freemium Internet.	The regulatory burden is the same as any other new license	The new carrier will be limited to its next-generation business model strategy but could plan a mix of 4G and Wi-Fi networks soon.

Source: Constitution No 36/1999 about Indonesia Telecommunication; Esselar, et.al., 2017).

In the countries like Europe and the US, OTT players are free to operate. No operator can block OTT service and slow down network speed for OTT. It causes telecom operators to upgrade infrastructure, but the core beneficiaries of new infrastructure are OTT companies. OTT and Internet of Things (IoT) companies will be able to operate better in 5G as they need more internet speed for operators however this process will bring for telecom companies needs to be studied.

Regulators need to comprehensively review the behavior of OTT services, setting fees on OTT to balance obligations for e-business actors. The regulatory imbalance between OTT and operators creates unhealthy competition (Bilbil, Ebru Tekin. 2018). Telecommunication regulations must consider that OTT services only benefit the country of origin while cellular

operators contribute to advancing the country's economy through various digital services and eliminating the digital divide. Therefore ATSI (2016) states that several recommended government regulations for every cellular industry player in the mobile digital ecosystem in the form:

1. There needs to be regulation, especially for OTT intersects with operator businesses such as messaging, video, and voice, as well as commercial OTT such as e-commerce. OTT is social/non-commercial and should not be treated the same. Open Internet policy.
2. A permit for OTT to open a representative in Indonesia. It will be functional in terms of control and tax, especially for commercial content/apps.
3. Arrangements and mechanisms for the relationship between cellular operators and application, content, and platform providers, to create a balanced telecommunications business ecosystem.
4. The government acts as a mediator/facilitator in building cooperation between content/app providers and operators in providing services.
5. Cellular operator tariffs are not generalized on a package basis but must be differentiation by paying attention to the type of data accessed by the URL of the data origin. So that operators are not disadvantaged by global OTT services. Thus, operators will get more revenue if users access global content for video. However, network operators must prepare tools to detect the type of data and the origin of the URL.

CONCLUSIONS AND RECOMMENDATIONS

Cellular service users consist of various segments with different and sometimes conflicting needs. It is a challenge to provide attractive communication services for all users. The basis for general segmentation is individual personal characteristics such as age, income, and lifestyle. Meanwhile, specific segmentation relates to individual preferences in some product or service classes, such as attributes and motives for using a product or service. There are differences in cellular service features that are preferred by individuals to a certain extent by the need for cellular communication services based on the solutions offered to meet the primary needs of users. Based on the explanation above, OTT services are better and cover many types of data services when compared to the services provided by cellular operators

Cellular operators also offer affordable internet bundling packages so that users of OTT services and applications become easy to use, cheaper, and more convenient. If mobile operators do not change their strategy and business model, they will continue to lose revenue. And if it is allowed to continue, cellular operators will only become dump pipes. For this reason, cellular operators need to strengthen products and services oriented toward the preferences of digital service users (Farooq and Raju 2019). Focusing on user behavior and trends will form the right marketing strategy.

The role of the government as a regulator is importance, considering that mobile operators have to buy bandwidth, 4G or 5G licenses, and invest in infrastructure which used to access OTT

via the network free of charge. Regulations are indispensable for managing OTT services. The results of this study show that regulation can provide a balance in the digital business ecosystem so that the OTT business model and cellular operators can be applied fairly. Thus, cellular operators can collaborate with OTT to improve the quality of user experience (customer experience), reduce operational costs, and increase profits because OTT content play an important role in the use of network traffic (Sujata, Dalal, Egbert, Chaudhary (2016).

Both operators and OTT players must have collaborative partnerships to support sustainable growth. For this reason, the government through the Ministry of Communication and Telematics (Kemenkominfo), needs to issue special regulations regarding OTT that does not conflict with the anti-monopoly law. This can be done by issuing regulations related to Amendments to Government Regulation No. 82 of 2012 concerning the implementation of Electronic Systems and Transactions, by adding regulations for OTT operations in Indonesia.

References

1. Ahmad, Norlia. 2012. "Utilitarian and Hedonic Values of Mobile Services: A Preliminary Analysis from the Users' Perspective." *Business & Accounting Review*. http://www.kwansei-ac.jp/iba/results/pdf/BandA_review_vol9_p69-83.pdf.
2. Antonopoulos, Angelos, Elli Kartsakli, Chiara Perillo, and Christos Verikoukis. 2017. "Shedding Light on the Internet : Stakeholders and Network Neutrality." *IEEE Communication*, 2–9.
3. APJII, and MASTEL. 2018. "Penetrasi & Perilaku Pengguna Internet Indonesia."
4. Arnold, René, and Anne Schneider. 2016. "OTT Services and Consumers' Communication Behaviour in Germany." http://www.wik.org/fileadmin/Studien/2016/OTT_Study_ENG.pdf.
5. ATSI. 2016. "Pembinaan Ecosystem Ict Dan Dampaknya Penyelenggaraan Telekomunikasi / ICT."
6. Babin, Barry J., William R. Darden, and Mitch Griffin. 1994. "Utilitarian Shopping Value." *Journal of Consumer Research* 20 (4): 644–57.
7. Baldry, Shirley, Markus Steingover, and Markus A. Hessler. 2014. "The Rose of OTT Players: What Is the Appropriate Regulatory Response." In 25th European Regional Conference of the International Telecommunication Society (ITS), Brussels, Belgium, 22-25 June 2014, 1–21.
8. Body of European Regulators for Electronic Communications [BEREC] (2012b). BEREC's comments on the ETNO proposal for ITU/WCIT or similar initiatives along these lines. BEREC. [http://berec.europa.eu/files/document_register_store/2012/11/BoR_\(12\)_120_BEREC_on_ITR.pdf](http://berec.europa.eu/files/document_register_store/2012/11/BoR_(12)_120_BEREC_on_ITR.pdf)
9. Bilbil, Ebru Tekin. 2018. "Methodology for the Regulation of Over-the-Top (OTT) Services: The Need of A Multi-Dimensional Perspective." *International Journal of Economics and Financial Issues* 8 (1): 101–10.
10. Bristy, Jannatul Ferdous. 2014. "Factors Affecting the Adoption of Social Network: A Study of Facebook Users in Bangladesh." *The Journal of Social Media in Society* 5 (1): 137–59.
11. Chitturi, Ravindra, Rajagopal Raghunathan, Vijay Mahajan, and Ravi Chitturi. 2008. "DELIGHT BY DESIGN: The Role of Hedonic Versus Utilitarian Benefits The First Author Acknowledges the Support of the Laura." *Journal of Marketing Article Postprint* 72 (3): 48–63. <https://pdfs.semanticscholar.org/d946/94d47e7eeb8bc850f9d48f7f5a3fbd3efc0f.pdf>.
12. Council of African Regulators, 2017. Minutes of the 2nd Meeting of the Council of African Regulators, 11th September 2017 Marriott Hotel, Rwanda

13. Digital TV Research (2015). Global Ottawa TV & Video Forecasts.
14. Esselaar, Stephen, and Christoph Stork. 2018. "OTTs Driving Data Revenue Growth OTTs Driving Data Revenue Growth." In Research ICT Solutions. <https://www.researchgate.net/publication/325987960>.
15. Esselaar, Steve, Steve Song, and Christoph Stork. 2017. "Freemium Internet: Next Generation Business Model to Connect Next Billion." In 28th European Regional Conference of the International Telecommunications Society (ITS): "Competition and Regulation in the Information Age", Passau, Germany, July 30 - August 2, 2017, 1–18.
16. Farooq, Muhammad, and Valliappan Raju. 2019. "Impact of Over-the-Top (OTT) Services on the Telecom Companies in the Era of Transformative Marketing." *Global Journal of Flexible Systems Management* 20 (2): 177–88.
17. Facebook Reports Fourth Quarter and Full Year 2013 Result. <https://www.prnewswire.com/news-releases/facebook-reports-fourth-quarter-and-full-year-2013-results-242637731.html>
18. FCC, "Openness in the Mobile Broadband Ecosystem", Full Annual Report of the Open Internet Advisory, 2013.
19. Ganuza, Juan Jose dan Viecens, Maria Fernanda. (2014). Over-The-Top (OTT) Content : Implications and Best Response Strategies of Traditional Telecom Operators, Evidence from Latin America. *Info*, 16(5), 59-69. Retrieved from Emerald Insight
20. Greene, Wedge dan Lancaster, Barbara. Over The Top Services. *Pipeline Magazine*, 12 2007. <http://pipelinepub.com>.
21. Gustafsson, Eva, and Annika Jonsson. 2003. "Always Best Connected." *IEEE Wireless Communication* Februari: 49–55.
22. Holbrook, Moris B, and Elizabethh C Hirschman. 1982. "The Experiential Aspects of Consumption: Consumer Fantasies, Feelings and Fun." *The Journal of Consumer Research* 9 (2, Sept 1982): 132–40.
23. IAB on Device Research. 2017. Always On – A Global Perspective of Mobile Consumer Experience.. June. 2017
24. Indotelko. (2014, 2 Desember). Operator Seluler Tolak Net Neutrality. Tersedia : <http://www.indotelko.com/kanal?c=id&it=Operator-Tolak-Net-Neutrality>
25. International Telecommunication Union (2017). Economic impact of OTTs - Technical Report 2017. Retrieved from https://www.itu.int/dms_pub/itu-t/opb/tut/T-TUT-ECOPO-2017-PDF-E.pdf.
26. Iqbal, Muhammad. (2015, 9 Januari). BRTI: Operator Tidak Kompak Atasi Polemik OTT. *Selular.id*. Tersedia : <http://selular.id/news/telco/2015/01/brti-operator-tidak-kompak-atasi-polemik-ott/> [Diakses 14 Februari 2020].
27. Jayakar, Krishna, and Eun-A Park. 2018. "Emerging Frameworks for Regulation of Over-the-Top Services on Mobile Networks: An International Comparison." *SSRN Electronic Journal*, no. 2011: 1–16.
28. Jirkasem, Monarat, and Hitoshi Mitomo. 2019. "Www.Econstor.Eu." In 30th European Conference of The International Telco Society (ITS): Towards a Connected and Automated Society. Hesinki, Findlan, 2–14.
29. Kamiruddin, Amir. (2014, Maret). Sinergi dengan Layanan OTT Salah Satu Kunci Bertahannya Operator Seluler. Tersedia : <https://dailysocial.net/post/sinergi-dengan-layanan-ott-salah-satu-kunci-bertahannya-operator-seluler>
30. Maslow, A.H. 1970. *Motivation and Personality*. 2nd edition. New York: Harper and Row.
31. Mazzoni, Clelia, Laura Castaldi, and Felice Addeo. 2007. "Consumer Behavior in the Italian Mobile Telecommunication Market." *Telecommunications Policy* 31 (10–11): 632–47.

32. Ministry of Communication and Informatics. 2018. "Survey Penggunaan Teknologi Informasi Dan Komunikasi."
33. Mohr, Niko. 2017. "Overwhelming OTT: Telcos' Growth Strategy in a Digital World."
34. MCPC (2011), "The Japanese Smartphone Market and Case Studies", Mobile Computing Promotion Consortium, Tokyo Japan
35. Nandhiosa, Astari, and Sigit Haryadi. 2015. "Indonesian Regulation Management Recommendation for Over-the-Top Services." IEEE Wireless Communication.
36. OECD (2011). Broadband Bundling: Trends and Policy Implications. OECD Digital Economy Papers, No. 175, OECD Publishing. doi: 10.1787/5kghtc8znnbx-en
37. OECD (2013). OECD Communications Outlook 2013. OECD Publishing. doi: 10.1787/comms_outlook-2013-en
38. Okada, Erica Mina. 2005. "Justification on Consumer Justification Effects Choice of Hedonic and Utilitarian Goods." Journal of Marketing Research 42 (1): 43–53.
39. Peitz, M., & Valletti, T. (2015). Reassessing competition concerns in electronic communications markets. Telecommunications Policy, 39(10), 896–912).
40. Price Water House Coopers. 2017. Entertainment and Media Outlook. <https://www.pwc.co.za/en/assets/pdf/entertainment-and-media-outlook-2017.pdf>
41. Shin, Jungwoo, Jae Young Choi, and Daeho Lee. 2016. "Model for Studying Commodity Bundling with a Focus on Consumer Preference : Evidence from the Korean Telecommunications Market." Simulation: Transactions of the Society for Modelling and Simulation International 92 (4): 311–21.
42. Shin, Jungwoo, Yuri Park, and Daeho Lee. 2016. "Strategic Management of Over-the-Top Services : Focusing on Korean Consumer Adoption Behavior." Technological Forecasting & Social Change 112: 329–37.
43. Stork, Christoph, Steve Esselaar, and Chenai Chair. 2017. "OTT - Threat or Opportunity for African Telcos?" Telecommunications Policy 41 (7–8): 600–616.
44. Sujata, Joshi, Sarkar Sohag, Dewan Tanu, Dharmani Chintan, Purohit Shubam, and Gandhi Sumit. 2015. "Impact of Over the Top (OTT) Services on Telecom.Pdf." Indian Journal of Science and Technology 8 (S4): 145–60.
45. Sung, Min, Eun Kim, Shinyoung Hwang, Junghwan Kim, and Seongcheol Kim. 2016. "Willingness to Pay for Over-the-Top Services in China and Korea." Telecommunications Policy, no. July: 0–1.
46. T. Wu, "Network Neutrality, Broadband Discrimination," J. Telecommunications and High Technology Law, 141, 2003
47. Verma, Lavisha. 2017. "Online Consumer Purchase Behavior & the Affecting Factors." International Journal for Research in Management and Pharmacy 6 (5): 18–23.
48. WATRA, 2017. West African Telecommunications Regulator's Assembly (WATRA) conference in Mali in November 2017.
49. Wellmann, Nicolas. 2019. "Are OTT Messaging and Mobile Telecommunication an Interrelated Market? An Empirical Analysis." Telecommunications Policy 43 (9): 1018-31.
50. Woodruffe-burton, Helen, Sue Eccles, and Richard Elliott. 2008. "Towards a Theory of Shopping : A Holistic Framework." Journal of Consumer Behavior 1 (3): 256–66.