CHAPTER 2

THEORETICAL FOUNDATION

2.1 Theoretical Foundation

This chapter will serve as the foundation of this research and will explain the concepts, theories, and literatures that have relevancies and impacts regarding, user acceptance towards technologies, and other aspects that will have impact towards this research.

2.1.1. Revolution of Internet Protocol Television

Moving pictures that we know as television today were introduced by Thomas Edison in the late 18th century. It was the establishments of new invention of revolution that is still being developed until today.

The newest developments of the convergence of Information Technology and Media have given a big transition to the media technologies. The awareness of the evolution from the shortage area of bandwidth to a new era of media richness would not happen without the influence from the analog to digital transition [10].

2.1.1.1. The Analog to the Digital Evolution

The beginning of the 20th century has been the foundation of the invention of analog types. Since then, the mass media has operated in one way of advertise. The programmers seek for the advertiser to pay for the cost in order to promote their marketing campaign through media analog. The growth of great multinational company such as Nestle, Ford, Coca Cola, Unilever, Procter & Gamble was parallel with the rise

of radio then followed by television. Some large company (ex Proctor & Gamble) realizes that their number of products has been increased since they differentiate their marketing campaign through advertise analog media such as television or radio. The deal was simple, people who want to broadcast their advertisement through media analog did not need to pay or deal with software design or encoding on condition that they were eager to put up with the commercials and paid some amount of money. CBS is one of the few commercial broadcast network that exist on radio and television area, William Paley as the Founder of CBS portrayed advertising slot as a "license to print money." [10]

There was a point where the development of cable and satellite network and the interruption of new broadcast network began to make it very difficult for each television program to comprehensive the mass audience needed for a basic consumer product. According to Jonathan Taplin during 1980 the common standard of the TV audience in France could reach 1/3 of the audience; however, today's top rated programs might only reach audience less than 1/3, in fact it only reach 1/8 of the TV audience. MTV channel that we still known today might be one of the examples, it is a program of music that is targeted on teenagers, where they put only cheap programming that contains videos from record companies for free and they were capable to sell the advertising with low price to companies that concerned of teenagers target. This was end up successfully MTV could reach a massive outcome based on an average audience of the viewers for each program. During 1990 and 2000 over 200 new slot cable and satellite network were created due to the risk ratio that was expulsive between them during those years.

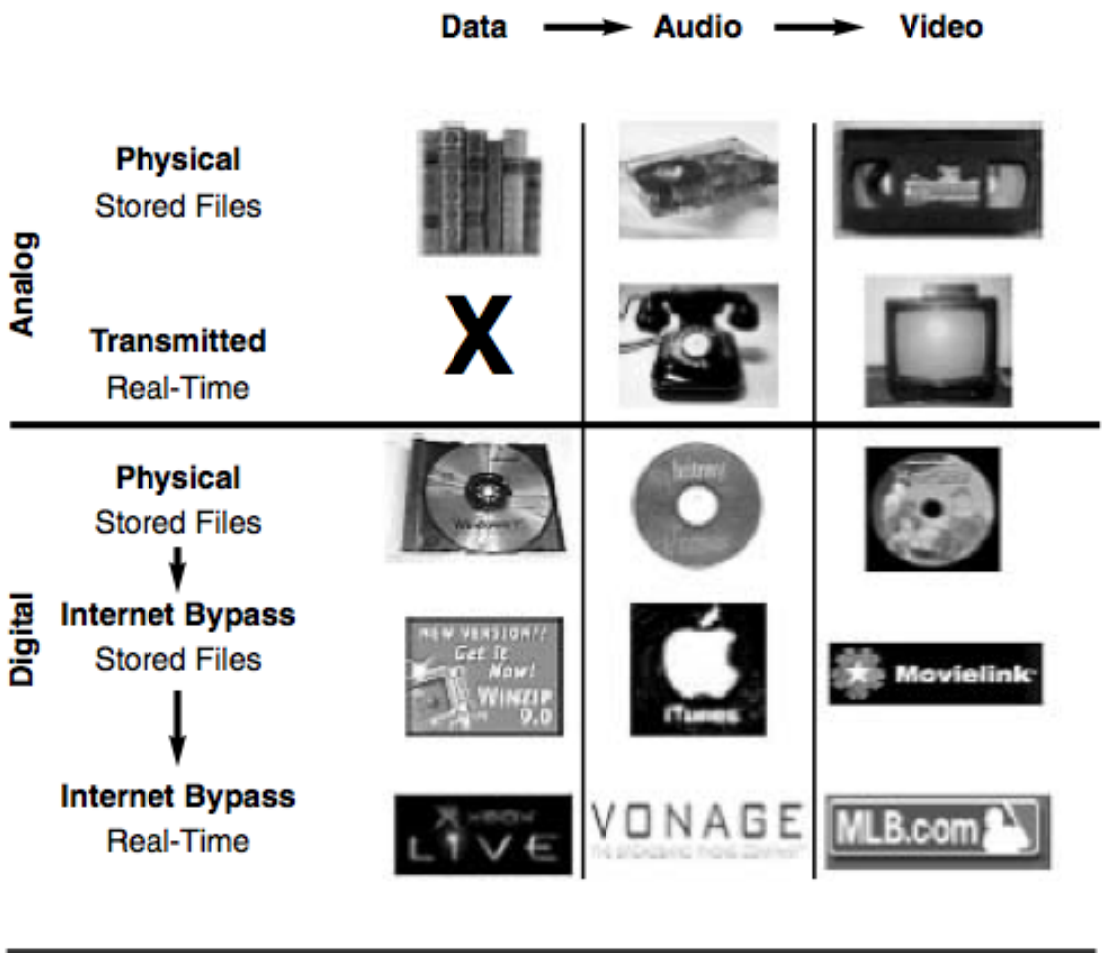

Fig 2.1. The transition from Analog to Digital [10]

2.1.1.2. The problem become an opportunity

The problem that struck in the last 19th century has created an innovative invention. The creation of IPTV Platform becomes achievable because of the existing media that has been created however it not enable yet. In the past 6 years, they have constructed an Internet Protocol based broadband network that has such a massive capacity that we do not have to depend on another mile of backbone fiber in the next couple of years [11].

2.1.2. The Convergence of Television and Internet

The technological era has been dominated in this century. New types of technology keep coming up to be dominated in the world. As the technology developed so as the population of Internet usage has been increased from time to time. Looking forward to the high population of Internet usage that keep increasing in this era, television world start a new invention that involve the combination of Internet and television area. There are many kinds of television distribution that distribute the content of television such as over the air broadcast television, through cable and satellite. However, the distribution types that allocate the content of television over the internet only two types which are internet television, and Internet Protocol Television which through Internet Protocol, and IPTV also include phone services. Regarding the concern about this thesis that only focus on the convergence of television and Internet, therefore the author only discuss about internet television and internet protocol television but this thesis more focus on IPTV.

2.1.2.1. Internet Television

Internet television is using internet interface in order to broadcast of news, weather, and TV shows to their over the air broadcast [11]. Internet television is convention television obtainer over the internet. Rather than watching television program broadcast over the air or over cable, television programs are retrieved over the internet and then watched in real time, using a technology which is known as video streaming [7]. Television station broadcasts Media players such as Windows Media Player, Apple's QuickTime Media Player, or Real Networks' RealPlayer support buffering of IP datagrams and a broadband

connection to the internet. In order to make more clear of what is Internet TV, the author takes this as the author's base definition for Internet TV:

"Internet Television is an open evolving framework where a huge number of small and medium- sized video producers contribute. This is due to the opening of different traditional channels which are retail and use for wide distribution." [7]

MiVo tv, WWITV, ABC news, and any other internet TVs are the types of Internet TV in the world wide that has been used by many users in the world. They provide a channel that is a live stream and user can also share their favorite channel through social network. There are also some features like pause and play again however once the users pause the channel and when they play it again it would not continue where they stop but will jump to the time live stream again. The benefit of internet TV is users has a freedom to watch all channel from all over the world however the quality of service that is provided will depends on the internet speed and if the quality of services has a problem there are no customer services provided to catch all up all the comments, the users can only left a comment under each channel. The other things are that the users can watch the internet TV freely without need to sign up in the internet TV website. The author analyze that if the user's speed is more or equal to 0.81 Mbps of downloading speed the quality picture of internet service will operate smoothly however it still need to consider the distance of it. If users watch internet TV from outside the country the quality of service would not be as good if they watch internet TV from the country itself.

In Indonesia there are also internet TV like MiVo TV, Metro TV News, TV one, and any other types. It can be watched from computer, or from smart phone as long it has a

supported program to watch internet TV. It does not require any additional fee; however, the quality of service does not guaranteed, it can be as good as cable television if the speed of the internet is fast to do a video streaming.

Fig 2.2. MiVo TV (Indonesia)

Fig 2.3. Metro TV News (Indonesia)

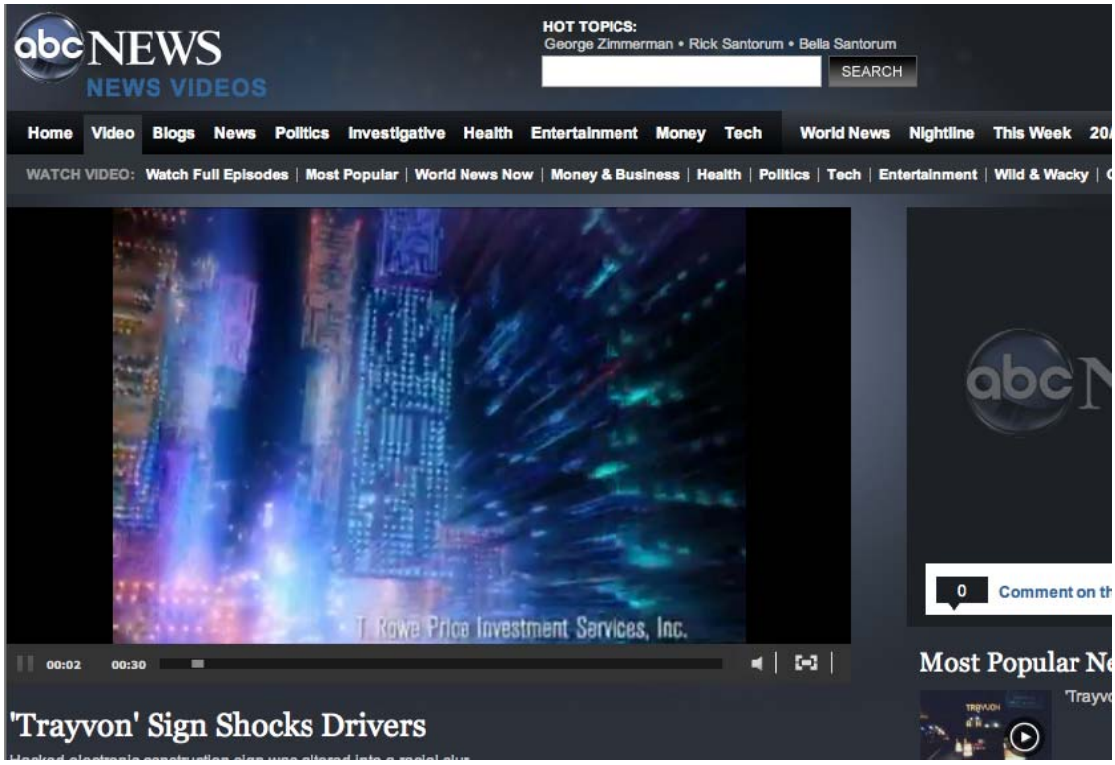

Fig 2.4. ABC News (United States)

2.1.2.2. Internet Protocol Television

Internet Protocol Television (IPTV) is actually the invention from the convergence services of television, Internet area, and phone providers as the media to deliver the internet into the modem, that is being developed nowadays over the world. Actually, IPTV was not the first television that spread the channel through internet protocol, there are the early version of IPTV which was known as TiVo. TiVo was the predecessor of IPTV, it allowed the users to capture the program into the internal hard disk storage so it can be viewed at anytime. However, the launched of TiVo technology was not released smoothly into the market. The progress of market acceptance of TiVo was not turn out splendidly [5].

Looking forward to the uncertainty attention from individual customer demand in order to drive the development of convergent services, it creates the diffusion of new technologies that is fulfill the customer demand to adopt the benefit of using the new innovative technologies that has been created. IPTV, which is known as Internet Protocol Television has given a tremendous affect into this technological era. Currently, there are many definitions about IPTV, however, Amy Harris & Greg Ireland theories is including the widely mentioned, in which they described IPTV like below.

" *IPTV does not mean the internet. IPTV does not mean unlimited access to video content delivered over the Internet. Instead, IPTV refers to Internet Protocol (IP), which is a transport protocol, a delivery mechanism, and not necessarily the Internet. There are existing internet – based video services that deliver on – demand digital content to a PC via a broadband connection but, these services do not typically deliver content to a TV viewing environment.*"[6]

IPTV is transferred through an IP that is different from the IP for the public network because the IP is manage in a manage network itself. It is not a video over the public Internet because the public Internet is actually collected of some independent networks with separate controls; it is NOT a managed network. For this reason, public internet not really qualified of transporting several streams of high definition video in the way subscribers now expect from a service provider.

BT Vision from British Telecom, Groovia TV from Telkom Indonesia, Fios TV from Verizon in US, are the some types of IPTV in the world.

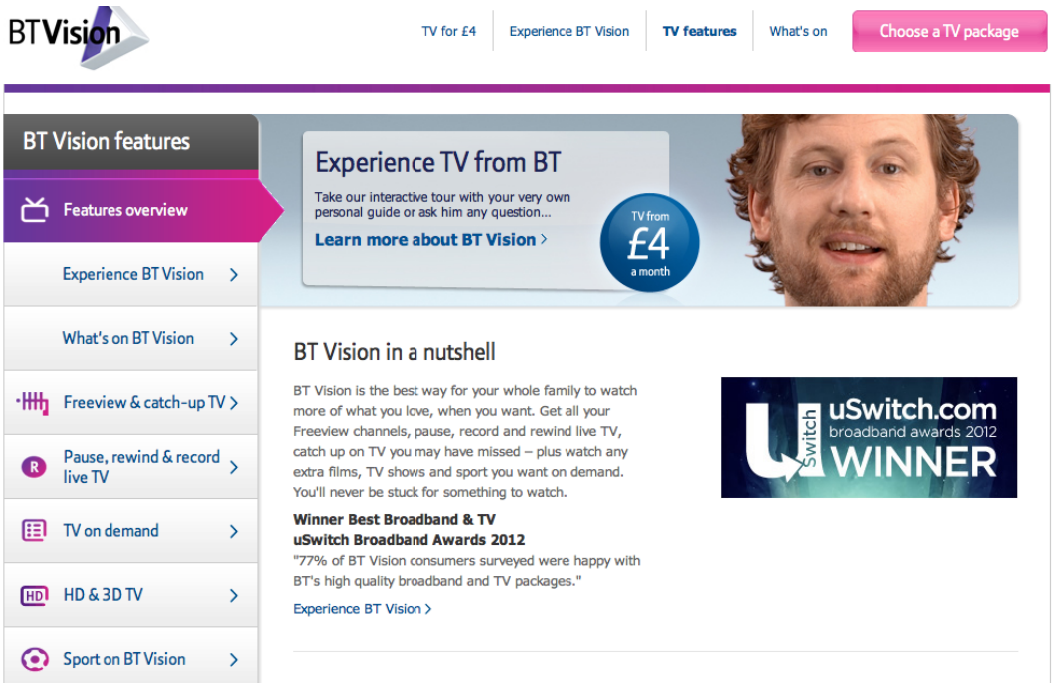

Fig 2.5. BT Vision (British Telecom)

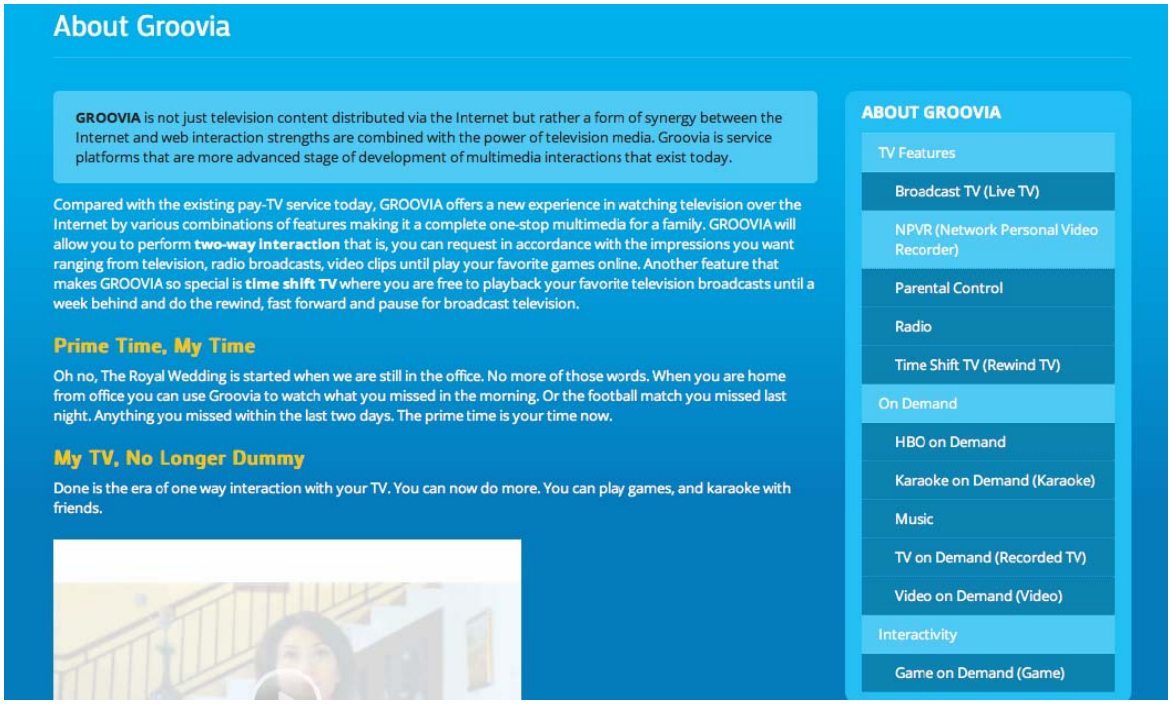

Fig 2.6. Groovia (Telkom Indonesia)

There are some features that differentiate IPTV and Internet TV beside from the way it works. IPTV provides services like on demand program where the users can record the program and play it anytime they want within a month, also pause, rewind, or record the live stream program, it means that the users can watch the online stream with functionality such as pause, rewind, or record in a better way than Internet TV. IPTV companies works with phone providers to operate them for example Groovia tv with Telkom Indonesia, BT Vision with British Telecom, and any others. IPTV is using a fiber optic to operate them [12]. Firstly, what is fiber optic, it is basically transmitter that uses a smooth, hair- thin strand of glass cable to transfer data very fast through a very thin cable that only has about a human hair's diameter.

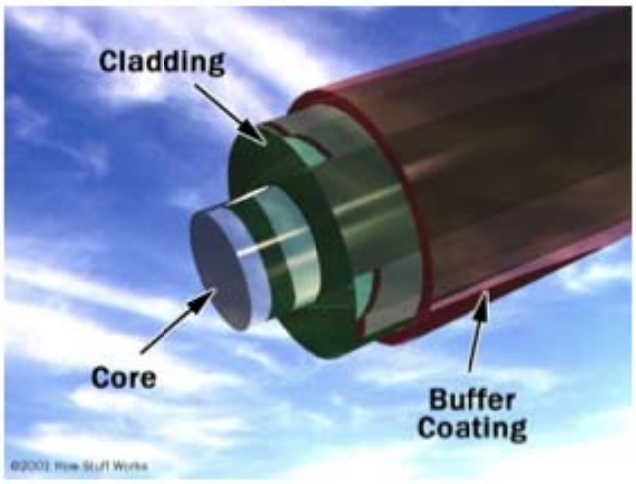

Fig 2.7. The component of fiber optic cable [13]

The cable of fiber optic was made up of three main sections. They are core, cladding, and buffer. As it is show in fig 2.7, First the core, is very important part of the fiber optic cable which located in the middle of the cable that made up of silica, functioned as the light transmitting and act as an border layer for the cable. Second component of the fiber optic is the cladding, ultimately reflect back into the core. The last component is buffer coating, it is made up of acrylic polymer, and the layer of the buffer defends the other two components against ultraviolet light and cable inflexibility.

In order to make fiber communication system work, it needs three basic elements that are optical fiber transmitter, optical fiber cable, and the optical fiber receiver. Firstly, the optical fiber transmitter receives a signal system that is sent and reach the system that is sent to the converter which can changes the electrical signal to light pulse. The optical transmitter commonly used for the light emitting diode (LED), and the laser diode (LD). Both of them usually operate at the wavelength of in between 850 – 1300 mm. Secondly, the optical fiber transmitter will put a current on light sources that perform as a waveguides, to the optical fiber cable. Thirdly, detectors in the optical receiver gather

the optical signal and transform it back to an electrical signal. The process has been summarized in Fig 2.8. [13].

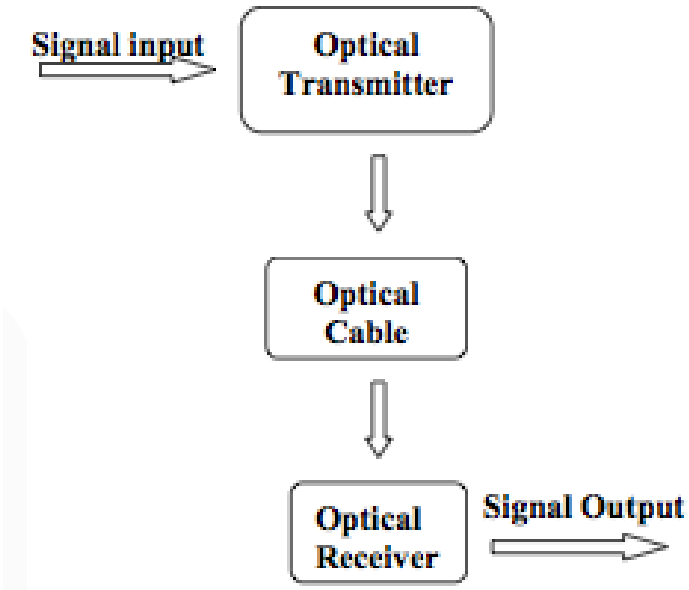

Fig 2.8. Diagram of optical fiber communication system. [13]

IPTV needs a set box to operate their functionality that consist of recorder, on gate way, and modem speedy. The difference that makes IPTV as new invention that differentiate from internet TV is the features of it. With IPTV users can pause, or rewind the movie that they watch in real time without jumping to the now time from the time that they pause. They will continue as what they pause. The other features are user can do Video On Demand, based they can request the video from two days before.

In Indonesia which is Groovia TV, they provide with more services products such as Music on Demand, Karaoke on Demand, Parental control (Service that helps parents to prevent their children from accessing adult-oriented movies), and any other features that can be seen in the Groovia website (http://groovia.tv/). IPTV can also be seen in Internet, however it is still under development in Indonesia.

Table 2.9 Difference between broadband TV (IPTV), and Internet video streaming (Internet TV). [12]

	Broadband TV	Internet video streaming
Footprint	Local (limited operator coverage)	Potentially supranational or worldwide
Users	Known customers with known IP addresses and known locations	Any users (generally unknown)
Video Quality	Controlled QoS, "broadcast" TV quality	Best effort quality, QoS not guaran-teed
Connection bandwidth	Between 1 and 4 Mbit/s	Generally below 1 Mbit/s
Video format	MPEG-2 MPEG-4 Part 2 MPEG-4 Part 10 (AVC) Microsoft VC1	Windows Media RealNetworks QuickTime Flash, and others
Receiver device	Set-top box with a television display	PC
Resolution	Full TV display	QCIF/CIF
Reliability	Stable	Subject to contention
Security	Users are authenticated and protected	Unsafe
Copyright	Media is protected	Often unprotected
Other services	EPG, PVR (local or network)	
Customer relationship	Yes; onsite support	Generally no
Complementarity with cable, terrestrial and satellite broadcasting	Potentially common STB, complementary coverage, common metadata	Pre-view and low-quality on-demand services

Both IPTV and Internet TV have the same function, but in IPTV the IP is managed in a IP network which is different from Internet TV that has a public IP. However they are different in the accessibility in the some protocols and on the QoS characteristics that affect the video quality. For the customer relationship, IPTV provide customer services where the customer's complaint can be process directly whereas for Internet TV there are no official customer services, if the users want to add a comment they can write it under the column that has provided.

2.1.2.2.1. Benefits

IPTV commonly mentioned as broadband television that become more famous of receiving one's television programming. The process includes receiving and sending information in a form of "packets". The process almost similar with internet and other computer network, however, the difference is IPTV is transferred over separate, closed network, independent of user who used the internet. This gives many benefits that are less over jammed network, more efficient of delivery, and give high quality and more attractive features. [14]

- High quality of pictures: Since IPTV is transferred over separate, closed network the disturbance of broken picture will not become a major issue. On other hand, for satellite TV most of the common issue is the loss of signal that mostly happen because of the poor weather that disturbs the signal. When the signal is disturbed, there is high possibility of losing favorite movie show that is going on.
- No distance limitation: With using IPTV, we can watch the program not only from our local channels, but also can watch other television program over the world. [15]
- Efficiency of installation: The easy way of installation IPTV makes users interested to use IPTV and enjoy other features that are proposed by IPTV if we compare with other television distribution.
- Video on Demand: If there is a time when time cannot be produced to watch favorite movie, IPTV features provides a two-way interaction which the user can request the impression they want from television, radio broadcast, video clips. [16]

- Games online: other than video on demand that is two way interaction, IPTV also provide games online which the customer can play it [16].
- Flexibility of play the movie: User can have a time shift television where the user can freely playback their favorite television broadcast, rewind, fast forward, and pause the broadcast television without jumping to the original time when they play again the play button. [16]

2.1.2.2.2. Limitations

Internet Protocol Television has become an emerged technology that converged technologies and entertainment that act as a multi service network which carrying broadband services. [17]

- Limitation of the bandwidth

IPTV is a multi service network that contains stream online that require a good bandwidth to transmit the data smoothly so the image will not be broken because of the limitation of the bandwidth.

- Major competition

The equipment that needed to operate IPTV included many parties such as cable operators, broadcasters, phone companies, and telecommunication, that is why it create many major competition between those parties that has the same area.

- Ensure quality

The carriers need to know how to accomplish high quality of standard to maintain their customer. Stable operations, and Internet operations of the combination in the network part need to maintain to guarantee high quality of services.

- Customer loyalty

The customer needed to be committed their attentiveness in adoption of IPTV. The features that concluded content of IPTV channels, cost, interoperability, and etc need to be concern because it can give influence for customer to have the intention to use IPTV. [17]

2.2 Technology Acceptance Model

TAM model is the base model for this paper, however there is certain modification that has been changed so it will fit the context to measure technology acceptance in general. TAM has been modified with certain researcher to help them identify factors that related to their studies. Davis [18] was the most influential developer that advanced TAM, in order to determine computer usage behavior. TAM has been adapted with the Theory (TRA) by Fishbein and Ajzen [19] and has proven that use of specific system is determined by the behavior intention of the individual users. The behavior intention is manipulated by the attitude (individual's positive or negative feeling) and subjective norm (person awareness) from the users. The TAM's objectives was "*to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified* [20]." According to theories of social psychology, such as TRA and Theory of planned behavior (TPB) [21]. TAM model has a strong framework for describing the intention to use of IT by users.

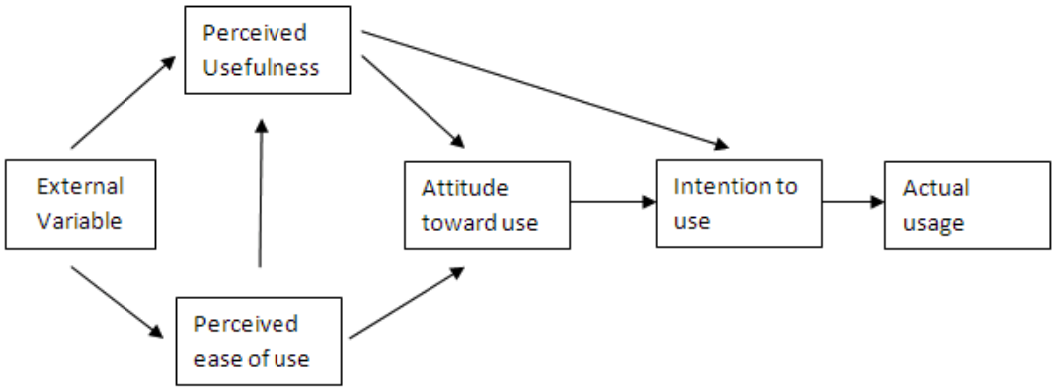

Fig 2.10. Technology Acceptance Model (TAM) (Davis et al, 1989)

Based on Jen- Her Wu, Shu- Ching Wang [22] that do empirical study evaluation of the revised technology acceptance model, two variables that are the most important in TAM model are PU and PEOU to identify the system use. The attitude toward using (ATU) variables is directly measure user's BI that determines AU. Certain researcher believes that TAM model need to be given an additional variables to make them to be a stronger model. [23]. Venkatesh and Davis [24] has recommended, TAM 2 as an extended of original TAM, that include social influence process which are subjective norms, voluntarism, and image , and also include cognitive instrumental process which are job relevance, output quality, result demonstrability, and PEOU.

2.2.1 Perceived Usefulness

Based on H. Heijden (2003) [25] perceived usefulness is influenced by perceived ease of use. According to the empirical study that has been tasted on 107 user's intention by [26] to use a specific system, the result was stated that perceived of usefulness have a high impact on people's intention, where perceived ease of use only has a less impact

that perceived of usefulness but still has a suggestive effect that decreased from time to time [26]. The previous study from Weniger [27] also includes Perceived Usefulness as one of her factors in her research. It refers to the people believe that by using specific system can give improvement in their work performance [28]. Based on Weniger [27], Even though,Weniger know IPTV as a hedonic system, she involved the usefulness variable to be involved in the proposed model. Thus, perceived of usefulness more likely advocate to individual's believe that IPTV can give a profitably and give optimistic predictable results. Beside Weniger, previous study from Hyori Jeon, Yonghee Shin, Munkee Choi, Jae Jeung Rho, and Myung Seuk Kim (2010) [29] also take this factor as one of their factors.

2.2.2. Perceived Enjoyment

Venkantesh [30] theory stated that enjoyment as an predecessor of ease of use and the outcome of it will be increased as the user gain understanding with the system. Nysveen [31] that research usage intention of four different mobile services such as SMS, contact, payment, and gaming encompassed perceived enjoyment as an additional characteristic of technology to resolute the impact of perceived enjoyment.

Weniger [27] has also include this in one of the factors in her research and conclude it based on Davis, Bagozzi & Warshaw 1992 [32], it refers to "the extent in which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated." While Based on Agarwal and Karahanna (2000) [33] it is an independent variable which is refers to the playfulness of IPTV features.

Lately, Shin [18] also discovered that perceived enjoyment has a great influenced on the use of portable Internet for entertainment purposes. Conversely, the particular influence of perceived enjoyment on convergent technologies has been unobserved. However, Perceived Enjoyment does not include in Hyori Jeon, Yonghee Shin, Munkee Choi, Jae Jeung Rho, and Myung Seuk Kim (2010) [29].

2.2.3. Perceived Content Quality

DeLone and McLean [34] stated that content quality refers to information quality and the better the information quality would influence the individual users to use IPTV. It concludes that the better the content quality of IPTV will make people attract to use IPTV. Therefore, Dong Hee Shin [17] includes perceived content quality as predictors to measure as a factor in IPTV use and adoption. It has an impact on attitude of individual users.

This factor also include in Weniger [27] research model however weniger conclude content quality, service quality, security, and interactivity as one part which called Perceived quality as it is shown in fig 9. On Weniger point of view that is based on Leeder et all [35] conclude that Perceived Content Quality is concern about the required characteristic that is accuracy, meaningfulness, and timeliness of the information delivered via IPTV. It does not mention in the Hyori [29] and other researchers theory (Fig 10) because they research IPTV from different view of Weniger [27] and Shin [18] however it still also has same similar factors that can be used to measure adoption of IPTV.

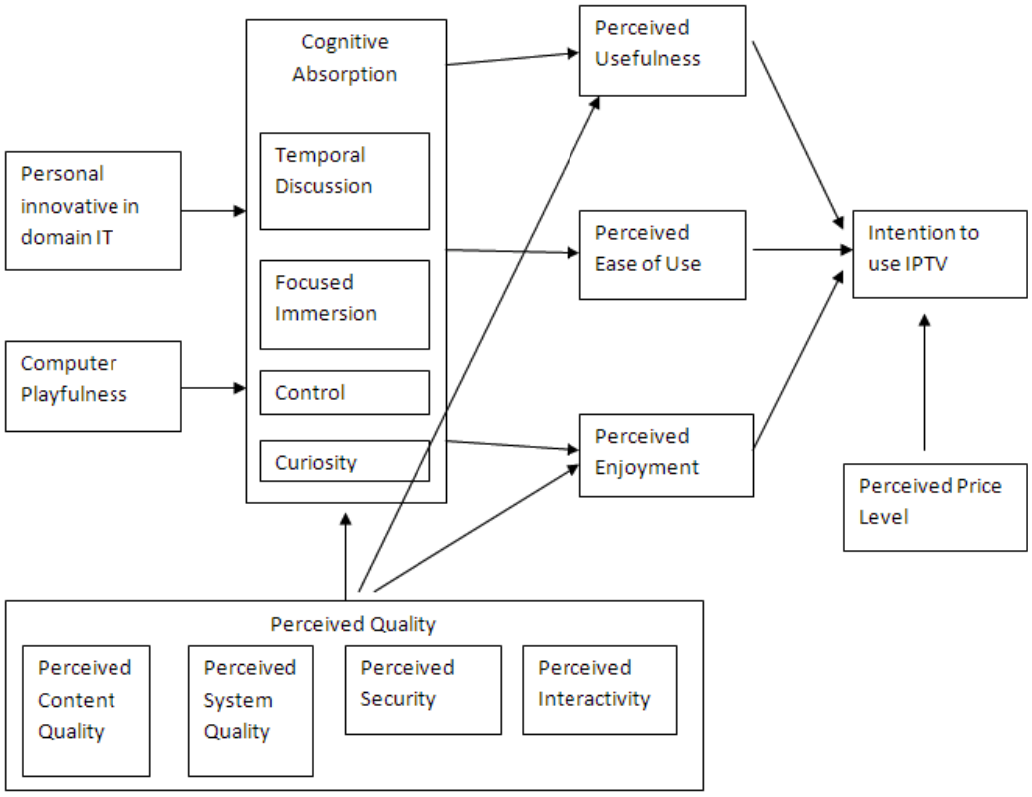

Fig 2.11. Technology Acceptance Theory by Sandra Weniger 2010 [27]

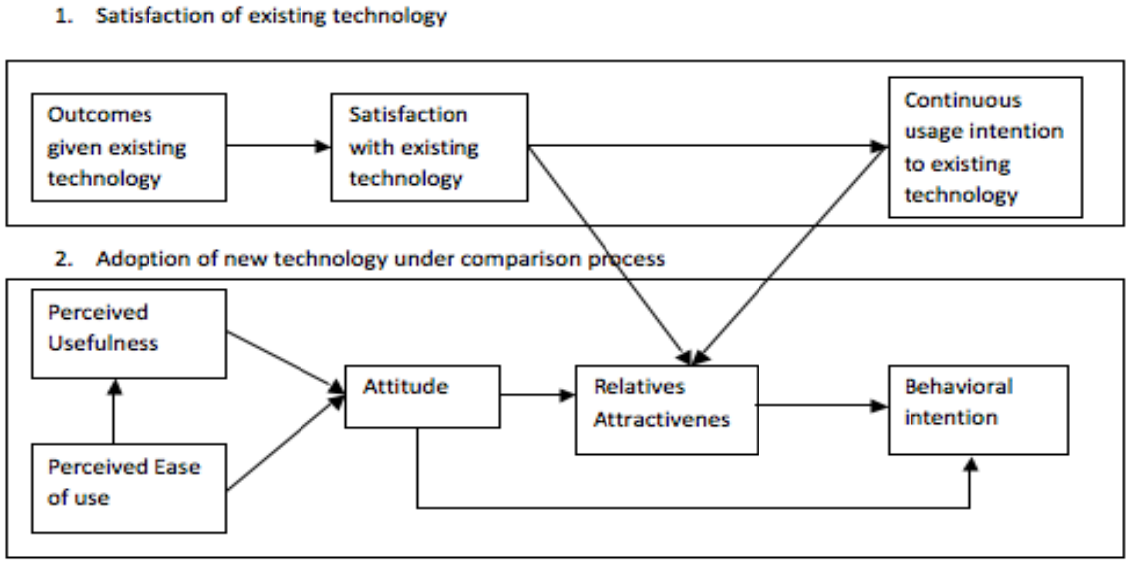

Fig 2.12. Technology Acceptance Theory by Hyori Jeon, Yonghee Shin, Munkee Choi, Jae Jeung Rho, and Myung Seuk Kim (2010) [29]

2.2.4. Perceived Quality of Services

Perceived quality of services is refers to the clearness of the image in IPTV platform. It is because IPTV is required real time data transmission to transport the content of IPTV. It reflects of the response time and system accessibility to measure quality of services. Therefore quality of service plays an important role in IPTV because it can affect intention to use of individual users [17].

2.2.5. Perceived Security

Perceived Security is refers to the security awareness of individual customer that use IPTV [35]. The effect of user's perceived security on intention to use has been explored on IPTV. IPTV provide individual users with many kind of security – sensitive function, and the awareness of security has been the major problem. It is because IPTV use stream for example like VoIP which are lead to many various security issues that are spoofing, spamming, content theft, and other types of security issue. On the other hand, in the analog area that not concern about hacking and encryption, IPTV has a great anxiety about that. The encryption on IPTV lies on the software level, hacking into a system purely needs download malicious code [17].

2.2.6. Perceived Cost

Dong Hee Shin [17] enhanced Perceived Cost as a variable in evolving the intention to use IPTV. In developing the behavior intention, users will relate the service that they got with the cost that they spent for its service and consider whether the cost that they paid is worth it or not. By using IPTV, it required certain cost to power them up for example the

devices, subscription charges, and then the monthly payment. The intention to use by individual users is influenced by their evaluation of the services that they got by using IPTV, and it is related to the perceived of cost [35]. Actually, this is one of the variables that are critical when developing the behavior intention. It is because the willingness of people to pay certain cost to use IPTV is based on the services that they got. Moreover, unsatisfying experience for example slow connection, poor quality, missing links, and other problems have make the customer furious about it because after all frustrating experience that they got, they still have to pay for it [35]. However in the Dong Hee Shin hypothesis he takes perceived cost is negatively correlated to the intention to use [17].

2.2.7. Perceived Control

Users are given an extraordinary level of control over services that is provided by IPTV, and Dong Hee Shin [17] feel that it is suitable to enhance perceived control in his study. Perceived control is the degree where people believe at some points in ability to influence a revolution. In the terms IPTV, it is refers to the individual belief where a situation can be control and the people can experience any services that is offer by IPTV at anytime. It is associated with sense of readiness, availability, and accessibility. Users feel that they are psychologically connected with the world, resources, and their friends or family through IPTV. It is also improved the self – efficacy when using IPTV [36].

Dong Hee Shin proposed research model in defining the influencing factors of adopting the IPTV by surveying 320 people. He found that perceived quality and the system quality have a significant impact on perceived usefulness and perceived playfulness. Moreover, perceived control was discovered that it has an effect on both extrinsic and

intrinsic that is related with his previous study on IPTV. Perceived price also act as a main driver of the users to use IPTV [27].

Table 2.13 Previous Study

	Dong Hee Shin	Sandra Weniger	Hyori et al
Perceived Usefulness	✓	✓	✓
Perceived Enjoyment	✓	✓	
Perceived Content Quality	✓	✓	
Perceived Quality of Services	✓	✓	
Perceived Security	✓	✓	
Perceived Contol	✓		
Cognitive Absorption		✓	
Perceived Ease of Use		✓	✓
Perceived Cost	✓	✓	

2.3 Theoretical Framework

In this thesis, the researcher takes Dong Hee Shin [17] research model that based on TAM model that has been modified by TRA theory as his/her base model to analyze the intention to use of IPTV in Jakarta. Basically, the previous study that has been researched by Sandra Weniger [27] and Hyori Jeon and friends [29] has the same basic framework model to design their own framework and there are same variable that they use. They all used TAM model as their base model to modified their research model to analyze technology adoption of IPTV. However, Sandra Weniger's [27] theory is so complex and it consists of many factors that are not really necessary to put in this thesis. Beside, since it had many factors that give out many questionnaires the author decide to choose Dong Hee Shin [17] theory that covers most of the important main factor to analyze the technology adoption of new technology to intention to use. From author point of view, the more questionnaires is given to the audience, the more inaccurate data the author will get. Considering the limited time of this thesis, Sandra Weniger's [27] theory is complex and not supported to finish this thesis on time.

In Indonesia, that just launch IPTV technology makes people aware of the new technology that keeps coming up. However, not most people already use IPTV in their home. Therefore, in this thesis the author decides to analyze the intention to use of IPTV not the usage behavior that analyze the user's perception that has already use the IPTV. For further study, researcher might continue to study the usage behavior of the user that has already use IPTV in time where IPTV is no longer known as new technology.

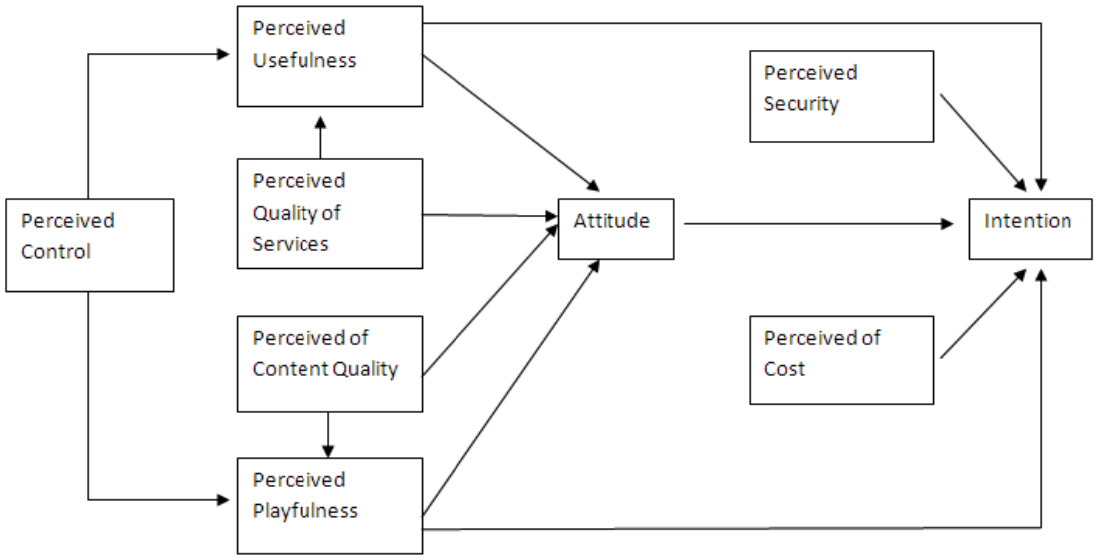

Fig 2.14. Theoretical Framework by Dong Hee Shin [17]

The author did not add additional variables to the Dong Hee Shin's framework because most of the variable that he takes, mostly use also by other researcher. For example: perceived usefulness and perceived ease of use also has being used by Hyori Jeon and friends, and Sandra Weniger theory. While other variables like perceived quality of services, perceived content quality, perceived cost, security, and playfulness also being used by Sandra Weniger theory. However, Sandra Weniger theory conclude perceived quality of services, content quality, and security as one point as what it is shown in the Sandra Weniger research model above.

Lin and Lu [22] summarize that Perceived system quality that is categorized of response time, and system accessibility as the IS qualities that can be used as predictors to measure perceived usefulness and perceived ease of use.

In the Dong Hee Shin research model it is stated that perceived cost has a negative impact on the user intention to use. However, in this thesis the author changes it. The author conclude that perceived cost has an impact on intention to use because the amount of cost that the user pay will have an impact of the willingness of people to buy or to implement new technology unless they are fully supported by their wealthy financial status.