

# Optimization Strategy of Mobile Cellular Network based on Customer Smartphone Penetration

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Abstract: This research is to determine a relationship between 4G device penetration and network development in Telkomsel, the biggest cellular operator in Indonesia. The framework is a combination of IDT (Innovation Diffusion Theory) and TAM (Technology Acceptance Model). As a qualitative research methodology, primary data is collected and processed based on interviews with some experts inside Telkomsel and also with the customers. While secondary data taken from internal data analytic were using forty thousand customer's data sampling in the Jakarta and surrounding areas. This research found that some of the reason behind the low penetration of 4G networks are: no subsidy in 4G devices and partnerships, not evenly device distribution, customer's perception that 4G devices are wasteful both the quota and the battery, also customers already felt enough with 3G network speed. This research suggested the program for increasing 4G USIM penetration include the initial distribution of all cards using USIM, mapping sites for customers other than 4G, campaign through CTP (customer touch points) and dealer partners and outbound calls for customers with high ARPU.

## 1 INTRODUCTION

The development of mobile technology from one generation to the next generation continues to rapidly progress, starting from 1G, 2G, 3G and now it implements 4G (LTE). Some countries even are experimenting 5G technology. With this speed of change, the cellular technology lifecycle is decreasing. It makes a big challenge for telco operator in exploiting the advantages of one technology before other advance technology takes place. Telco operator is facing pressures in reaching the targeted ROI from the previous investment of existing and legacy technology. On the other hand, the telco operator cannot delay new investment in new technology because of the sustainability issue.

Some of the advantages of 4G technology among others: down link speed up to 300 Mbps and uplink speed up to 75 Mbps, latency (delay in access) that is pretty low of less than 30 milliseconds and supports high-mobility. The presence and superiority of 4G technology have spurred customers to access broadband data usage. Based on Telkomsel internal data, there is a significant increase in broadband data usage as shown in Figure 1, although it has not reached a maximum level. To be able to serve a large

number of customers, it requires a network that has comprehensive coverage of services to remote areas throughout Indonesia. Telkomsel continues to develop its service coverage both 2G, 3G, and 4G networks. Until the end of 2017, the number of BTS was 160,000. The ability to build networks, especially 4G / LTE, is key to supporting the presence of smartphones.

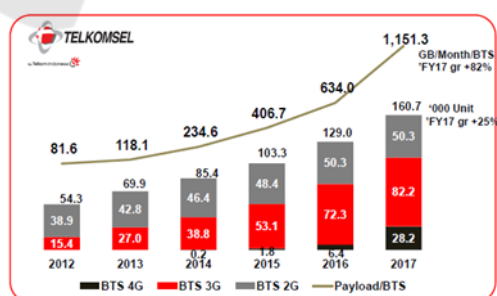


Figure 1. Telkomsel Data Broadband.  
Source: Annual report Telkomsel (2017)

4G technology encourages device manufacturers to continue to produce a variety of 4G-capable devices at a more affordable price for the customers. The operator is trying to boost the growth of smartphone users in various ways. Based on XL

Axiata's annual report released in 2017, smartphone penetration was reached 70% where the number of customers reached 53.5 million and smartphone users amounted to 38.3 million. The market Meanwhile, Telkomsel the biggest operator with 161.5 million customers in July 2018 manages 60.4% of smartphones devices, 18.4% of feature phones (non-smartphone phones that have internet data access capabilities) and 11.2% of basic phones (non-smartphone phones that do not have data access capabilities).

The requirement to be able to use 4G service is sufficient 4G network and customers were using the 4G device with USIM Card 4G. The fact that 4G networks development has been massively built compared to 2G and 3G technologies, do not make the 4G device usage penetration reach the optimal number. Data as of July 2018, reported that the penetration of 4G subscriber devices still reaches 42% and the use of USIM cards reaches 32%. Based on this matter, this paper aims to investigate the causes of 4G device usage not being maximized and associated with how to optimize the 4G network to be used by the customer. The innovation diffusion theory (IDT) seems the right theory that can be used to start with.

## 2 THEORETICAL BACKGROUND

### 2.1 Innovation Diffusion Theory

The Innovation Diffusion Theory (IDT) emerged at the beginning of the 20th century in 1903 which was introduced by Gabriel Tarde, a French sociologist, by making an S-shaped Diffusion Curve. The S curve illustrates the relationship between innovations/adopted by someone or a group of people based on time (Roger, 2003). The more people who contact with innovation, the more the rate of spread increases. Eventually, so many members of the community will be affected in adopting the innovation.

According to (Roger, 2003: 5) the notion of diffusion is "as the process of innovation is communicated through certain channels over time among the members of a social system". This definition highlights four key words: innovation, communication channels, time, and social system (Sahin, 2006). Furthermore, in innovation, there are five other variables, namely relative advantages, complexity, compatibility, trialability and observability (Roger, 2003).

### 2.2 Technology Acceptance Model

Technology Acceptance Model (TAM) is a behaviour theory developed by Davis in 1986 (Indrawati, 2017). It is used to measure why consumer attitudes and beliefs can influence consumer behaviour in accepting or rejecting a product. In TAM there are two variables, namely perceived usefulness and perceived ease to use. Perceived usefulness is defined as the level of a person believes that he/she will improve his/her performance by using a new particular system. While perceived easy to use is defined as the level a person believes that using the particular new system is effortless (Davis, 1986).

Some previous research has combined between the theory of IDT and TAM used in the study of information technology (Chen, Gillensen, & Sherrel, 2002; Oh, Ahn, & Kim, 2003; Wu & Wang, 2005; Min, Noh, & Ghee, 2018). For example, Min et al. (2018) investigated the factor to influence the intention to use smartwatches using the integrated model of technology acceptance model (TAM) and innovation diffusion technology (IDT). Based on the previous research mentioned above, this paper assumed, a combine between TAM and IDT can be used to measure the penetration of smartphones as describes in Figure 2.

Some variables in IDT which are part of the variables perceived as attributes of innovation (Roger, 2003) can be defined as:

- a. Compatibility is the degree to which an innovation is perceived as consistent with the existing value, past experiences and need of potential adopters.
- b. Observability is the degree to which the result of innovation is visible to others.
- c. Trialability is the degree to which an innovation may have experimented on a limited basis.

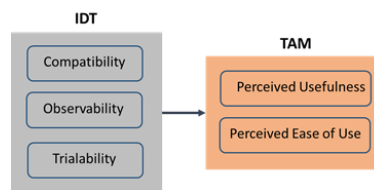


Figure 2 Combined IDT and TAM.  
Source : J. Min, Y. Noh., Ghee. (2018).

## 3 METHODOLOGY

### 3.1 Research Character

Based on the problems and objectives that have been determined, the research methodology used is a

qualitative method. Qualitative business research is research conducted to business objectives through techniques that enable researchers to present material to interpret research phenomena without depending on numerical measurements (Sugiyono, 2014).

This study has a focus on acquiring real meaning and getting insights about problems and research questions (Zikmund, Babin, Carr, & Graffin, 2010). Qualitative research methods are often called naturalistic research methods because their research is carried out in natural settings (Sugiyono, 2014). Based on the purpose, this study uses descriptive to describe and explain the phenomenon that occurs and look for answers to the research questions that has been explained.

### 3.2 Data Collection and Measure

The primary data is obtained from in-depth interviews with some informants from Telkomsel’s employees. The informants are selected based on the employee’s level of expertise that reflected by their position at the managerial level. It includes vice president (VP) and manager who understands the problem. In addition, this study also invites some customers who have been using Telkomsel services for more than 5 years, but they have not used 4G services. It is because either their device is not 4G or has not used the 4G USIM card. Interviews with participants were conducted between November-December 2018.

Table 1. A sampling of questionnaire interviews.

Variable	Questionnaire
Perceived Useful	Based on data penetration of 4G devices only reached 42%, what are the factors cause this to happen?
	How are the strategies for increasing 4G device penetration?
	Device usage is approaching saturation. Why does this happen?
Perceived Ease to Use	How easy is to use a 4G network and plan ahead?
	How easy are you to use the Telkomsel network?
Compatibility	What is the compatibility between the need for internet data access with a 3G device and not replacing the 4G device?
Observability	Have you ever observed 4G services and what relative advantages did you get?
Trialability	Have you ever tried a 4G device? And what is your experience?

Source : Interviews data collecting

Interviews were audio-recorded at PT. Telkomsel TSO (Telkomsel Smart Office) Building, South Jakarta. The topic of interview was about exploring some issues: (1) the cause of 4G Telkomsel handset penetration has not reached 50%, (2) strategy to increase 4G device penetration, (3) ease of using 4G network, (4) conformity between the need for internet data access with 3G devices, (5) observability and trialability.

In order to understand the phenomenon better, the secondary data was collected. Artefact in this study is data sampling of 40 thousand customers in the Jakarta and surrounding areas that use smartphones, feature phone, and basic phones. Some parameters used in this data collection are: MSISDN, Device Type, USIM, Device. Secondary data was taken from Telkomsel internal data on October 2018.

Validity test is done by: First, by using triangulation process that combines several points of view and methods. This triangulation process is done by comparing several interviews that have been conducted, both for the VP (vice president) level and the manager level who have competence in the field under study. Second, by implementing expert validation. It involves key informants who have detailed knowledge of ideas, concepts, and relationships between concepts of phenomena that exist in the research. Third, by using the credibility test to make sure whether the views of respondents to the results of research are in accordance with those presented and reconstructed by researchers.

When data collection is done, data analysis takes place. Analysis of answers to be delivered at the time the interview is conducted before the interview process takes place. If the answers submitted by the informant at the time of the interview are not satisfactory, then the research question will continue to a certain extent until data that is deemed credible is obtained. Miles and Huberman’s model (in Sugiyono, 2003) emphasizes the analytical activities carried out interactively and continuously until the data is saturated.

Activities in data analysis include data reduction, data display, and conclusion. Before entering into data reduction, researchers first carry out anticipatory data reduction. Data reduction occurs when the researcher decides which conceptual model is used, the object to be studied, the research question to be used, and the method of data collection to be used (Sugiyono, 2014). Finally, conclusions are based on the results of data reduction and combining with previous information.

## 4 RESULT

### 4.1 Secondary Data

The secondary data process in the Jakarta area shows that 76% of customers had used smartphones and 57% were a 4G device capable. This is logic since the Jakarta region has the highest economic level/level of economic capacity compared to other regions. As the most developed business area, information updates are automatically as well as the need for access to internet data usage in the Jakarta region is greater than in other regions. Beside the development of cellular infrastructure is the most mature compared to other regions in Indonesia. Figure 3 shows the customers data regarding the ownership of the device.

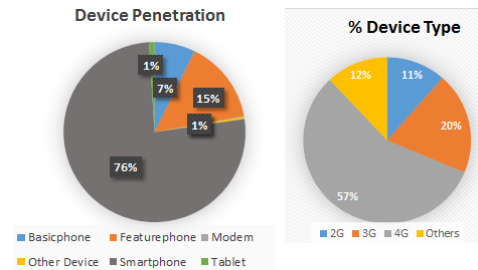


Figure 3: % Device Penetration.  
Source : Secondary Data Processing Result

Table 2: Secondary Data Sampling.

No	MSISDN	Device Type	USIM	Device
1	6285215495560	Smartphone	Y	4G
2	6285254815373	Featurephone	N	Others
3	6281380475456	Smartphone	Y	4G
4	6281311221371	Featurephone	N	2G
5	6281311242788	Smartphone	Y	4G
6	628128348786	Smartphone	Y	4G
7	6281387878899	Smartphone	Y	4G
8	628129504899	Smartphone	Y	4G
9	6281318421564	Smartphone	Y	4G
10	628128019990	Smartphone	Y	4G
11	6281314207888	Featurephone	N	2G
12	6281384915158	Smartphone	N	4G
13	628129985695	Smartphone	Y	3G
14	6281394866009	Smartphone	Y	4G
.....	628128913026	Smartphone	Y	4G
40000	628128908082	Smartphone	Y	4G

Source : Telkomsel Internal Data

From 40 thousand customers, only 47% have used USIM (4G sim card). It means that 4G customers' USIM penetration has not been maximized. While for 4G device users who have used USIM cards is 15,379, while compared with the number of 40,000 customers, then those using 4G and USIM 4G devices (15,379/40,000) are equal to 38.44%. This indicates that Telkomsel customers that use 4G network services in the Jakarta area are still relatively small. Market is still available in the future. Information from secondary data is the basic for interviews with the participants to find out the cause of 4G penetration is still relatively low.

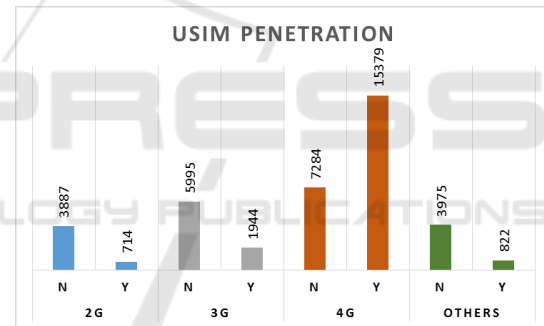
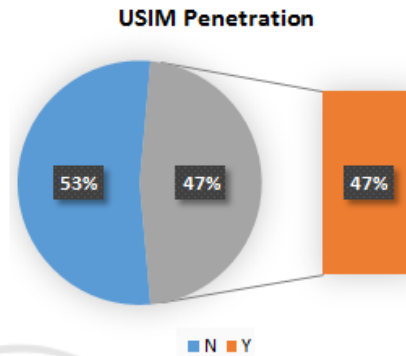


Figure 4: USIM Penetration.  
Source: Secondary Data Processing Result

### 4.2 Primary Data

Primary data is achieved by conducting interviews with experts in Telkomsel internally. The participants were selected based on their skill and feasibility and experience. It ensures they have enough knowledge and awareness about the present study problems. The coding step identified a big picture of the facts as qualitative data analysis and collecting and drawing conclusions on a psychological analysis (Mahpur, 2017). The results from coding will be analysed related to the development of 4G network optimization based on smartphone penetration.

After collecting data and conducting interviews, the recording in audio form then converted into writing and in text form known as Verbatim transcript. Verbatim transcripts are grouped into each

variable according to the questions asked. The results of the complete. Then each verbatim transcript data will undergo a reduction process, where data is important and directly related to the research which is the main note to take a conclusion. Coding for Expertise using I, and for Customer using II.

#### 4.2.1 Compatibility

Compatibility is used to measure the suitability of 3G device usage is associated with the need to access of internet. Some respondents answered questions as follows:

*The device has 4G capability but it's not a 4G USIM card, because I felt too lazy to go to Graphari office, another reason caused by wasteful battery handset (II.1).*

*The device has 4G capability but it's not a USIM card because welds queue to Graphari office (II.2)*

*The device is still 3G, including the sim card, it is sufficient with 3G (II.3)*

*Using 3G device with sufficient speed for internet connection. (II.4)*

*Lack of understanding the 4G technology, using 3G is enough for internet connection. (II.5)*

From the customer side, the reason is not to replace the 4G handset, because of 3G technology services are sufficient, so they do not need to exchange 4G services. The use of internet data activity for social media is sufficient even if only using 3G handsets. For customers who already used 4G handsets, but have not replaced the sim card with 4G USIM. The reasons as revealed by resource persons II.1 and II.2 is the reluctance to queue graphically when changing cards and there is a view that by using 4G wasteful quota.

This is in accordance with what was stated by the Expertise 1 (I.1) that replacing the 4G USIM card is more of a challenge:

*For me, the more challenging is customer want to change the sim card, this is different from the others, if it used to be 2G, 3G people don't need to change the sim card, but in 4G, people have to change sim card. (I.1).*

More clearly explained by the Expertise 2 (II.2), the factors that affect customers who have not replaced the 4G USIM are:

*Well, usually, they don't want to change 4G devices due to some aspects, there is a perception that using 4G data has a fast impact on the internet quota and the battery. (I.2).*

This shows that the matching between the answers presented by the customer is not different from the experience found by experts. There is a view that using 4G technology causes fast quota spending and handset battery is the main reason, aside from that customers feel enough to use 3G technology services. Besides the reluctance of customers to replace the 4G USIM card through a service at Telkomsel office.

#### 4.2.2 Observability

To find out that customers have observed 4G technology, both 4G device usage and information related to 4G technology. The advantages of 4G technology are compared with 3G technology. The answers from the respondents are as follows:

*Ever observed, the information is faster to access the data (II.1)*

*Ever observed and tried it. (II.2)*

*Ever watched (II.3)*

All participants claimed to have observed 4G devices. While technology has heard and learned about the advantages of 4G technology compared to 3G technology. This shows that the introduction of 4G technology has been well obtained by customers, both in the from corporate and information from the media. Customers have socialized the capabilities of 4G technology and devices. Various offers made by 4G device providers at relatively low prices make customers observe 4G device capabilities. While cellular operators are intensively developing 4G networks to the regions.

#### 4.2.3 Trialability

After making observations, in general a participant will try on the known technology. Trialability is to ensure that participants feel the need to change the device. The answers from the respondents are as follows:

*I have tried it, and the data rate is more accessible. (II.1)*

*I have tried and compared with the 4G device. (II.2)*

*Never before, because I don't need it yet. (II.3)*

*I once used a husband's 4G device. (II.4)*

*So far, I have never tried it. (II.5)*

Most participants have tried with 4G devices. This shows that there is a desire from customers to know more about 4G devices, after making observations in the previous stage. The presence of 4G technology in Indonesia since 2016 has been well known by customers, so they tried the reliability of this 4G technology. Although their needs have not yet been desired, they are enjoying the 3G technology that has been used so far.

IDT theory has compatibility, observability and trialability variables are more important to see device penetration from the customer side. This is because to measure the level of satisfaction and experience of customers towards both 3G and 4G technology. While TAM is a continuation of IDT to measure the company to find out the cause of 4G device penetration is still low. As well as strategies that will be carried out by companies to deal with these problems.

#### 4.2.4 Perceived Useful

In the variable perceived useful not only from the customer side but from the problems faced by the company related to 4G device penetration. As contained in secondary data presented at the beginning of the study, national penetration of 4G Telkomsel handsets up to July 2017 still reaches 42%. While for the Jakarta region based on sampling data on 40 thousand customers, the penetration reached 57%, and 38% used USIM cards.

Based on the interview, the responses from the participants were:

*“So, if we go back to the problem, maybe it’s the fundamentals because we don’t subsidize so we submit to the market mechanism, so the number of the penetration may not be as much as countries that apply mobile subsidies.” (I.1)*

*Actually, Telkomsel for 4G penetration is very closely related to partnerships carried out by Telkomsel itself. This means that Telkomsel is not a device provider, whether we want it or not, we must cooperate with the partnership parties. (I.2)*

The results show that the factors that caused the low penetration of 4G Telkomsel handsets are because Telkomsel did not subsidize customers’ handset. Telkomsel depends on market mechanisms, the bundling program is more in collaboration with partners and Telkomsel provides products and the sim card. In addition, the availability of handsets in the market and the distribution of handsets between regions varies. Partnership partners will certainly

count by looking for markets in regions that will absorb 4G handset purchases. Not all 4G handsets will be provided by partnership partners. This is especially true in rural areas where the economic rank is lower compared to urban or suburban areas.

Based on the chart of 4G Telkomsel handsets, it appears that since the beginning of the 4G service Telkomsel was launched (December 2014) has increased, especially in 2017 until mid-2018, but after that there has been a slowing down and approaching saturation. From the results of interviews with the respondent saying that:

*“I don’t know what to do with the sim card registration, maybe, I don’t know that, but if you see the timings like having a straight line with the sim card registration, because after that April there is a sim card registration (I.1)*

*This data in my opinion there are actually two sides, first, is the economy really turbulent, it could be that he will buy purchases for the handset, because our new IMEI is also small, that’s one. (I.2)*

There is a connection between the registration sim card conducted by Regulator with the slow penetration of 4G Telkomsel handsets, because the NIK and NOK (identity number) based registration process has made customers stay more with their old handsets and not replace new cards. In addition, the tendency of customers to hold back in replacing new handsets is the reason for the penetration of 4G handsets to slow down.

Researchers predict that the growth of 4G devices in the future will not increase dramatically as in the previous period, there will be an increase along with the increasing coverage network built by Telkomsel, although not as large as the period before April 2018. As in life cycle technology theory, this phase is approaching maturity stage, flat growth and approaching deceleration. With the number of 4G handsets approaching 70 million, the predictions of penetration researchers will reach a maximum level of 90 million. This is inseparable from the factors revealed by the experts above. The tendency of customers not to buy a new handset and feel sufficient with the condition of the handset that is now owned is the biggest factor that influences it.

#### 4.2.5 Perceived Ease to Use

Furthermore, it relates to the ease and strategies for improving 4G device and USIM card usage, participants explained that:

*Efforts that have been made by Telkomsel in increasing the penetration of the 4G USIM include distribution of all the initial cards using USIM, mapping sites for customers other than 4G, campaign through CTP (customer touch points) and dealer partners and outbound calls for customers with high ARPU. As stated by the resource person (II.2)*

*“First, for the product side, all of the first distribution now, have started using all of us, that’s already from 2017 or 2016, all of them have begun to work.” (II.2)*

*“Well, if the programs have been done, first it will map to those areas, the points where per site, per site where there are still a lot of sim cards, at any point, we make the first priority.” (II.3)*

*“The campaign to migrate to 4G at the point of our CTP, then we are also cooperating with AD (authorize dealer) partners, TDC (Telkomsel Distribution Channel), then we have More.” (II.3)*

*The strategy is carried out with campaign and awareness for customers to increase device penetration and 4G sim card in various ways (II.4).*

Efforts made by Telkomsel to facilitate customers in obtaining services for customers and increase 4G device penetration. Various ways are started from awareness, contacting customers directly, cooperating with Telkomsel partners, and offering additional products for customers. Besides the provision of 4G networks that have reached the area by Telkomsel to make it easier for customers to communicate with 4G technology.

## 5 CONCLUSIONS

This paper combines the concept of IDT (i.e. compatibility, observability and trialability variables and TAM (i.e. perceived variables is useful and perceived ease to use). These two theories are used to explore the relationship between customer experience also the presence of 4G technology and 4G technology provided by telecommunications operators. By knowing this, the telco operators will have the right strategy in overcoming the problem.

From the data, we can conclude that the compatibility variable in IDT’s theory plays a vital role compared with observability and trialability variables. It seems that compatibility does not accordance with customer needs for the presence of new technologies, even though new technologies represent service excellence. While the observability

and trialability are only support to find out the reliability of the new technology. Even though, in the end customer needs become the top priority. There is a very close relationship between the variables in IDT and TAM’s theory in influencing customer decisions in adopting new technologies.

The customer’s opinion is using 4G devices wasteful in both their quota and handset battery, and customers already feel sufficient with the speed of 3G network data access. For customers who use 4G devices but have not replaced the 4G USIM card due to the reluctance to wait a long time when visiting Ghrapari Telkomsel Office.

Strategies for increasing 4G USIM penetration include the initial distribution of all cards using USIM, mapping sites for customers other than 4G, campaign through CTP (customer touch points) and dealer partners and outbound calls for customers with high ARPU. The development of 4G networks continues to be achieved equilibrium with regions that require an increase in 4G network coverage, more selective development for regions that need 4G services.

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