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INNOVATIVE SERVICE PRICE PLAN PREDICTION OF MOBILE TELECOMMUNICATION
OPERATORS IN THAILAND

Miss Manarach Amornrattanapaichit



จุฬาลงกรณ์มหาวิทยาลัย

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ภาคธุรกิจบริการโทรคมนาคมเป็นธุรกิจหนึ่งที่มีการเติบโตอย่างรวดเร็วที่สุด โดยเฉพาะอย่างยิ่งการสื่อสารแบบไร้สาย แต่อย่างไรก็ตาม การยกเลิกสัญญาการใช้บริการ (Subscriber churn) เป็นปัจจัยหลักที่ส่งผลกระทบต่อประสิทธิภาพการทำงานสำหรับผู้ประกอบการโทรศัพท์เคลื่อนที่ ดังนั้นวิทยานิพนธ์ฉบับนี้จึงมีจุดมุ่งหมายที่จะนำทฤษฎีแบบจำลองการยอมรับเทคโนโลยี (TAM) เพื่อที่จะวิเคราะห์พฤติกรรมการใช้งานของผู้ใช้บริการและสร้างแบบจำลองเพื่อใช้ในการประเมินการใช้งานและคาดการณ์แผนราคาที่เหมาะสมเพื่อให้สามารถตอบสนองความต้องการของลูกค้าในแต่ละบุคคล โดยการศึกษานี้ได้มีการพัฒนากรอบแนวคิดจากการศึกษาที่ผ่านมาพร้อมทั้งคำแนะนำและแนวคิดจากผู้เชี่ยวชาญในแวดวงโทรคมนาคม ทำให้ได้โมเดลพื้นฐานที่เรียกว่าแบบจำลองพฤติกรรมการใช้งานโทรศัพท์เคลื่อนที่ในประเทศไทย ซึ่งจากผลการศึกษาแบบจำลองดังกล่าว แสดงให้เห็นว่าปัจจัยหลักที่มีผลต่อการรับรู้โรคในการเลือกใช้บริการโทรศัพท์เคลื่อนที่ ได้แก่ การคำนึงถึงประโยชน์ที่ได้รับ ทัศนคติ และความตั้งใจในการใช้งาน นอกจากนี้ยังพบว่า ความไว้วางใจ ความหลากหลายของบริการโครงสร้างพื้นฐานและทัศนคติต่อการให้บริการยังเป็นปัจจัยเพิ่มขึ้นจากแบบจำลองดั้งเดิมที่พัฒนาโดยเดวิส (1989) อีกทั้งยังเป็นการแสดงให้เห็นว่าในปัจจุบันความง่ายในการใช้งาน ไม่ใช่เป็นสิ่งที่ต้องคำนึงถึงในการเลือกใช้งานโทรศัพท์เคลื่อนที่อีกต่อไป เนื่องจากบริการดังกล่าวได้เป็นปัจจัยที่จำเป็นในการดำรงชีวิต ในขั้นที่สาม โมเดลที่ใช้ในการคาดการณ์ปริมาณการใช้งานของลูกค้าได้มีการพัฒนาขึ้นผ่านการสำรวจโดยใช้แบบสอบถามและการวิเคราะห์ข้อมูลด้วยการวิเคราะห์ปัจจัยและการวิเคราะห์การถดถอยพหุคูณ ทำให้ได้สมการที่ใช้ในการคาดการณ์ปริมาณการใช้งานของลูกค้าในอนาคต Y (ปริมาณการใช้งาน) = $365.266 + .689$ (ปริมาณการใช้งานเฉลี่ย) - 27.597 (ทัศนคติ) - 23.970 (ความตั้งใจในการใช้งาน) และในขั้นตอนสุดท้ายคือการพัฒนาแบบสนับสนุนการตัดสินใจด้วยแผนภูมิควบคุมที่สร้างขึ้นเพื่อให้สามารถระบุรูปแบบการใช้งานและชี้ให้เห็นถึงพฤติกรรมการใช้งานที่ผิดปกติของผู้ใช้บริการ รวมถึงการนำเสนอแผนราคาที่เหมาะสมให้กับลูกค้า ซึ่งจากการทดสอบการใช้งานเบื้องต้นกับลูกค้า 136 ราย ระดับการตอบรับในการเปลี่ยนไปยังแผนราคาที่เหมาะสมเพิ่มขึ้น 100% จากกระบวนการรักษาฐานลูกค้าในปัจจุบัน ด้วยระบบดังกล่าวผู้ประกอบการจะสามารถดำเนินการแก้ปัญหาเชิงรุกได้อย่างทันทั่วถึง เพื่อป้องกันค่าใช้จ่ายที่ไม่พึงประสงค์ที่อาจเกิดขึ้น ผลก็คือผู้ให้บริการสามารถนำแนวคิดเหล่านี้ไปปรับปรุงความพึงพอใจของลูกค้าส่งผลให้ลูกค้ามีการใช้งานมากยิ่งขึ้นและมีอัตราการยกเลิกสัญญาการใช้บริการโทรศัพท์เคลื่อนที่ลดลงในที่สุด

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ปีการศึกษา 2556

ลายมือชื่อนิสิต

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MANARACH AMORNATTANAPAICHIT: INNOVATIVE SERVICE PRICE PLAN PREDICTION OF MOBILE TELECOMMUNICATION OPERATORS IN THAILAND. ADVISOR: ASST. PROF. NATCHA THAWESAENGSKULTHAI, Ph.D., DECHA DECHAWATANAPAISAL, Ph.D., 186 pp.

Telecommunication service is one of the fastest growing businesses in Thailand, especially in mobile communication. However, subscriber churn is a fundamental driver of performance for mobile network operators. This thesis aims to develop subscriber usage behavior model by utilizing the theory of Technology Acceptance Model (TAM) in order to improve subscriber retention and performance. Firstly, the subscriber usage behavior model was developed from the literature review of the TAM model along with expert interviews was used to examine the behavior of the selected postpaid subscribers. Secondly, Structure Equation model (SEM) was employed to analyze and test the hypotheses of subscriber usage behavior model. It presents that perceived usefulness, attitude and intention to use are the key predictive factors for subscriber's behavior when choosing their mobile phone service. Furthermore, we found three additional elements to the original TAM model which are Trust, Variety of service, and Facilitating conditions. Also, the study found that ease of use is not a discriminant to the adoption of mobile service in Thailand.

Next, factor analysis and multiple regression were employed to analyze a service price plan prediction model. The multiple regression analysis describes predictive voice usage: Predicted (Voice usage) = 365.266 + .689 (AVGVoiceusage) - 27.597 (Attitude) - 23.970 (Intention). Finally, the innovative price plan monitoring and advisory system was developed in order to monitor service usage by applying control chart to identify usage pattern and unusual usage behavior of subscribers, and then bringing next best offering to each subscriber. Regarding pilot testing, 136 reachable subscribers, forty percent of reachable subscribers were sign up. This rate is 100 percent increased from the current retention process. Such tool enables timely and proactive action for subscribers to avoid unexpected expenses. As a result, mobile network operators can increase the service usage, improve customer satisfaction and ultimately reduce a subscriber churn.

Field of Study: Technopreneurship and
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Student's Signature

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LIST OF ABBREVIATIONS

n	Number of respondents
Mean	Average
S.D.	Standard deviation
Max	Maximum
Min	Minimum
C.V.	Covariance
Sk	Skewness
Ku	Kurtosis
β	Regression coefficient
R	Coefficient of correlation
R ²	Multiple coefficient of determination
df	degrees of freedom
p	probability value
RMR	Root Mean Square Residual
GFI	Goodness of Fit Index
AGI	Adjusted Goodness of Fit Index
TE	Total Effect
DE	Direct Effect
IE	Indirect Effect
Useful	Perceived usefulness
Enjoy	Perceived enjoyment
Expense	Perceived expense
Risk	Perceived risk
Noneed	Perceived no need
Social	Social influence
Trust	Trust
Trial	Trialability
VS	Variety of service
FC	Facilitating condition
Trait	Trait
Attitude	Attitude
Intention	Intention to use
Usage	Voice usage
AOU	Age of use

CHAPTER I INTRODUCTION

1.1 The Statement of the problem

A service is a perspective on value creation through the view of customers based on value in use. A key characteristic of service is the co-creation of value with customers (Edvardsson, Gustafsson, & Roos, 2005). Services such as health, education, telecommunications and transport, are becoming significant parts of different economies (OECD, 2003). The service sector is an important component of any economy and makes a significant contribution to GDP in most countries (OECD, 2008). In 2009, the services sector contributed 45.1 percent of Thailand's GDP (valued at 2,268.1 billion baht in 4Q2009), while industry contributed 43.3 percent and agriculture accounted for 11.6 percent (OECD, 2011). Telecommunication service is one of the fastest growing sectors, especially mobile communication. In 2011, mobile communication service penetration reached an estimated 86.7 percent of the population globally and 78.8 percent in developing countries (ITU, 2012). In addition, mobile services were beginning to be increasingly adopted by the consumer after they had largely been used as a business tool (OECD Communications Outlook 2011, 2011). Today, mobile communication covers a wide range of services, including voice, SMS, MMS and data. Mobile data revenue has been growing strongly for the last 12-24 months while revenue growth continues to slow down for voice and SMS due to market maturity, changing consumer behavior and fierce competition in the Asian telecommunication market (BNPPARIBAS, 2012).

In Thailand, the mobile communication market has been tremendous growth in the past ten years with increasing adoption of mobile devices and a growing number of subscribers. At the end of 2011, Thailand's mobile communication market had reached 76.6 million mobile subscribers in total (Wireless Intelligence, 2012), compared with just four million subscribers in 2001. According to statistics reported by the National Broadcasting and Telecommunications Commission (NBTC, the industry regulator), the mobile penetration rate has reached 109.9 percent of total population (67.7 Million Thai people) and it is expected to continue rising. Despite the decline of revenues from voice and SMS services, Thailand mobile data revenue had the strongest growth among ASEAN-4 (Malaysia, Singapore, Indonesia and Thailand) at 46.5% in 2010 (BNPPARIBAS, 2012). The reason for this was the increase in Internet usage through smartphones and the rolling out of 3G, on 850-900 MHz within existing concession (dtac performance analysis report, Q1/2012). BNPPARIBAS (2012) also found that Thailand had the strongest growth in terms of subscribers adopting smartphones.

Even high growth data revenue, however, overall data penetration in Thailand remains relatively low compared with all Asian telecommunication mobile networks. The upcoming 3G

(2.1 GHz) auctions in October 2012 and the prosperous forecast of increasing penetration should drive the adoption of smart devices and mobile data (BNPPARIBAS, 2012) even though churn rate remains a constant concern for all Mobile network operators. Therefore it is very important for mobile network operators that they are well aware of factors that drive the consumers' intention and behavior for using their mobile services in order to maintain market share among aggressive competition and to sustain profitability.

Thailand had a plan to introduce third-generation (3G: 2.1 GHz) mobile phone technology since 2010, but due to the regulatory problems and new 3G licensing rules, a Thai court ordered the termination of a third-generation mobile license auction. Nevertheless, the three largest mobile network operators; AIS, DTAC and Truemove have rolled out 3G services by using the spectrum of the government-owned CAT Telecom and TOT. However, the Thailand 3G on 2.1 GHz auction is done in October 2012 with top three companies are authorized to grant the license.

The arrival of 3G allows customers to access the Internet faster on mobile devices for downloading data and other contents and also allows operators to generate new business from data services.. Within two years 3G must cover at least 50 percent of the total population and 80 percent of the population within five years. Furthermore, Thailand Smartphone penetration is only around 14 percent of the total mobile subscriber base (BNPPARIBAS, 2012). Therefore, there is still a vast possibility for growth in Thailand.

The exposure of 3G services and competitive smartphone prices have given the mature mobile market a welcome boost and has opened operators' opportunity to higher value non-voice service revenue. In early 2012 the telecom committee of the National Broadcasting and Telecommunications Commission set a new maximum limit for a mobile-phone service call tariff of 99 satang per minute aimed at lowering cellular rates. Only significant market players (SMPs - with market shares exceed 25 percent) like AIS and DTAC are required to follow the new regulation.

Currently mobile network operators use pricing plans as their main tool in the market to attract new customers and retain existing subscribers. They also offer a variety of services to suit customer needs and consumption preferences to increase/maintain revenue per customer. With a high penetration rate and market saturation, innovations in price plans are being used to strengthen existing subscribers' loyalty rather than to attract new subscribers (Corrocher & Zirulia, 2010). A number of previous researchers have found that acquiring new customers is much more expensive than keeping existing ones (Reichheld & Teal, 1996; Storbacka, Strandvik, & Grönroos, 1994) and it is not less than 20 times more expensive to attract a new customer (Goodman, O'Brien, & Segal, 2000). Moreover, a 5% improvement in customer retention can generate a profit increase from 25 percent to 85 percent (Reichheld & Sasser, 1990). Therefore,

building relationship is an important factor for organizations trying to achieve long-term profits (Frow & Payne, 2009).

Service plan optimization is a key strategy used by companies in the mobile communication sector to enhance customer satisfaction and increase retention (Seo, Ranganathan, & Babad, 2008). In light of the increasing variety of services and evolving consumer behavior, this paper aims to understand subscriber usage behavior in order to address mismatched subscriber price plans. There are many models from previous research that explain how consumers adopt and accept new technologies. The Technology Acceptance Model or TAM (Davis, 1989) is applied to predict users acknowledgement of information about technology and their usage by using a measure of BI (Behavioral Intention) to use and real usage record (Turner, Kitchenham, Brereton, Charters, & Budgenc, 2010) by focusing on the perceived usefulness and the perceived ease of use. Moreover, TAM is a valid and robust predictive model that has been widely used (King & He, 2006). Another theory of The Unified Theory of Acceptance and Use of Technology or UTAUT (Venkatesh, Morris, Davis, & Davis, 2003) is widely cited to describe the adoption possibilities and the acceptance pattern of new technology. The main constructs of UTAUT is based on and similar variables parameter with TAM model. The diffusion of innovation (Rogers, 2003) is used to explain the use and/or diffusion of the information and communication technology which founded from five innovative characteristics which are the relative advantage, the compatibility, the complexity, the trialability and the observability.

From the models mentioned above, TAM model was applied in uncountable studies in order to test the user acknowledgement of information technology and to predict potential usages. Nevertheless, many studies used a modified version rather than the original TAM model. Almost all of the previous studies predicting potential usage used subjective measures rather than objective (Turner et al., 2010). Prior research concluded that the objective measures of potential usage presented a stronger relationship in TAM when compared to subjective measures of potential usage and suggested that future research should examine usage by combining both objective and subjective measurements in order to avoid measurement problems (Straub, Limayem, & Karahanna-Evaristo, 1995). Hence, this research combines both subjective and objective measures to predict our price plan.

In order to find out the factors that facilitate user adoption of the mobile service in developing countries, a few research studies have been conducted, but there was none in Thailand. They mainly focused on advance mobile services like mobile financial service, mobile banking and mobile commerce. Mobile network operators in Thailand are still in the initial stages of advanced services. They only provide and charge customers with basic services such as voice, SMS, data and other valued added services.

Currently the mobile network operators in Thailand offer price plans generated manually with regard to customer money saving factor and match the price plan with potential usage. This process is time consuming and does not focus on the individual needs of each customer. To generate customer value and loyalty, to sustain a relationship with customers in a long run and to increase value for a life time by decreasing churn, the pricing plan and price fairness should be considered as critical factors to accomplish mutual benefits for both customer and company. As Bouwman, Vos, & Haaker (2008) mentioned that mobile services have to concern about offering a precise match with customer habits if they are to deliver added value.

In this study, the study will examine key determinants that influence customer intention for using mobile services to explain usage subscriber usage behavior. And then, develop innovative price plan prediction model that most accurately reflect usage and individual needs. This model will help suggest the most suitable price plans to customers based on their usage. To formulate better strategies to retain current customers (Revels, Tojib, & Tsarenko, 2010), this research will offer a methodology to estimate the customer usage behavior and service pattern based on individual consumption data. The results of this research will be further developed so as to suggest the most appropriate price plan for each subscriber before they change to another operator.

1.2 Research objectives

This research aims to investigate the mobile subscribers' behavior intention based on the developed price plan prediction model. In addition, this model will be used to develop suitable price plans that will ensure customer benefits and stimulate usage while reducing churn¹. The research objectives for this study can be summarized as listed below:

1. To explore an existing Technology Acceptance Model (TAM) and customer behaviors to adopt mobile service.
2. To identify the causes which potentially have effect on using mobile services for recommend suitable price plans for Thai mobile subscribers.
3. To develop a service price plan prediction model of Mobile Telecommunication operators in Thailand
4. To develop and test an innovative price plan monitoring and advisory system of Mobile Telecommunication operators in Thailand.

¹ Churn is defined as rate of termination of service

1.3 Scope of the research

For this research, one of mobile number operator in Thailand is tasked for our study subject. The scope and focus of this research is described below:

1. The study concentrates on active postpaid subscribers due to high value subscriber base and generates main revenues.
2. This research will mainly focus on voice and data service price plans established in August 2012.
3. The proposed individual price plan prediction model will be tested with postpaid subscriber only.

1.4 Thailand's telecommunication service industry

Mobile phone subscribers all over the world can access a standard combination of applications and features operating on GSM services. After a mobile phone has successfully connected with a GSM's network and start the consumption, charges will begin. Services offered in a GSM network are classified into two categories, namely, Basic Services and Supplementary Service (SS). As the name suggests, basic services are the primary services offered by a mobile network. They include voice telephony, SMS and circuit-switched data service. Supplementary services modify or supplement the basic services and do not have significance independently (2G Mobile Networks: GSM and HSCSD).

Thailand's mobile communication market has been tremendous growth in the past decade. The increase in the mobile subscriber numbers per year has eased substantially. However, after year 2006 the growth slowed to around 3% yearly (See Figure 1-1) and the mobile penetration rate had surpassed 100% in 2010.

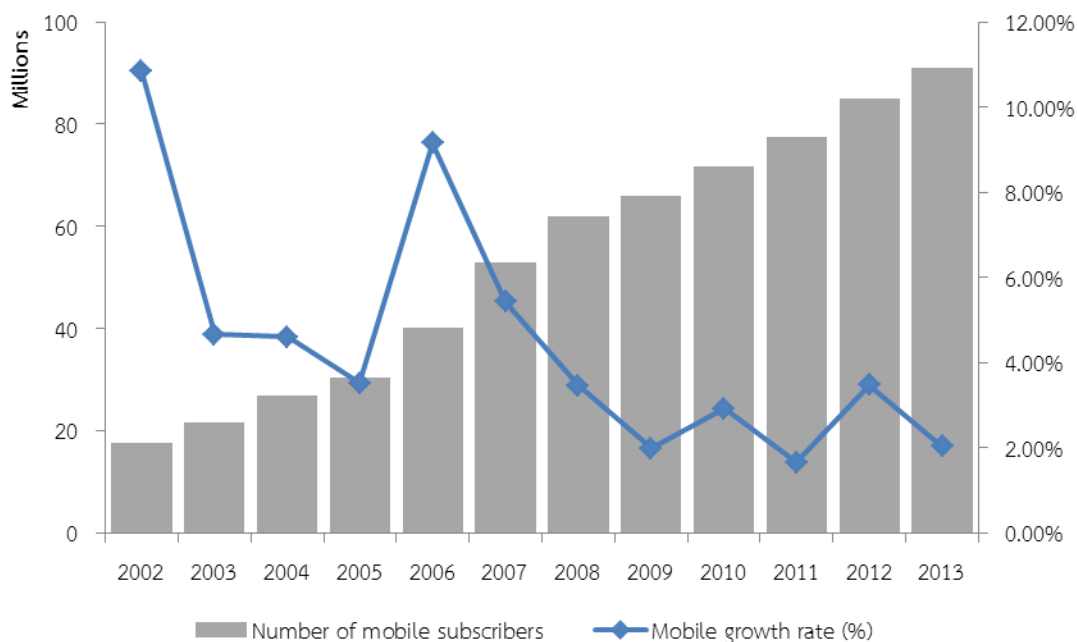


Figure 1-1 Number of mobile subscribers and mobile growth rate in the Thai mobile telecommunications service market

At the end of 2011, Thailand's mobile market had reached 76.6 million mobile subscribers in total (Intelligence, 2012) compared with 2001 when there were just 4 million subscribers. The average growth of adoption of mobile subscribers is high in Thailand. According to statistics reported from the National Broadcasting and Telecommunications Commission (NBTC), the mobile penetration rate has already reached 109.99% (See Figure 1-2) of total population (67.7 Million Thai people).

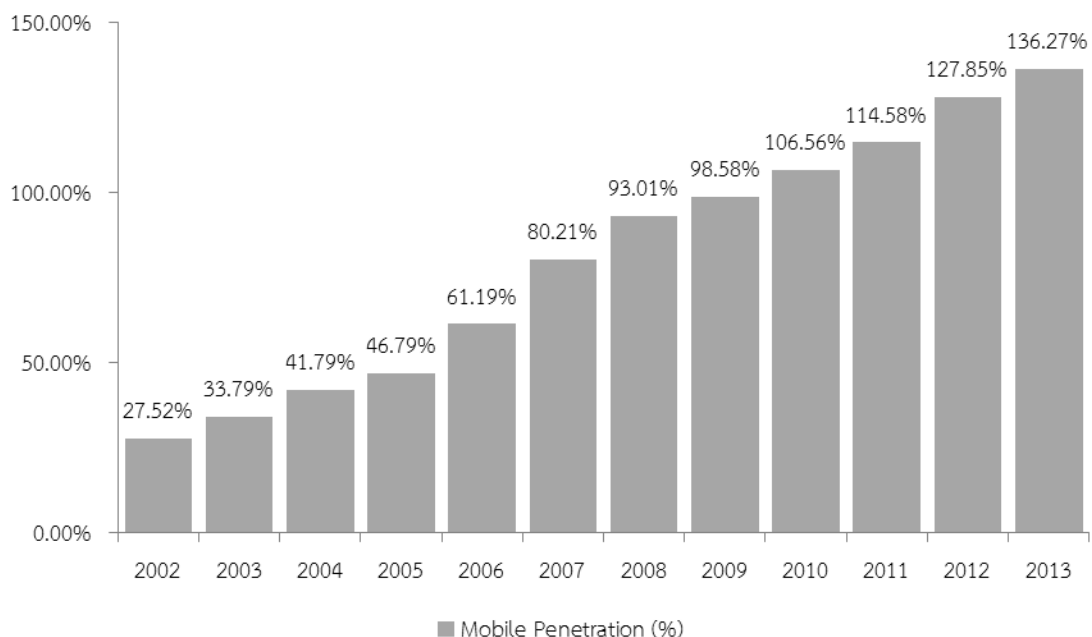


Figure 1-2 Penetration rate in the Thailand mobile telecommunications service market

Currently, Thailand is slowly rebounding through its strong service sector and mobile network operators are facing a sluggish growth rate. Costs of telecommunications, especially mobile and broadband services, are likely to decline steadily (NBTC, 2008). With the economic downturn, competition in the market changes and the rate of termination of service (Churn Rate) is higher. The average annual rate of customer churn in Thailand is around 4.3% (Intelligence, 2012).

Customer retention has become more important than customer acquisition (Ahmad & Buttle, 2002; Fornell, 1992) in order to maintain revenues and market share. The service provider substantially pays high cost in acquiring a new customer comparing with a lower cost on retaining an existing and they have to pay five times more to replace a customer than to retain one. From literature review, the three major reasons for the business of wireless communications to be successful are to retain customers, customer loyalty and customer satisfaction (Gerpott, Rams, & Schindler, 2001)

According to Kallio, Tunnilla & Tseng, it is said that the user consumption through coordinated handset and service design are progressively improving by successful operators rather than working purely on increasing bandwidth and complex technologies as well as focusing on creating effective billing systems, offering services at reasonable prices, and targeted marketing strategies (Kallio, Tinnila, & Tseng, 2006). A strategy that could create a long term competitive advantage is customer satisfaction. The competitive advantage is to retain consumers for a longer period of time. The strongest determinant of consumer satisfaction is fairness of price. Call clarity is also found to have a significant relationship with customer satisfaction and consumer retention (Ali et

al., 2010). In addition, they suggested that continuously satisfied customers were the key success factor for service provider to retain. Similarly, the main cause of customers were the desire to change their handsets or displeasure with provided service characteristic e.g. price plan and call quality in the Korean mobile market (H.-S. Kim & Yoon, 2004). Furthermore, the strong relationship of price, user satisfaction and loyalty in B2C (Business-to-Customer) has been found in many empirical studies (Hidalgo, Manzur, Olavarrieta, & Farias, 2008; Kukar-Kinney, 2006).

Nevertheless, telecommunication services in Thailand have been governing under competition legislations to prevent product supply shortages and protect consumers from abusive pricing of products (Trade Competition Act, 1999). In addition, there are many Industrial-specific legislations that related to cost for operators in Thailand to set up their price plans such as Interconnection-charge regime (NTC, 2007), 99-satang-a minute rule: maximum cellular call rate 99 satang per minute (NBTC, 2012), accounting separation implementation, and market competition.

CHAPTER II LITERATURE REVIEW

Prior research related to mobile service usage has been reviewed in order to better understand mobile users' behavior and for developing a conceptual model that will help predict potential usage. The developed model is based on an extended Technology Acceptance Model. This literature review consists of four main sections that aim to review theoretical and methodological contributions to a particular topic and current technical knowledge as follows.

1. Innovative price plan prediction model
 - 1.1 The Technology Acceptance Model (TAM)
 - 1.2 Customer behavior of mobile services
 - 1.3 Price plan in Thai mobile telecommunication service provider
 - 1.4 Conceptual framework
2. Statistical control charts
3. Decision Support Systems

2.1 Innovative price plan prediction concept

2.1.1 The Technology Acceptance Model (TAM)

There are many models from previous research that explain consumer adoption and acceptance patterns to new technologies. Among these, the Technology Acceptance Model (TAM) has been employed to measure the acceptance of the products and services. The TAM Model (Davis, 1989) is used to foretell a user's acknowledgement of Information Technology (IT) and their usage by applying a measure of BI (behavioral intention to use) that seems to correlate with real usage (Turner et al., 2010). This can provide information on perceived usefulness and ease of use. The TAM model is a valid and robust predictive that has been used extensively (King & He, 2006). Furthermore, the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003) is used to describe the adoption possibilities and acceptance patterns of new technology. Meanwhile, the diffusion of innovation (Rogers, 2003) is used to describe the adoption and/or diffusion of technological information and communication based on five innovative characteristics: the relative advantage, the compatibility, the complexity, the trialability and the observability. The development of Technology Acceptance Model (TAM) is defined as Table 2-1.

Table 2-1 The development of Technology Acceptance Model (TAM)

Source	Year	Technology Acceptance Model
Ajzen and Fishbein	1980	Theory of Reasoned Action (TRA) is one of the most fundamental and influential theories of human behavior. To discover the impacts of external variables on a user's perceptions, attitudes, intentions, and actual usage of the technology.
Davis et al.	1989	Technology Acceptance Model (TAM) is based on the Theory of Reasoned Action (TRA). TAM is to predict user acceptance of information Technology and their usage with two specific variables, perceived usefulness (U) and perceived ease of use (EU) and the dependent variable behavioral intention (BI). By using this model, almost 40% of the variance in attitude towards use can be explained. (Hu et al., 1999)
Ajzen	1985, 1991	Theory of Planned Behavior (TPB) was extended from TRA by adding perceived behavioral control in the model. Therefore the constructs of TPB are attitude, subject norm, and perceived behavioral control
Venkatesh and Davis	2000	Technology Acceptance Model 2 (TAM2) is to predict user acceptance of information Technology and their usage with two particular variables, perceived usefulness and ease of use, which did not include "Attitude Toward Use" and incorporated additional variables to perceived usefulness.
Pedersen et al.	2003	TPB-based adoption model was modified and extension of the theory of planned behavior (TPB) to study the adoption of mobile services and proposing adoption model difference across service categories and user segments.
Venkatesh et al.	2003	Unified Theory and Acceptance and Use of Technology model (UTAUT) is adapted from original TAM model, has three direct determinants of behavioral intention: performance expectancy, effort expectancy and social influence; one direct determinant of use behavior: facilitation conditions. All factors to behavior intention and use behavior are moderated by gender, age, experience, and voluntariness of use.

Source	Year	Technology Acceptance Model
Rogers	2003	Diffusion of Innovation Model described the innovation-diffusion process and proposed five attributes of innovation to explain rate of adoption of innovation which are relative advantage, compatibility, complexity, trialability and observability.
King and He	2006	Technology Acceptance Model with incorporated with four major categories of factors; these included external factors, contextual factors, other factors from other theories and consequence measures

The TAM model has been applied in many studies in order to test users' acknowledgement of information technology and to predict potential usage. Nevertheless, many studies have employed a modified version rather than the original TAM model. Over the years, researchers have tried to develop various constructs based on the Technology Acceptance Model (TAM). Nevertheless, many of the previously developed models are similar to the original TAM model and only differ in terms of the application context. Since the TAM model is a well-embraced concept that is widely applicable, this research also developed a model in the mobile service context based on the TAM model. TAM utilizes two measurements: one is perceived usefulness and the other is perceived ease of use; both of these show a significant correlation between current usage and future usage (Davis, 1989).

Perceived usefulness, according to Davis (1989), was the degree to which a person sees that he or she can increase one's ability by using a specific system.

Perceived ease of use, Davis (1989), was defined as the degree to which a person believes that by using a specific system, he or she would do things much easier.

In Davis (1989) studies, perceived usefulness shows a significant relationship with user behavior comparing to the perceived ease of use.

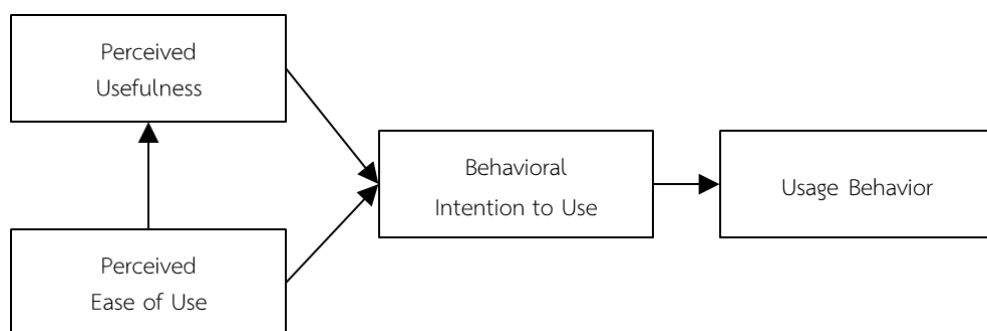


Figure 2-1 Technology Acceptance Model (Davis, 1989)

The TAM model has been continuously developed in various industries such as information technology, government, healthcare, education and tourism. There are four major factors that can help to increase TAM's predictive power: external factors, specific factors derived from different contexts, contextual factors and consequence factors (King & He, 2006). As in Table 2-2 which shows the summary of prior studies of TAM model in mobile service context. According to Harris, the differences in mobile data service adoption and usage across countries may be associated with factors such as an infrastructure of mobile telecommunications, an offer from range of mobile data services, marketing plans by service providers, and cultural influences upon the use of mobile data service (Harris et al., 2005). Hence, other adoption factors in mobile network operators will be explored in this study.



Table 2-2 Summary of prior studies of TAM model in mobile service context

Author	Year	Research area	Population studies and setting	Statistical Analysis	Sample size (N)	Response rate	Variance explained
Lu, J., Liu, C., Yu, C.-S., & Wang, K.	2008	Mobile data service	1,432 participants in several metro cities across China	Structural equation model (SEM)	1,432		-
Yang, K., & Jolly, L. D.	2009	Mobile data service	Participants were from mobile service users in America and Korea	Structural equation model (SEM)	400	100%	-
Teng, W., Lu, H.-P., & Yu, H.	2009	3G Mobile phones	The participants of open enrolment courses or evening classes in a university in Taipei	A confirmatory factor analysis (CFA) By using LISREL 8.5	500	67%	-
Jung, Y., Perez-Mira, B., & Wiley-Patton, S.	2009	Mobile TV	Mobile TV users in South Korea and conducted by Web-based survey with 216 questionnaires were collected over three-week survey period	Structural equation model (SEM)	216	96%	-
Wei, Marthandan, Chong, Ooi, & Arumugam,	2009	m-commerce	Data was collected from mobile device users in Malaysia due to likely to	Correlation and multiple regression	222 (Mobile device users)	94.09%	-

Author	Year	Research area	Population studies and setting	Statistical Analysis	Sample size (N)	Response rate	Variance explained
			adopt m-commerce				
Revels, J., Tojib, D., & Tsarenko, Y.	2010	Mobile service (m-service)	Participants who had prior experience with using m-commerce services	Confirmatory Factor Analysis by using AMOS 17.0 and examined using the Structural Equation Model (SEM)	151	-	-
Indrawati, Raman, M., & Chew, K.-W.	2010	3G Mobile Multimedia Services	154 respondents that are mobile phone users but non 3G users in Indonesia	-	-	-	-
Wu, C.-S., Cheng, F.-F., Yen, D. C., & Huang, Y.-W. (2011)	2011	Wireless technologies for Business-based mobile commerce services	Employee in organizations that bring mobile commerce into practice	A confirmatory factor analysis (CFA) By using LISREL	231	86%	69-73%

Author	Year	Research area	Population studies and setting	Statistical Analysis	Sample size (N)	Response rate	Variance explained
Lu, Y., Yang, S., Chau, P. Y. K., & Cao, Y.	2011	Mobile Payment	Carried out two rounds of data collection through a web-based survey.	A Confirmatory analysis and partial least square (PLS-Graph version 3.01060)	961 valid responses	-	
Kim, K. K., Shin, H. K., & Kim, B.	2011	New mobile communication services	1,016 mobile service subscribers	The partial least squares (PLS)	1,016		
Shin	2012	VoIP over mobile phones	There are 2 rounds of collection (online survey and marketing firm)	A confirmatory factor analysis (CFA) , The reliability and validity of the measurement were evaluated with AMOS 18	353 (Online survey), 94 (Korean users of mobile internet service)	93% (Online survey)	52%
Chong, Chan, & Ooi	2012	Mobile Commerce (m-commerce)	Data was collected at various mobile phone shops in Malaysia and	Factor Analysis, Regression Analysis	394	100%	-

Author	Year	Research area	Population studies and setting	Statistical Analysis	Sample size (N)	Response rate	Variance explained
			China				
Wang, K., & Chien-Liang Lin.	2012	Mobile Value-added service	An online survey involving 304 subjects	A partial least square (PLS)	389	78%	-
Chong, A. Y.-L., Ooi, K.-B., Lin, B., & Bao, H.	2012	3G	Data is collected from Chinese consumers via self-administered questionnaire	Structural equation model (SEM)	-	-	-
Cecere and Corrocher	2012	VoIP use	Individuals who have used the internet in the last 3 months which collected by Italian Statistics Office (ISTAT)	Factor Analysis	13,363	78%	-
Islam, Low, & Hasan	2013	Advanced mobile phone services	Quantitative study with questionnaire survey from young people in Dhaka, Bangladesh.	Regression Analysis	130	92%	-

2.1.2 Customer Behavior of mobile services

Most consumers seem to find additional benefits through a product's use, and the said advantage may depend on the network externalities added into the service (Moore and McKenna, 1999). Therefore, it is believed that what customers perceive is most important at the initial adoption stage. With reference to Teng, Lu & Yu (2009), technology does not count as an important factor influencing a consumer's intention to adopt because most consumers do not have insightful information on a distinct service (Teng, Lu, & Yu, 2009). Considered as core variables in TAM, perceived usefulness and ease of use affect a user's view and behavioral intentions in regard to choosing a technology system (Schepers & Wetzels, 2007); furthermore, they have been shown to be important to a user's perceptions of mobile services. Previous studies (Pagani, 2004; Teng et al., 2009) have demonstrated that the correlation between perceived expense and adoption intention is related to age and financial level. Demographic variables may be moderating variables with respect to adoption in a model consisting of gender, age, and financial level. In addition, research on m-commerce adoption recommended that future studies should focus on the investigation of user demographic profiles, as this may help predict customers' intention to use m-commerce (Wei, Marthandan, Chong, Ooi, & Arumugam, 2009).

Pricing plan optimizations are emphasized as the key element of company strategies in the mobile communication sector. Lewis (2005) discovered that focusing on identifying dynamic customer behavior through pricing schemes resulted in an increase in the long-term profits of an organization. Therefore, understanding customer behavior in regard to mobile services may enable mobile network operators to prevent churn in a saturated market (Ahn, Han, & Lee, 2006).

According to today's Total Quality Management concept and philosophy, focusing on customers (Khan, 2003) quality, customer satisfaction, and continuous improvement (Karia & Asaari, 2006) have been identified as the key components in terms of both product and service. While views on quality depend on an organization's characteristics, in summary it can be said that a company tries to satisfy customers by meeting their needs. In practice, some previous research has pointed out that increasing customer satisfaction is a goal of TQM (Draghici & Petcu, 2010). In order to survive, organizations need to work closely with customers (Andersson, Eriksson, & Torstensson, 2006) and maintain a focus on continued improvement of customer satisfaction (Dahlgard, Kristensen, & Kanji, 1998).

In service firms, customer satisfaction and loyalty have a positive impact on a company's financial performance as measured by revenue growth and profitability. When compared with product firms, customer satisfaction has almost twice the total impact on the revenue growth of

service firms (Edvardsson, Johnson, Gustafsson, & Strandvik, 2000). For this reason, mobile operators should consider customer satisfaction and loyalty as critical factors. Sustaining relationships with customers over the long run will lead to decreased churn, and in turn result in greater profitability. However, companies should keep in mind that mobile services must match with customers' habits if they are to deliver added value (Bouwman, Vos, & Haaker, 2008).

From the literature review, the traditional TAM model does not cover all concerns in behavioral intention for using mobile services. This study will incorporate twelve independent variables including demographic profile. Some variables consist of various determinants that have similar characteristics and are closely related. The demographic profile of Thai subscribers has also been added as another variable. Each variable is explained as Table 2-3.



Table 2-3 Mobile services variables correlation

Independent Variables	Dependent Variables					
	Perceived usefulness	Perceived ease of use	Social Influence	Attitude	Behavioral Intention	Usage Behavior
1. Perceived usefulness				●	●	
2. Perceived ease of use	●			●		
3. Social influence					●	
4. Facilitation conditions	●	●				
5. Perceive enjoyment					●	
6. Perceived expense					●	
7. Variety of services	●					
8. Trait			●			
9. Trust	●	●				
10. Trialability		●				
11. Perceived risk					●	
12. Perceived no need					●	
13. Attitude					●	
14. Demographical profile					●	
15. Behavioral intention						●

NOTE: ● indicates +/- Correlation for proposed hypothesis

2.1.2.1 Perceived usefulness

Perceived usefulness, according to Davis (Davis, 1989), is the degree to which a person sees that he or she can increase one's ability by using a specific system. Many studies have shown that perceived usefulness is a primarily determinant for the adoption mobile service (Chong, Ooi, Lin, & Bao, 2012; Jung, Perez-Mira, & Wiley-Patton, 2009; Pagani, 2004; Shin, 2011; K. Wang & Lin, 2012; C.-S. Wu, Cheng, Yen, & Huang, 2011).

Furthermore, the relative advantage in innovation diffusion theory (Rogers, 1995) positively affects attitude toward behavioral intention to adopt Multimedia Messaging Service (Kim, Shin, & Kim, 2011; Lu, Yang, Chau, & Cao, 2011). According to Venkatesh et al. (2003) Performance expectancy was shown to negatively affect 3G MMS adoption in Indonesia due to bad network connection (Indrawati, Raman, & Chew, 2010). Functional value was found to affect mobile data

services' attitude in United states and Korea (Yang & Jolly, 2009). Perceived usefulness did not have significant relationship with mobile commerce (m-commerce) adoption in China and Malaysia due to familiarity with mobile phones. Nevertheless, a study on consumers' intention to use mobile service for post-adoption behavior (Revels et al., 2010) found that perceived usefulness positively affected customers' satisfaction with mobile service. Therefore, perceived usefulness is believed to have a crucial impact on attitude toward behavioral intention to use mobile services.

2.1.2.2 Perceived ease of use

Perceived ease of use, according to Davis (1989) is the degree to which a person believes that by using a specific system, he or she would do things much easier. Many of empirical researches have shown that perceived ease of use is a main determinant for the adoption of mobile service (Chong, Ooi, et al., 2012; Jung et al., 2009; Pagani, 2004; Shin, 2011; K. Wang & Lin, 2012; C.-S. Wu et al., 2011). Some studies have shown that perceived ease of use had a strong predictor of perceived usefulness (Revels et al., 2010). The effort expectancy in UTAUT model (Venkatesh et al., 2003) negatively affected the use of 3G Mobile Service devices due to difficulty of use (Indrawati et al., 2010). Nevertheless, perceived ease of use did not have identical correlation to a consumers' decision to use mobile commerce in China and Malaysia due to high penetration rate of mobile phones. In multimedia messaging services, perceived ease of use was counted as a key determinant that influences attitude toward behavioral intention and relative advantage (Kim et al., 2011). Therefore, perceived ease of use is believed to have a positively correlation with perceived usefulness and has direct impulse on attitude in regard to the use of mobile services.

2.1.2.3 Social influence

Venkatesh et al. (2003) defined the social influence to be a degree to which an individual perceives toward what the others believe that an individual should use the new system and it was a direct determinant of behavioral intention to use (Baron, Patterson, & Harris, 2006; Chong, Chan, & Ooi, 2012; Chong, Ooi, et al., 2012; Indrawati et al., 2010; Venkatesh et al., 2003). Social influence was represented as subject norm in Theory of Reasoned Action model (TRA) (Fishbein & Ajzen, 1975).

Many empirical studies (K. K. Kim, Shin, & Kim, 2011; Yang & Jolly, 2009) have shown that subject norm had an important relationship with behavioral intention. Social value had negatively effect on intention to use mobile data service (Yang & Jolly, 2009). However, examination of Lu, Liu, Yu, & Wang (2008) has demonstrated that social influences did not have an important impact on both perceived ease of use and perceived usefulness of WMDS (Wireless Mobile Data Service).

Image from Innovation Diffusion Theory (IDT) (Rogers, 1995) was one of the three constructs related to social influence: subjective norm, social factor and image. In prior research, image directly affected customers intention to use mobile payment services (Lu, Yang, Chau, & Cao, 2011). However, Revels et al. (2010) argued that perceived image did not have significant affected customer satisfaction with mobile service in Australia. Therefore, social influence is supposed to have a direct impact towards behavioral intention in regard to use mobile service.

2.1.2.4 Facilitating conditions

Facilitating conditions in the view of Venkatesh et al. (2003) is the degree to which one's belief regarding an existing organizational and technical infrastructure supports the use of system. There were two main constructs from previous studies on facilitating conditions: perceived behavioral control from TPB (Ajzen, 1991) and compatibility from IDT (Rogers, 1995). In one study of MMS usage (Kim et al., 2011), the result showed that technology-facilitating conditions influenced perceived behavioral control toward MMS behavioral intention while perceived credibility of MMS influenced user attitude toward behavioral intention and usage. Indrawati et al. (2010) modified the UTAUT Model from Venkatesh et al. (2003) proposing a conceptual model for behavioral intention to use 3G Mobile Multimedia Services in the country of Indonesia. The study demonstrated that the effect of facilitating conditions on behavioral intention resulted from age and gender; however, in the area of wireless internet data services via mobile phone, facilitating conditions had a clear effect on perceived usefulness (Lu, Liu, Yu, & Wang, 2008).

In an mVoIP context (Shin, 2012), the effect of call quality was shown to have an influence on perceived usefulness, while mobility and coverage positively influenced perceived ease of use. Service quality was found to significantly affect both perceived usefulness (Chong, Ooi, et al., 2012; Shin, 2012; K. Wang & Lin, 2012) and perceived ease of use (K. Wang & Lin, 2012). According to Wang & Lin (2012), the important factors affecting perceived usefulness and perceived ease of use are the quality of information and system. Therefore, the facilitating conditions are expected to have an important influence on perceived usefulness and ease of use in regard to using mobile services.

2.1.2.5 Perceived enjoyment

Perceived enjoyment has been defined by Venkatesh (Venkatesh, 2000) as one can sense the pleasure and joy at its own right by performing an activity. Venkatesh (2000) have shown that perceived enjoyment played an important role on perceived ease of use. In study of World-Wide-Web (WWW), the "perceived playfulness" was added into the TAM to study WWW acceptance and usage behavior (Moon & Kim, 2001). In terms of mobile data service, the empirical study have shown that the emotional value was concerned as the strongest effect on attitude and had the most significant value to using mobile data service in both Korea and United states. The

emotional value had a greater impact in Korea than United states because of more development in the entertainment aspect (Yang & Jolly, 2009). The study of Revels et al. (201) for post-adoption behavior indicated that perceived enjoyment was the strongest driver and predictor of customer satisfaction in regard to the use mobile service. Therefore, perceived enjoyment is expected to create direct impact on behavioral intention to use mobile services.

2.1.2.6 Perceived expense

Perceived expense was one of the barrier that drove consumers away from mobile services adoption. When customers intended to buy the services, they have weighted a benefit against cost before making a purchase. If they perceived that the expense was greater than the benefits of their use, the willingness of purchase may be reduced. Therefore, perceived expense was shown to have an influence on customer behavior in regard to the use of mobile service. Based on a qualitative study of consumer adoption to using 3G MMS (Indrawati et al., 2010), price was ranked the third factor in adopting mobile service after perceived usefulness and perceived ease of use. In addition, many experimental-based studies have shown that price was the most important determinant (Pagani, 2004; Teng et al., 2009) to adopt mobile service (Indrawati et al., 2010).

Perceived cost (Chong, Chan, et al., 2012; Lu et al., 2011; Revels et al., 2010) and monetary value (Yang & Jolly, 2009) were found to have a significantly negative affect to use mobile data service. While other research has shown that the perceived cost did not have an influence on attitude toward MMS usage behavioral intention (Kim et al., 2011) and consumer intention to adopt m-commerce respectively (Chong, Chan, et al., 2012). Therefore, perceived expense is expected to have a significant impact on customer intention in regard to use mobile services.

2.1.2.7 Variety of services

It has been found that variety of services had a significant effect on customers' desire to adopt m-commerce (Chong, Chan, et al., 2012) but this did not influence the perceived usefulness of 3G adoption (Chong, Ooi, et al., 2012). Content is one service factor affecting 3G adoption as confirmed by a number of empirical studies on customer intention to use 3G MMS (Indrawati et al., 2010) and the perceived usefulness in regard to use mobile TV (Jung et al., 2009). Therefore, variety of services is believed to have a direct impact on perceived usefulness and customer intention to use mobile services.

2.1.2.8 Trait

Peer influence played as a key role in shaping subject norm. The empirical studies demonstrated that the psychological trait of self-efficacy and peer influence were important

factors to behavioral intention to use MMS (Kim et al., 2011). Therefore, trust is expected to have a direct effect on social influence and behavioral intention to use mobile services.

2.1.2.9 Trust

Trust has been defined as the confidence of a person with respect to the actions of another (Allen & Wilson, 2003; Mayer, Davis, & Schoorman, 1995). Trust is positively related with a consumer's decision to use mobile service in many areas such as mobile commerce (Chong, Chan, et al., 2012), mobile payment service (Lu et al., 2011), and Wireless Mobile Data Service (Lu, Liu, Yu, & Wang, 2008). In addition, Lu et al. (2008) discovered that trust had an important effect on perceived usefulness and perceived ease of use. Nevertheless, Chong, Ooi, et al. (2012) found that trust was not counted as a significant effect to the relationship with intention to use 3G in China due to confidence with 3G technology and belief in security/privacy. Therefore, trust seems to have a direct impact on the perceived usefulness and perceived ease of use in regard to the use of mobile services, which results from a customer's intention.

2.1.2.10 Trialability

From empirical analysis of 3G adoption in China, trialability was found to have positively affected the perceived ease of use. While it did not have an influence on perceived usefulness (Chong, Ooi, et al., 2012). In mobile commerce context, trialability has shown inconsistent results from Chong, Chan, et al. (2012) regarding mobile commerce adoption in China and Malaysia. Therefore, trialability is expected to have a direct impact on the perceived ease of use in regard to the use of mobile services which results from a behavioral intention.

2.1.2.11 Perceived risk

Perceived risk has been defined by Bauer (1967) as an outcome from the combination of uncertainty and seriousness. The uncertainty upon the possible unpleasant consequences to use products or services was commonly claimed to be a perceived risk. If consumers are aware of the product's high risk or high expenses compared with the advantages, they might delay their usage or purchasing decision. Risk was a crucial reason that affected a consumer's adoption. Perceived risk has been identified in many studies as one potential barrier to adoption, included extended TAM. For instance, Lu et al., (2011) found that perceived risk had negatively affected user behavioral intention to make a payment on mobile. Furthermore, some studies demonstrated that perceived risk was a crucial inhibitor to e-service adoption and 3G mobile phones (Featherman & Pavlou, 2003; Teng et al., 2009). Therefore, perceived risk is expected to have a direct impact toward customer intention to use mobile services.

2.1.2.12 Perceived no need

Perceived no need has been defined by Engel, Blackwell, & Miniard (1993) as the condition when one's desire couldn't be completed or fulfilled due to the actual state. Perceived no need was shown to negatively affect 3G mobile phone adoption (Teng et al., 2009).

Therefore, perceived no need is expected to create a direct influence on customer intention in regard to the use of mobile services.

2.1.2.13 Attitude

Attitude has been found to have a positively influences on behavioral intention to use mobile service and usage behavior (K. K. Kim et al., 2011; Shin, 2012; C.-S. Wu et al., 2011) including extended TAM from previous empirical researches (King & He, 2006; Schepers & Wetzels, 2007; Turner et al., 2010; K. Wu, Zhao, Zhu, Tan, & Zhengb, 2011). From a telecommunication business perspective, attitude was the most influential factor with respect to the behavioral intention to use mobile internet (Cheong & Park, 2005). Therefore, attitude is expected to have an important influence on behavioral intention in regard to use mobile service in Thailand.

2.1.2.14 Behavioral intention

Behavioral intention theory and previous empirical studies (Ajzen, 1991; Davis, Bagozzi, & Warshaw, 1989; Fishbein & Ajzen, 1975) have clearly confirmed that attitudes strongly influence the intention to use and have a direct effect on usage behavior (Venkatesh et al., 2003).

2.1.2.15 Demographic profiles

Demographic profiles are commonly used to examine and identify customer demographics including gender, age and education level. The impact of demographic profiles has been investigated in much previous researches (Chong, Darmawan, Ooi, & Lin, 2010; Chong, Ooi, et al., 2012; Wei et al., 2009). Previous empirical research has shown that the demographic profiles had a direct effect on internet usage (Teo, 2001). Having access to subscriber profiles will help mobile network operator understand behavior in each segment and enable them to develop appropriate strategies for their subscribers.

The summary of the definition of 15 core variables including demographic profiles are illustrated in this research (see Table 2-4 and Table 2-5)

Table 2-4 Definition and reference cited for each core variable

Core variables	Determinants	Definitions
Perceived Usefulness/ Relative advantage /Compatibility (Davis, 1989)/(Rogers, 2003)	Perceived of Usefulness	“the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989).
	Performance Expectancy	“The degree to which an individual believes that using the system will help him or her to attain gains in job performance” (Venkatesh et al., 2003).
	Relative advantage	“the degree to which an innovation is perceived as being better than the idea it supersedes” (Rogers, 2003).
	Compatibility	“the degree to which an innovation is perceived as being consistent with the existing values, needs and past experiences of potential adopters” (Rogers, 2003).
Perceived Ease of Use/ Complexity (Davis, 1989)/ (Rogers, 2003)	Perceived Ease of Use	“the degree to which a person believes that using a particular system would be free of effort” (Davis, 1989).
	Effort Expectancy	“the degree of ease associated with the use of the system” (Venkatesh et al., 2003).
	Complexity	“the degree to which an innovation is perceived as relatively difficult to understand and use” (Rogers, 2003).
Social influence (Venkatesh et al., 2003)	Social influence	“the degree to which an individual perceives that it is important others believe he or she should use the new system” (Venkatesh et al., 2003).
	Social value	“the utility derived from the product’s ability to enhance social self-concept” (Sweeney & Soutar, 2001).
	Subjective norm	“the person’s perception that most people who are important to him think he should or should not perform the behavior in question” (Fishbein & Ajzen, 1975).
	Image	“the degree to which use of an innovation is

Core variables	Determinants	Definitions
		perceived to enhance one's image or status in one's social system" (Moore & Benbasat, 1991)
Facilitating Conditions /Compatibility (Venkatesh et al., 2003)/(Rogers, 2003)	Facilitating Conditions	"the degree to which an individual believes that an organization and technical infrastructure exists to support use of the system" (Venkatesh et al., 2003).
	Coverage	Ability for mobile phone to connect to a carrier base station depends on the strength of the signal (Shin, 2011).
	Perceived utility of a new technology	"a consumer's overall assessment of the utility based on the perceptions of what is obtained from the technology" (Zeithaml, 1988).
	Perceived utility of a new service	"a consumer's overall assessment of the utility based on perceptions of what is obtained from the service" (Zeithaml, 1988).
	Perceived utility of a new handset	"a consumer's overall assessment of the utility based on perceptions of what is obtained from the handset with a new telecommunications technology" (Zeithaml, 1988).
	Perceived Creditability	The quality or power of inspirational belief in security, consistency and ability (Kim et al., 2011).
	Perceived behavioral control	"the perceived ease or difficulty of performing the behavior" (Ajzen, 1991).
	Call quality	"refers to voice quality and data speed" (Shin, 2011).
	Information Quality	"the ability of the system to convey the intended meaning of intended meaning of information" (DeLone & McLean, 1992)
	System Quality	"focuses on the technical level of success of a system with respect to information production" (DeLone & McLean, 1992)
Service quality	"refers to customer support aspects, including reliability, responsiveness, and assurance"	

Core variables	Determinants	Definitions
		(Shin, 2012).
	Functional Value	“the utility derived from the perceived quality and expected performance of the product” (Sweeney & Soutar, 2001)
	Mobility	Capability for customer to be able to move to different physical locations and use a device (Shin, 2012).
	WMDS Technology	Utility based on wireless mobile data service (WMDS)
Perceived enjoyment (Venkatesh et al., 2003)	Perceived enjoyment	“the degree to which performing an activity is perceived as providing pleasure and joy in its own right” (Venkatesh, 2000).
	Perceived playfulness	“a relatively enduring tendency, while being playful represents a temporary state at some specific time” (Moon & Kim, 2001)
	Emotional value	“the utility derived from the feelings or affective states that a product generates” (Sweeney & Soutar, 2001).
	Cognitive concentration	“the extent to which an individual attention is absorbed by the activity” (Hoffman & Novak, 1996)
Perceived expense (Voss, Parasuraman, & Grewal, 1998)	Perceived expense	“the monetary sacrifices necessary to obtain a new mobile phone and services” (Voss et al., 1998).
	Perceived cost	The monetary expense included the actual mobile equipment and access cost included mobile transaction fee (Revels et al., 2010).
	Monetary value	“the utility derived from the product due to the reduction of its perceived short term and longer term costs” (Sweeney & Soutar, 2001).
Variety of Services (Chong, Chan, et al., 2012)	Variety of Services	Capability for operator to provide various of services (Chong, Chan, et al., 2012).
	Content	Capability for operator to offer content as consumer desired (Jung et al., 2009).

Core variables	Determinants	Definitions
Traits (Baron et al., 2006)	Self-Efficacy	“ an individual ’s belief in his or her capability to perform a specific task at a specific level of performance” (T. Lin, and Huang, C. , 2009)
	Consumer traits	Individual consumer characteristics (Baron et al., 2006)
	Peer influence	“peer pressure along with superior influence and social influence shape and individual’s opinion and decision” (Taylor & Todd, 1995).
Perceived risk (Bauer, 1960)	Perceived risk	“the degree of uncertainty or fear experienced by a consumer regarding the consequences when considering the purchase of a mobile phone with a new telecommunication technology” (Bauer, 1960).
	Personal innovativeness in information technology (PIIT)	Willingness of an individual to try out any new IT (Lu, Liu, Yu, & Wang, 2008).
Trust (Mayer et al., 1995)	Trust	“the willingness of a party to be vulnerable to the actions of another party based on the expectation that the latter one will perform particular actions, which are important to the former one” (Allen & Wilson, 2003; Mayer, Davis, & Schoorman, 1995).
Trialability (Chong, Ooi, et al., 2012)	Trialability	Free trials are more likely to accept a new technology (Chong, Ooi, et al., 2012).
Perceived no need (Engel, Blackwell, & Miniard, 1993)	Perceived no need	“when the perceptible difference between the actual and desired states with respect to a particular need or want is not considerable” (Engel et al., 1993).

Table 2-5 Demographical profile and reference cited for each demographic

Demographical profile	Reference cited
Demographic variable	Gender (Chong, Chan, et al., 2012; Chong, Ooi, et al., 2012; Indrawati et al., 2010; Shin, 2012; Venkatesh et al., 2003)
	Age (Cecere & Corrocher, 2012; Chong, Chan, et al., 2012; Chong, Ooi, et al., 2012; Indrawati et al., 2010; Shin, 2012; Venkatesh et al., 2003)
	Marital status (Cecere & Corrocher, 2012)
	Education level (Cecere & Corrocher, 2012; Chong, Chan, et al., 2012; Chong, Ooi, et al., 2012; Shin, 2012)
	Professional status (Cecere & Corrocher, 2012)
	Region of residence (Cecere & Corrocher, 2012)
	Voluntariness of use (Venkatesh et al., 2003)
	Experience (Baron et al., 2006; Venkatesh et al., 2003)
	Types of service (Shin, 2012)
	Connection (Shin, 2012)
	Types of usage (King & He, 2006)
	Purpose of Uses (King & He, 2006; Shin, 2012)

2.1.3 Price Plan in Thai Mobile Telecommunication Service Provider

In the mobile phone industry, there are two principal ways to pay for mobile telephony: the “pay-as-you-go” (also known as “pre-pay” or “prepaid”) model where a customer pays in advance of the service being consumed or the “contract” model on the other hand where customers are credited to pay bills which issued and settled after the service has been consumed based on either the terms of a contract or on the amount of services they have used. The customer will be billed at a flat rate for any usage equal to or less than the agreed allowance. Extra charges will be applied for any usage above that limit.

Currently, there are four major types of mobile services offered: voice communications, SMS, MMS, and GPRS/3G data service. The purpose of a service charge depends on the nature of mobile service provided. Voice communication (telephoning), mobile subscribers usually pay for the connection time (typically using in-plan or prepaid minutes) for outgoing calls, SMS and MMS will be charged by message, and Time-based (subscribers are charge per minute) /Volume-based (subscribers are charged per megabyte) is charged for data service.

GPRS/3G data service is typically supplied either as part of a bundle with unlimited usage or on a pay-as-you-use basis. Usage above the bundle cap is either disallowed or charged per minute/megabyte. The pay-as-you-use charge is typically per megabyte of traffic. In addition, bundled services benefit consumers through offering lower prices and increasingly popular in OECD countries (OECD, 2011).

The recent statistics (OECD Communications Outlook 2005) revealed that the percentage of prepaid accounts from the total mobile phone market in the OECD region is 40%. It is increasingly common for a consumer to purchase a basic/main package and then top-up services and functionality to create a subscription customized to the users’ needs.

The current structures of price plan of Thai Mobile Telecommunication Service Provider are listed as below;

1. Main package
2. Additional package

2.1.4 Conceptual framework

In order to develop and offer suitable price plans for their customers, a company has to understand the key factors which directly impact customers’ behavior on using mobile services. A conceptual framework of subscriber usage behavior model of Thai mobile market is created based on the above literature review as shown in Figure 2-2. The extended TAM framework is carefully intended to examine the causes influencing the adoption of mobile services. This study proposes a mobile service acceptance model that includes the perceived usefulness, the perceived ease of use and key determinants that show an indicative impact on a user’s decision

in adopting mobile services. From literature review, the traditional TAM model does not cover all aspects of usage behavior in regard to mobile service. This study will incorporate fourteen constructs with a demographic profile into the original TAM. The summary of core constructs from TAM prior research is shown as Table III.

In order to explain customer behavior and predict potential usage, this research proposed to examine the following structural relationships based on the previous research using the Technology Acceptance Model (TAM).

H1a. Trust of mobile service has an influence on perceived usefulness in regard to the use of mobile service in Thailand.

H1b. Trust of mobile service has an influence on perceived ease of use in regard to the use of mobile service in Thailand.

H2. Trialability of mobile service has an influence on perceived ease of use in regard to the use of mobile service in Thailand.

H3. Variety of services has an influence on perceived usefulness in regard to the use of mobile service in Thailand.

H4a. Facilitation conditions have an influence on Perceived usefulness in regard to the use of mobile service in Thailand.

H4b. Facilitation conditions have an influence on Perceived ease of in regard to the use of mobile service in Thailand.

H5a. Perceived ease of use mobile service has an influence on attitude in regard to the use of mobile service in Thailand.

H5b. Perceived ease of use mobile service has an influence on perceived usefulness in regard to the use of mobile service in Thailand.

H6a. Perceived usefulness of mobile service has an influence on attitude in regard to the use of mobile service in Thailand.

H6b. Perceived usefulness of mobile service has an influence on behavioral intention in regard to the use of mobile service in Thailand.

H7. Perceived enjoyment of mobile service has an influence on behavioral intention in regard to the use of mobile service in Thailand.

H8. Perceived expense of mobile service has an influence on behavioral intention in regard to the use of mobile service in Thailand.

H9. Perceived risk of mobile service has an influence on behavioral intention in regard to the use of mobile service in Thailand.

H10. Perceived no need has an influence on behavioral intention in regard to the use of mobile service in Thailand.

H11. Trait has an influence on social influence in regard to use mobile service in Thailand.

H12. Social influence has an influence on behavioral intention in regard to the use of mobile service in Thailand.

H13. Attitude towards mobile service has an influence on behavioral intention in regard to the use of mobile service in Thailand.

H14. Behavioral intention to use mobile service has an influence on subscriber usage behavior in regard to the use mobile service in Thailand.

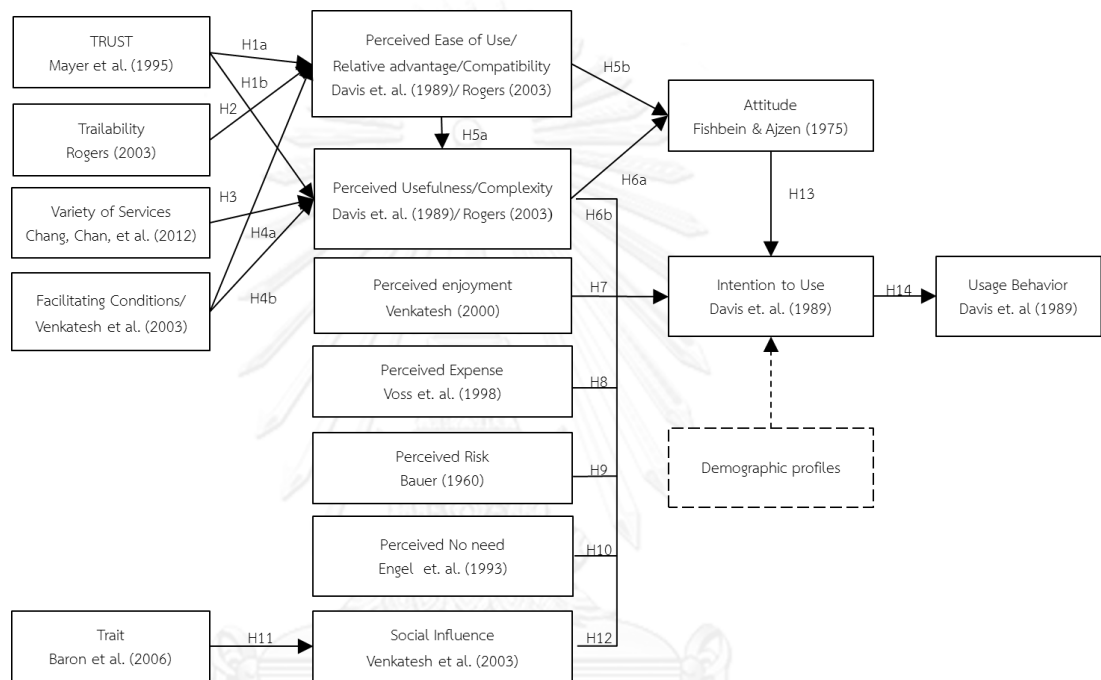


Figure 2-2 A conceptual framework of subscriber usage behavior model of Thai mobile market

2.2 Statistical control charts

A control chart is a tool for Statistical Process Control (SPC) by using statistical data to control the process. It was first developed by W.A. Shewhart (Shewhart, 1931) and was one of the popular techniques of statistical quality control in manufacturing and other industries. The control chart was used to control and monitor processes to indicate that the process currently remains in-control. There are many tools for statistical process controls such as data figures, Pareto analysis, cause and effect analysis, trend analysis, histogram, scatter diagrams, and process control charts (Kerzner, 2009).

A process control chart is a popular widely used tool for monitoring process mean and variation. The main objectives are to prevent defects and improve productivity. In this research, the \bar{X} Chart and R-Chart are used to monitor and evaluate the customer usage behavior.

- The \bar{X} Chart is a control chart that presents the mean or average value of quality characteristics of the process changed over time and often used to monitor the process average or mean quality level of a quality characteristic (Montgomery, 2005). However, this chart is normally applied for repetitive production with high production rate.
- R-Chart is used to monitor the range (variance) of the process.

The advantage of the control charts are created and applied in various industries as Table 2-7. With the benefit of control chart in the process improvement, it increase the process efficiency and financial cost saving (Bischak & Silver, 2004).

Table 2-7 The advantage of the control charts are created and applied in various industries

Application for control charts	Industry	Benefit	Ref.
1. Develop algorithm for managing and deploying manpower by proposing the an M-chart	Manufacturing	To decide the appropriate number of inspectors and/or working time that should be deployed to a process and finally minimize the total cost.	(Z. Wu, Shamsuzzaman, & Wang, 2006)
2. Monitor a drilling process by integration of Statistical process control (SPC) and Automatic process control (APC)	Engineering	To faster detect the start of the transition from stable drilling to chatter vibration	(Gültekin, Elsayed, English, & Hauksdóttir, 2002)
3. Monitor the performance of queuing systems (Service system in which customers arrive at random to receive service) by applying the control charts for attributes data.	Service	To real-time monitor the queue size (customer in the system whom are being served and queued) to indicate a state of instability that requires intervention.	(Shore, 2006)
4. Monitoring overall Hospital-Associated (HA) incidences of infections with variety of control	Healthcare	To detect a change in infection rates in the pediatric ICU and improve infection monitoring practice at the	(Limaye, Mastrangelo, & Zer, 2008)

Application for control charts	Industry	Benefit	Ref.
charts e.g. CUSUM chart, u-chart, g-type control chart		children's hospital	
5. Monitor the variations of density values for the heavy medium vessel circuit and cyclone circuit in the coal washing plant by using a Range (R) control chart and Multidimensional Scaling (MDS) analysis	Energy	To determine the density values in order to help decision maker get more information for effectively management	(Yerel & Ankara, 2011)
6. Performance appraisal with quality control charts when the rating is on the ordinal scale measurement	Human resource management	To aid manager understand variation among workers and distinguish the causes to effect a work system	(Bakir, 2005)
7. Monitoring time and cost of construction project by integrating approach of earn value (EV) and control charts	Project management	To gain more reliable project control and help to discover critical change in duration and cost progress of the project even it's very small trends	(Aliverdi, Moslemi Naeni, & Salehipour, 2012)
8. Monitoring supply network dynamics with control chart by using Kalman filtering (KF) track the system states and the correlation of waiting time between consecutive orders	Supply Network management	To signal potential abnormal event at each monitoring stage in demand requirements, capacity, delivery time, manufacturing time and cost	(S. Wang, Wu, Weng, & Fowler, 2012)

Therefore, this study will apply the control chart in telecommunication industry to monitor and control individual's subscriber usage consumption. In addition, the process capability indices

will be used to indicate the level of fit between subscriber's usage consumption and their chosen price plan.

In this study, a quality control charts, are applied to identify level of fit between usage and their chosen service price plan. They can be used to monitor individual subscriber usage and trigger their exceeded usage. In conclusion, this method could improve the overall level of individual subscriber usage fit. As a result, a company could satisfy their customer and decrease churn finally.

2.3 Decision Support Systems

The aim of this research is to explore and develop the decision support system by using quality control chart to identify subscriber usage behavior and provide critical visibility into subscriber consumption. In addition, using decision support system concept will help mobile network operator increase their revenues and profits. In order to improve subscriber experience, the appropriate price plan will be offered to meet their individual usage consumption needs.

Gorry & Morton (1971) explained a decision support system (DSS) as interactive system. Based on computer performance, it helps management to effectively utilize specific data and models to solves unorganized problem in the organization (Gorry & Morton, 1971). A DSS was a methodology to support the decision making in all phases of decision process. A knowledge component can be also included in the process. DSS usually employed models and was built by an interactive process to support the solution of a certain problem or for evaluation of an opportunity. In general, a decision support system was comprised of four attributes which were data management, model management, knowledge-based and user-friendly interface as key components of the system (Turban & Aronson, 2001). Nevertheless, the technical solution was not the only factor to develop decision support system (Dong & Srinivasan, 2013). There were various important factors that need to be concerned and focused in the system development. Azad et al. (2013) presented that the system, analysis and transaction were important factors which effected to decision supporting system. Whereas, operational decision was a crucial measurement variable for transaction (Azad, Sadeghi, Zarifi, & Farkian, 2013). A Decision Support System (DSS) was designed and utilized for supporting decision making in many areas such as the decision making process by utilizing expert knowledge, spatial data and geographical modeling for wireless communication (Scheibe, Jr., Rakes, & Rees, 2006), decision making framework based on service delivery for managing complexity of business processes in dynamic organization (Dong & Srinivasan, 2013).

CHAPTER III RESEARCH STRATEGY

This study explores the casual relationship by focusing on key determinants that influence the subscriber intention to use mobile service in Thailand as well as develop predictive mobile service acceptance model. Therefore, mobiles subscriber requirement for their selective price plan has been identified by interviewing with management team to get the direction and deeper understanding of dynamic situation in Thailand's telecommunication industry. To reach our main objectives, the research process in this study consists of six phases as follows.

Phase 1: Conceptual framework development

Phase 2: Subscriber usage model development

Phase 3: Monitoring usage tool development

Phase 4: Development of innovative price plan monitoring and advisory system

Phase 5: Validity test of innovative price plan monitoring and advisory system

Phase 6: Application acceptance testing of innovative price plan monitoring and advisory system

The details of research process framework as shown in Figure 3.1.

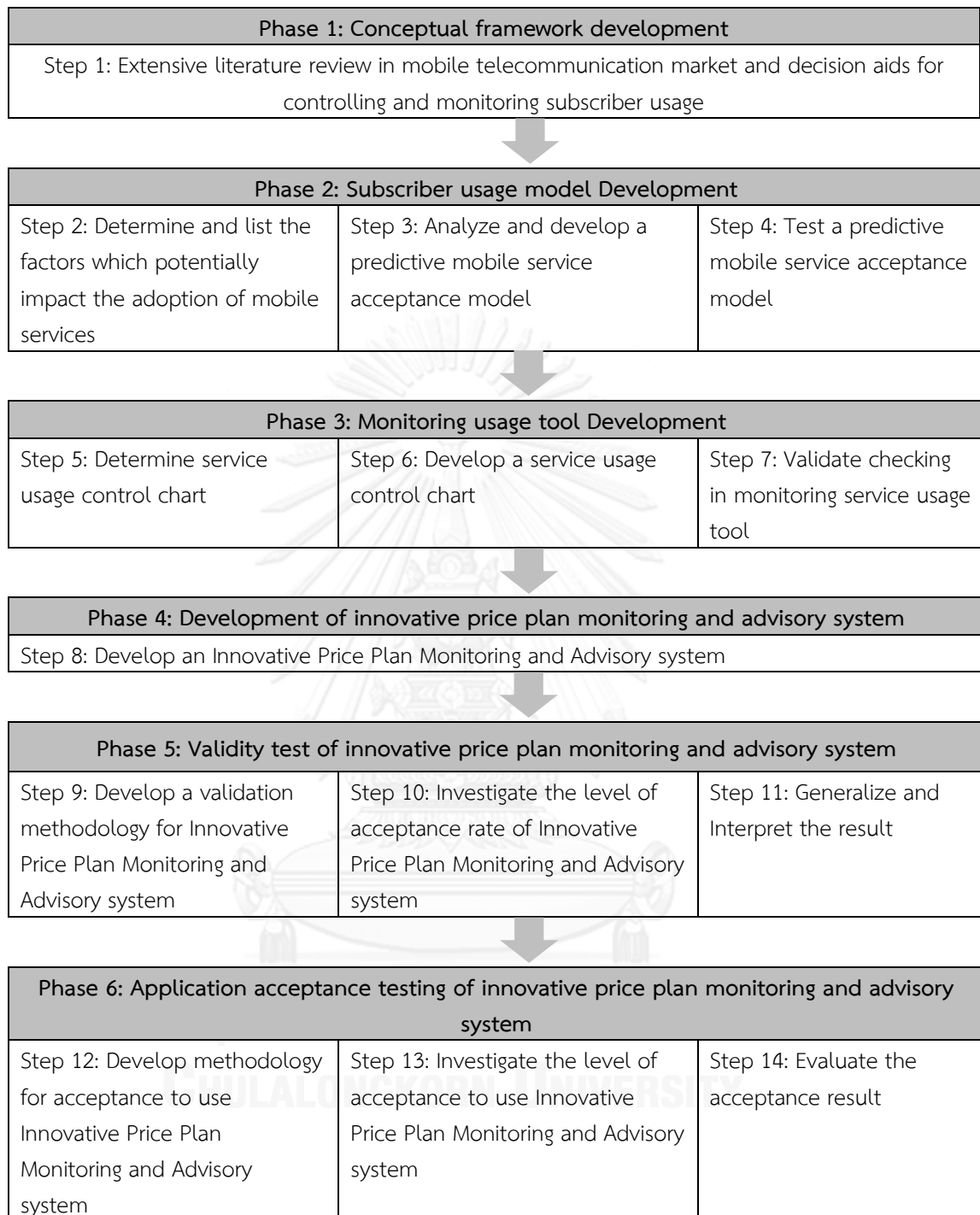


Figure 3.1 The research process framework

3.1 Phase 1: Conceptual framework development

To develop conceptual framework, literatures in Technology Acceptance Model (TAM) and related mobile services context have been reviewed for a better understanding of study area and precisely conceptualize in the research topic. The main objectives of this research are listed below:

1. To explore and understand the existing Technology Acceptance Model (TAM) and their applications
2. To determine the key determinants of Technology Acceptance Model (TAM) in related mobile service context
3. To find out characteristics and behavior of mobile's subscribers
4. To explore the research procedures and methods similar to the research topic to select an effective methodology that is capable of providing valid answer to the research
5. To propose new mobile service acceptance model for prediction price plan in Thailand

After the objective of literature review was set, the following procedures were taken for systematic review to identify current research finding on related topic and potential research method we could use.

1. In order to map a subject focus and relevant content, the online library was identified. Science Direct and ISI Web of Science are the main source for literature searching
2. Effectively search for existing literature in Technology Acceptance Model (TAM) in related mobile service context. The potential search terms were identified as follows.
 - 2.1 Technology Acceptance Model OR TAM
 - 2.2 Technology Acceptance Model OR TAM AND Mobile Service OR Wireless Service
 - 2.3 Consumer adoption OR Consumer behavior AND Mobile Service OR Wireless Service
 - 2.4 Pricing OR Tariff AND Mobile Service OR Wireless Service

The inclusion criteria for this research are:

- a. Peer reviewed journal articles were key considered to review
- b. Focused on Technology Acceptance Model in mobile service context
- c. Qualitative and quantitative empirical studies were included
- d. The duplicate documents were discarded
3. Reviewed and filtered out the related materials.
4. Recorded and summarized the theoretical frameworks and their key methodology for later use reference.
5. Developed a conceptual framework and hypotheses of usage behavior model of Thai mobile market.

3.2 Phase 2: Subscriber usage model development

This phase is designed to develop a conceptual framework for mobile service acceptance in Thailand. The mobile service acceptance model will be analyzed based on previous study's conceptual framework, which related to mobile service context.

3.2.1 Population and data sampling

In this research, one of mobile network operator in Thailand was tasked for case study. Regarding the research scope, the study focused on active customers who have used postpaid service price plan and experienced mismatch price plan in the past. The main reason for choosing this group of customers is that they are majority revenue and operator still has a possibility to increase customer satisfaction by offering the right price plan. The details of sampling criteria are described as below.

Population

This study examined the behavior of postpaid subscribers who had exceeded the usage limits of their package. The characteristics of subscribers were selected as follows

1. Postpaid subscribers who were active status in February 2013.
2. Subscribers who have experienced with mismatch price plan by checking against with current benefit from price plan in last month (30 days).
3. Subscribers who had data usage consumption whether they had data package or not
4. Subscribers who did not have an additional package.

Sample

The 400 subscribers were selected from one mobile network operator in Thailand which 340 subscribers were holding the postpaid package with exceeding limit usage from their own tariff. They owned the numbers and were responsible for the payment themselves. Whereas 60 subscribers were holding the same postpaid package but their usages were within the tariff. The records of target subscribers with usage were sorted in descending and ordering by usage. Systematic random sampling was used to select samples from total population. In order to gain valid information for the analysis, an outbound call survey was conducted. Moreover, to increase the response rate and shorten the interview lead time, 4,000 subscribers were provided upfront. Additionally, a brief session was conducted with the outbound team to ensure a common understanding regarding the queries and sample requirements. The participants were informed the survey purpose and their personal information would be kept strictly confidential. Participants were able to take the survey at another time if it was more convenient for them.

3.2.2 Research variables

The dependent and independent variables measured in this research were developed from previous studies based on literature review. 35 items were used to measure 11 independent variables and 2 items were used to measure dependent variables. The factor that potentially impact the adoption of mobile service were measured using a five-point Likert scale ranging from 1 to 5 (1 = strong disagree; 5 = strongly agree), except for demographic characteristics. The sample questionnaire is attached in the Appendix B.

The variables that potentially impact the adoption of mobile service were listed as follows.

1. Perceived Usefulness/Complexity

Construct	Measure items
Perceived Usefulness/Complexity	PU1: Using mobile services makes my life easier PU2: I use mobile services to pass time

2. Social Influence

Construct	Measure items
Social Influence	SI1: Using mobile services improves my self- image SI2: People who use mobile services are information technology savvy

3. Facilitating conditions

Construct	Measure items
Facilitating conditions	FC1: In using mobile service, I do not experience noise, distortion, echo, and jitter. FC2: I think that the speed of mobile data services is fast. FC3: I think that mobile data services are reliable. FC4: I believe that the content offered by providers is interesting. FC5: I believe that the mobile package offered by providers will satisfy my needs. FC6: I believe that the mobile packages offered by provider are easy to use. FC7: I believe that provider will provide the best signal quality and coverage. FC8: I think that After Sale Service is satisfactory.

4. Perceived enjoyment

Construct	Measure items
Perceived enjoyment	PEJ1: Using mobile services is enjoyable. PEJ2: Mobile services make me want to use them.

5. Perceived expense

Construct	Measure items
Perceived expense	PEP1: The current price of mobile phones is reasonably

Construct	Measure items
	priced.
	PEP2: The total cost of mobile service adoption is expensive
6. Variety of services	
Construct	Measure items
Variety of services	VS1: The current available mobile services/applications are attractive to me.
	VS2: There are many mobile services/applications that meet my needs.
7. Trait	
Construct	Measure items
Trait	T1: I can easily operate the mobile services on my own.
8. Trust	
Construct	Measure items
Trust	TR1: I am sure of the continuous availability (i.e., no breaking down) of the system.
	TR2: I am sure that certain managerial and technical procedures exist to secure all the data being processed on the system.
9. Trailability	
Construct	Measure items
Trailability	TR1: I would like to know more about mobile services/applications before using it.
	TR2: Have free access to mobile services/applications for a month might convince me to use it.
	TR3: Allow me to easily stop unwanted service subscriptions.
10. Perceived risk	
Construct	Measure items
Perceived risk	PR4: The customer service doesn't provide sufficient product knowledge and professional manner

11. Perceived no need

Construct	Measure items
Perceived no need	PN1: There are few occasions when I need to use a mobile phone.

12. Attitude

Construct	Measure items
Attitude	A1: I would have positive feelings towards using mobile services.

13. Intention to use

Construct	Measure items
Intention to use	BI1: I intend to continue using mobile services in the future. BI2: I intend to use mobile data services frequently.

3.2.3 Research instrument

For data collection method, the survey was proposed to gather customer behaviors in using mobile services and their demographical profile via questionnaire. The questionnaire was comprised of four sections, including a measurement scale for assessing the factors that potentially impact the adoption of mobile service. Section 1 was demographic characteristics, which were used to depict the characteristics of the subscribers in the sample e.g. age, gender, experience to use mobile service. Section 2 and 3 assessed factors which potentially impact the adoption of mobile service, attitude and intention to adopt mobile service respectively. The last section, customer satisfaction was assessed. Beside the demographic characteristics was structured by multiple-choice questions. The rest sections were structured by 5 point Likert scale which used to ask respondents to indicate their degree of agreement by checking one of five response categories. The following scales were shown as follows.

Level	Rating scale
Strongly disagree	1
Disagree	2
Neither agrees nor disagrees	3
Agree	4
Strongly Agree	5

To achieve the research objectives and desire results, the six steps required for questionnaire development are listed below.

1. Specified the concepts of the research and defined a suitable data collection mode.
2. Reviewed the existing literatures as well as another data sources or surveys with similar researches, including interviews with mobile industry subject experts as a guidance to construct the question item.
3. Determined the range of issues and questions to be consistent with the objectives and benefits of the research.
4. Constructed and created the draft questionnaires.
5. Content validity was performed by qualitative survey with expert's opinions in order to ensure that the questionnaire would obtain the necessary information and eliminate ambiguous question. Therefore, the five subject experts were asked to give a feedback and evaluated the consistency of the index of the item.

The subject experts were asked to rate the relevance of each item to content domain

- 1 Indicate the item was not a measure of the objective
- 0 Meant that the judge was undecided
- +1 Indicate that the item was definite measure of the objective

Based on feedback from subject experts, of total 43 items, there were 14 items with an index of item-congruence less than 0.5. Therefore, such items were deleted from the questionnaire. As following the survey, the item with low item loading for each construct were excluded in the final questionnaire, as shown in the Appendix A.

The results of the index of item-congruence in each factor that influence the customer behavior as shown in Table 3-1.

Table 3-1 The results of the index of item-congruence in each factor that influence the customer behavior

Constructs	No. of items	Validity
Perceived usefulness	2	1.00
Social influence	2	0.70
Facilitation conditions	8	0.95
Perceived enjoyment	2	1.00
Perceived expense	2	0.80
Variety of services	2	0.90
Trait	1	0.60
Trust	2	1.00
Trialability	3	0.93
Perceived risk	1	0.60
Perceived no need	1	1.00

Constructs	No. of items	Validity
Attitude	1	1.00
Behavioral intention	2	0.80
Total	29	0.90

6. After each significant revision of the questionnaire, thirty respondents were selected for the pilot survey before moving to the main survey. The pilot group was similar to the respondents in terms of their characteristics. The responses obtained during the pilot survey were analyzed for internal consistency of reliability. The results of pilot survey were shown as Table 3-2.

Table 3-2 The results of internal consistency reliability statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.942	.943	29

Cronbach's Alpha was used to measure the internal consistency reliability of the items. The alpha coefficient for the twenty nine items was .942 and the construct reliabilities of the constructs ranged between 0.60 and 1.00, indicated that the items had quite high internal consistency (a reliability coefficient of .90 or higher was considered "Excellent").

Item loading and the Average Variance Extracted (AVE) were evaluated for convergent validity (Fornel & Larcker, 1981). The item loading and the Average Variance Extracted have been shown in tables 3-3. All items loading were greater than 0.50 and the AVE value ranged from 0.57 to 0.92. The eigenvalue for each item was greater than 1.0 (1.228, 4.551, 1.799, 1.770, and 1.459). As the item loadings and AVE value fell within range, it could be concluded that all conditions for convergent validity were met (Joseph F. Hair, Black, Babin, & Anderson, 2010).

Table 3-3 Convergent validity measurement

Factor	Item (s)	Item loading(s)	Eigen values	AVE
Perceived usefulness	PU1: Using mobile services makes my life easier	.78	1.228	.61
	PU2: I use mobile services to pass time	.78		
Social influence	SI1: Using mobile services improves my self- image	.95	1.809	.90
	SI2: People who use mobile services are information technology savvy	.95		
Facilitation conditions	FC1: In using mobile service, I do not experience noise, distortion, echo, and jitter.	.78	4.551	.57
	FC2: I think that the speed of mobile data services is fast.	.78		
	FC3: I think that mobile data services are reliable.	.83		
	FC4: I believe that the content offered by providers is interesting.	.76		
	FC5: I believe that the mobile package offered by providers will satisfy my needs.	.73		
	FC6: I believe that the mobile packages offered by provider are easy to use.	.79		
	FC7: I believe that provider will provide the best signal quality and coverage.	.71		
	FC8: I think that After Sale Service is satisfactory.	.64		
Perceived enjoyment	PEJ1: Using mobile services is enjoyable.	.96	1.835	.92
	PEJ2: Mobile services make me want to use them.	.96		
Perceived expense	PEP1: The current price of mobile phones is reasonably priced.	.85	1.455	.73
	PEP2: The total cost of mobile service adoption is expensive	.85		
Variety of services	VS1: The current available mobile services/applications are attractive to me.	.95	1.700	.90
	VS2: There are many mobile services/applications that meet my needs.	.95		

Factor	Item (s)	Item loading(s)	Eigen values	AVE
Trust	TR1: I am sure of the continuous availability (i.e., no breaking down) of the system.	.94	1.770	.89
	TR2: I am sure that certain managerial and technical procedures exist to secure all the data being processed on the system.	.94		
Triability	TRI1: I would like to know more about mobile services/applications before using it.	.81	2.231	.74
	TRI2: Have free access to mobile services/applications for a month might convince me to use it.	.94		
	TRI3: Allow me to easily stop unwanted service subscriptions.	.84		
Intention	BI1: I intend to continue using mobile services in the future.	.85	1.459	.73
	BI2: I intend to use mobile data services frequently.	.85		



3.2.4 Data collection

To ensure an appropriate data collection method, the following four steps of data collection procedures were implemented.

1. Market research team who had deep understanding of this research was asked to involve the research at the beginning.
2. In order to have a common understanding of query and sample requirements, a meeting with the team was conducted.
3. A total of four hundreds interviews were conducted for two weeks in April'2013. To increase the response rate and shorten the interview lead time, 4,000 subscribers were provided upfront.
4. After the data collection process has been done, the quality of the questionnaire was analyzed for completeness and reliability.

3.2.5 Multiple Regression Analysis

Multiple regression analysis (McClave, Benson, & Sincich, 1998) is a method to analyze the correlation of the dependent variable (Y) and the independent variable (X). The strength of the relationship between y and x, the prediction equation was used to estimate the mean value of y or to predict some future value of y for a given value of x. The techniques developed will enable to model a response, y, as a function of both quantitative and qualitative variables. As in the case of a simple linear regression, a multiple regression analysis involves fitting the model to a data set, testing the utility of the model, and using it for estimation and prediction.

Probabilistic models that include term involving two or more independent variables are called multiple regression models. The general form of this model is

$$y = B_0 + B_1x_1 + B_2x_2 + \dots + B_kx_k + e$$

Where

y is the dependent variable

x_1, x_2, \dots, x_k are the independent variables

B_i determines the contribution of the independent variable x_i

In general, there are five steps to develop the multiple regression models

1. Hypothesize the deterministic component of the model. This component relates the mean, $E(y)$, to the independent variables x_1, x_2, \dots, x_k .
2. Use the sample data to estimate the unknown model parameters $B_0, B_1, B_2, \dots, B_k$ in the model

3. Specify the probability distribution of the random error term, e and estimate the standard deviation of the distribution
4. Statistical evaluate the usefulness of the model
5. When satisfied that the model is useful, use it for prediction

In light of the characteristics of the variables and the research objective of this study, multiple regression was deemed to be an appropriate statistical method of analysis.

3.2.6 Confirmatory Factor Analysis

Factor analysis (Johnson, 1998) is a collection of methods used to examine how underlying constructs influence the responses on a number of measured variables. There are basically two types of factor analysis:

1. Exploratory Factor Analysis (EFA) attempts to discover the nature of the constructs influencing a set of responses.
2. Confirmatory Factor Analysis (CFA) tests whether a specified set of constructs is influencing responses in a predicted way.

In summary, the objectives of factor analysis are as follows.

1. To determine whether a smaller set of uncorrelated variables exists that will explain the relationships that exist between the original variables.
2. To determine the number of underlying variables.
3. To interpret these new variables.
4. To evaluate individuals or experimental units in the data set on these new variables.
5. To use new variables in other statistical analyses of the data

In this study, the collected data based on questionnaire were analyzed through descriptive and inferential statistics by using SPSS software to design and test the model proposed. An Exploratory factor analysis (EFA) was performed to identify the latent dimension.

1. Confirmatory factor analysis (CFA) was applied to verify the factor structure for checking the reliability and internal consistency.
2. Structure equation model (SEM) was performed to test the model, using the maximum likelihood method. The assessment items with their index to indicate for overall model fit are as following.

Assessment item	Recommended results
Chi-Square (X^2)	Smaller the better
Normed chi-square (X^2/df)	Less than 3 (<3)
Goodness of Fit Index (GFI)	More than 0.8 (>0.8)
Adjust goodness of Fit Index (GFI)	More than 0.8 (>0.8)

Assessment item	Recommended results
Root Mean Square Error of Approximation (RMSEA)	Less than 0.06 (<0.06)
Comparative fit index (CFI)	More than 0.9 (>0.9)

3.3 Phase 3: Monitoring usage tool development

In this research, the mean and variation of the subscriber usage were measured. Due to data characteristics to be controlled are variable data and subgroups of three, thus, these two charts were used to measure and control. Therefore the combination of \bar{X} and R chart were applied. The major steps of control charts implementation were constructed and depicted as follows.

1. Define the processes and quality characteristics to control and determine where the charts should be implemented in the process.
2. Determine sampling plan including sampling size and its frequency
3. Collect data from the process and data collection system by using same subgroup size
4. Calculate the average (\bar{X}) and standard deviation (R) of each subgroup
5. Calculate the average of the subgroup average ($\bar{\bar{X}}$) and average of standard deviation (\bar{R})
6. From these two values ($\bar{\bar{X}}, \bar{R}$), the control limits are calculated based on collected data. Control charts used a center line to represent the mean value and two others lines; the upper control limit (UCL) and the lower control limit (LCL) are chosen to be the control limits value. The trial control limits are determined:

- The Center Line and Control Limits of \bar{X} chart

$$UCL = \bar{\bar{X}} + A_2 \bar{R}$$

$$\text{Center Line} = \bar{\bar{X}}$$

$$LCL = \bar{\bar{X}} - A_2 \bar{R}$$

Where $\bar{\bar{X}}$ is as estimate mean; $\sigma_{\bar{X}}$ is standard deviation used to determine control limits is estimated from the average variation within subgroups. Typically, control limits of \bar{X} chart are set at 3 standard deviations above and below the center line.

- The Center Line and Control Limits R-Chart

$$UCL = D_4 \bar{R}$$

$$\text{Center Line} = \bar{R}$$

$$LCL = D_3 \bar{R}$$

7. Plot \bar{X} and R values of all subgroups against control limits

8. Analyze the chart by checking whether all points are within control limits. The pattern of \bar{X} and R should be seen if process is in control due to normal distribution such as most points are close to center line, not many points are close or outside to UCL and LCL, points are distributed randomly. If there is a necessary to revise the chart, R chart will be revised first until all remaining points are within control limits.
9. Use the chart to monitor and control the process.
10. Continue to improve the process and adjust the chart according to the new process.

The process capability is the ability of the process to produce product to meet the specification limits which are measured with the widely used process capability indices C_p and C_{pk} (Kane, 1986). C_p describes how well the process fits within specification limits (Upper and lower limits) but the process shifts and associated variability will be explained more from C_{pk} value. These two capability indices widely used for the process capability estimation by measuring short term potential and actual capability (Kotz & Johnson, 2002). C_p and C_{pk} are calculated as following form (Montgomery, 2005)

$$C_p = \frac{USL - LSL}{6\sigma_{within}}$$

$$C_{pk} = \min(C_{pu}, C_{pl})$$

$$= \min\left(C_{pu} = \frac{USL - \mu}{3\sigma}, C_{pl} = \frac{\mu - LSL}{3\sigma}\right)$$

Furthermore, the capability indices can be assessed by using quality control charts with mean and variance of the process, however, the process need to be established in a state of statistical control before using these indices (Kotz & Johnson, 2002).

3.4 Phase 4: Development of innovative price plan monitoring and advisory system

For innovation price plan monitoring and advisory system development, generic product development process (Ulrich & Eppinger, 2008) was introduced. There were six phases of product development process as Table 3-4

Table 3-4 Product development process

Product development process	Description
Phase 0: Planning	This phase begins with organization strategy and includes assessment of technology developments and market objectives.
Phase 1: Concept Development	The needs of the target market are identified, alternative product concepts are generated and evaluated, and one or more concept are selected for further development and testing.
Phase 2: System-Level Design	The system-level design phase includes the definition of the product architecture and the decomposition of the product into subsystems and components.
Phase 3: Detailed Design	The detail design phase includes the complete specification of geometry, materials and user interface design (UI).
Phase 4: Testing and Refinement	This phase will involve the construction and evaluation of multiple preproduction versions of the product.
Phase 5: Production Ramp-up	The product will be made for using the intended production system. The purpose of ramp-up is to train the work force and to work out any remaining problems in the production processes.

3.5 Phase 5: Validity test of innovative price plan monitoring and advisory system

For the validity test of Innovative price plan monitoring and advisory system, the innovative price plan monitoring and advisory system was tested to determine that the subscriber level of acceptance rate to change a new best fit offering to ensure that predictive subscriber usages model is accepted and valid with appropriate level.

3.5.1 Population and sampling procedure

The data was collected from the same criteria of the research with only one price plan for this validity test. The subscribers who have postpaid service price plan, no additional price plan and remain the same for last three months. The systematic random sampling was used to select the subscribers for this test in order to avoid bias of sample.

3.5.2 Validity test instrument

In order to meet the objectives of the validity test approach, an outbound call was employed and evaluated the success rate of the offering to new price plan from Innovative Price Plan Monitoring and Advisory system.

3.6 Phase 6: Application acceptance testing of Innovative price plan monitoring and advisory system

For the application acceptance for Innovative price plan monitoring and advisory system, the acceptance of predictive subscriber usage and advisory package model was investigated by evaluation with Technology Acceptance Model (TAM). This methodology was employed to evaluate perceived of usefulness, perceived ease of use, user interface and user satisfaction by using the innovative price plan monitoring and advisory system.

3.6.1 Population and sampling procedure

The data were collected from the agent who called to subscribers for price plan offering. The five agents who use Innovative price plan monitoring and advisory system were selected.

3.6.2 Acceptance test instrument

In order to meet the objectives of the testing approach, the questionnaire was employed and evaluated the innovative price plan monitoring and advisory system. The questionnaire contained perceived usefulness, perceived ease of use, user satisfaction, usability and personal information. All of these measurements had a number of questions constructed to evaluate the effectiveness of the system. 5 point Likert Scale ranging from 1 (Strong disagree) to 5 (Strongly agree) was applied for each set of questionnaires. The questionnaire is attached in Appendix C.

1. Perceived usefulness refers to the degree of feeling that agents believes that using Innovative price plan monitoring and advisory system would improve their job performance in monitoring and advisory package
2. Perceived ease of use (Usability) refers to the degree of easiness that agents feel when using Innovative price plan monitoring and advisory system
3. User Interface refers to the degree of feeling toward interaction with an Innovative price plan monitoring and advisory system
4. User satisfaction refers to the degree of satisfy that agents feel when using Innovative price plan monitoring and advisory system

CHAPTER IV RESULTS OF EMPIRICAL STUDY

This study is a survey research, the purpose of this research was to identify the factors affecting to service usage and then develop a predictive mobile service acceptance model. The results of analysis are divided into four stages as follows

1. Preliminary data analysis
2. Correlation analysis tests
3. Predictive subscriber usage model by Multiple regression
4. Subscriber usage behavior model by Confirmatory factor analysis

In order to present the data analysis and understanding the results of data analysis and interpretation are more convenient. The list of commonly used symbols in statistics and variables meaning are as follows.

4.1 Preliminary data analysis

To present the results of analysis in this section aims to study distribution of demographic variables and statistics of the observed variable that related to mobile service acceptance model e.g. minimum (min), maximum (max) , mean, standard deviation (S.D), variance, skewness (sk), kurtosis (ku) and standard error of skewness and kurtosis.

The results of analysis are divided into two parts. The first part concentrates on the number and percentage of respondents and the next is to find the preliminary statistics for variables in mobile service acceptance model.

The data used for the analysis were taken from a survey based on outbound call with 400 subscribers. The 400 subscribers consist of 340 holding the postpaid package with exceeding limit usage from their own tariff, responsible for their payment and are the own number and 60 subscribers holding the same postpaid package but their usage were within the tariff. The questionnaires were completed by end of April 2013.

A total of 340 observations were conducted during two weeks in April, 2013 via outbound call. Of the participating subscribers who had exceed their usage limit, 200 were male (58.8 percent) and 140 were female (41.2 percent). A majority of the subscribers surveyed were between 31 and 50 years old, representing more than 60 percent of the sample, and most of the respondents were married (62.1 percent). In terms of age of use, almost 70% of subscribers had used mobile service for more than three years (see Table 4-1).

Table 4-1 Demographic profile for respondents

Variables		Frequency	Percentage
Gender	Male	200	58.8
	Female	140	41.2
Age	< 15 years old	1	0.3
	15 - 20 years old	15	4.4
	21 – 25 years old	21	6.2
	26 – 30 years old	28	8.2
	31 – 35 years old	42	12.4
	36 – 40 years old	57	16.8
	41 – 45 years old	50	14.7
	46 – 50 years old	58	17.1
	51 – 55 years old	28	8.2
	56 – 60 years old	24	7.1
	60+ years old	16	4.7
Marital Status	Single	111	32.6
	Married	211	62.1
	Diverced/Separated	17	5.0
	Others	1	.3
Education level	Junior high school or below	45	13.2
	Senior high school	103	30.3
	College/University	167	49.1
	Graduate school or above	25	7.4
Occupation	Corporation	97	28.5
	State Enterprise	6	1.8
	Government	38	11.2
	Entrepreneur	97	28.5
	Housewife	40	11.8
	Student	22	6.5
	Unemployed	40	11.8
AOU	Less than 1 year	29	8.5
	1 – 2 years	52	15.3
	2 – 3 years	30	8.8
	3 – 5 years	229	67.4
Voice usage	Min. voice usage	324.18	
	Max. voice usage	1,544.38	
	Avg. Voice usage	527.42	

The mean values for perceived usefulness, perceived enjoyment, perceived expense, perceived risk, perceived no need, social influence, trust, trialability, variety of service, facilitation conditions, trait, attitude and intention to use range from 3.57 to 4.36 on the five-point Likert scale (see Table 4-2).

Table 4-2 The number and percentage of the factors in regards to use mobile service

Factors		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean
Perceived usefulness	Frequency	11	-	65	141	123	3.87
	Percent	3.2	-	19.1	41.5	36.2	
Perceived enjoyment	Frequency	11	22	96	132	79	3.57
	Percent	3.2	6.5	28.2	38.8	23.2	
Perceived expense	Frequency	13	16	60	121	130	3.81
	Percent	3.8	4.7	17.6	35.6	38.2	
Perceived risk	Frequency	11	4	46	160	119	4.09
	Percent	3.2	1.2	13.5	47.1	35	
Perceived no need	Frequency	12	1	24	152	151	4.36
	Percent	3.5	0.3	7.1	44.7	44.4	
Social influence	Frequency	13	19	80	114	114	3.69
	Percent	3.8	5.6	23.5	33.5	33.5	
Trust	Frequency	4	13	54	158	111	3.95
	Percent	1.2	3.8	15.9	46.5	32.6	
Trialability	Frequency	4	13	54	158	111	4.07
	Percent	1.2	3.8	15.9	46.5	32.6	
Variety of service	Frequency	12	9	84	126	109	3.73
	Percent	3.5	2.6	24.7	37.1	32.1	
Facilitating conditions	Frequency	-	-	36	237	67	4.05
	Percent	-	-	10.6	69.7	19.7	
Trait	Frequency	15	-	39	135	151	4.20
	Percent	4.4	-	11.5	39.7	44.4	
Attitude	Frequency	11	2	33	147	147	4.23
	Percent	3.2	0.6	9.7	43.2	43.2	
Intention to use	Frequency	7	1	33	123	176	4.21
	Percent	2.1	0.3	9.7	36.2	51.8	

4.2 Correlation analysis tests

Prior to assessing model fit and testing the hypotheses, normal distribution and correlation statistics were analyzed. Therefore, the data is valid and reliable for further analysis.

4.2.1 Normal distribution

Table 4-3 shows the distribution of data of factors in the mobile service acceptance model as proposed in Chapter 2, the Kolmogorov-Smirnov test (KS-test) was determined. The result indicated that all variables were not normally distributed data (p -value < 0.05).

Table 4-3 Tests of Normality with Kolmogorov-Smirnova

	Kolmogorov-Smirnova		
	Statistic	df	Sig.
Useful	0.143	340	.000
Enjoy	0.168	340	.000
Expense	0.163	340	.000
Risk	0.279	340	.000
Noneed	0.274	340	.000
Intention	0.210	340	.000
FC	0.124	340	.000
VS	0.189	340	.000
Trust	0.195	340	.000
Trial	0.173	340	.000
Trait	0.260	340	.000
Attitude	0.264	340	.000
Social	0.171	340	.000
Usage	0.261	340	.000

Besides Kolmogorov-Smirnova test, Z-test for skewness and kurtosis in each variable has been examined and evaluated.

The result from Table 4.4 indicated that the distribution was not significantly skewed with $Z \geq |1.96|$ therefore all variables were not normal distribution. Similarly, almost Z-test for Kurtosis fell outside the range.

Table 4.4 Tests of Normality with skewness and kurtosis index

Variable	S.D	C.V.	Sk	S.E.	Ku	S.E.	Z-test (Sk)	Z-test (Ku)
Perceived usefulness	0.88	0.78	-0.97	0.13	1.57	0.26	-7.31	5.93
Perceived enjoyment	0.95	0.91	-0.60	0.13	0.20	0.26	-4.58	0.77
Perceived expense	1.00	1.00	-0.95	0.13	0.66	0.26	-7.19	2.51
Perceived risk	0.90	0.82	-1.34	0.13	2.51	0.26	-10.18	9.51
Perceived no need	0.88	0.78	-1.81	0.13	4.37	0.26	-13.71	16.56
Social influence	0.99	0.99	-0.79	0.13	0.29	0.26	-6.00	1.10
Trust	0.79	0.63	-0.83	0.13	1.07	0.26	-6.29	4.05
Trialability	0.79	0.63	-1.18	0.13	1.83	0.26	-8.95	6.93
Variety of services	0.94	0.88	-0.85	0.13	0.69	0.26	-6.42	2.60
Facilitation conditions	0.45	0.20	-0.62	0.13	0.12	0.26	-4.71	0.45***
Trait	0.96	0.92	-1.61	0.13	3.04	0.26	-12.23	11.53
Attitude	0.89	0.80	-1.62	0.13	3.47	0.26	-12.24	13.16
Intention	0.79	0.62	-1.57	0.13	3.87	0.26	-11.90	14.67
Usage	481.39	231734.76	6.67	0.13	71.61	0.26	50.55	271.26

Remark: Significant testing for skewness and kurtosis are calculated from statistical $Z_{sk} = Sk/SE_{sk}$ and $Z_{ku} = Ku/SE_{ku}$; SE for skewness = .13; SE for kurtosis = .26

*p < .05. ** p < .01. ***p < .001.

4.2.2 Coefficient correlation

Regarding non-normality distributed data, to determine the relationship between two variables that were defined in the mobile service acceptance model so the Spearman correlation coefficient was used to measure. Therefore, fourteen paired data are calculated for Spearman's correlation coefficient and subsequent significance testing. After validating the correlation, the results showed that several factors were not significant ($p < 0.05$). Therefore, they were excluded from the model for further analysis. Summary results of the correlation analysis with spearman are listed in Table 4-5.

1. FC (Sig. = 0.001), VS (Sig. = 0.000) and Trust (Sig. = 0.46) were found to be significant at 95 percent confidence level. In comparison, Trial (Sig. = 0.084) and Trait (Sig. = .182) were found to have no significant on Useful.
2. Useful (Sig. = 0.21) was found to be significant at 95 percent confidence level on attitude to use mobile services.
3. Attitude (Sig. = 0.000) was found to be significant on the intention to use mobile services at 95 percent confidence level. In comparison, Useful (Sig. = .421), Enjoy (Sig. = .805), Expense (Sig. = .474), Noneed (Sig. = .092), Risk (Sig. = .086) and Social (Sig. = .770) were found to have no significant.
4. Intention (Sig. = .000) was found to be significant on mobile services usage at 95 percent confidence level.

Table 4-5 Symmetric Measures: factors

Spearman Correlation	Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Useful * FC	.180	.056	3.363	.001c
Useful * VS	.210	.058	3.956	.000c
Useful * Trust	.108	.059	2.004	.046c
Useful * Trial	-.094	.058	-1.736	.084c
Social * Trait	.072	.059	1.336	.182c
Attitude * Useful	.125	.058	2.310	.021c
Intention * Useful	-.044	.060	-.806	.421c
Intention * Enjoy	.013	.060	.247	.805c
Intention * Expense	-.039	.061	-.717	.474c
Intention * Noneed	.091	.058	1.689	.092c
Intention * Risk	-.093	.059	-1.721	.086c
Intention * Social	-.016	.061	-.292	.770c
Intention * Attitude	.251	.057	4.772	.000c
Usage * Intention	-.204	.056	-3.837	.000c

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

In addition, the Spearman correlation coefficient is used to measure the demographic of subscriber profile. Summary results of the correlation analysis with spearman are listed in Table 4-6.

1. Average voice usage (Sig. = .011) and Age (Sig. = .046) were found to be significant at 95 percent confidence level on intention to use mobile service. In comparison, Average data usage:MB (Sig. = .650), Age of use (Sig. = .698) were found to have no significant.

Table 4-6 Symmetric Measures: demographic

Spearman Correlation	Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Intention * AVGVoiceusage	-.138	.056	-2.555	.011 ^c
Intention * AVGDatausageMB	.025	.054	.454	.650 ^c
Intention * Age	-.108	.055	-2.001	.046 ^c
Intention * AOU	.021	.056	.389	.698 ^c

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Regarding the correlation for Nominal by Interval, statistic eta was used to measure with Cohen's guidelines for the effect size index for eta (Small = .10, medium = .24 and large = .37).

The summary results of the correlation analysis for demographic subscriber profile with eta are listed in Table 4-7.

1. Region (Sig. = .254) was only found to be significant at 95 percent confidence level on intention to use mobile services.
2. In comparison, Gender (Sig. = .035), MaritalStatus (Sig. = .125), Education level (Sig. = .168), Occupation (Sig. = .181), Type of Service (Sig. = .127), Connection EDGE (Sig. = .107), Connection 3G (Sig. = .056), Connection WiFi (Sig. = .027), Social Network (Sig. = .016), E-mail (Sig. = .088), Internet (Sig. = .035), Shopping online (Sig. = .018), Music & Movie (Sig. = .071) and Purpose of Use (Sig. = .065) were found to have no significant on intention to use mobile services.

Table 4-7 Directional Measures

Eta	Value
Intention * Gender	.035
Intention * MaritalStatus	.125
Intention * Educationlevel	.168
Intention * Occupation	.181
Intention * Region	.254
Intention * TypeofServices	.127
Intention * Connection_EDGE	.107
Intention * Connection_3G	.056
Intention * Connection_WiFi	.027
Intention * Social_Network	.016
Intention * E_Mail	.088
Intention * Internet	.035
Intention * Shopping_Online	.018
Intention * Music_Movie	.071
Intention * PurposeofUses	.065

As correlation of all variables above have been tested and validated, the following factors were construct a model, many items with low item loading and not significant were excluded from for further analysis as Figure 4-1.

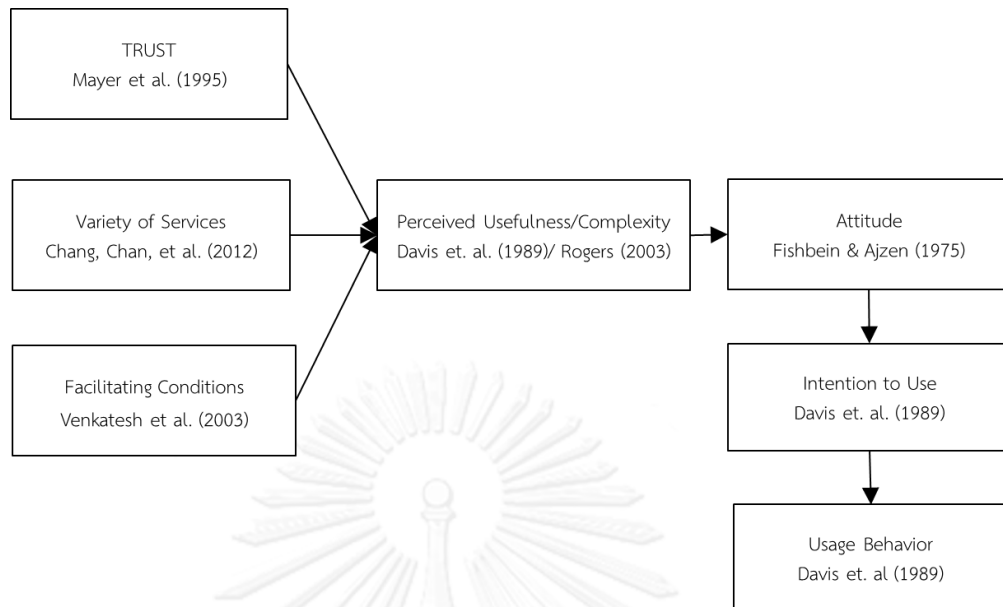


Figure 4-1 A refined subscriber usage behavior model

4.3 Predictive subscriber usage model by multiple regression

The objective of this study is to understand and examine key determinants that influence on mobile voice usage in order to explain subscriber usage behavior and predict potential usage. Multiple regression analysis is a method to analyze the correlation of the dependent variable (Y) and the independent variable (X) (McClave et al., 1998). In light of the characteristics of the variables and the research objective of this study, multiple regression was deemed to be an appropriate statistical method of analysis.

To apply the regression procedure, “Voice usage” was selected as the dependent variable (Y) to be predicted by independent variables representing the perceptions of subscribers and their demographic profiles. The following 13 variables were included as independent variables:

X1	Perceived usefulness	X7	Gender
X2	Facilitation conditions	X8	Age
X3	Variety of services	X9	Marital Status
X4	Trust	X10	Education level
X5	Attitude	X11	Occupation
X6	Intention	X12	Age of Use (AOU)
		X13	Average voice usage

The outbound call survey obtained 340 respondents from the subscriber base. All 340 respondents provided completed response; therefore, 340 observations were available for

analysis. To determine statistical power, the sample size requirement was assessed. The desired level of sample size was between 15 to 20 observations for each independent variable (Joseph F. Hair et al., 2010). As the observations fell within the range, the sample size was deemed appropriate.

In order to specify the regression model, stepwise estimation was selected to analyze due to the most popular sequential approach. After obtaining the results of the regression model and assessing overall model fit, the unstandardized coefficient (B) was employed to describe the relationship between the variables in order to predict and explain voice usage (dependent variable). Thus, the regression equation to describe predictive voice usage is as follows:

$$\text{Predicted (Voice usage)} = 365.266 + .689 (\text{AVGVoiceusage}) - 27.597 (\text{Attitude}) - 23.970 (\text{Intention})$$

Table 4-8 Model Summary^d

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.887 ^a	.787	.786	102.9003856
2	.897 ^b	.805	.803	98.6854253
3	.900 ^c	.810	.808	97.5577984

- a. Predictors: (Constant), AVGVoiceusage
 b. Predictors: (Constant), AVGVoiceusage, Attitude
 c. Predictors: (Constant), AVGVoiceusage, Attitude, Intention
 d. Dependent Variable: Voiceusage

Table 4-8 showed that the coefficient of correlation (R) value 0.900, indicating quite a strong relationship between the predictor variables and the coefficient of determinant (R^2) with a value of .810; thus, 81.1% of variation in voice usage can be accounted for average voice usage, attitude and intention. However, trust, variety of service, facilitating conditions and perceived usefulness were not found to be significantly associated with mobile voice usage.

Table 4-9 Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	138.389	13.614		10.165	.000		
	AVGVoiceusage	.705	.022	.887	32.029	.000	1.000	1.000
2	(Constant)	282.340	31.480		8.969	.000		
	AVGVoiceusage	.704	.021	.886	33.364	.000	1.000	1.000
	Attitude	-33.952	6.756	-.133	-5.025	.000	1.000	1.000
3	(Constant)	365.266	43.505		8.396	.000		
	AVGVoiceusage	.689	.022	.868	32.015	.000	.938	1.066
	Attitude	-27.597	7.074	-.108	-3.901	.000	.891	1.122
	Intention	-23.970	8.788	-.078	-2.728	.007	.841	1.189

a. Dependent Variable: Voiceusage

Once the model estimation completed, multicollinearity was tested in order to confirm the appropriateness of the results. Tolerance and Variance-Inflation Factor (VIF) were applied. The test result in Table 4-9 showed that the tolerance indicator for AVGVoiceusage, attitude and intention were all greater than 0.1 and the VIF of all the predictor variables was less than 10. Hence, it was concluded that all three of the predictor variables were useful in the model and there was no evidence of multicollinearity.

Table 4-10 ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10862508.711	1	10862508.711	1025.879	.000 ^b
	Residual	2943600.040	278	10588.489		
	Total	13806108.751	279			
2	Regression	11108457.504	2	5554228.752	570.319	.000 ^c
	Residual	2697651.247	277	9738.813		
	Total	13806108.751	279			
3	Regression	11179272.121	3	3726424.040	391.533	.000 ^d
	Residual	2626836.630	276	9517.524		
	Total	13806108.751	279			

e. Dependent Variable: Voiceusage

f. Predictors: (Constant), AVGVoiceusage

g. Predictors: (Constant), AVGVoiceusage, Attitude

h. Predictors: (Constant), AVGVoiceusage, Attitude, Intention

To test the hypothesis that the potential predictor variables had a significant impact on voice usage, a one-way analysis of variance (ANOVA) was conducted. Table 4-10 showed that the value of *F-statistic* was 391.533 and the *p-value* was 0.000. Hence, there was a significant relationship

between the adoption variables and the actual use of mobile service (voice usage), confirming the fitness of the model at $p < .05$ level.

Table 4-11 Residuals Statistics^a

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	255.963058	1501.974854	527.424813	200.1726148	280
Residual	-199.2365417	222.8522644	.0000000	97.0318765	280
Std. Predicted Value	-1.356	4.869	.000	1.000	280
Std. Residual	-2.042	2.284	.000	.995	280

a. Dependent Variable: Voiceusage

Table 4-12 Tests of Normality with Kolmogorov-Smirnov for Standardized Residual

	Kolmogorov-Smirnov ^a		
	Statistic	df	Sig.
Standardized Residual	.045	280	.200*

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 4-13 Tests of Normality for Standardized Residual with skewness and kurtosis index

Variable	S.D	C.V.	Sk	S.E.	Ku	S.E.	Z-test (Sk)	Z-test (Ku)
Standardized Residual	.99460913	.989	.248	.146	-.401	.290	1.699	-1.383

To ensure that the regression model was able to predict the dependent variable, the possible significant outliers were detected by using “casewise diagnostics” analysis and a standardized residual was also examined. Moreover, residuals for a normal distribution were investigated. After validation, 60 observations were removed. The result showed that the standardized residual was larger than two and had mean of zero. The normality distribution for residuals was tested with Kolmogorov-Smirnova ($p < 0.05$), skewness and a kurtosis index with $Z \geq |1.96|$ as shown in Table 4-13. As the Z-test fell within the range, it can be concluded that the residuals were approximately normally distributed. Therefore, the regression model was deemed appropriate.

After confirmation of the regression equation as shown above, the predictive equation based on the three independent variables (X_5 -Attitude, X_6 -Intention to use, X_{13} -Average voice usage) was evaluated by focusing on the regression coefficients for the estimated signs to indicate the relationship between the independent and dependent variables. Average voice usage was the only independent variable that had positive coefficient, meaning that more usage consumption in the past (higher usage) leads to increased subscriber usage. The other variables had a reversed

sign for X_5 (Attitude), X_6 (Intention to use), suggesting that an increase in the perceptions of these variables has a negative impact on predicted subscriber usage.

To assess the relative importance of the variables, the beta coefficients of the independent variables were compared. As shown in Table 4-9, X_{13} (Average voice usage) was the most important, followed by X_5 (Attitude) and X_6 (Intention to use).

In summary, average usage, attitude and intention to use are able to significantly predict the usage of Thai mobile subscribers. Attitude and intention to use have a negative standardized coefficient, which suggests that higher attitude and intention will reduce usage consumption. Therefore H_5 , H_6 and H_7 are supported. Perceived usefulness, facilitation conditions, variety of services and trust don't have significant relationship with Thai subscribers' decision to adopt mobile services, thus H_1 , H_2 , H_3 and H_4 are rejected.

4.4 Subscriber usage behavior model by Confirmatory factor analysis

Regarding previously correlation analysis, we found that there were only seven constructs associated. However, for Structure equation modeling (SEM) analysis, correlations for thirteen constructs were examined again. The similar result is shown as following

Prior to assessing the characteristics of each component, the descriptive statistical of all observed variables were examined via descriptive analysis.

Table 4-14 Minimum, Maximum, Mean, Standard Deviation, Variance, Skewness and Kurtosis for observed variables

Variable	Min	Max	M	SD	C.V.	Sk	Ku
Facilitation conditions							
FC1	1.00	5.00	4.25	0.96	0.23	-1.81	3.68
FC2	1.00	5.00	4.25	0.88	0.21	-1.55	3.26
FC3	1.00	5.00	4.03	0.91	0.23	-1.16	1.96
FC4	1.00	5.00	3.81	0.95	0.25	-0.466***	-0.01*
FC5	1.00	5.00	3.96	0.95	0.24	-0.99	1.18
FC6	1.00	5.00	4.12	0.84	0.20	-1.00	1.43
FC7	1.00	5.00	4.09	0.80	0.20	-0.81	0.39*
FC8	1.00	5.00	4.15	0.79	0.19	-1.18	2.79
Variety of services							
VS1	1.00	5.00	3.63	1.07	0.29	-0.69	0.08*
VS2	1.00	5.00	3.76	1.12	0.30	-0.91	0.58**
Trust							
TR1	1.00	5.00	3.78	0.93	0.25	-0.53	0.35*
TR2	1.00	5.00	4.15	0.92	0.22	-1.09	1.22
Perceived usefulness							
PU1	1.00	5.00	4.39	0.81	0.19	-2.11	6.33

Variable	Min	Max	M	SD	C.V.	Sk	Ku
PU2	1.00	5.00	3.43	1.29	0.38	-0.54	-0.68**
Attitude							
A1	1.00	5.00	4.23	0.88	0.21	-1.66	3.87
Intention							
BI1	1.00	5.00	4.37	0.94	0.22	-2.10	4.81
BI2	1.00	5.00	4.12	0.92	0.22	-1.54	3.07
Usage							
U1	324.18	1,544.38	527.42	222.45	0.42	1.57	0.24

Note: Significance of skewness and kurtosis calculated from $Z_{sk} = Sk/SE_{sk}$ and $Z_{ku} = Ku/SE_{ku}$; SE for skewness = .146; SE for kurtosis = .290

* Significant at the 0.05 level (2-tailed); ** Significant at the 0.01 level (2-tailed); *** Significant at the 0.001 level (2-tailed).

4.4.1 Measurement model evaluation

Prior to assessing the model fit and testing the hypothesis, the construct validity of all seven constructs contained in the proposed model were assessed via Confirmatory Factor Analysis (CFA) by using LISREL 8.72. Each scale was modeled as reflective indicator of its hypothesized latent construct. The maximum-likelihood confirmatory factor analysis was chosen as the model estimation method.

Table 4-15 Measurement model validity

Construct	X2	p	df	X ² /df	RMSEA	NFI	CFI	RMR	GFI	AGFI
Facilitation conditions	21.27	0.07	13	1.64	0.05	0.90	0.96	0.03	0.98	0.95
Variety of services	1.37	0.24	1	1.37	0.04	0.98	1.00	0.03	1.00	0.99
Trust	3.65	0.06	1	3.65	0.10	0.91	0.93	0.08	0.99	0.95
Perceived usefulness	1.83	0.18	1	1.83	0.05	0.79	0.88	0.08	0.99	0.98
Intention	2.50	0.11	1	2.50	0.07	0.77	0.84	0.07	0.99	0.97

Table 4-16 Factor correlations

Construct	Perceived usefulness	Attitude	Intention	Usage	Facilitation conditions	Variety of services	Trust
Perceived usefulness	1.000						
Attitude	0.297	1.000					
Intention	0.137	0.461	1.000				
Usage	-0.054	-0.181	-0.393	1.000			
Facilitation conditions	0.140	0.042	0.019	-0.008	1.000		
Variety of services	-0.078	-0.023	-0.011	0.004	0.523	1.000	
Trust	-0.131	-0.039	-0.018	0.007	0.310	0.062	1.000

Table 4-17 Measurement of the constructs with multiple items

Constructs	Indicators	Estimated Loading	Standard Error	t-values	(R ²)	SS	SC
Facilitation conditions	FC1	0.30***	0.07	4.34	0.09	0.30	0.30
	FC2	0.40***	0.07	5.88	0.16	0.40	0.39
	FC3	0.29***	0.07	4.30	0.08	0.28	0.28
	FC4	0.37***	0.07	5.45	0.14	0.37	0.38
	FC5	0.36***	0.07	5.14	0.13	0.36	0.36
	FC6	0.24***	0.08	2.99	0.06	0.24	0.24
	FC7	0.52***	0.06	8.48	0.27	0.52	0.52
	FC8	0.48***	0.07	7.24	0.23	0.48	0.48
Variety of services	VS1	0.57***	0.06	9.63	0.34	0.57	0.58
	VS1	0.74***	0.05	13.52	0.56	0.74	0.75
Trust	TR1	1.00***	0.04	23.88	1.00	1.00	1.00
	TR2	0.40***	0.05	7.56	0.17	0.41	0.41
Perceived usefulness	PU1	1.00	<-->	<-->	1.00	1.00	1.00
	PU2	0.19***	0.05	3.48	0.04	0.19	0.19
Attitude	A1	1.00	<-->	<-->	1.00	1.00	1.00
Intention	BI1	0.83	<-->	<-->	0.68	0.82	0.82
	BI2	0.29***	0.07	4.23	0.08	0.29	0.29
Usage	U1	1.00	<-->	<-->	1.00	1.00	1.00

Notes: Goodness-of-fit statistics: Chi-square (df = 114, p = .071) = 136.836, $\chi^2/df = 1.200$, RMR = 0.064, GFI = .948, AGFI = .922, NFI = 0.837, RMR = .064, RMSEA = .027; ***p < .001;

<--> = Not estimated when loading set to fixed value, then no value for Standard Error and t-values

SS = Standardized solution, SC = Completely standardized solution

A scale validity assessment was conducted by examining the goodness-of-fit of the overall CFA measurement model for each construct. Table 4.17 shows that these construct measures were all within the recommend values.

Table 4-18 Goodness-of-Fit Measures of Subscriber Behavior Usage model

Goodness of Fit Index	Subscriber Behavior model
Absolute Measures	
Chi-Square (χ^2)	136.84
Degrees of freedom (df)	114
P-value	0.07
Goodness of Fit Index (GFI)	0.95
Root Mean Square Error of Approximation (RMSEA)	0.027
Confident interval of RMSEA	0.000-0.042
Root Mean Square Residual (RMR)	0.063
Standardized RMR	0.063
Normed chi-square (χ^2/df)	1.20

Incremental Fit Measures	
Normed Fit Index (NFI)	0.84
Non-Normed Fit Index (NNFI)	0.94
Comparative Fit Index (CFI)	0.95
Relative Fit Index (RFI)	0.78
Parsimony Measures	
Adjust goodness of Fit Index (AGFI)	0.92
Parsimony Normed Fit Index (PNFI)	0.62

As shown in Table 4-18, the information shows the overall fit statistics from testing the subscriber usage behavior model. Based on a sample of 280 respondents and a seven-construct model with 18 total indicator variables, the chi-square (χ^2) value was 136.84 with 114 degree of freedom ($p < .05$) and the normed chi-square (χ^2/df) was 1.20 as suggested value below 2 by (Carmines & McIver, 1981). GFI values of greater than .95, indicating reasonable model fit (Chin, 2000). Furthermore, the model SRMR was 0.06 with CFI above 0.92 (0.95), with RMSEA value less than 0.07 (0.027) and 90% confidence interval of 0.00 to 0.042. Therefore, all of these measures were within a recommended range that would be indicated good model fit (Bollen, 1989; Hu & Bentler, 1998; Joseph F. Hair et al., 2010).

4.4.2 Assessing the Structural Model Validity

The structure model shown in the path diagram in Figure 4-3 was validated for the model fit and assessed the consistency of the structural relationships with theoretical expectation. In Table 4-18, the information shows the overall fit statistics from testing the Subscriber Behavior model. The chi-square (χ^2) value was 136.84 with 114 degree of freedom ($p < .05$) and the normed chi-square was 1.20. The model CFI is 0.95, with RMSEA of 0.027 and 90% confidence interval of 0.00 to 0.042. All of these measures were within a recommended range that would be associated with good model fit (Bollen, 1989; Hu & Bentler, 1998; Joseph F. Hair et al., 2010).

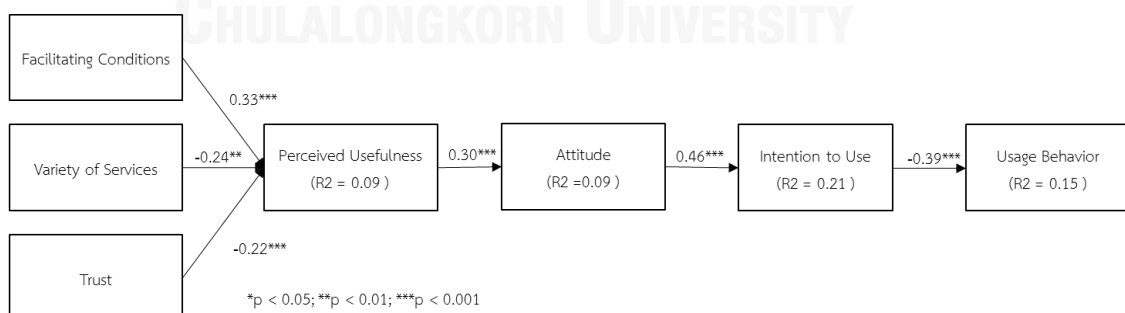


Figure 4-2 Subscriber usage behavior model of Thai mobile market

As illustrated in Figure 4-2, it was found that perceived usefulness was positive influence on attitude ($b = 0.30$; $p < 0.001$), meaning that more perceived usefulness lead to increased attitude. Attitude was also found to positively relate to intention to use mobile service ($b = 0.46$; $p < 0.001$), thus, it might be concluded that increasing of attitude lead to increased intention to use mobile service. It's also showed that attitude was explained well for subscriber to intention to use mobile services, which present that subscriber, would have greater intention to use mobile service if they had positive attitude towards those services (C.-S. Wu et al., 2011).

Moreover, facilitating conditions, variety of services and trust were investigated. The results revealed that trust ($b = -0.22$; $p < 0.001$) and variety of services ($b = -0.24$; $p < 0.01$) were negatively associated with perceived usefulness. On the other hand, facilitating conditions ($b = 0.33$; $p < 0.001$) was positively associated with perceived usefulness.

In summary, perceived usefulness, attitude and intention to use have a predictive power for usage behavior of Thai mobile subscriber. Therefore, H6a, H13 and H14 are support. In additions, we might conclude that these findings consistent with previous research and highlight that usefulness for using mobile service would come from three main conditions; facilitating conditions, variety of services and trust; thus, H1b, H3 and H4b are supported. For other variables were not found to affect the adoption of mobile service in Thailand. It showed that perceived ease of use, trialability, perceived enjoyment, perceived expense, perceived risk, perceived no need, trait and social influence were not considered by subscribers in regard to use of mobile service.

Table 4-19 Path coefficients of the proposed Subscriber Usage Behavior Model and hypothesis verification

Structural Relationship	Hypothesis	Path Coefficient	Verification Result
Trust → Perceived ease of use	H1a	NA	Unsupported
Trust → Perceived usefulness	H1b	-0.22	Supported
Trialability → Perceived ease of use	H2	NA	Unsupported
Variety of services → Perceived usefulness	H3	-0.24	Supported
Facilitating conditions → Perceived ease of use	H4a	NA	Unsupported
Facilitating conditions → Perceived usefulness	H4b	0.33	Supported
Perceived ease of use → Perceived usefulness	H5a	NA	Unsupported
Perceived ease of use → Attitude	H5b	NA	Unsupported
Perceived usefulness → Attitude	H6a	0.30	Supported
Perceived usefulness → Intention to use	H6b	NA	Unsupported
Perceived enjoyment → Intention to use	H7	NA	Unsupported
Perceived expense → Intention to use	H8	NA	Unsupported
Perceived risk → Intention to use	H9	NA	Unsupported
Perceived no need → Intention to use	H10	NA	Unsupported

Structural Relationship	Hypothesis	Path Coefficient	Verification Result
Trait → Social influence	H11	NA	Unsupported
Social influence → Intention to use	H12	NA	Unsupported
Attitude → Intention to use	H13	0.46	Supported
Intention → Usage	H14	-0.40	Supported

Notes: Goodness-of-fit statistics: Chi-square (df = 114, p = .071) = 136.836, $\chi^2/df = 1.200$, RMR = 0.064, GFI = .948, AGFI = .922, NFI = 0.837, RMR = .064, RMSEA = .027
*p < 0.05; **p < 0.01; ***p < 0.001

In addition, the total effects on usage behavior was 0.39 for intention to use, -0.18 for attitude but perceived usefulness, facilitating condition, variety of service and trust were low predictive in predicting usage behavior as indicated in Table 4.20.

Table 4-20 Direct, indirect and total effects in predicting usage behavior

	Perceived usefulness			Attitude			Intention			Usage		
	DE	IE	TE	DE	IE	TE	DE	IE	TE	DE	IE	TE
Facilitation conditions	0.33	-	0.33	-	0.10	0.10	-	0.05	0.05	-	-0.02	-0.02
Variety of services	-0.24	-	-0.24	-	-0.07	-0.07	-	-0.03	-0.03	-	0.01	0.01
Trust	-0.22	-	-0.22	-	-0.07	-0.07	-	-0.03	-0.07	-	0.01	0.01
Perceived usefulness	-	-	-	0.30	-	0.30	-	0.14	0.14	-	-0.05	-0.05
Attitude	-	-	-	-	-	-	0.46	-	0.46	-	-0.18	-0.18
Intention	-	-	-	-	-	-	-	-	-	-0.39	-	-0.39

As illustrated in Figure 4-2, the proposed subscriber usage behavior model that included perceived usefulness, attitude and intention to use had a predictive power for usage. Facilitating conditions, variety of services and trust explained 9% of the variance in perceived usefulness. The variance of intention to use explained 21% in this study was higher level that explained in perceived usefulness and attitude but the model account for only 15% of the variance in usage behavior. As noted, it showed that facilitation condition was more strongly influenced (0.33) to perceived usefulness than variety of service (0.24) and trust (-0.22). It also showed that attitude was explained well for subscriber to intention to use mobile services, which presented that subscriber, would have greater intention to use mobile service if they had positive attitude towards those services (C.-S. Wu et al., 2011). Therefore, we might conclude that these findings have been confirmed in previous research and highlighted that usefulness for using mobile service would come from three main conditions; facilitating conditions, variety of services and trust.

Beside the main elements that influence to subscriber usage behavior, the profile of respondent indicates that demographic profile has direct impact on subscriber behavior to use

mobile service, there is significant difference by age, and more than 60 per cent of the respondent might be called workers segmentation. This result has been confirmed in prior research (Wei et al., 2009).

Thus, the theory of TAM model by Davis (1989) with three additional elements to the original TAM model which are facilitating conditions, varieties of service and trust can contribute to gain more understanding and providing the evidence in explaining and predicting subscriber's intention to use mobile services in Thai mobile market for preventing customer churn. In addition, some supportive information from prior research indicated that call quality is related influence to customer churn (Ahn et al., 2006).



CHAPTER V ESTABLISHMENT OF MONITORING SERVICE USAGE TOOL

The monitoring service usage tool is explored and established from statistical control chart literature review. Additionally, it's compared and analyzed from the control charts which were applied to related areas e.g. manufacturing, automotive. With the benefit of control charts for process improvement, thus the control chart was applied to telecommunication industry to monitor and control subscriber usage. The general methodology for determining the level of subscriber usage with the combination of \bar{X} and R charts as follows

1. Service usage control chart determination
2. Development of service usage control chart
3. Validity check of monitoring service usage tool

5.1 Service usage control chart determination

From literature reviewed, many characteristics of quality control charts and process capability indices are useful and beneficial for continuously monitoring service usage.

- \bar{X} and R- charts focus values of the observations. Therefore all past observations are considered in term of the mean or average value of subscribers' usage.
- \bar{X} and R- charts characteristics are often compared to service usage consumptions. Normal and abnormal variations should be detected.
- \bar{X} and R- charts are useful to provide a visual mean or average. They indicate the level of variability and eliminate the variability before unexpected results occur.
- \bar{X} and R- charts are rather simple and easily drawn from process output. In addition, the process mean and variation are obtained directly

5.2 Development of service usage control chart

The methodology for determining the level of subscriber usage with the combination of \bar{X} and R charts are as follows

Step 1: Selected the interesting price plan and collected its subscriber usages. Then three subgroups of subscriber usage consumption were determined. Subgroup represents for subscriber usage in each month.

Step 2: Calculated mean (\bar{X}), range (R) of individual usage

Table 5-1 Control limits of \bar{X} and R- charts for each subscriber from price plan example
(Small usage)

Subscriber No.	Subscriber Measurements (Minutes)			\bar{X}	\bar{R}
	Month 1	Month 2	Month 3	\bar{X}	R = max-min
				81.01	60.69
1	50.86	52.53	59.88	54.42	9.02
2	77.21	51.83	25.13	51.39	52.08
3	152.08	113.14	78.78	114.66	73.3
4	35.75	19.22	81.11	45.36	61.89
5	85.76	41.75	74.81	67.44	44.01
...
N	127.75	69.96	110.6	102.77	57.79

Step 3: Calculated control limit based on collected data and plot \bar{X} and R value with the calculated center lines and control limits. Then check if usage is in control both \bar{X} and R- charts. The chart will be revised by removing subgroups that beyond control limits recalculate limits and check their status. If some subgroups are still beyond the limits, they need to be removed until all remaining usage points are within control limits.

However, the R-chart is first examined to ensure that the usage variation is stable. When the R-chart indicates that usage variation is in control and then the \bar{X} chart is analyzed. Therefore, both charts show in-control state as follow and they are ready to use these limits to monitor and control subscriber usage.

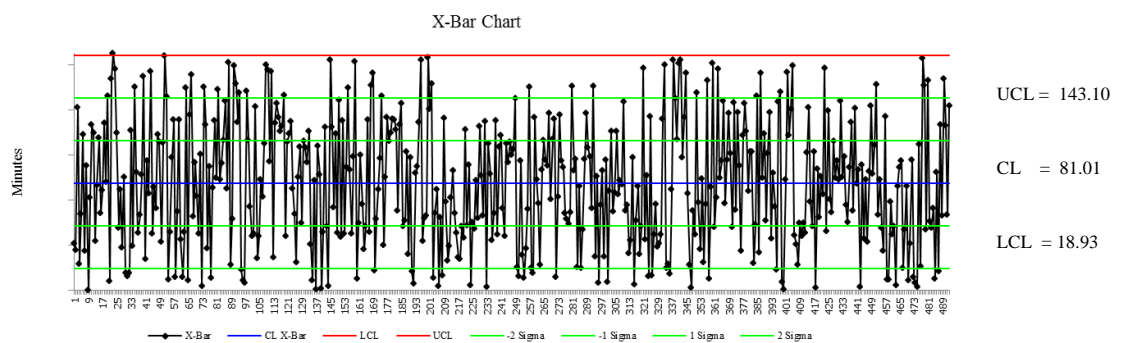


Figure 5-1 \bar{X} chart of subscriber usage mean (minutes) from price plan example (Small usage)



Figure 5-2 R- chart of subscriber usage range (minutes) from price plan example (Small usage)

Step 4: After that, a process capability analysis with process capability indices (C_p , C_{pk}) was calculate to identify short-term potential and actual capability that explained the performance level of service price plan to its target. these indices were calculated from the large sample in order to increase the accuracy (H.-C. Lin & Sheen, 2005). The process capability indices results are illustrated in Table 5-2.

Table 5-2 The result of process capability analysis for mobile service price plan

Price plan package	Process Capability (C_p)	Process Capability Index (C_{pk})
Small usage	1.02	0.75
Medium usage	0.81	0.45
High usage	0.77	0.26
Very High usage	0.82	0.13
Premium usage	0.56	0.06

For the result in Table 5-2 showed that C_p and C_{pk} value were small comparing with stable process with normal distributed data, the C_p and C_{pk} values should be at least 1.33. But for the above information all both process capability indices were less than 1.33, it indicated that the price plans were not fit for subscribers or meet minimum consumption requirement for potential capability. On the other hand, subscriber couldn't utilize their quota since consumption usage was far away from the target value ($C_{pk} < C_p$).

5.3 Validity check of monitoring service usage tool

To validate the proposed control chart model, a simulation model representing the subscriber usage consumption in latest month to detect the mismatch subscribers is developed. The results indicate that the subscriber detection has more accuracy and timeliness for providing the corrective action.

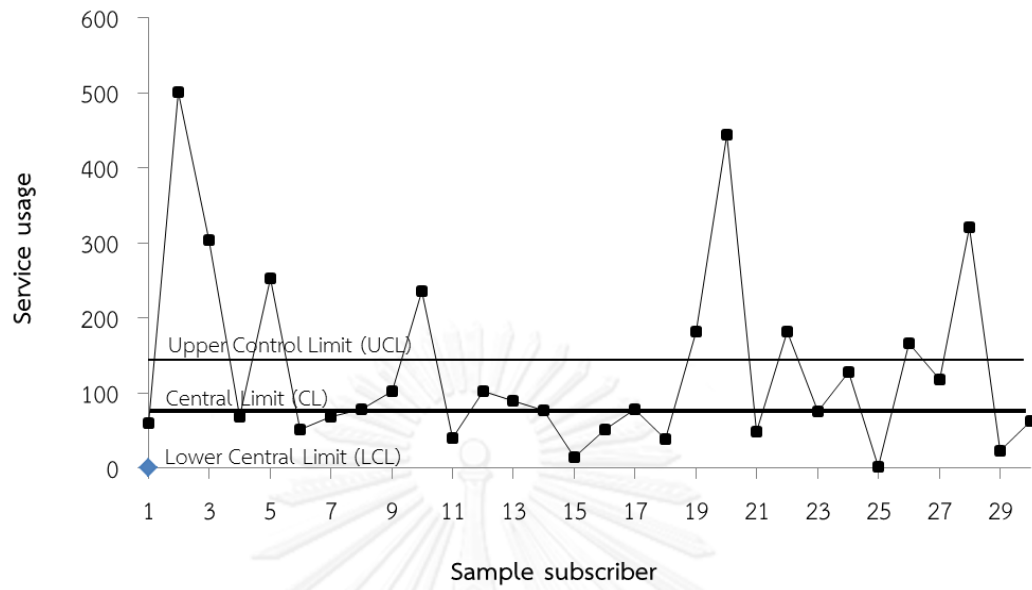


Figure 5-3 The proposed control charts are plotted with latest month of subscriber usage to detect potential mismatch price plan

CHAPTER VI DEVELOPMENT OF INNOVATIVE PRICE PLAN MONITORING AND ADVISORY SYSTEM

This chapter utilizes the result of empirical study for Technology Acceptance Model (TAM) by integrating subscriber usage behavior model of Thai mobile market and statistical control chart. This application provides warning signal for excessive subscriber usage and bringing next best offering to each subscriber with more precise usage prediction. It helps marketing strategy team automatically monitor subscriber usage which would otherwise have to be performed manually. The goals of Innovative Price Plan monitoring and Advisory System are:

1. To decrease decision making time
2. Improve decision quality
3. To provide automated tool for marketing team to monitor subscriber usage

6.1 Innovative price plan monitoring and advisory system development

The innovative price plan monitoring and advisory system is developed based on HTML5 platform consisting of four main components as follows.

1. Manage price plan: this part of the system will keep and maintain price plan characteristics and forecasting model
2. Detection condition: this part of the system will create conditions in each price plan to detect subscriber usage
3. Subscriber monitoring: to speed up the detection of potential excessive usage, this part of the system works as interactive advisor to help managers analyze their subscriber usage based on designed detection conditions.
4. Package advisory: this part of the system works as human advisor to calculate and estimate subscriber the potential usage based on predefined usage forecasting pattern as well as to propose and suggest the suitable price plans to the target subscriber.

6.2 PPMA 1.0 features and functionality

This section outlines the overall functionalities for Innovative Price Plan monitoring and Advisory System which consist of the following four major modules

1. Manage price plan: To keep and maintain price plan characteristics and forecasting model

Use case name: Manage price plan

Use case description: Create price plan and forecasting usage is a ability to record price plan characteristics to use across functionalities

<u>Actor:</u>	Marketing analyst
<u>Functional requirement</u>	<ol style="list-style-type: none"> 1. Marketing analyst selects “Manage price plan” action 2. System requests marketing analyst to entry price plan characteristics and parameters for forecasting usage model 3. System validates price plan 4. System submits and confirms the price plan
<u>Post-conditions:</u>	Price plan have been created

2. Detection condition: To monitor and control individual’s subscriber usage as well as using process capability indices to indicate the level of fit between subscriber’s usage consumption and their chosen price plan, control limit for each price plan will be modeled by extracting and processing sampling subscriber records. To get accurate control limit, subscriber data shall be processed as regular basis e.g. monthly or ad-hoc basis.

<u>Use case name:</u>	Develop detection conditions
<u>Use case description:</u>	Detection algorithm is a condition to monitor and detect unusual behavioral subscriber.

<u>Actor:</u>	Marketing analyst
<u>Functional requirement</u>	<ol style="list-style-type: none"> 1. Marketing analyst selects “detection condition” action 2. System requests marketing analyst to upload/retrieve subscriber profile to calculate threshold 3. Marketing analyst provides subscriber profile 4. System validates subscriber profile e.g. single subscriber 5. System submits subscriber profile for processing and calculate threshold with specific formula 6. Marketing analyst puts the detect conditions 7. System submits and confirms the conditions.
<u>Post-conditions:</u>	Detection conditions for each price plan have been created

3. Subscriber monitoring: The manager accesses the Innovative Price Plan monitoring and Advisory System, manager can run all current subscriber usage against control limit parameters configured. This also includes graphical/interactive dashboard representation

of a Usage Shift and the system shall be able to show the number and percentage of subscribers that would get excessive usage. To detect warning signal for subscriber usage, subscriber data shall be uploaded and validated as regular basis e.g. monthly or ad-hoc basis.

Use case name: Detecting subscriber
Use case description: Detection subscriber is the ability to detect unusual subscriber usage with predefined conditions.

Actor: Manager

Pre-condition Detection conditions has been identified

Functional requirement

1. Manager selects “Monitoring subscriber” action
2. System requests manager to upload/retrieve subscriber target
3. Manager provides subscriber target as specified path
4. System validates subscriber target information e.g. single subscriber
5. System submits subscriber target information for processing as predefined conditions
6. System presents usage behavior with dashboard and generate list of unusual behavior subscriber for further action

Post-conditions: Unusual usage subscribers have been monitored and detected

4. Package advisory

4.1 Predicting subscriber usage: By applying innovative price plan prediction model to a subscriber’s current usage and latest price plan, the system shall be able to forecast appropriate usage that most accurately match usage and individual needs. Data is processed and updated automatically on a daily, weekly and monthly or ad-hoc basis.

Use case name: Predicting subscriber usage

Use case description: Predicting subscriber is the ability to calculate and forecast subscriber usage based on their historical usage and individual behavior with innovative price plan prediction model.

Actor: Manager

Pre-condition List of unusual behavior subscriber is generated

Functional requirement Manager selects “Predicting subscriber usage” action

System requests manager to select unusual subscribers for predicting usage

System submits unusual subscribers for processing as predefined calculation model.

System presents list of unusual behavior subscriber with their predictive usage characteristics for further action

Post-conditions:

Predictive subscriber usage characteristics have been generated

- 4.2 Sizing and offering price plan: To analyze price plan and enable subscriber choices for a selection of subscribers or all, the system shall have ability to predict the most appropriate subscriber choices based on actual subscriber usage and financial implication e.g. revenue for different price plan. This includes prioritize with compare them with percentage of fit in each price plan.

Use case name:

Sizing and offering price plan

Use case description:

Sizing and offering price plan is the ability to match individual predictive usage with suitable price plan

Actor:

Manager

Pre-condition

Individual predictive subscriber usage characteristics have been generated

Functional requirement

1. Manager selects "Sizing and offering price plan" action
2. System requests manager to select list of unusual behavior subscriber with their predictive usage characteristics
3. System submits unusual behavior subscriber with their predictive usage characteristics for matching with most appropriate price plan by predefined offering criteria.
4. System presents offering choice with percentage of fitness

Post-conditions:

Suitable price plans have been initiated and offer to subscriber

6.3 PPMA 1.0 menu and user experience

This section explains the basic capabilities of the PPMA 1.0, describes the characteristic and forecasting model in each price plan, condition identification to monitor subscriber usage, and then details various procedures to offer price plan for target subscribers.

For the security purposes, this application will display the logon screen by using provided URL. On this screen, the user will be asked for a username and password. Then, features will be available.



Figure 6-1 PPMA 1.0 Logon screen

6.3.1 Manage Price plan

This section focus on the price plan master record, the data contained therein is required for forecasting subscriber usage and offering the next appropriate price plan in the package advisory.

The master data of price plan is made up for two parts. The general data is available for all package advisory. The price plan structure is specified, monthly service fee, free call all network, maximum 3G speed for 42 Mbps, dtac WiFi and overage/extra service fee as Figure 6-2 and 6-3.

☰ > price plan

price plan

PRICE PLAN

New Price Plan ↕

PACKAGE NAME	MONTHLY SERVICE FEE	FREE CALL ALL NETWORKS (MINUTES)	MAXIMUM 3G SPEED FOR 42 Mbps (MB)	DTAC WIFI	OVERAGES AND EXTRA SERVICE FREE					MANAGE
					VOICE CALLS (BATH/MESSAGE)	INTERNET (MINUTES)	INTERNET (MB)	SMS	MMS	
Dtac voice 299	299	300	50	Unlimited	1	50	100	3	30	EDIT
dtac voice 499	499	550	-	-	1.5	1	-	2	5	EDIT
dtac voice 799	799	950	-	-	1.5	1	-	2	5	EDIT
dtac voice 1199	1199	1600	-	-	1.5	1	-	2	5	EDIT
More choice429	429	250	750	Unlimited	1.5	-	-	1	5	EDIT
test 199	199	199	100	unlimited	1	2	2	3	5	EDIT
More choice529	529	250	1.5GB	Unlimited	1.5	-	-	1	5	EDIT

Figure 6-2 Summary information about price plan

☰ > price plan > new price plan

price plan

PRICE PLAN CHARACTERISTICS

Package Name :

Monthly Service Fee :

Free Call All Networks (Minutes) :

Maximum 3G Speed For 42 Mbps : MB GB

Dtac WIFI :

overages and extra service fee

Voice Calls (Bath/Minute) :

Internet (Minutes) :

Internet (MB) :

SMS (Bath/Message) :

MMS (Bath/Message) :

Figure 6-3 General information about price plan

For formula to calculate subscriber usage is specified in the price plan forecasting model area. This includes condition of calculation in each segment of voice usage and internet usage e.g. risky subscriber, healthy subscriber. Figure 6-4 shows the basic structure of price plan forecasting model.

price plan forecasting model :

voice
internet

VOICE

PREDICTION FORMULAS FOR RISKY SUBSCRIBER :

Constant :

AVG Voice Usage Score :

Attitude score :

Intention score :

Attitude value :

Intention value :

* Predicted voice usage = +(AVG Voice Usage) + ({})(ATTITUDE) + ({})(INTENTION) *

PREDICTION FORMULAS FOR HEALTHY SUBSCRIBER :

Constant :

AVG Voice Usage Score :

Attitude score :

Intention score :

Attitude value :

Intention value :

* Predicted voice usage = +(AVG Voice Usage) + ({})(ATTITUDE) + ({})(INTENTION) *

SAVE

Figure 6-4 Forecasting model for usage prediction of price plan

6.3.2 Detection condition

This section focuses on the detection condition of price plan, the data contained therein is required for subscriber monitoring. This data contains specific data of the price plan, such as subscriber usage range, average subscriber usage, price plan capability and specification as Figure 6-5.

[🏠 > detection condition](#)

condition

PRICE PLAN : dtacvoice 149 ▼

Upload New Condition ↕

DATE	Subscriber usage range (MAX-MIN)			Subscriber usage (x-bar)			Cp	Cpk	Usage Variation (Sigma)	Status
	Lower range	Average	Upper range	Lower usage	Average	Upper usage				
2013-09-09	-	60.69	156.22	18.93	81.01	143.1	1.02	0.75	3	Active
2013-09-09	-	60.69	156.22	18.93	81.01	143.1	0.46	0.36	3	Closed
2013-09-09	-	-	-	-	-	-	-	-	3	Closed

Figure 6-5 Summary information for detection condition

When going to the new condition, the system automatically navigates to new condition screen where you can enter the specific data of the condition and uploading required data (see Figure 6.6).

🏠 > *condition* > *upload new condition*

condition & package capability

Price Plan: dtac voice 149

Upload New Subscriber File : No file chosen

Usage Specification Limit :

Lower Usage Specification Limit (LSL) :

Uper Usage Specification Limit (USL) :

No. of Usage Variation Limit (Sigma) :

Figure 6-6 Data structure of detection condition

6.3.3 Subscriber monitoring

The subscriber monitoring refers to the processing of monitoring and detecting subscriber usage. The condition of subscriber monitoring is structured according to various market needs and separate the individual price plan. In this context, the subscriber monitoring has the following functions:

- Selection of subscribers with their usage via upload
- Generate of subscriber list

Before executing the subscriber monitoring, the condition of subscriber segmentation and price plan offering are set that depend on the price plan in the Figure 6-7, 6-8.

🏠 > *subscriber monitoring*

subscriber monitoring

PRICE PLAN :

DATE	Subscriber usage (x-bar)			Subscriber usage range (MAX-MIN)		Cp	Cpk	Usage Variation (Sigma)	
	Lower range	Average	Upper usage	Lower usage	Upper usage				
2013-09-09	0	60.69	156.22	18.93	81.01	143.1	1.02	0.75	3

📌 UPLOAD NEW SUBSCRIBER FILE : No file chosen

Subscriber Segmentation: (%)"/>

Offering Condition: (%)"/>

Figure 6-7 Data structure of subscriber monitoring

subscriber monitoring summary

No.	Date	PRICE PLAN	VOICE USAGE TREND	ARPU INCREASE	Total	Remaining	Complete	Status	Manage
1	2013-09-09	dtac voice 149	30	10	56	55	1	1	View
2	2013-09-09	dtac voice 149	30	20	57	57	0	1	View
3	2013-09-09	dtac voice 149	30	10	56	54	2	1	View
4	2013-09-09	dtac voice 149	30	20	57	56	1	1	View
5	2013-09-10	dtac voice 149	30	20	57	57	0	1	View
6	2013-09-10	dtac voice 149	30	20	57	57	0	1	View
7	2013-09-10	dtac voice 149	30	20	57	56	1	1	View

Figure 6-8 Summary of subscriber monitoring

> subscriber monitoring > segmentation

subscriber segmentation

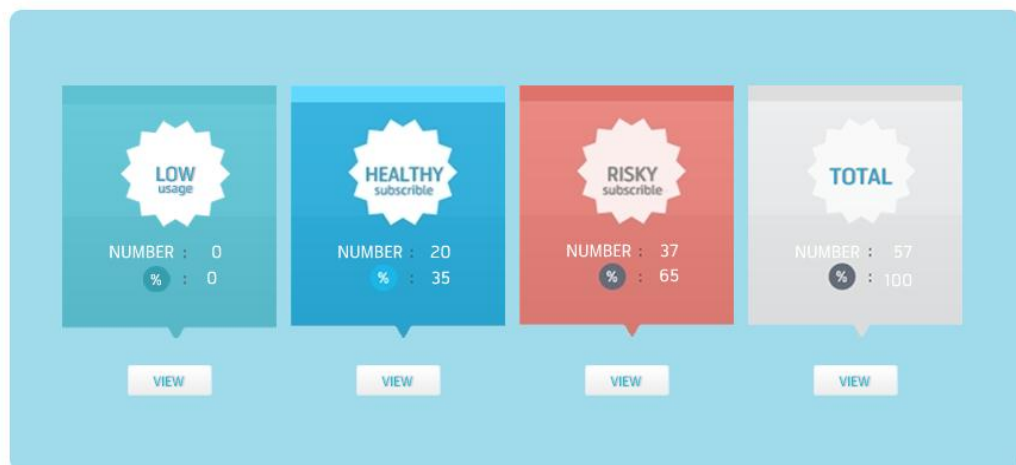


Figure 6-9 Segmentation of monitored subscribers

☰ > subscriber monitoring > segmentation

segmentation

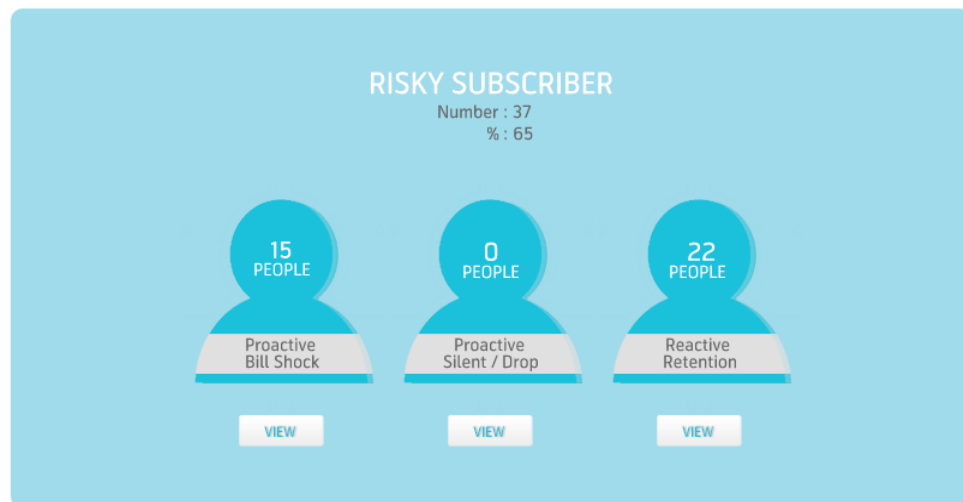


Figure 6-10 Selective segmentation of subscribers

☰ > subscriber monitoring > segmentation

REACTIVE RETENTION

Export ↕

SUBSCRIBER NO.	CUSTOMER NAME	CURRENT MAIN PACKAGE	ADDITION PACKAGE	ARPU	VOICE USAGE (LASTMONTH)	VOICE USAGE (AVERAGE)	VOICE USAGE (PREDICT)	SUBSCRIBER STATUS	STATUS	MANAGE
66816553197	Manarach 37	dtac voice 149		3,384	2,307	3,751	2,743	Active	-	View
66816553194	Manarach 34	dtac voice 149		2,779	1,903	1,800	1,399	Active	-	View
66816553187	Manarach 27	dtac voice 149		1,814	1,260	1,369	1,102	Active	-	View
66816553189	Manarach 29	dtac voice 149		1,406	988	1,314	1,065	Active	-	View
66816553196	Manarach 36	dtac voice 149		729	537	489	496	Active	-	View
66816553213	Manarach 53	dtac voice 149		691	512	469	482	Active	-	View
66816553209	Manarach 49	dtac voice 149		687	508	471	484	Active	-	View
66816553212	Manarach 52	dtac voice 149		660	491	455	472	Active	-	View
66816553211	Manarach 51	dtac voice 149		591	445	422	450	Active	-	View

Figure 6-11 The list of potential subscriber to be offered price plan

6.3.4 Package advisory

A package advisory in this application defines which price plan is used for offering. The specifications for offering method are made during the subscriber monitoring process and depend on subscriber need while offering process. In this context, there are two types of offering which are company offering and customer preference. The best three choices of price plans that fit with their usage will be shown for offering as Figure 6-14. Similarly, subscriber preference will be shown as Figure 6-15.

Before offering to subscriber, the general subscriber information with their historical is presented to subscriber as Figure 6-12, 6-13.

> subscriber monitoring > advisory

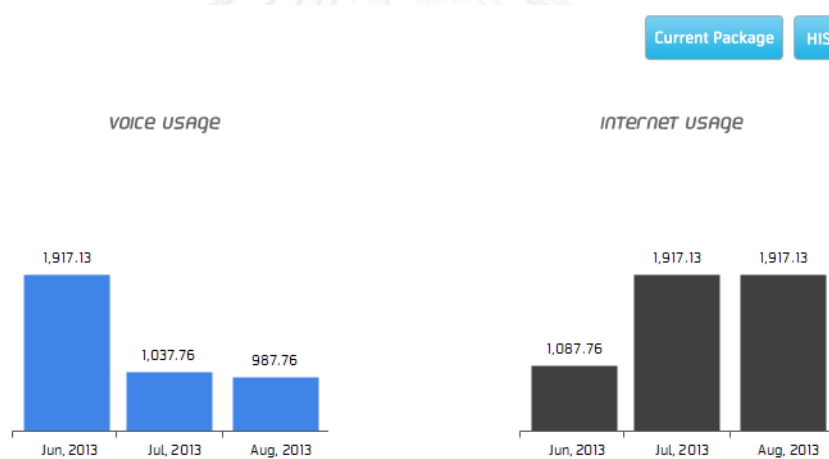
subscriber information

CUSTOMER NO. : 535309269 SUBSCRIBER NO. : 66816553189 CUSTOMER NAME : Manarach 29
 CURRENT MAIN PACKAGE : dtac voice 149 CURRENT ADDITION PACKAGE : SUBSCRIBER STATUS : Active
 ARPU (LAST MONTH) : 1,406 ARPU (PREDICT) : 1,521 STATUS : -

TYPE OF SERVICE	USAGE (LAST MONTH)	USAGE (AVERAGE)	USAGE (PREDICT)	USAGE CHANGE (%)
Voice Usage (min)	988	1,314	1,065	77 (8%)
Internet (mb)	1,917	1,641		

Current Package HISTORICAL USAGE

Figure 6-12 The general information for target subscriber



Current Package HISTORICAL USAGE

Figure 6-13 The comparison of historical usages for target subscriber

dtac voice 149

MONTHLY SERVICE FEE 149	FREE CALL ALL NETWORKS (MINUTES) 150	VOICE CALL (BAHT/MESSAGE) 1.5	Maximum 3G Speed for 42 Mbs (MB) NO	DTAC WIFI NO
---	--	---	--	---

AVERAGE CHARGE AND EXTRA SERVICE FREE**

<ul style="list-style-type: none"> ● VOICE CALLS : 1.5 (BAHT/MINUTES) ● SMS : 2 (BAHT/MINUTES) 	<ul style="list-style-type: none"> ● INTERNET : (BAHT/MESSAGE) ● MMS : 5 (BAHT/MESSAGE)
--	---

Current Package HISTORICAL USAGE

Figure 6-14 The details of current subscriber price plan

Company Offering Subscriber preference

retention offering
upsell offering

1	More choice749_V <ul style="list-style-type: none"> ● Expected expense: 749 bath ● Expected usage: 800 mins 	<ul style="list-style-type: none"> ● Expected change: -369 bath (-33%) ● Usage change (Mins): 4 mins (0%)
<hr/>		
2	dtac voice 799 <ul style="list-style-type: none"> ● Expected expense: 799 bath ● Expected usage: 950 mins 	<ul style="list-style-type: none"> ● Expected change: -319 bath (-29%) ● Usage change (Mins): 154 mins (19%)
<hr/>		
3	More choice849 <ul style="list-style-type: none"> ● Expected expense: 849 bath ● Expected usage: 800 mins 	<ul style="list-style-type: none"> ● Expected change: -269 bath (-24%) ● Usage change (Mins): 4 mins (0%)

status: SUBMIT

Figure 6-15 The best three choice of price plan for target subscriber (Company offering)

Company Offering Subscriber preference

subscriber preference

Price:

1	dtac voice 799 <ul style="list-style-type: none"> ● Expected expense: 1,000 bath ● Expected usage: 1,084 mins 	<ul style="list-style-type: none"> ● Expected change: -149 bath (-13%) ● Usage change (Mins): 267 mins (33%)
<hr/>		
2	More choice749_V <ul style="list-style-type: none"> ● Expected expense: 999 bath ● Expected usage: 967 mins 	<ul style="list-style-type: none"> ● Expected change: -150 bath (-13%) ● Usage change (Mins): 150 mins (18%)
<hr/>		
3	More choice849 <ul style="list-style-type: none"> ● Expected expense: 1,000 bath ● Expected usage: 901 mins 	<ul style="list-style-type: none"> ● Expected change: -149 bath (-13%) ● Usage change (Mins): 84 mins (10%)

status: SUBMIT

Figure 6-16 The best three choices of price plan for target subscriber (Customer preference)

The corresponding screen displays the details of the proposed and current subscriber price plan, once the price plan is selected to offering (see Figure 6-16, 6-17).

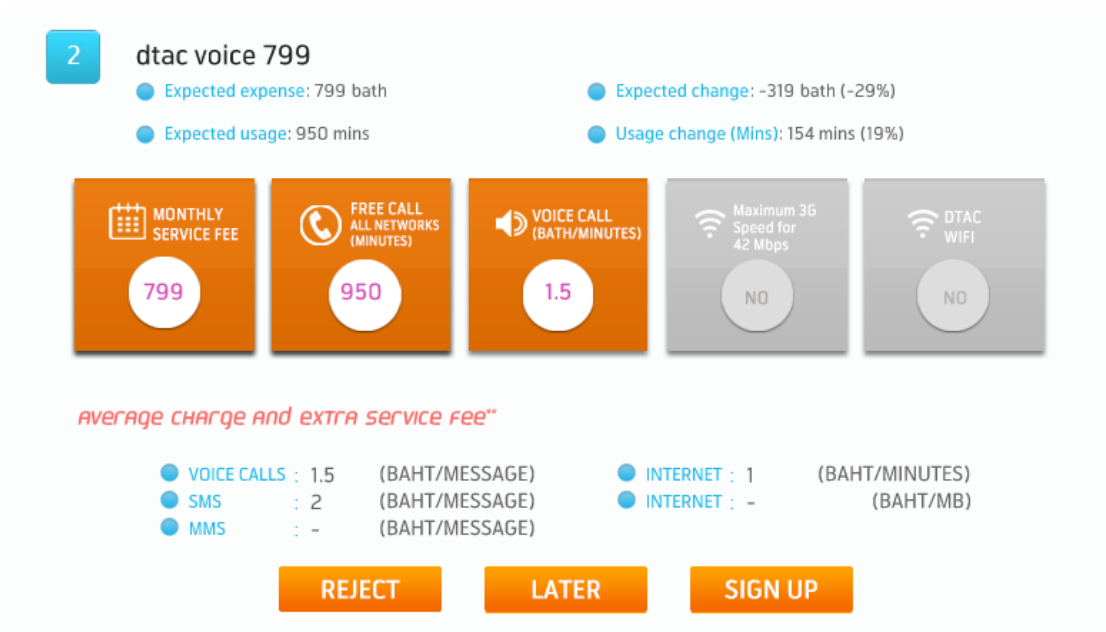


Figure 6-17 The details of the proposed price plan

At the end of this advisory package, the three lists of subscriber responses are shown, for example, reject, later and sign up. When the response is selected, the Subscriber Response dialog box opens (see Figure 6.18). Then, the response is saved with additional information or reason which depends on subscriber response.

REJECT

Reason

ลูกค้าไม่สนใจรับข้อเสนอ/ไม่ต้องการเพิ่มค่าใช้จ่าย

CANCEL **SUBMIT**

Figure 6-18 The Subscriber Response dialog box

6.3.5 Reporting

This report is enabling marketing analysis and manager to view the subscriber status as well as tracking the performance of the offering for the price plan.

report

report

Price Plan to

Offering Date to

Agent Name

Subscriber No. Status

Export

OFFERING DATE	CURRENT MAIN PACKAGE	CUSTOMER NO.	SUBSCRIBER NO.	CUSTOMER NAME	STATUS	REASON	NEW PACKAGE	AGENT NAME
No data								

Figure 6-19 Package advisory report and monitoring



CHAPTER VII VALIDITY TEST OF INNOVATIVE PRICE PLAN MONITORING AND ADVISORY SYSTEM

In this chapter, the proposed Innovative Price Plan Monitoring and Advisory system (PPMA 1.0) was tested and validated to determine that the subscriber level of acceptance rate to change a new best fit offering to ensure that predictive subscriber usages model is accepted and valid with appropriate level. By the end of the validity testing period, the company will be able to make a decision to launch this application on a larger scale and move on to the rollout phase or not. The procedures and methodologies are described as Figure 7-1.

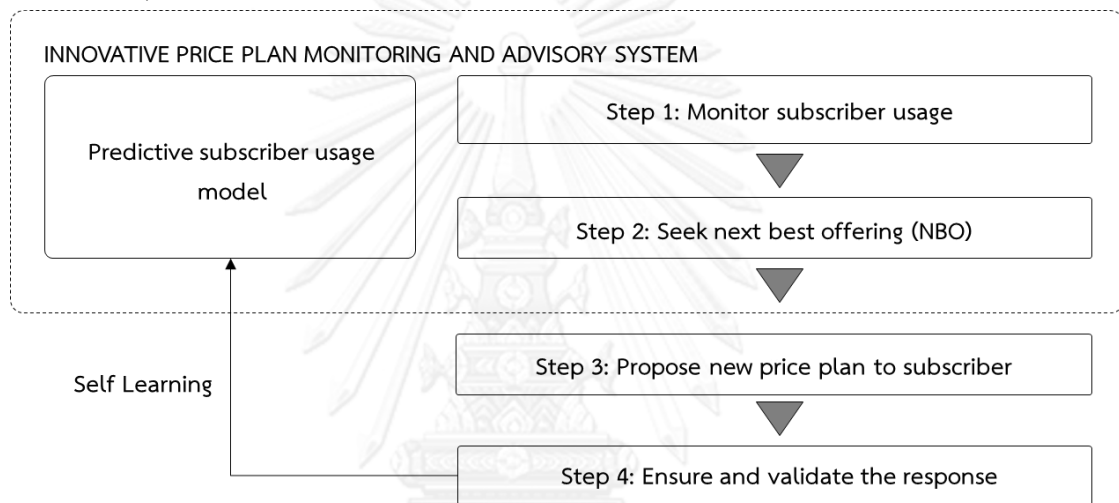


Figure 7-1 The procedure and methodology for application validity test

7.1 Application validity testing methodology

This application testing was conducted during beginning of September 2013. One price plan was selected for testing. The outbound call was used in this test. The data were collected from the same group with the same criteria of the research. The details of population and sampling criteria are listed below.

7.1.1 Population and Sampling procedure

The population for this test was the subscribers who have postpaid service price plan (Target price plan) in July 2013 and there have no additional price plan and their price plan haven't been changed in last three months (May-July'2013).

In order to avoid bias of sample, the systematic random sampling was employed to select the subscribers for this test. The rational to use the systematic random sampling was made because all subscribers have the same probability of selection and completed list of subscriber is ready to obtain from the database as was the case for research. The 100 subscribers were selected from "Risky subscriber" for testing application validity. The criterion for screening

potential over usage subscriber is automatically defined in Innovative price plan monitoring and advisory system as following instruction.

1. The detection condition is created in Innovative price plan monitoring and advisory system from sampling of subscriber list in targeted price plan. The last three months usage (May-July'2013) was used for this test.
2. The processing of monitoring subscriber is generated via "Subscriber monitoring" by uploading the target subscriber list. The three segmentations were identified by predefined condition criteria as following
 - a. Low usage segmentation
 - b. Healthy subscriber segmentation
 - c. Risky subscriber segmentation
3. For this step, the list of risky subscriber is generated and 100 target subscribers were selected by systematic random sampling ordering the records in descending by usage.

7.1.2 Application validity test instrument

For this validity test, an Innovative price plan monitoring and advisory system version 1.0 is in place.

7.1.3 Application validity method analysis

For this validity test, descriptive statistics were used to summarize information.

7.1.4 Result for application validity test

The primary purpose was to test and validate predictive subscriber usage model and proposed offering to subscribers. When the data collection was conducted with 254 target subscribers by followed the sampling process as above.

In the validity test, there were 53.5% of subscribers can be reachable, 37.8% outbound call failed due to not reachable subscriber and 8.7% were not illegal criteria for this validity test due to switch off, suspend and already changed their price plan. The results of this validity test are summarized in Table 7-1.

Table 7-1 Summary subscriber status

Subscriber status	No. of subscriber	% of subscriber
Reachable subscriber	136	53.5%
Not reachable subscriber	96	37.8%
Illegal subscriber (Criteria)	22	8.7%
Total	254	100%

As table 7-2, Forty percent of reachable subscribers were sign up, 30.1% response with later and 29.4% reject the offering.

Table 7-2 The result of subscriber response

Type of response	No. of subscriber	% of subscriber
Sign up	55	40.4%
Later	41	30.1%
Reject	40	29.4%
Total	136	100.0%

With 40.4% of subscribers sign up to the new price plan that are more suitable due to their usage. There were 90.9% of subscriber were changed to premium price plan with the same family, only 9.1% moved to another family due to their usage behavior tend to be new entry for data user. The results are summarized in Table 7-3.

Table 7-3 List of price plan for subscriber sign up

Price plan	No. of subscriber	% of subscriber
Premium voice 1	24	43.6%
Premium voice 2	25	45.5%
Premium voice 3	1	1.8%
Premium Smart 1	2	3.6%
Premium Smart 2	2	3.6%
Premium Smart 3	1	1.8%
Total	55	100.0%

7.2 Conclusion for application validity test

The data and observations collected during the validity allow us to conclude that the customer offerings have been predicted and advised subscriber usage from Innovative price plan monitoring and advisory system are valid for company package advisory.

With Innovative price plan monitoring and advisory system, company can make an appropriate and timely decision through insight subscriber usage behavior to gain more understand their subscriber demand and propose the fit offerings. In addition, an effective tools will help company to retain the subscribers including letting subscribers have their awareness to maintain their usage within selected price plan.

CHAPTER VIII APPLICATION ACCEPTANCE TESTING OF INNOVATIVE PRICE PLAN MONITORING AND ADVISORY SYSTEM

When the proposed Innovative Price Plan Monitoring and Advisory system (PPMA 1.0) was developed, the acceptance of predictive subscriber usage and advisory package model was investigated.

The application acceptance testing is a smaller version of pilot in a controlled but real environment with limited agents. The main objectives of this test are as follows.

1. To check the PPMA 1.0 in order to make sure that all the system functionalities are working properly
2. To check the users' friendliness of the process and transactional flows
3. To test the level of acceptance from potential users

This methodology aimed to measure the agent's opinion on usability, user interface and its functionalities to use Innovative Price Plan Monitoring and Advisory system. In parallel, efficiency and effectiveness were captured.

8.1 Application acceptance testing methodology

This application acceptance testing was conducted during beginning of September 2013, the same time for application validity testing with subscriber. The four keys for acceptance testing are measured as below.

1. Perceived usefulness refers to the degree of feeling that agents believes that using Innovative price plan monitoring and advisory system would improve their job performance in monitoring and advisory package
2. Perceived ease of use refers to the degree of easiness that agents feel when using Innovative price plan monitoring and advisory system
3. Usability refers to the degree of feeling that agents have an easy to use when using Innovative price plan monitoring and advisory system
4. User satisfaction refers to the degree of satisfy that agents feel when using Innovative price plan monitoring and advisory system

8.1.1 Population and Sampling procedure

The surveys targeted all agents who called to subscribers for price plan offering. The six agents to use Innovative price plan monitoring and advisory system were selected. The total of six survey questionnaires, with a cover letter that explained the study and objectives, was sent to agents, after validity test has been done. The response rate was 100% (n=6).

8.1.2 Application acceptance test instrument

In order to meet the objectives of the testing approach, the questionnaire was employed with the objective of evaluation and acceptance testing the Innovative Price Plan Monitoring and Advisory system. The questionnaire consists of four sections;

Section 1 is demographic characteristics, which are used to depict the characteristics of the respondents e.g. gender, age, education level and occupation.

Section 2 is designed to discover what the agent opinion to use the Innovative Price Plan Monitoring and Advisory system. In this section, agents asked to look at five categories on new mechanic for package advisory, usability, user interface, comparison to traditional tools of package advisory and benefit to use Innovative Price Plan Monitoring and Advisory system by choosing the answers which most closely match how agent feel.

Section 3 assesses the opportunities and possibilities to use the Innovative Price Plan Monitoring and Advisory system for price plan advisory in the future.

Section 4 is designed to ask for problems and suggestions on how to use the Innovative Price Plan Monitoring and Advisory system for price plan advisory in order to improve the quality of application.

For this application acceptance test, an Innovative price plan monitoring and advisory system version 1.0 is in place.

8.2 Acceptance of Innovative Price Plan Monitoring and Advisory system test results

For acceptance test of Innovative Price Plan Monitoring and Advisory system, there are five criteria that will be measured

8.2.1 User characteristics

The totals of 6 questionnaires were analyzed from the agents from customer service team, one man and five women. The respondents age range between 20-39 years old and having bachelor degree.

Table 8-1 Respondents demographic characteristics

		Number of respondents
Gender	Male	1
	Female	5
Age	< 15 years old	
	20 – 29 years old	5
	30 – 39 years old	1
	40+ years old	
Education level	Senior high school	1
	College/University	5
	Graduate school or above	
Occupation	Customer service	5
	Head of customer service	1

8.2.2 Perceived usefulness

For agents, the perception on the impact on performance and effectiveness were above the midpoint on the 5-Likert scale scored 3.83 - 4.17. The average perception of the perceived usefulness was 3.88 as shown in Appendix D.

8.2.3 Perceived ease of use (usability)

Overall, the appreciation of the perceived ease of use scored 3.50 – 4.00. For all items, the score of “The clear goal of instruction to use” and “The program is easy to use” were the most rank with score 4.00 as shown in Appendix D.

8.2.4 User Interface

The average ratings on the PPMA 1.0 user interface were above the midpoint, scored 3.67 – 3.83. The appreciation of modernization application, an appropriate of font size and background and clear /contrast picture were 3.83 as shown in Appendix D.

8.2.5 User satisfaction

In general, agents considered to be satisfied with the PPMA 1.0. The average ratings on the satisfaction were above the midpoint, scored (3.83 - 4.00). The appreciation of the retain their customer base by using the application (4.00), help in optimization for package advisory (3.83) and the most valuable of package advisory (3.83) respectively as shown in Appendix D.

8.3 Conclusion of Acceptance test for Innovative Price Plan Monitoring and Advisory system

Evaluation of Innovative price plan monitoring and advisory system acceptance and adoption confirmed that PPMA 1.0 have positively impact on their work performance and effectiveness. With a user-friendly design in term of ease of use and user interface made agents considered to be satisfied with PPMA 1.0 and tend to use in the future.

With above of supporting information and opportunity/possible to use PPMA 1.0 in the future average score was 3.83. Therefore, we could conclude that the agents accept the system and agree for future use.



CHAPTER IX COMMERCIALIZATION

The Innovative Price plan Monitoring and Advisory system is a software solution for mobile network operators that provide insight usage behavior. The solution delivers an effective monitoring tools and automatic suggest the best offering price plan that drive customer satisfaction and loyalty in the long run.

For mobile network operators, the Innovative Price plan Monitoring and Advisory system offers:

1. Timely detect of subscriber behaviors in term of type of service consumption such voice, internet.
2. Real-time subscriber usage and categorized segmentation.
3. Automate mapping an appropriate price plan based on individually subscriber data usage integrated with insight price plan behavior.
4. Dynamic and customized price plan
5. Campaign performance tracking via dynamic filtering and search engines with combination of views.

With this application, mobile network operators can take advantage insight behavior via monitoring usage tool that include measurement capabilities in each price plan. These will improve decision making with quality and the possibility of additional service revenue opportunities. There the commercialization phasing will be:

9.1 MNO agent service

At first launch, the objective is to provide tools for mobile network operators to manage their subscriber campaign by themselves. Therefore, the application is a Web-based application that demonstrates how to detect their subscriber usage behavior and pattern. This solution is built and run through an internal portal application (web browser with single central server).

This trial version will be provided for free to the company for a period of time in order to complete and improve functionalities e.g. Price plans prediction by individual subscriber, online integration with Business Intelligence (BI) for real-time update subscriber information.

After the application has been improved, this Innovative Price Plan Monitoring and Advisory system is ready to commercialization. The application is sold as a product with license bundling with service support as shown in Table 9-1.

Table 9-1 Price elements and binding offer

Price element	Binding offer
Core platform	Software license (Pay as you grow)
Hardware	Optional
Integration and Customization/Interfaces	% Customization
Project management-deployment	Man/day
Professional services	Man/day
User Interface customization	
- WEB (GUI Customization for existing functionalities)	% Customization
- iOS, Android, Windows	% Customization
- Local language (GUI Customization for existing functionalities)	% Customization

The initial project costs based on the scope of this document are as Table 9-2, 9-3.

Table 9-2 Estimating the total development cost

Development role	Price per Man-Day (THB)	Man-Day	Summary Price per Role (THB)
1. Project Manager	15,000.00	45.9	688,500.00
2. Architecture	12,000.00	15.3	183,600.00
3. System Analyst (SA)	10,000.00	49	490,000.00
4. Developer	6,500.00	105	682,500.00
5. Tester	5,500.00	89	489,500.00
6. Performance Test Engineer	8,000.00	20	160,000.00
7. Technical Document Writer	4,000.00	63	252,000.00
			2,946,100.00

Table 9-3 The details of estimating the total development cost

Development type	Development Skill	QTY	Description	System Analyst (SA)		Developer		Tester		Technical Document Writer	
				Per unit	sum	Per unit	sum	Per unit	sum	Per unit	sum
1. Screen Type											
Add Data	Low	1	1-10 Fields , Single record , 4 Browsers	0.5	0.5	1	1	0.5	0.5	1	1
	Medium	4	11-20 Fields, Single record, 4 Browsers	1	4	3	12	1	4	2	8
	High	0	21-40 Fields, Multi records, 4 Browsers	2	0	5	0	1.5	0	4	0
Search Data	Low	1	1-10 Fields , Single record, 4 Browsers	0.5	0.5	1	1	0.5	0.5	1	1
	Medium	2	11-20 Fields, Single record, 4 Browsers	1	2	3	6	1	2	2	4
	High	0	21-40 Fields, Multi records, 4 Browsers	2	0	5	0	1.5	0	4	0
Edit Data	Low	1	1-10 Fields , Single record, 4 Browsers	0.5	0.5	1	1	0.5	0.5	1	1
	Medium	2	11-20 Fields, Single record, 4 Browsers	1	2	3	6	1	2	2	4
	High	0	21-40 Fields, Multi records, 4 Browsers	2	0	5	0	1.5	0	4	0
Delete Data	Low	1	1-10 Fields , Single record, 4 Browsers	0.5	0.5	1	1	0.5	0.5	1	1
	Medium	0	11-20 Fields, Single record, 4 Browsers	1	0	3	0	1	0	1.5	0
	High	0	21-40 Fields, Multi records, 4 Browsers	2	0	5	0	1.5	0	2	0
2. Backend Process											
	low	3	1-2 Process/Class	2	6	4	12	3	9	1	3
	Medium	1	3-7 Process/Class	4	4	6	6	5	5	2	2
	High	1	8-15 Process/Class	6	6	8	8	8	8	4	4

Development type	Development Skill	QTY	Description	System Analyst (SA)		Developer		Tester		Technical Document Writer	
				Per unit	sum	Per unit	sum	Per unit	sum	Per unit	sum
3. Report											
	low	5	1-3 Table (Join) , 4 Browsers	2	2	2	4	5	25	4	20
	Medium	0	4-7 Table (Join), 4 Browsers	3	5	3	7	8	0	6	0
	High	1	8-15 Table (Join), 4 Browsers	4	10	4	10	12	12	8	8
4. Interface											
Web Service	low	0	Single Record	1	0	4	0	2	0	1	0
	High	0	Multi Record (Master-Detail)	3	0	10	0	4	0	3	0
Table Interface	low	0	Single Table	1	0	2	0	2	0	1	0
	High	0	Multi Table (Master-Detail /Table Relationship)	3	0	6	0	4	0	3	0
Text File Interface	low	0	Single Record	1	0	4	0	4	0	1	0
	High	2	Multi Record (Master-Detail)	3	6	15	30	10	20	3	6
Summary				-	49	-	105	-	89	-	63

9.2 Customer self service

In recent years, the rapid development of mobile application, therefore for the next phase the application will be deploy to mobile platform and let subscriber to do monitoring and changing the price plan by themselves. With these platforms will help subscriber to monitor and keep track their usage and select price plan based on preference conditions. This application requires subscriber to input mobile number and data plan. It then detects the usage based price plan data limits and alert will be notified when the usage crossed the limit.

Business model: A mobile licensing platform

Model description:

- To accommodate the preference of mobile users
- The eligible subscribers will be able to download application from various platforms for free or making a purchase using online payment gateway e.g. PayPal account, PaySbuy, or charging purchases to mobile network operator billing.
- The application will be embedded to be one of feature for customer self-service.

Benefits:

- Mobile network operators will have ability to trigger their subscriber based on promotions and campaign.
- Gain understanding their subscriber behaviors and preference

9.3 Financial outlay

An innovative price plan monitoring and advisory system is as software solution package for mobile network operators to monitor and suggest the most appropriate price plan to their subscribers. This software package is an innovative product to retain and attract new subscribers by providing the better experience and optimize their monthly expenses.

To develop a decision support system, the financial is simulated and analyzed as shown in Table 9-4.

Assumption

1. Number of mismatched price plan subscribers (Subscribers)	10,000
2. % of potential subscriber to continue the contract (%)*	11%
3. Number of potential subscriber to continue the contract (Subscribers)	1,083
4. % of revenue decrease (%)	30%
5. Mobile ARPU Included IC (Baht/Month)	466
6. AOU increased (years)	2

*50% of sign up new price plan will continue the contract

Table 9-4 Financial metrics summary

BENEFITS : Proposed new price plan and then increased AOU to 5 years					
	Year1	Year2	Year3	Year4	Year5
Number of revenue months	12	12	12	12	12
Mobile ARPU Included IC (Baht/Month)	466	466	466	326.20	326.20
Revenue per subscriber (Baht)	5,592	5,592	5,592	3,914	3,914
Number of potential subscriber	1,083	1,083	1,083	1,083	1,083
Total Benefits/Decrease revenue	6,054,331	6,054,331	6,054,331	4,238,031	4,238,031
BENEFITS: Baseline revenues					
Number of revenue months	12	12	12	-	-
Mobile ARPU Included IC (Baht/Month)	466	466	466	-	-
Revenue per subscriber (Baht)	5,592	5,592	5,592	-	-
Number of potential subscriber	1,083	1,083	1,083	-	-
Total Benefits/Baseline	6,054,331	6,054,331	6,054,331	-	-
Benefits SUMMARY					
Benefits (revenue for 5 years).....	6,054,331	6,054,331	6,054,331	4,238,031	4,238,031
Benefits (Baseline for 3 years).....	6,054,331	6,054,331	6,054,331	-	-
NET Benefits	-	-	-	4,238,031	4,238,031

CHAPTER X DISCUSSION AND RECOMMENDATION

Subscriber churn is a fundamental driver of performance for mobile network operators. Understanding of subscribers and the ability to predict their behavior through continuous usage monitoring are vital to improve subscriber retention and performance. Improving quality of product and service is one of the main factor influencing on customer relation management (Azad, Roshan, & Hozouri, 2013). Service plan optimization is a key element of company strategies in the mobile communication sector to enhance customer satisfaction and retention (Seo, Ranganathan, & Babad, 2008). Current CRM practices focus on price plan suggestion based on average subscriber usage without considering variations: both common and special cause variations. Therefore, this study intends to fulfill the gap between traditional customer relation management system and theory concepts and build the decision supporting system. This system provides the functionality to suggest the most appropriated price plan to each subscriber by focusing on their usages and behaviors. Such tool enables timely and proactive action for subscribers to avoid unexpected expenses. Mobile network operators can utilize these concepts to increase service usage, improve customer satisfaction and ultimately reduce churn.

This study is divided into four main objectives; explore an existing Technology Acceptance Model (TAM) and customer behaviors to adopt mobile service in Thailand, identify the causes which potentially have effect on using mobile services, develop a service price plan prediction model and then develop and test an innovative price plan monitoring and advisory system of Mobile Telecommunication operators in Thailand.

Regarding the development of Innovative service price plan prediction of mobile telecommunication operators in Thailand, this chapter presents the summary of research findings, discussion for research findings, research limitation, and contribution to knowledge as well as recommendation for future research.

10.1 Summary of research findings

The key research findings have found in relation to research objective can be summarized in the Table 10.1

Table 10.1 Summary of research findings

Research objective	Chapter	Research method	Research findings
1. To explore an existing Technology Acceptance Model (TAM) and customer behaviors to adopt mobile service.	Chapter II	Systematic literature review	<p>A conceptual framework of subscriber usage behavior based on the literature reviews; there are 14 relevant factors that influence customer intention to use mobile services and their usage.</p> <ol style="list-style-type: none"> 1. Trust 2. Trialability 3. Variety of services 4. Facilitating conditions 5. Perceived usefulness 6. Perceived ease of use 7. Attitude 8. Perceived enjoyment 9. Perceived expense 10. Perceived risk 11. Perceived no need 12. Trait 13. Social influence

Research objective	Chapter	Research method	Research findings
			14. Intention to use



Research objective	Chapter	Research method	Research findings
2. To identify the causes which potentially have effect on using mobile services for recommend suitable price plans for Thai mobile subscribers.	Chapter III	1. The draft questionnaires was constructed and created based on literature review	<p>There are four main sections of questionnaire with demographic, adoption factors of mobile service, attitude/intention and customer satisfaction. Beside the demographic profile was structured by multiple-choice, 5 point-Likert scale is used for the rest of sections.</p> <ul style="list-style-type: none"> - To indicate the degree of related factors, the 43 items 14 constructs are defined.
	Chapter III	2. Content validity was performed by qualitative survey with obtaining the feedback from 5 subject experts with Index of item-congruence (IOC) to ensure that there are no any ambiguous questions.	<p>The result of the index correspond to the objectives of the factors the influence the behavior and attitude of subscribers to use mobile service are presented in 29 items 13 constructs</p> <ul style="list-style-type: none"> - There were 14 items with an index of item-congruence less than 0.5 were removed from the questionnaire. - “Perceive ease of use” is also removed due to consensus of 5 subject experts. They explained that with current market situation and Thailand penetration rate, perceived ease of use is no longer a criterion for using mobile services.
	Chapter III	3. Reliability Test from Pilot survey of 30 units of questionnaire to	<ul style="list-style-type: none"> - Cronbach’s alpha based on standardized item is .943 and the construct reliabilities ranged between 0.60 and 1.00,

Research objective	Chapter	Research method	Research findings
		<p>ensure the consistency and reliability of the construct</p>	<p>indicated that the items have quite high internal consistency.</p> <ul style="list-style-type: none"> - Convergent validity was evaluated by item loading and AVE, all item loadings were greater than 0.5 and AVE ranged from 0.57 to 0.92. Hence, all conditions for convergent validity were met. <p>Therefore, the questionnaire is appropriate for data collection.</p>
	Chapter IV	<p>Field survey to obtain the information as research objectives. A total for four hundreds interviews were conducted.</p> <p>In order to understand the subscriber usage behavior, the statistics are introduced to analysis the data as follows</p> <ol style="list-style-type: none"> 1. Descriptive analysis 2. Correlation analysis 3. Confirmatory factor analysis 	<ol style="list-style-type: none"> 1. All factors have been tested and validated, there are 6 factors that influence to subscriber usage as follows <ol style="list-style-type: none"> 1.1 Trust 1.2 Variety of services 1.3 Facilitating conditions 1.4 Perceived usefulness 1.5 Attitude 1.6 Intention to use 2. Perceived usefulness, attitude and intention to use have a predictive power for subscriber usage. 3. Attitude was explained well subscriber to intention to use mobile service

Research objective	Chapter	Research method	Research findings
			<p>4. “Perceived usefulness” would come from three main conditions; trust variety of services and facilitating condition.</p> <p>5. Facilitating condition was more strongly influenced to perceived usefulness than variety of services and trust</p>



Research objective	Chapter	Research method	Research findings
3. To develop a service price plan prediction model of Mobile Telecommunication operators in Thailand.	Chapter IV	Multiple regressions: stepwise method is employed to do an analysis.	<p>The result revealed that there were only 3 factors have potential to predict voice usage; Average voice usage, attitude, Intention to use.</p> <p>The equation result was stated as follows.</p> $\text{Predicted (Voice usage)} = 365.266 + .689 (\text{AVGVoiceusage}) - 27.597 (\text{Attitude}) - 23.970 (\text{Intention})$

Research objective	Chapter	Research method	Research findings
<p>4. To develop and test an innovative price plan monitoring and advisory system of Mobile Telecommunication operators in Thailand.</p>	<p>Chapter V Chapter VI Chapter VII Chapter VIII</p>	<ul style="list-style-type: none"> - A monitoring service usage tool development by Statistical Process Control chart (SPC) - New Product Development (NPD) - Pilot testing program with 254 target subscribers - Application acceptance test with Technology Acceptance Model (TAM) 	<ul style="list-style-type: none"> - An innovative price plan monitoring and advisory system is a decision support tool by integrate statistical control chart with service price plan prediction model, will help company to retain the subscribers including given an awareness to subscribers for their usage. - A monitoring service usage tool can provide critical visibility into subscriber consumption especially in exceeding usage - The application validity is tested with 254 target subscribers, 40.4% of reachable subscribers signed the new price plan offering. Benchmarking percentage of subscriber sign up with traditional retention, there was a bit higher rate. - Innovative price plan monitoring and advisory system has positively impact on their work performance and effectiveness. - The agent acceptance testing is measured in four key criteria: Perceived usefulness, Perceived ease of use, User Interface and User satisfaction. The overall evaluation score

Research objective	Chapter	Research method	Research findings
			is quite good, hence with a user-friendly design in term of ease of use and user interface made agents considered to be satisfied and tend to use in the future.



10.2 Discussion of research findings

The study was set out to understand and identify subscriber usage behavior for mismatch price plan subscriber customer behavior based on the theory of Technology Acceptance Model (TAM). Also, the study has sought to know and develop a service price plan prediction model and embedded to innovative price plan monitoring and advisory system of Mobile Telecommunication operators in Thailand. The theoretical literatures on this topic and in the context of mobile service have been reviewed.

This study conducted an outbound call survey to mobile phone subscribers from one of the largest case companies in Thailand. Target customers who have exceeded their chosen price plan's usage limit. A total of 340 participants who were responsible for their own payment and had their own numbers were selected. A structured questionnaire was developed from previous studies based on the literature review of TAM. Multiple regressions and confirm factor analysis were employed to analyze and test the hypotheses.

10.2.1 Subscriber behavior to use mobile service in Thailand

This research has explored the customer behavior to use mobile service in Thailand in order to understand their usage and offer the best fit price plan to subscriber. Based on 14 main factors had an influence on customer intention in regard to use mobile services, this research found that there were only seven factors; trust, variety of services, facilitating conditions, perceived usefulness, attitude, intention to use. It was also found that perceived usefulness, attitude and intention to use were the key predictive factors for subscriber's usage behavior when choosing their mobile phone service. From the research indicated that attitude mediated the effects on subscriber's intention, consistent with previous research (Islam, Low, & Hasan, 2013).

This research suggests that mobile network operator should mainly consider on variety of services and facilitating conditions. The perceived usefulness may have come from network quality, information quality, and service quality. This study clearly confirmed that these factors are practicable. Besides, the significant relationship between trust and perceive usefulness in the study indicated the important of trust in mobile service, similar to advanced mobile service e.g. m-commerce (Wei et al., 2009). It might be concluded that trust is the one of major concern to improve the usefulness of the system and service.

On the contrary, other factors including perceive enjoyment, perceived expense, perceive no-need, perceived risk, social influence and trait was found to not significant influence to intention to use mobile service. Even many previous researches suggested that other factors had impact on intention to use mobile service. The reason would be the subscriber usage consumption mainly from their attitude and intention to use mobile service; hence, this subscriber group didn't take these factors into account when they used mobile services.

In addition, the behavior to use mobile service from this research have been proposed and confirmed with other largest companies in Thailand in order to check if the model is valid for Thai subscribers. Questionnaire was used to collect information on a convenience sample of subscribers. A total of 34 observations were asked to complete a questionnaire, 14 were male (41.2 percent) and 20 were female (58.8 percent). A majority of the subscribers surveyed were between 26 and 45 years old, representing more than 88.2 percent of the sample, and most of the respondents were single (55.9 percent). In term of age of use, almost 91% of subscribers had used mobile service for more than three years. Surprisingly, more than 35 percent of the sample had exceeded their usage limit and the majority of samples (52.9 percent) were experiencing mismatched price plan as Table 10-2.

Table 10-2 Demographic profile for respondents (model confirmation)

Variables		Frequency	Percentage
Gender	Male	14	41.2
	Female	20	58.8
Age	< 15 years old	-	-
	15 - 20 years old	-	-
	21 – 25 years old	3	8.8
	26 – 30 years old	6	17.6
	31 – 35 years old	8	23.5
	36 – 40 years old	9	26.5
	41 – 45 years old	7	20.6
	46 – 50 years old	1	2.9
	51 – 55 years old	-	-
	56 – 60 years old	-	-
Marital Status	Single	19	55.9
	Married	5	44.1
	Divorced/Separated	-	-
Education level	Junior high school or below	-	-
	Senior high school	-	-
	College/University	11	32.4
	Graduate school or above	23	67.6
Occupation	Corporation	21	61.8
	State Enterprise	7	20.6
	Government	1	2.9
	Entrepreneur	4	11.8
	Housewife	-	-

Variables		Frequency	Percentage
Age of use	Student	1	2.9
	Less than 1 year	-	-
	1 – 2 years	2	5.9
	2 – 3 years	1	2.9
	3 – 5 years	31	91.2
Average current bill payment	Lower than selected price plan	6	17.6
	Within selected price plan	16	47.1
	Higher than selected price plan	12	35.3

Of the participating subscribers who had exceeded their usage limits, all the average rating on the perception were above midpoint, scored between 4.04 and 4.88 as shown in Table 10-3. Hence, we might concluded that perceived of usefulness, facilitation conditions, variety of services, trust, attitude and behavioral intention were key predictive factors in regard to the use of mobile service in Thailand

Table 10-3 The result of subscriber response in regard to the use of mobile service

Factor	Average perception score	Standard deviation
Perceived of usefulness	4.71	0.40
Facilitating conditions	4.15	0.60
Variety of services	4.29	0.58
Trust	4.04	0.84
Attitude	4.33	0.78
Behavioral intention	4.88	0.31

Therefore, we could confirm that the main contribution factors of the original TAM model in predicting subscriber acceptance for using mobile service besides perceived usefulness, attitude and intention use are trust, variety of services and facilitating conditions. However, note from this study perceived ease of use is not a discriminant to the adoption of mobile service in Thailand which is totally different from prior researches. According to TAM model and its advanced elements, perceived ease of use is a main important factor to explain user intention to use the particular system and mobile services. This is due to mobile device become one of the life essential for Thai people. Nevertheless, this result has been also confirmed in advance mobile phone services research (Islam et al., 2013). With aim of this study to utilize Technology Acceptance Model (TAM) to understand subscriber behavior, it help mobile network operator utilize these concepts to increase service usage, improve customer satisfaction and ultimately reduce churn.

10.2.2 A service price plan prediction model

Regarding the research, the multiple regression analysis is proposed and attempted to predict the subscriber usage based on their perceptions and profiles, multiple regressions with stepwise method was employed to do an analysis. The result revealed that there were only 3 factors had potential to predict voice usage. The equation result was stated as follows.

$$\text{Predicted (Voice usage)} = 365.266 + .689 (\text{AVGVoiceusage}) - 27.597 (\text{Attitude}) - 23.970 (\text{Intention})$$

The aim of this research was to utilize the Technology Acceptance Model (TAM) to identify the subscriber usage behavior that leads to increased service usage and to more accurately predict the usage of subscribers. Regarding the research, multiple regression analysis was used to predict subscriber usage based on their perceptions and profiles.

Average voice usage was the demographic factor found to be the most important to predict subscriber usage to use mobile service in Thailand, followed by attitude and intention. These two factors have been confirmed in previous research on TAM in regard to mobile service (K. K. Kim et al., 2011; Shin, 2012; C.-S. Wu et al., 2011). The results from this study indicated that age did not have a significant influence on predicting subscribers' intention to use mobile service. However, historical usage played an important role in predicting usage.

Perceived usefulness and trust were found to be important predictors to explain mobile service adoption in many prior research studies (Jung et al., 2009; J. Lu, Liu, Yu, & Wang, 2008; Revels et al., 2010). The significant relationship between trust and perceived usefulness indicated the importance of trust in advanced mobile service, e.g., m-commerce (Wei et al., 2009). Nonetheless, it's quite surprising that perceived usefulness and trust were not found to significantly impact mobile service adoption in this study, even though this factor had previously been shown to influence the intention to adopt technology, including a mobile service context. The reason for this might be the tremendous growth of mobile subscribers in Thailand over the past ten years. As discussed earlier, Thailand's mobile market reached 76.6 million mobile subscribers in 2011. Therefore, subscribers already have a good understanding of the benefits of mobile services. This result is in line with the study of the adoption of m-commerce in China and Malaysia (Chong, Chan, et al., 2012).

Variety of services was not found to have a significant impact on the use of mobile service. It might be concluded that as the subscribers in this study had exceeded their usage limits, the services provided by mobile network operators were not their main concern. This result aligned with the findings of Chong, Chan, et al. (2012). As such, whether or not mobile network operators provide a variety of services will not influence the adoption mobile service.

In many studies, facilitating conditions was one of the factors that was found to explain the adoption of advanced mobile phone services (Shin, 2012; K. Wang & Lin, 2012) and impact usage behavior (Venkatesh et al., 2003). In addition, functional value was found to affect attitudes about consuming mobile data services for consumers in the United States and Korea (Yang & Jolly, 2009). The findings in this study contradict these existing findings, as facilitating conditions did not have a significant relationship with subscribers' intention to use mobile service. Similar to the findings in a study on the adoption of 3G mobile phones in Taiwan, technology was not a significant factor influencing consumers' adoption of 3G (Teng et al., 2009).

In addition, perceived ease of use was not found to affect the adoption of mobile service in Thailand, which is totally different from the findings of prior research. According to the TAM model and its advanced elements, perceived ease of use is the most important factor to explain users' intention to use a particular system and mobile services. This is due to the fact that mobile devices have become one of life's essentials for Thai people. Nevertheless, this result has also been confirmed in previous advanced mobile phone services research (Islam et al., 2013).

Therefore, the results of this study confirm that the main factor, in addition to attitude and intention to use, allowing for the prediction of the usage of subscribers in Thailand who have exceeded their chosen price plan's usage limit is historical voice usage. On the other hand, trust, variety of services, facilitating conditions, perceived usefulness and perceived ease of use were not considered by subscribers in regard to the use of mobile services.

10.2.3 A Innovative price plan monitoring and advisory system

The Innovative price plan monitoring and advisory system is presented in this paper can make an appropriate and timely decision through insight subscriber usage behavior to gain more understand their subscriber demand and propose the best fit offerings. An application includes statistical control chart embedded under monitoring service usage tool and integrated with predictive subscriber usage by multiple regression. This application has shown the interesting result which beyond acceptance rate comparing with current retention process.

Therefore, with such an effective tool will help company to retain the subscribers including letting subscribers have their awareness to maintain their usage within selected price plan. In the future, the internet usage will be focused to provide the best fit offering as well as predictive usage for healthy subscriber. Additionally, new feature of individual analysis will be introduced and let subscribers can match the price plan by themselves. Result from this model will help manager to understand subscriber's behaviors in Thailand market. As a result, the manager can effectively control churn problem which is a major factor to raise customer complaint level.

10.3 Contribution

In accordance with the Technopreneurship and Innovation Management program regulation, the doctoral dissertation must meet all three main criteria; Technology, Innovation and Management. This research comply these requirements as follows.

Technology (T):	<ul style="list-style-type: none"> - Decision support system in area of statistical control chart which help mobile network operator monitor and timely detect their subscriber's usage by embedded under service monitoring usage tool in the web-based decision support system. This tool will be used to monitor individual subscriber usage and trigger their exceeding from their average usage and variation.
Innovation (I):	<ul style="list-style-type: none"> - An integrated service price plan prediction model by combining objective and subjective behavior (Usage and customer behavior) that accurately reflect usage and individual needs. - An innovative price plan monitoring and advisory will let mobile network operators to gain more understand their subscriber demand and propose the best fit offerings by introducing a new methodology to estimate the customer usage and service pattern based on individual consumption.
Management (M):	<ul style="list-style-type: none"> - Subscriber behavior to adopt mobile service based on TAM to formulate better price plan strategies to retain customers

10.3.1 Contribution to theory

The TAM model has been applied in various industries for more two decades. There were many researches related to mobile service lately. Nevertheless, almost researches stated to advance mobile service in 3G/4G technology. For this reason, this research investigates subscriber behavior in Thailand. In term of contribution to theory, this study provides a better understanding of subscriber usage behavior of Thai mobile market by using the theory of TAM by Davis (1989). There are additional three elements to the original TAM which are trust, variety of service, and facilitating conditions. In addition, perceived ease of use was not found to affect the adoption of mobile service in Thailand, which is totally different from the findings of prior research. This is due to the fact that mobile devices have become one of the life's essentials for Thai people. Such kind of subscriber behavior has been identified and guided the mobile network operator to

effectively manage their price plans and subscribers. Therefore, this study results illustrate the implications of Technology Acceptance Model theory to strategic retention management and addition knowledge to the customer behavior research field especially in telecommunication industry.

10.3.2 Contribution to Practice

The fundamental driver of performance for mobile network operators is customer churn. Almost operators have used service plan optimization as a key element of company strategies to enhance customer satisfaction and retention (Seo et al., 2008). The results from Innovative price plan monitoring and advisory system demonstrated that the subscribers' usages were able to predict and offer more precisely match with their usage. These were proved by benchmarking with traditional retention process with higher percentage of sign up to new price plan.

Therefore, this study provide a managerial implication that the manager will understand their own subscriber's behaviors by providing three main necessary factors which are facilitation conditions, variety of service and trust for subscribers to perceive usefulness of mobile service in order to motivate them the adoption and using mobile service in their life. In addition, the subscriber usage trigger and recommended offering help the manager to effectively address the churn problem which is a major factor to raise customer complaint level.

10.4 Research limitation and recommendation for future research

This study was conducted in Thailand even though this study has contribution to theory and practice. The research results confirmed TAM model with additional elements to adopt mobile service. However, this research focuses only one postpaid price plan and only voice usage; hence further studies can focus on conducting on multi-segmentation in term of subscriber group and mobile service user types.

For example, respondents from healthy subscribers, pre-paid price plan and internet usage might find different behavior to use mobile service. Therefore, for beneficial comparison future study might investigate whether there are any significant differences in mobile service adoption between different segmentations. The behavior comparison between groups would be useful for future study and help mobile network operator deeply understand their subscriber's behavior.

Despite findings and contributions, this study has some limitations. First, sample size of respondents to do SEM analysis was a bit lower than sample size requirements due to removed outliers. Based on model complexity and characteristics of measurement model, minimum 300 sample sizes are required (Joseph F. Hair et al., 2010). For future research, in order to avoid sample size issue and based on a set of factors, it should be increased to be adequate to represent the population. Second, the number of measured items in some constructs weren't

aligned with the general consensus in the multivariate statistics field. Each construct should have a minimum of three items, ideally four items (Joseph F. Hair et al., 2010) since some measured items from literature reviews were removed from marketing focus group and IOC process by industry experts. Even there were only two items but the item communalities were aligned (.5 or higher). Anyhow, for the future research to produce more stable solutions for SEM model, the observed variables might be special concern.

Finally, the result showed that the factors had an influence on subscriber usage behavior in regard to the use of mobile service in Thailand. From the study, the path significance and model explanatory power were examined. All the path coefficients in the final model were significant. Nevertheless, the explanatory power of the model is different comparing to other prior researches adopting TAM model. The model accounts for 15% of the variance in usage behavior, 21% of the variance in intention to use, 9% of the variance in attitude and 9% of the variance in perceived usefulness. In order to better understand for the factors influence to use mobile service, the related factors should be more reviewed and included in the model.

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APPENDIX



จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

APPENDIX A: QUESTIONNAIRE FOR INDEX OF ITEM OBJECT CONGRUENCE

แบบแสดงความคิดเห็นของผู้ทรงคุณวุฒิที่มีต่อแบบสอบถาม

เรื่องปัจจัยที่มีอิทธิพลต่อพฤติกรรมและทัศนคติของผู้ใช้บริการโทรศัพท์มือถือในประเทศไทย

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แบบแสดงความคิดเห็นฉบับนี้จัดทำขึ้นเพื่อตรวจสอบคุณภาพและค่าความเที่ยงตรงเชิงเนื้อหาของแบบสอบถาม (IOC : Index of Item Object Congruence) โดยจะประเมินค่าความสอดคล้องระหว่างข้อคำถามกับวัตถุประสงค์ถึงปัจจัยที่มีอิทธิพลต่อพฤติกรรมและทัศนคติการให้บริการโทรศัพท์มือถือในประเทศไทย

ขั้นตอนการดำเนินการหาปัจจัย

1. หัวข้อและประเด็นปัญหาที่เกิดขึ้นกับผู้ใช้บริการโทรศัพท์มือถือในประเทศไทย
2. จากการทบทวนทฤษฎีและผลงานวิจัยที่เกี่ยวข้องต่อปัจจัยที่ส่งผลต่อการเป็นต่อพฤติกรรมและทัศนคติของผู้ใช้บริการโทรศัพท์มือถือ

คำชี้แจงสำหรับผู้ตอบแบบแสดงความคิดเห็นที่มีต่อแบบสอบถามงานวิจัย

แบบแสดงความคิดเห็นจะประกอบไปด้วยการประเมินความสอดคล้องของปัจจัยที่มีอิทธิพลต่อพฤติกรรมและทัศนคติการให้บริการโทรศัพท์มือถือในประเทศไทย เพื่อประโยชน์ในการนำไปพิจารณาปรับปรุงต่อไป โดยกำหนดเกณฑ์พิจารณาคือ

เห็นว่าสอดคล้อง	ให้คะแนน	+1
ไม่แน่ใจ	ให้คะแนน	0
เห็นว่าไม่สอดคล้อง	ให้คะแนน	-1

แบบแสดงความคิดเห็นฉบับนี้เป็นส่วนหนึ่งของวิทยานิพนธ์ปริญญาเอกหัวข้อ นวัตกรรมการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทย (INNOVATIVE SERVICE PRICE PLAN PREDICTION OF MOBILE TELECOMMUNICATION OPERATORS IN THAILAND)
ข้อมูลที่เกี่ยวข้องในการวิจัยนี้จะเป็นความลับและใช้ในการศึกษาเท่านั้น

ขอขอบคุณผู้เชี่ยวชาญทุกท่านที่ให้ความร่วมมือในการตอบแบบแสดงความคิดเห็นเป็นอย่างดี

นางสาวมนรัช อมรัตน์ไพจิตร

นิสิตปริญญาเอกหลักสูตรธุรกิจเทคโนโลยีและการจัดการนวัตกรรม จุฬาลงกรณ์มหาวิทยาลัย

โทร. 081-655-3161 Email: manarach@gmail.co.th

เลขที่แบบแสดงความคิดเห็น _____

แบบแสดงความคิดเห็นของผู้ทรงคุณวุฒิที่มีต่อแบบสอบถาม

เรื่องปัจจัยที่มีอิทธิพลต่อพฤติกรรมและทัศนคติการใช้บริการโทรศัพท์มือถือในประเทศไทย

ผู้เชี่ยวชาญที่ทำการประเมินชื่อ: _____ นามสกุล: _____ สายงานที่รับผิดชอบ: _____

คำชี้แจง: ขอให้ท่านผู้เชี่ยวชาญได้กรุณาแสดงความคิดเห็นของท่านที่มีต่อปัจจัยที่มีอิทธิพลต่อพฤติกรรมการใช้บริการโทรศัพท์มือถือในประเทศไทย โดยทำเครื่องหมาย (✓) ลงในช่องความคิดเห็นของท่านพร้อมเขียนข้อเสนอแนะที่เป็นประโยชน์ในการนำไปพิจารณาปรับปรุงต่อไป

ประเภทของปัจจัย	หัวข้อปัจจัย	ความคิดเห็น			ข้อเสนอแนะ
		ไม่สอดคล้อง	ไม่แน่ใจ	สอดคล้อง	
ด้านประโยชน์ในการใช้งาน (Perceived usefulness)	PU1: การใช้งานโทรศัพท์มือถือทำให้ชีวิตของท่านง่ายขึ้น				
	PU2: การใช้งานโทรศัพท์มือถือเป็นมากกว่าการโทรออกและรับสาย เช่น หาข้อมูลต่างๆ ดูหนัง ฟังเพลง เป็นต้น				
ด้านความง่ายในการใช้งาน (Perceived ease of use)	PE1: เป็นเรื่องง่าย ที่จะเรียนรู้วิธีการใช้งานโทรศัพท์มือถือและฟังก์ชันต่างๆ				
	PE2: บริการต่างๆจากผู้ให้บริการ เช่น แพ็กเกจ การดาวน์โหลดเพลงหรือแอปพลิเคชันต่างๆ มีความชัดเจนและเข้าใจง่าย				
ด้านอิทธิพลทางสังคม	SI1: การใช้โทรศัพท์มือถือส่งผลให้ท่านเป็นที่ยอมรับจาก				

ประเภทของปัจจัย	หัวข้อปัจจัย	ความคิดเห็น			ข้อเสนอแนะ
		ไม่สอดคล้อง	ไม่แน่ใจ	สอดคล้อง	
(Social Influence)	คนอื่นๆ				
	SI2: การใช้โทรศัพท์มือถือส่งผลให้ท่านเป็นที่ประทับใจของผู้พบเห็น				
	SI3: การใช้โทรศัพท์มือถือส่งผลให้ภาพลักษณ์ของท่านดูดีขึ้น				
	SI4: ท่านคิดว่าผู้ที่ใช้โทรศัพท์มือถือส่งผลให้ถูกมองว่าเป็นผู้ที่มีความเข้าใจด้านเทคโนโลยีมากขึ้น				
ด้านโครงสร้างพื้นฐาน (Facilitation conditions)	FC1: ไม่มีเสียงรบกวนหรือสัญญาณแทรกขณะที่ท่านใช้โทรศัพท์มือถือ				
	FC2: สามารถใช้งานด้านข้อมูลได้อย่างรวดเร็วและต่อเนื่อง				
	FC3: การรับ-ส่งข้อมูลบนโทรศัพท์มือถือมีความถูกต้องแม่นยำและน่าเชื่อถือ				
	FC4: ผู้ให้บริการมีเนื้อหา (Content) ที่น่าสนใจสำหรับท่าน				
	FC5: ท่านเชื่อว่าแพ็คเกจโทรศัพท์มือถือที่นำเสนอโดยผู้ให้บริการจะตอบสนองการใช้งานของท่าน				
	FC6: ท่านรู้สึกแพ็คเกจโทรศัพท์มือถือที่นำเสนอโดยผู้ให้บริการเข้าใจง่ายและไม่ซับซ้อนในการใช้งาน				

ประเภทของปัจจัย	หัวข้อปัจจัย	ความคิดเห็น			ข้อเสนอแนะ
		ไม่สอดคล้อง	ไม่แน่ใจ	สอดคล้อง	
	FC7: ท่านเชื่อว่าผู้ให้บริการจะให้บริการสัญญาณเครือข่ายที่ดี และครอบคลุมพื้นที่การใช้งาน				
	FC8: ท่านคิดว่าฝ่ายบริการลูกค้าสามารถให้คำแนะนำตอบคำถามและช่วยเหลือท่านได้เมื่อมีปัญหา				
ด้านความสนุกสนาน (Perceived enjoyment)	PEJ1: ท่านรู้สึกสนุกสนาน เพลิดเพลินกับการใช้บริการต่างๆ ที่มีบนโทรศัพท์มือถือ				
	PEJ2: บริการต่างๆ บนโทรศัพท์มือถือทำให้ท่านรู้สึกอยากใช้งานมากขึ้น				
ด้านค่าใช้จ่ายในการใช้ บริการ (Perceived expense)	PEP1: ปัจจุบันราคาของเครื่องโทรศัพท์มือถือเป็นราคาที่เหมาะสมเหตุผล				
	PEP2: ท่านรู้สึกว่าค่าใช้จ่ายในการใช้บริการโทรศัพท์มือถือมีราคาสูง				
ด้านความหลากหลายของ บริการ (Variety of services)	VS1: บริการต่างๆ บนโทรศัพท์มือถือ น่าสนใจสำหรับท่าน				
	VS2: บริการต่างๆ บนโทรศัพท์มือถือ สามารถตอบสนองความต้องการของท่าน				

ประเภทของปัจจัย	หัวข้อปัจจัย	ความคิดเห็น			ข้อเสนอแนะ
		ไม่สอดคล้อง	ไม่แน่ใจ	สอดคล้อง	
ด้านลักษณะเฉพาะบุคคล (Trait)	T1: ท่านสามารถใช้งานโทรศัพท์มือถือได้ด้วยตัวท่านเอง				
	T2: ท่านรู้สึกมั่นใจ ที่จะสามารถใช้งานโทรศัพท์มือถือได้ด้วยตัวท่านเอง โดยไม่ต้องมีคนแนะนำ				
	T3: ครอบครัวของท่านมีส่วนในการตัดสินใจเลือกผู้ให้บริการโทรศัพท์มือถือ				
	T4:ญาติของท่านมีส่วนในการตัดสินใจเลือกผู้ให้บริการโทรศัพท์มือถือ				
	T5: : เพื่อนของท่านมีส่วนในการตัดสินใจเลือกผู้ให้บริการโทรศัพท์มือถือ				
ด้านความน่าเชื่อถือของผู้ให้บริการ (Trust)	TR1: ท่านมั่นใจว่าระบบจะสามารถให้บริการได้อย่างต่อเนื่อง				
	TR2: ท่านมั่นใจว่าผู้ให้บริการมีขั้นตอนการบริหารจัดการ และเทคนิคที่เพียงพอเพื่อรักษาความปลอดภัยข้อมูลทั้งหมดของท่าน				
	TR3: ท่านมั่นใจว่าขั้นตอนการบริหารจัดการและเทคนิคมีอยู่เพื่อปกป้องข้อมูลส่วนบุคคลของท่าน				
การทดลองใช้งาน (Triability)	TR1: ท่านต้องการจะทราบข้อมูลที่ชัดเจนเกี่ยวกับบริการจากผู้ให้บริการโทรศัพท์มือถือก่อนที่จะใช้งาน				

ประเภทของปัจจัย	หัวข้อปัจจัย	ความคิดเห็น			ข้อเสนอแนะ
		ไม่สอดคล้อง	ไม่แน่ใจ	สอดคล้อง	
	TRI2: การทดลองใช้บริการต่างๆ จากผู้ให้บริการมีผลต่อการตัดสินใจในการเลือกใช้บริการนั้น				
	TRI3: การขอยกเลิกบริการหลังจากที่มีการทดลองใช้งาน เป็นไปอย่างง่ายดาย				
ด้านความเสี่ยงที่จะเกิดขึ้นในการใช้บริการ (Perceived risk)	PR1: เทคโนโลยีในปัจจุบันยังไม่ได้รับการพัฒนาอย่างเต็มที่ มีผลต่อการตัดสินใจเลือกใช้บริการ				
	PR2: การพัฒนาบริการต่างๆ ที่เกี่ยวข้องกับโทรศัพท์มือถือในปัจจุบันยังไม่สมบูรณ์และรองรับการใช้งานได้อย่างเต็มที่ มีผลต่อการตัดสินใจเลือกใช้บริการ				
	PR3: ความสามารถของเครื่องโทรศัพท์มือถือในปัจจุบันมีผลต่อการตัดสินใจเลือกใช้บริการ				
	PR4: คุณภาพของฝ่ายบริการลูกค้ามีผลต่อการตัดสินใจเลือกใช้บริการ				
ความจำเป็นในการใช้งาน (Perceived no need)	PN1: ท่านรู้สึกว่าการใช้โทรศัพท์มือถือมีความจำเป็นต่อท่าน				
	PN2: บริการต่างๆ บนโทรศัพท์มือถือในปัจจุบันไม่เหมาะสมสำหรับท่าน				
ทัศนคติในการใช้บริการ	A1: ท่านมีความรู้สึกที่ดีต่อการใช้บริการโทรศัพท์มือถือ				

ประเภทของปัจจัย	หัวข้อปัจจัย	ความคิดเห็น			ข้อเสนอแนะ
		ไม่สอดคล้อง	ไม่แน่ใจ	สอดคล้อง	
โทรศัพท์มือถือ (Attitude)					
	A2: ท่านคิดว่าการใช้โทรศัพท์มือถือจะทำให้ชีวิตของท่านมีสีสันมากขึ้น				
แนวโน้มการใช้บริการโทรศัพท์มือถือในอนาคต (Behavioral Intention)	BI1: ท่านมีความตั้งใจจะใช้บริการโทรศัพท์มือถือต่อไป				
	BI2: ท่านมีความตั้งใจจะใช้บริการข้อมูลบนโทรศัพท์มือถือบ่อยขึ้น				
ความพึงพอใจต่อการใช้บริการโทรศัพท์มือถือ (Customer Satisfaction)	CS1: ท่านรู้สึกพึงพอใจต่อการใช้บริการทางด้านเสียง (Voice Service)				
	CS2: ท่านรู้สึกพึงพอใจต่อการใช้บริการทางด้านข้อมูล (Data Service)				
	CS3: ท่านรู้สึกพึงพอใจต่อแพ็คเกจค่าบริการ (Price plan)				
	CS4: ท่านรู้สึกพึงพอใจต่อคุณภาพของสัญญาณและความครอบคลุมของการให้บริการ				
	CS5: ท่านรู้สึกพึงพอใจต่อการให้บริการของฝ่ายบริการลูกค้า				

APPENDIX B: QUESTIONNAIRE OF THE SURVEY

แบบสอบถามเพื่อการวิจัย

เรื่องปัจจัยที่มีอิทธิพลต่อพฤติกรรมและทัศนคติของผู้ใช้บริการโทรศัพท์มือถือในประเทศไทย

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คำชี้แจงสำหรับผู้ตอบแบบสอบถามงานวิจัย

แบบสอบถามฉบับนี้จัดทำขึ้นเพื่อสำรวจถึงปัจจัยที่มีอิทธิพลต่อพฤติกรรมการใช้บริการโทรศัพท์มือถือในประเทศไทย เพื่อประโยชน์ในการปรับปรุงการให้บริการและตอบสนองต่อความต้องการของลูกค้าแบบสอบถามฉบับนี้มีจำนวน 7 หน้าโดยแบ่งออกเป็น 4 ส่วนได้แก่

ส่วนที่ 1 ข้อมูลพื้นฐานเกี่ยวกับผู้ตอบแบบสอบถามทางด้านประชากรศาสตร์ (Demographic) จำนวน 11 ข้อ

ส่วนที่ 2 ปัจจัยที่มีอิทธิพลต่อการตัดสินใจในการเลือกใช้บริการโทรศัพท์มือถือจำนวน 26 ข้อ

ส่วนที่ 3 มุมมองและแนวโน้มในการใช้บริการโทรศัพท์มือถือ จำนวน 3 ข้อ

ส่วนที่ 4 ความพึงพอใจโดยรวมในการใช้บริการโทรศัพท์มือถือ จำนวน 6 ข้อ

ขอความกรุณาท่านโปรดช่วยตอบคำถามทุกคำถาม ผู้วิจัยขอขอบคุณท่านเป็นอย่างสูงที่ท่านกรุณาให้ความร่วมมือในการตอบแบบสอบถามนี้

แบบสอบถามนี้เป็นส่วนหนึ่งของวิทยานิพนธ์ปริญญาเอกหัวข้อ นวัตกรรมการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทย (INNOVATIVE SERVICE PRICE PLAN PREDICTION OF MOBILE TELECOMMUNICATION OPERATORS IN THAILAND)

ข้อมูลที่เก็บในการวิจัยนี้จะเป็นความลับและใช้ในการศึกษาเท่านั้น

หากท่านมีข้อซักถามเกี่ยวกับแบบสอบถามหรือต้องการแบบสอบถามฉบับภาษาอังกฤษ กรุณาติดต่อ นางสาวมนรัช อมรัตน์ไพจิตร

นิสิตปริญญาเอกหลักสูตรธุรกิจเทคโนโลยีและการจัดการนวัตกรรม จุฬาลงกรณ์มหาวิทยาลัย

โทร. 081-655-3161 Email: manarach@dtac.co.th

เลขที่แบบสอบถาม.....

แบบสอบถามเพื่อการวิจัย

เรื่องปัจจัยที่มีอิทธิพลต่อพฤติกรรมและทัศนคติของผู้ใช้บริการโทรศัพท์มือถือในประเทศไทย

ชื่อ-นามสกุลผู้ให้บริการ: หมายเลขโทรศัพท์มือถือ:

วันที่สัมภาษณ์: ผู้สัมภาษณ์:

ส่วนที่ 1 ลักษณะทั่วไปของผู้ตอบแบบสอบถาม (ลักษณะทางประชากรศาสตร์)

คำชี้แจง: โปรดทำเครื่องหมาย ลงในช่อง ที่ตรงกับท่านมากที่สุด

1. คุณเป็นผู้ใช้เบอร์นี้ _____ เป็นประจำ ใช่หรือไม่
 - 1. ใช่ (ถามต่อข้อ 2)
 - 2. ไม่ใช่ (ปิดการสัมภาษณ์)
2. คุณเป็นผู้ตัดสินใจและเลือกระบบโทรศัพท์มือถือ ด้วยตัวเอง ใช่หรือไม่
 - 1. ใช่ (ถามต่อข้อ 3)
 - 2. ไม่ใช่ (ปิดการสัมภาษณ์)
3. คุณเป็นผู้รับผิดชอบค่าใช้จ่ายของเบอร์ _____ ใช่หรือไม่คะ
 - 1. ใช่ (ถามต่อข้อ 4)
 - 2. ไม่ใช่ (ปิดการสัมภาษณ์)
4. เพศ 1. ชาย 2. หญิง
5. อายุ 1. ต่ำกว่า 15 ปี 2. 15 - 20 ปี 3. 21 - 25 ปี
 4. 26 - 30 ปี 5. 31 - 35 ปี 6. 36 - 40 ปี
 7. 41 - 45 ปี 8. 46 - 50 ปี 9. 51 - 55 ปี
 10. 56 - 60 ปี 11. มากกว่า 60 ปี
6. สถานภาพสมรส 1. โสด 2. สมรส 3. หย่าร้าง/หม้าย/แยกกันอยู่
 4. อื่นๆ โปรดระบุ
7. ระดับการศึกษา 1. มัธยมศึกษาตอนต้นหรือต่ำกว่า 2. มัธยมศึกษาตอนปลาย
 3. ปริญญาตรี 4. สูงกว่าปริญญาตรี
8. อาชีพ 1. พนักงานบริษัทเอกชน 2. พนักงานรัฐวิสาหกิจ
 3. ข้าราชการ 4. ประกอบธุรกิจส่วนตัว
 5. พ่อบ้าน/แม่บ้าน 6. นักเรียน/นักศึกษา

7. อื่นๆ โปรดระบุ
9. ระยะเวลาในการใช้โทรศัพท์มือถือ
1. น้อยกว่า 1 ปี 2. 1 – 2 ปี
3. 2 – 3 ปี 4. มากกว่า 3 ปี
10. ลักษณะบริการที่ใช้งาน
1. บริการเสียง 2. บริการเสียงและข้อมูล
3. บริการข้อมูล
11. การเชื่อมต่อสัญญาณเพื่อใช้บริการด้านข้อมูลผ่านโทรศัพท์มือถือ
1. 2G/EDGE 2. 3G
3. Wi-Fi 4. อื่นๆ โปรดระบุ
12. วัตถุประสงค์ในการใช้งาน
1. เพื่อประกอบอาชีพและธุรกิจ
2. เพื่อใช้งานส่วนบุคคล
13. คุณตัดสินใจเลือกการใช้งานเครือข่ายด้วยตนเองหรือไม่ 1. ใช่ 2. ไม่ใช่
14. การใช้งานข้อมูลกับบริการประเภทใด
1. บริการเครือข่ายสังคม เช่น Facebook, Twitter, Instagram 2. E-mail
3. หาข้อมูลผ่านทางอินเทอร์เน็ต 4. Shopping online
5. ดูหนัง ฟังเพลง

ส่วนที่ 2: ปัจจัยที่มีอิทธิพลต่อการตัดสินใจในการเลือกใช้บริการโทรศัพท์มือถือ

คำชี้แจง: โปรดทำเครื่องหมาย ✓ ลงในช่องที่ตรงกับความคิดเห็นของท่านมากที่สุดเพียงช่องเดียว

ปัจจัยที่มีอิทธิพลต่อการตัดสินใจในการเลือกใช้บริการโทรศัพท์มือถือ	เห็นด้วยอย่างยิ่ง (5)	เห็นด้วย (4)	เฉยๆ (3)	ไม่เห็นด้วย (2)	ไม่เห็นด้วยอย่างยิ่ง (1)
1. ด้านประโยชน์ในการใช้งาน (Perceived usefulness)					
PU1: การใช้งานโทรศัพท์มือถือทำให้ชีวิตของท่านง่ายขึ้น					
PU2: การใช้งานโทรศัพท์มือถือเป็นมากกว่าการโทรออกและรับสาย เช่น หาข้อมูลต่างๆ ดูหนัง ฟังเพลง เป็นต้น					
2. ด้านอิทธิพลทางสังคม (Social Influence)					
SI1: การใช้โทรศัพท์มือถือส่งผลให้ภาพลักษณ์ของท่านดูดีขึ้น					
SI2: ท่านคิดว่าผู้ใช้โทรศัพท์มือถือส่งผลให้ถูกมองว่าเป็นผู้ที่มีความเข้าใจด้านเทคโนโลยีมากขึ้นและเป็นคนทันสมัย					
3. ด้านโครงสร้างพื้นฐาน (Facilitation conditions)					
FC1: ไม่มีเสียงรบกวนหรือสัญญาณแทรกขณะที่ท่านใช้โทรศัพท์มือถือ					
FC2: สามารถใช้งานด้านข้อมูลได้อย่างรวดเร็วและต่อเนื่อง					
FC3: การรับ-ส่งข้อมูลบนโทรศัพท์มือถือมีความถูกต้อง แม่นยำและน่าเชื่อถือ					
FC4: ผู้ให้บริการมีเนื้อหา (Content) เช่น บริการเสียง ข้อมูล บริการระหว่างประเทศ เป็นต้นที่น่าสนใจสำหรับท่าน					
FC5: ท่านเชื่อว่าแพ็คเกจโทรศัพท์มือถือที่นำเสนอโดยผู้ให้บริการจะ					

ปัจจัยที่มีอิทธิพลต่อการตัดสินใจในการเลือกใช้บริการโทรศัพท์มือถือ	เห็นด้วยอย่างยิ่ง (5)	เห็นด้วย (4)	เฉยๆ (3)	ไม่เห็นด้วย (2)	ไม่เห็นด้วยอย่างยิ่ง (1)
ตอบสนองการใช้งานของท่าน					
FC6: ท่านรู้สึกแพ็คเกจโทรศัพท์มือถือที่นำเสนอโดยผู้ให้บริการเข้าใจง่ายและไม่ซับซ้อนในการใช้งาน					
FC7: ท่านเชื่อว่าผู้ให้บริการจะให้บริการสัญญาณเครือข่ายที่ดี และครอบคลุมพื้นที่การใช้งาน					
FC8: ท่านคิดว่าฝ่ายบริการลูกค้าสามารถให้คำแนะนำ ตอบคำถามและช่วยเหลือท่านได้เมื่อมีปัญหา					
4. ด้านความสนุกสนาน (Perceived enjoyment)					
PEJ1: ท่านรู้สึกสนุกสนาน เพลิดเพลินกับการใช้บริการต่างๆ ที่มีบนโทรศัพท์มือถือ					
PEJ2: บริการต่างๆ บนโทรศัพท์มือถือทำให้ท่านรู้สึกอยากใช้งานมากขึ้น					
5. ด้านค่าใช้จ่ายในการใช้บริการ (Perceived expense)					
PEP1: ปัจจุบันราคาของเครื่องโทรศัพท์มือถือเป็นราคาที่สมเหตุสมผล					
PEP2: ท่านรู้สึกว่าค่าใช้จ่ายในการใช้บริการโทรศัพท์มือถือมีราคาสูง					
6. ด้านความหลากหลายของบริการ (Variety of services)					
VS1: บริการต่างๆ บนโทรศัพท์มือถือ น่าสนใจสำหรับท่าน					
VS2: บริการต่างๆ บนโทรศัพท์มือถือ สามารถตอบสนองความต้องการของท่าน					
7. ด้านลักษณะเฉพาะบุคคล (Trait)					
T1: ท่านสามารถใช้งานโทรศัพท์มือถือได้ด้วยตัวท่านเอง					
8. ด้านความน่าเชื่อถือของผู้ให้บริการ (Trust)					

ปัจจัยที่มีอิทธิพลต่อการตัดสินใจในการเลือกใช้บริการโทรศัพท์มือถือ	เห็นด้วยอย่างยิ่ง (5)	เห็นด้วย (4)	เฉยๆ (3)	ไม่เห็นด้วย (2)	ไม่เห็นด้วยอย่างยิ่ง (1)
TR1: ท่านมั่นใจว่าระบบจะสามารถให้บริการได้อย่างต่อเนื่องทั้งในประเทศและต่างประเทศ (Roaming)					
TR2: ท่านมั่นใจว่าผู้ให้บริการมีขั้นตอนการบริหารจัดการและเทคนิคที่เพียงพอเพื่อรักษาความปลอดภัยข้อมูลทั้งหมดของท่าน					
9. การทดลองใช้งาน (Trialability)					
TRI1: ท่านต้องการจะทราบข้อมูลที่ชัดเจนเกี่ยวกับบริการจากผู้ให้บริการโทรศัพท์มือถือก่อนที่จะใช้งาน					
TRI2: การทดลองใช้บริการต่างๆ จากผู้ให้บริการมีผลต่อการตัดสินใจในการเลือกใช้บริการนั้น					
TRI3: การขอยกเลิกบริการหลังจากที่มีการทดลองใช้งานเป็นไปอย่างง่ายดาย					
10. ด้านความเสี่ยงที่จะเกิดขึ้นในการใช้บริการ (Perceived risk)					
PR1: คุณภาพของฝ่ายบริการลูกค้ามีผลต่อการตัดสินใจเลือกใช้บริการ					
11. ความจำเป็นในการใช้งาน (Perceived no need)					
PN1: ท่านรู้สึกว่าการใช้โทรศัพท์มือถือมีความจำเป็นต่อท่าน					

ส่วนที่ 3: มุมมองและแนวโน้มในการใช้บริการโทรศัพท์มือถือ

คำชี้แจง: โปรดทำเครื่องหมาย ✓ ลงในช่องที่ตรงกับความคิดเห็นของท่านมากที่สุดเพียงช่องเดียว

มุมมองและแนวโน้มในการใช้บริการโทรศัพท์มือถือ	เห็นด้วยอย่างยิ่ง (5)	เห็นด้วย (4)	เฉยๆ (3)	ไม่เห็นด้วย (2)	ไม่เห็นด้วยอย่างยิ่ง (1)
1. ทักษะคติในการใช้บริการโทรศัพท์มือถือ (Attitude)					
A1: ท่านมีความรู้สึกที่ดีต่อการใช้บริการโทรศัพท์มือถือ					
2. แนวโน้มการให้บริการโทรศัพท์มือถือในอนาคต (Behavioral Intention)					
BI1: ท่านมีความจำเป็นที่จะต้องใช้บริการโทรศัพท์มือถือต่อไปในอนาคต					
BI2: ท่านมีความจำเป็นที่จะต้องใช้บริการข้อมูลบนโทรศัพท์มือถือมากขึ้นใน การทำกิจกรรมต่างๆ ในชีวิตประจำวัน					

ส่วนที่ 4: ความพึงพอใจโดยรวมต่อการใช้บริการโทรศัพท์มือถือ

คำชี้แจง: โปรดทำเครื่องหมาย ✓ ลงในช่องที่ตรงกับความคิดเห็นของท่านมากที่สุดเพียงช่องเดียว

ความพึงพอใจโดยรวมต่อการใช้บริการโทรศัพท์มือถือ	พอใจอย่างยิ่ง (5)	ค่อนข้างพึงพอใจ (4)	ปานกลาง (3)	ไม่พึงพอใจ (2)	ไม่พึงพอใจเลย (1)
CS1: ท่านรู้สึกพึงพอใจต่อการใช้บริการทางด้านเสียง (Voice Service)					
CS2: ท่านรู้สึกพึงพอใจต่อการใช้บริการทางด้านข้อมูล (Data Service)					
CS3: ท่านรู้สึกพึงพอใจต่อแพ็คเกจค่าบริการ (Price plan)					
CS4: ท่านรู้สึกพึงพอใจต่อคุณภาพของสัญญาณและความครอบคลุมของการให้บริการ					
CS5: ท่านรู้สึกพึงพอใจต่อการให้บริการของฝ่ายบริการลูกค้า					
CS6: ท่านรู้สึกพึงพอใจต่อสิทธิประโยชน์ (Privilege) และผลประโยชน์ (Benefit) ที่ได้รับ					

*** ขอขอบคุณผู้ตอบแบบสอบถามทุกท่านที่ให้ความกรุณาในการตอบครั้งนี้ ***

APPENDIX C: QUESTIONNAIRE OF THE APPLICATION ACCEPTANCE

แบบสอบถามการประเมินผลการใช้งานโปรแกรมสำหรับการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการ
โทรศัพท์เคลื่อนที่ในประเทศไทย

คำชี้แจงสำหรับผู้ตอบแบบสอบถามงานวิจัย

แบบสอบถามนี้จัดทำขึ้นเพื่อทำการทดสอบคุณภาพของโปรแกรมและการนำโปรแกรมไปใช้งานจริงเพื่อ
สรุปผลการพัฒนาโปรแกรมการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทย

แบบสอบถามฉบับนี้มีจำนวนทั้งหมด 6 หน้าโดยจะประกอบไปด้วย 2 ส่วนดังนี้

ส่วนที่ 1 ข้อมูลพื้นฐานเกี่ยวกับผู้ตอบแบบสอบถามทางด้านประชากรศาสตร์ (Demographic)

ส่วนที่ 2 การทดสอบนำโปรแกรมไปใช้งานจริงเป็นการตอบแบบสอบถามของผู้ใช้โปรแกรมที่มีต่อการนำ
โปรแกรมไปทดลองใช้งานในการการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่

ส่วนที่ 3 การประเมินโอกาสและความเป็นไปได้ในการใช้งานโปรแกรมการคาดการณ์แผนราคาค่าบริการของ
ผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทยในอนาคต

ส่วนที่ 4 ปัญหาและข้อเสนอแนะในการใช้งานโปรแกรมการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการ
โทรศัพท์เคลื่อนที่ในประเทศไทย

ขอความกรุณาท่านโปรดช่วยตอบคำถามทุกคำถามตามความเป็นจริงเพื่อผู้วิจัยสามารถนำไป
ปรับปรุงและพัฒนาโปรแกรมให้ดียิ่งขึ้น ผู้วิจัยขอขอบคุณท่านเป็นอย่างสูงที่ท่านกรุณาให้ความร่วมมือในการ
ตอบแบบสอบถามนี้

แบบสอบถามนี้เป็นส่วนหนึ่งของวิทยานิพนธ์ปริญญาเอกหัวข้อ นวัตกรรมการคาดการณ์แผนราคา
ค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทย (INNOVATIVE SERVICE PRICE PLAN
PREDICTION OF MOBILE TELECOMMUNICATION OPERATORS IN THAILAND)
ข้อมูลที่ได้ในการวิจัยนี้จะเป็นความลับและใช้ในการศึกษาเท่านั้น

หากท่านมีข้อซักถามเกี่ยวกับแบบสอบถาม กรุณาติดต่อ

นางสาวมนรัช อมรัตน์ไพจิตร

นิสิตปริญญาเอกหลักสูตรธุรกิจเทคโนโลยีและการจัดการนวัตกรรม จุฬาลงกรณ์มหาวิทยาลัย

โทร.081-655-3161 Email: manarach@gmail.com

เลขที่แบบสอบถาม.....

แบบสอบถามการประเมินผลการใช้งานโปรแกรมสำหรับการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการ
โทรศัพท์เคลื่อนที่ในประเทศไทย

ส่วนที่ 1 ข้อมูลพื้นฐานเกี่ยวกับผู้ตอบแบบสอบถามทางด้านประชากรศาสตร์ (Demographic)

คำชี้แจง: โปรดทำเครื่องหมาย ลงในช่อง ที่ตรงกับท่านมากที่สุด

1. เพศ ชาย หญิง
2. อายุ น้อยกว่า 20 ปี 20 – 29 ปี
 30 – 39 ปี 40 ปีขึ้นไป
3. ระดับการศึกษา อนุปริญญาหรือเทียบเท่า ปริญญาตรี
 ปริญญาโท ปริญญาเอก
 อื่นๆ ระบุ
4. อาชีพ เจ้าหน้าที่ฝ่ายบริการลูกค้า หัวหน้าฝ่ายบริการลูกค้า
 ฝ่ายการตลาด อื่นๆ ระบุ

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ส่วนที่ 2 การทดสอบการนำโปรแกรมการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทยไปใช้งานจริง

คำถามในส่วนนี้มีจุดมุ่งหมายเพื่อสอบถามและประเมินผลการนำโปรแกรมไปใช้งานในการคาดการณ์แผนราคาค่าบริการให้กับลูกค้าจริง

โปรดทำเครื่องหมาย ✓ ลงในช่องช่องที่ท่านเห็นว่าเหมาะสมในความคิดของท่านมากที่สุด

ข้อ	การใช้งานโปรแกรม	ระดับความคิดเห็น				
		มากที่สุด (5)	มาก (4)	ปานกลาง (3)	น้อย (2)	น้อยที่สุด (1)
1. การนำเทคนิคใหม่มาช่วยในการคาดการณ์แผนราคาค่าบริการ						
1.1	ลดการสูญเสียเวลาในการหาแนวคิดการคาดการณ์แผนราคาค่าบริการ					
1.2	ช่วยให้กระบวนการการคาดการณ์แผนราคาค่าบริการเป็นระบบและมีประสิทธิภาพขึ้น					
1.3	เพิ่มความครอบคลุมในกระบวนการคาดการณ์แผนราคาค่าบริการ					
1.4	ช่วยตัดสินใจเลือกแนวทางการคาดการณ์แผนราคาค่าบริการที่ก่อให้เกิดคุณค่ามากที่สุด					
2. ความง่ายต่อการใช้งาน (Usability)						
2.1	เป้าหมายของการใช้งานโปรแกรมมีความชัดเจน					
2.2	มีการอธิบายขั้นตอนการทำงานของโปรแกรมอย่างชัดเจน					
2.3	ง่ายที่จะเรียนรู้และเข้าใจในขั้นตอนการปฏิบัติงานของโปรแกรม					
2.4	ขั้นตอนการทำงานของโปรแกรมง่ายต่อการใช้งาน					
2.5	ผู้ใช้โปรแกรมสามารถใช้โปรแกรมช่วยในการการคาดการณ์แผนราคาค่าบริการได้โดยง่าย					
2.6	รูปแบบของโปรแกรมที่ช่วยในการคาดการณ์แผนราคาค่าบริการมีความเหมาะสม					

ข้อ	การใช้งานโปรแกรม	ระดับความคิดเห็น				
		มากที่สุด (5)	มาก (4)	ปานกลาง (3)	น้อย (2)	น้อยที่สุด (1)
2.7	โปรแกรมมีความง่ายในการใช้งาน					
3. ส่วนติดต่อกับผู้ใช้งานโปรแกรม (User Interface)						
3.1	โปรแกรมมีความน่าใช้งาน					
3.2	โปรแกรมมีความทันสมัย					
3.3	ขนาดตัวอักษร สีของตัวอักษรและพื้นหลังมีความเหมาะสม					
3.4	รูปภาพมีความชัดเจน คมชัดและมีขนาดที่เหมาะสม					
4. การใช้งานโปรแกรมการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทย (PPMA 1.0) ในการคาดการณ์แผนราคาค่าบริการเปรียบเทียบกับการคาดการณ์แผนราคาค่าบริการที่ไม่ได้ใช้โปรแกรม						
4.1 ช่วยลดเวลาที่ใช้ในการคาดการณ์และแนะนำแผนราคาค่าบริการ						
	ใช้งานโปรแกรม PPMA 1.0					
	ไม่ได้ใช้โปรแกรม PPMA 1.0					
4.2 ลดความต้องการด้านทักษะ ความชำนาญและประสบการณ์ในการคาดการณ์แผนราคาค่าบริการของผู้ใช้โปรแกรม						
	ใช้งานโปรแกรม PPMA 1.0					
	ไม่ได้ใช้โปรแกรม PPMA 1.0					
4.3 ความสะดวกและความง่ายในการทำงานตามขั้นตอนของกระบวนการคาดการณ์และแนะนำแผน						

ข้อ	การใช้งานโปรแกรม	ระดับความคิดเห็น				
		มากที่สุด (5)	มาก (4)	ปานกลาง (3)	น้อย (2)	น้อยที่สุด (1)
ราคาค่าบริการ						
	ใช้งานโปรแกรม PPMA 1.0					
	ไม่ได้ใช้โปรแกรม PPMA 1.0					
4.4 ความสามารถในการลดขั้นตอนการทำงานที่ซ้ำซ้อน						
	ใช้งานโปรแกรม PPMA 1.0					
	ไม่ได้ใช้โปรแกรม PPMA 1.0					
4.5 ความสามารถในการแก้ไขปรับเปลี่ยนข้อมูลการการาคาการณ์และแนะนำค่าบริการ						
	ใช้งานโปรแกรม PPMA 1.0					
	ไม่ได้ใช้โปรแกรม PPMA 1.0					
4.6 ความสามารถในการจัดเก็บข้อมูลอย่างเป็นระบบ						
	ใช้งานโปรแกรม PPMA 1.0					
	ไม่ได้ใช้โปรแกรม PPMA 1.0					
4.7 ความสามารถในการเก็บรวบรวมข้อมูลทั้งหมดเกี่ยวกับการการาคาการณ์และแนะนำค่าบริการ						
	ใช้งานโปรแกรม PPMA 1.0					
	ไม่ได้ใช้โปรแกรม PPMA 1.0					
4.8 ความสามารถในการค้นหาข้อมูลการการาคาการณ์แผนราคาค่าบริการที่ผ่านมา						

ข้อ	การใช้งานโปรแกรม	ระดับความคิดเห็น				
		มากที่สุด (5)	มาก (4)	ปานกลาง (3)	น้อย (2)	น้อยที่สุด (1)
	ใช้งานโปรแกรม PPMA 1.0					
	ไม่ได้ใช้โปรแกรม PPMA 1.0					
4.9 ข้อมูลถูกรวบรวมเป็นเอกสาร/รายงานและสามารถเรียกพิมพ์เอกสาร/รายงานได้						
	ใช้งานโปรแกรม PPMA 1.0					
	ไม่ได้ใช้โปรแกรม PPMA 1.0					
5. การนำโปรแกรมการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทยไปทดลองใช้งานจริง						
5.1	สามารถนำโปรแกรมไปประยุกต์ใช้งานในการแนะนำแผนราคาค่าบริการและรักษาสถานลูกค้าได้จริง					
5.2	การนำโปรแกรมมาช่วยในการเพิ่มประสิทธิภาพของการคาดการณ์และแนะนำแผนราคาค่าบริการ					
5.3	การนำโปรแกรมมาช่วยในการหาผลลัพธ์ของแนวทางการคาดการณ์แผนราคาค่าบริการที่มีคุณค่ามากที่สุด					

ส่วนที่ 3 การประเมินโอกาสและความเป็นไปได้ในการใช้งานโปรแกรมการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทยในอนาคต

คำถามในส่วนนี้มีจุดมุ่งหมายเพื่อประเมินโอกาสและความเป็นไปได้ในการใช้งานโปรแกรมการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทยในอนาคต

โปรดทำเครื่องหมาย ✓ ลงในช่องช่องที่ท่านเห็นว่าตรงกับความคิดเห็นของท่านมากที่สุด

ข้อ	โอกาสและความเป็นไปได้ในการนำโปรแกรมมาใช้งานในอนาคต	ระดับความคิดเห็นในการใช้งานโปรแกรม PPMA 1.0 ในอนาคต				
		แน่นอนที่สุด (5)	แน่นอน (4)	อาจจะ (3)	อาจจะไม่ (2)	ไม่แน่นอน (1)
1.	โอกาสและความเป็นไปได้ในการนำโปรแกรมมาใช้งานในอนาคต หากโปรแกรมการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทย (PPMA 1.0) สามารถตอบสนองต่อความต้องการของผู้ใช้งานและมีราคาตามที่คาดหวัง					

ส่วนที่ 4 ปัญหาและข้อเสนอแนะในการใช้งานโปรแกรมการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทย

คำถามในส่วนนี้มีจุดมุ่งหมายเพื่อนำปัญหาและข้อเสนอแนะจากผู้ใช้งานโปรแกรมเพื่อนำไปปรับปรุงและพัฒนาโปรแกรมการคาดการณ์แผนราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ในประเทศไทย

4.1 ฟังก์ชันอื่นๆที่โปรแกรมควรมี

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4.2 ปัญหาหลักๆที่พบในการใช้งานโปรแกรม

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4.3 ข้อเสนอแนะอื่นๆ

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APPENDIX D: RESULTS FOR APPLICATION ACCEPTANCE

ผลลัพธ์การทดสอบการนำโปรแกรมการคาดการณ์แนวราคาค่าบริการของผู้ให้บริการโทรศัพท์เคลื่อนที่ใน
ประเทศไทยไปใช้งานจริง



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1. การนำเทคนิคใหม่มาช่วยในการคาดการณ์แผนราคาค่าบริการ (Perceived usefulness)

ข้อ	การใช้งานโปรแกรม	ระดับความคิดเห็น						เฉลี่ย
		Participant I	Participant II	Participant III	Participant IV	Participant V	Participant VI	
1.	ลดการสูญเสียเวลาในการหาแนวคิด การคาดการณ์แผนราคาค่าบริการ	4.00	4.00	3.00	5.00	4.00	5.00	4.17
2.	ช่วยให้กระบวนการการคาดการณ์ แผนราคาค่าบริการเป็นระบบและมี ประสิทธิภาพขึ้น	4.00	4.00	4.00	4.00	3.00	4.00	3.83
3.	เพิ่มความครอบคลุมในกระบวนการ คาดการณ์แผนราคาค่าบริการ	3.00	3.00	4.00	4.00	4.00	4.00	3.67
4.	ช่วยตัดสินใจเลือกแนวทางการ คาดการณ์แผนราคาค่าบริการที่ ก่อให้เกิดคุณค่ามากที่สุด	4.00	4.00	4.00	4.00	4.00	3.00	3.83

2. ความง่ายต่อการใช้งาน (Perceived ease of use/Usability)

ข้อ	การใช้งานโปรแกรม	ระดับความคิดเห็น						เฉลี่ย
		Participant I	Participant II	Participant III	Participant IV	Participant V	Participant VI	
1.	เป้าหมายของการใช้งานโปรแกรมมีความชัดเจน	4.00	4.00	4.00	4.00	4.00	4.00	4.00
2.	มีการอธิบายขั้นตอนการทำงานของโปรแกรมอย่างชัดเจน	4.00	3.00	4.00	3.00	4.00	3.00	3.50
3.	ง่ายที่จะเรียนรู้และเข้าใจในขั้นตอนการปฏิบัติงานของโปรแกรม	3.00	4.00	3.00	4.00	4.00	3.00	3.50
4.	ขั้นตอนการทำงานของโปรแกรมง่ายต่อการใช้งาน	3.00	4.00	4.00	3.00	4.00	3.00	3.50
5.	ผู้ใช้โปรแกรมสามารถใช้โปรแกรมช่วยในการการคาดการณ์แผนราคาค่าบริการได้โดยง่าย	4.00	4.00	4.00	4.00	3.00	4.00	3.83
6.	รูปแบบของโปรแกรมที่ช่วยในการคาดการณ์แผนราคาค่าบริการมีความ	4.00	3.00	3.00	4.00	3.00	5.00	3.67

ข้อ	การใช้งานโปรแกรม	ระดับความคิดเห็น						เฉลี่ย
		Participant I	Participant II	Participant III	Participant IV	Participant V	Participant VI	
	เหมาะสม							
7.	โปรแกรมมีความง่ายในการใช้งาน	4.00	4.00	4.00	4.00	4.00	4.00	4.00

3. ส่วนติดต่อกับผู้ใช้งานโปรแกรม (User Interface)

ข้อ	การใช้งานโปรแกรม	ระดับความคิดเห็น						เฉลี่ย
		Participant I	Participant II	Participant III	Participant IV	Participant V	Participant VI	
1.	โปรแกรมมีความน่าใช้งาน	4.00	4.00	4.00	4.00	2.00	4.00	3.67
2.	โปรแกรมมีความทันสมัย	4.00	4.00	4.00	4.00	3.00	4.00	3.83
3.	ขนาดตัวอักษร สีของตัวอักษรและพื้นหลังมีความเหมาะสม	4.00	4.00	4.00	4.00	4.00	3.00	3.83
4.	รูปภาพมีความชัดเจน คมชัดและมีขนาดที่เหมาะสม	4.00	4.00	4.00	4.00	4.00	3.00	3.83

4. ความพึงพอใจในการใช้งาน (User satisfaction)

ข้อ	การใช้งานโปรแกรม	ระดับความคิดเห็น						เฉลี่ย
		Participant I	Participant II	Participant III	Participant IV	Participant V	Participant VI	
1.	สามารถนำโปรแกรมไปประยุกต์ใช้งานในการแนะนำแผนราคาค่าบริการและรักษารฐานลูกค้าได้จริง	4.00	4.00	4.00	4.00	4.00	4.00	4.00
2.	การนำโปรแกรมมาช่วยในการเพิ่มประสิทธิภาพของการคาดการณ์และแนะนำแผนราคาค่าบริการ	4.00	4.00	4.00	4.00	4.00	3.00	3.83
3.	การนำโปรแกรมมาช่วยในการหาผลลัพธ์ของแนวทางการคาดการณ์แผนราคาค่าบริการที่มีคุณค่ามากที่สุด	4.00	4.00	3.00	4.00	4.00	4.00	3.83

5. โอกาสและความเป็นไปได้ในการนำโปรแกรมมาใช้งานในอนาคต

ข้อ	โอกาสและความเป็นไปได้ในการนำ โปรแกรมมาใช้งานในอนาคต	ระดับความคิดเห็นในการใช้งานโปรแกรม PPMA 1.0 ในอนาคต						เฉลี่ย
		Participant I	Participant II	Participant III	Participant IV	Participant V	Participant VI	
1.	โอกาสและความเป็นไปได้ในการนำ โปรแกรมมาใช้งานในอนาคต หาก โปรแกรมการคาดการณ์แผนราคา ค่าบริการของผู้ให้บริการ โทรศัพท์เคลื่อนที่ในประเทศไทย (PPMA 1.0) สามารถตอบสนองต่อ ความต้องการของผู้ใช้งานและมีราคา ตามที่คาดหวัง	4.00	3.00	4.00	4.00	4.00	4.00	3.83

APPENDIX E: INNOVATIVE PRICE PLAN MONITORING AND ADVISORY
SYSTEM USER MANUAL



Innovative price plan monitoring and advisory system

User's Manual



จุฬาลงกรณ์มหาวิทยาลัย

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1. Introduction

1.1 Document Objectives

The objective of this document is to provide the how-to on the Innovative price plan monitoring and advisory system. The document also elaborates how-to use in each functionality.



2. Accessing to Innovative price plan and monitoring system

To access the Innovative price plan and monitoring system, please follow the following steps

Step 1: Types the URL into the address field on your browser (for example, <http://hostname/advisory>) as figure 2-1.



Figure 2-1: Login Page

Step 2: Types your User ID and Password into Text Box

Step 3: Click at **LOG IN**, and then the page will display the Welcome Page as figure 2-2.

After your user ID and password have been verified, the welcome screen appears. The functions will be enabled based on each user's privileges.



Figure 2-2: Welcome page

Overall, the Innovative price plan monitoring and advisory system divided into 6 functions include

1. Manage price plan
 - a. Create new price plan
 - b. Edit price plan
2. Detection condition
 - a. View detection conditions
 - b. Create new detection condition
3. Subscriber monitoring
 - a. Create monitoring campaign
4. Package advisory
 - a. View subscriber usage monitoring campaign
 - b. Select subscriber usage monitoring campaign
 - c. Perform package advisory
5. Reporting
 - a. Generate the package advisory report
 - b. To export into other format
6. Add account
 - a. Add new user
 - b. Change user account
 - c. Delete user account

By which the detail displayed in each function and how to use each of them will be explained later in the following sections.



3. How to use manage price plan

The manage price plan is designed to contain price plan characteristics, required information for forecasting subscriber usage to offer the next appropriate price plan for subscribers. When price plan creation, the price plan management comprised of 2 following categories:

- Price plan characteristics
- Price plan forecasting model, the price plan forecasting model is divided from service type into 2 tabs include
 - Voice
 - Internet

When selected this tab, the required information lists will be displayed.

3.1 Create new price plan

New Price Plan is the function used to create new price plan and its characteristics

1. Click at the “Manage price plan” from the menu bar, the system will navigate to managing price plan function.
2. When user would like to create new price plan, point the mouse over and click on the “New Price Plan” as figure 3-1.
3. The system will display the application form with blank fields for price plan characteristics and forecasting model. Please refer to figure 3-2 and figure 3-3 for the example of price plan information shown.

☰ > price plan

price plan

PRICE PLAN dtac voice 149 ▾

New Price Plan ↕

PACKAGE NAME	MONTHLY SERVICE FEE	FREE CALL ALL NETWORKS (MINUTES)	MAXIMUM 3G SPEED FOR 42 Mbps (MB)	DTAC WIFI	OVERAGES AND EXTRA SERVICE FREE				MANAGE
					VOICE CALLS (BATH/MESSAGE)	INTERNET (MINUTES)	INTERNET (MB)	SMS/MMS	
dtac voice 149	149	150	-	-	1.5	1	-	2 5	Edit

Figure 3-1: To choose the desired price plan

3.1.1 Price plan characteristics

This section is designed to create and maintain characteristics of price plan

1. Refer to figure 3-2, the required information need to be input in the system according new price plan will display.
2. Input the data as desired value of the price plan.

3. Click **SAVE** button on bottom of the screen to record the information after input the desired value of the price plan. The screen pop up for save the data to the desired price plan will display as figure 3-3.
4. Click **ACCEPT** button to save the data or **CANCEL** button to back on screen to maintain the data as required.

☰ > price plan > new price plan

price plan

PRICE PLAN CHARACTERISTICS

Package Name :	<input type="text"/>	Monthly Service Fee :	<input type="text"/>
Free Call All Networks (Minutes) :	<input type="text"/>	Maximum 3G Speed For 42 Mbps :	<input type="text"/> <input checked="" type="radio"/> MB <input type="radio"/> GB
Dtac WIFI :	<input type="text"/>		
overages and extra service fee			
Voice Calls (Bath/Minute) :	<input type="text"/>	Internet (Minutes) :	<input type="text"/>
Internet (MB) :	<input type="text"/>	SMS (Bath/Message) :	<input type="text"/>
MMS (Bath/Message) :	<input type="text"/>		

Figure 3-2: After selecting the “Upload new price plan”, the required data lists for price plan characteristic will list out all the screen belongs to this function.

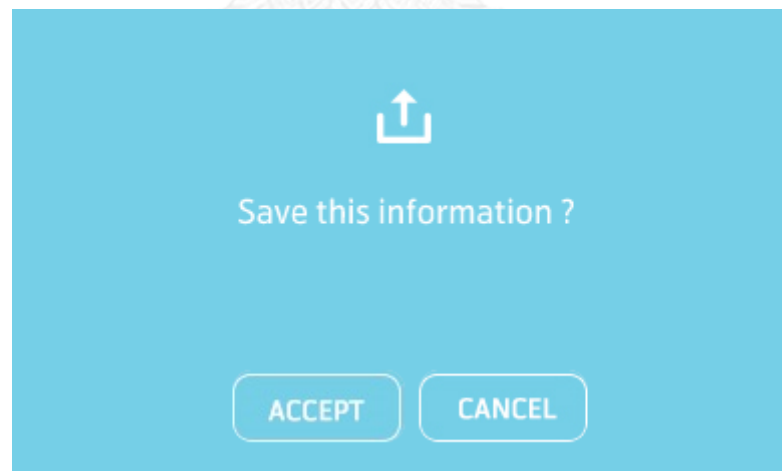


Figure 3-3: Options to save the price plan information

3.1.2 Price plan forecasting model

This section is designed to create and maintain price plan forecasting model.

1. Refer to figure 3-4, the required information need to be input in the system according new price plan will display.

- Click at the type of service name on the right side to access the service, shown as tab name. The screen will display blank field on the screen belong to this desired service.
- Input the data as desired value of the price plan.
- Click **SAVE** button on bottom of the screen to record the information after input the desired value of the price plan. The screen pop up for save the data to the desired price plan will display as figure 3-3.
- Click **ACCEPT** button to save the data or **CANCEL** button to back on screen to maintain the data as required.

price plan forecasting model :

VOICE *internet*

VOICE

PREDICTION FORMULAS FOR RISKY SUBSCRIBER :

Constant :

AVG Voice Usage Score :

Attitude score :

Intention score :

Attitude value :

Intention value :

* Predicted voice usage : +(AVG Voice Usage) + (|)(ATTITUDE) + (|)(INTENTION) *

PREDICTION FORMULAS FOR HEALTHY SUBSCRIBER :

Constant :

AVG Voice Usage Score :

Attitude score :

Intention score :

Attitude value :

Intention value :

* Predicted voice usage : +(AVG Voice Usage) + (|)(ATTITUDE) + (|)(INTENTION) *

SAVE

Figure 3-4: After selecting the “Upload new price plan”, the required data lists for price plan forecasting model will list out all the screen belongs to this function.

3.2 Edit price plan

Edit price plan is the function used to display the detail information of the price plan.

- Click at the drop down list to select the desired price plan as figure 3.5.
- The information displayed will refresh and change according to the selected price plan automatically after user changes to the desired price plan.
- When user would like to edit price plan, point the mouse over and click on the “Edit” to display the details of desired price plan.

4. The application will display the data belong to the desired price plan.
5. Update or delete the price plan value as required. Please refer to figure 3-6 and figure 3-7 for the example of price plan information shown.
6. Click **SAVE** button on bottom of the screen to record the information after change the desired value of the price plan. The screen pop up for save the data to the desired price plan will display as figure 3-3.
7. Click **ACCEPT** button to save the data or **CANCEL** button to back on screen to maintain the data as required.

☰ > price plan

price plan

PRICE PLAN dtac voice 149 ▾

New Price Plan ↕

PACKAGE NAME	MONTHLY SERVICE FEE	FREE CALL ALL NETWORKS (MINUTES)	MAXIMUM 3G SPEED FOR 42 Mbps (MB)	DTAC WIFI	OVERAGES AND EXTRA SERVICE FREE				MANAGE
					VOICE CALLS (BATH/MESSAGE)	INTERNET (MINUTES)	INTERNET (MB)	SMS/MMS	
dtac voice 149	149	150	-	-	1.5	1	-	2 5	Edit

Figure 3-5: To choose the desired price plan

☰ > price plan > edit price plan

price plan

PRICE PLAN CHARACTERISTICS

Package Name : Monthly Service Fee :

Free Call All Networks (Minutes) : Maximum 3G Speed For 42 Mbps : MB GB

Dtac WIFI :

overages and extra service fee

Voice Calls (Bath/Minute) : Internet (Minutes) :

Internet (MB) : SMS (Bath/Message) :

MMS (Bath/Message) :

Figure 3- 6: After selecting the “Edit”, the price plan characteristic lists will list out all the screen belongs to this price plan.

price plan forecasting model :

VOICE INTERNET

VOICE

PREDICTION FORMULAS FOR RISKY SUBSCRIBER :

Constant :

AVG Voice Usage Score :

Attitude score :

Intention score :

Attitude value :

Intention value :

* Predicted voice usage : $20 + 1(\text{AVG Voice Usage}) + (15)(\text{ATTITUDE}) + (-23.9723)(\text{INTENTION})$ *

PREDICTION FORMULAS FOR HEALTHY SUBSCRIBER :

Constant :

AVG Voice Usage Score :

Attitude score :

Intention score :

Attitude value :

Intention value :

* Predicted voice usage : $0 + 1(\text{AVG Voice Usage}) + (0)(\text{ATTITUDE}) + (0)(\text{INTENTION})$ *

SAVE

Figure 3-7: After selecting the “Edit”, the price plan forecasting model details will list out all the screen belongs to this price plan.



4. How to use detection condition

The detection condition is designed to view and create the detection condition for subscriber's usage monitoring. This data contained therein is specific for each price plan. When going to the new conditions creation, the system will automatically navigates to new condition screen where user enter the condition value of the price plan.

Please note that once the condition detection creation, it's not allowed to maintain or change the detection condition value

4.1 View detection conditions

Detection condition view is the function used to display the current criteria for subscriber's usage monitoring.

1. Click at the "Detection condition" from the menu bar, the system will navigate to detection condition function.
2. Click at the drop down list to select the desired price plan as figure 4-1.
3. The information displayed will refresh and change according to the selected price plan automatically after user changes to the desired price plan.
4. The application will display the detection criteria belong to the desired price plan

☰ > detection condition

condition

PRICE PLAN : dtac voice 149 ▾

Upload New Condition ↕

DATE	Subscriber usage range (MAX-MIN)			Subscriber usage (x-bar)			Cp	Cpk	Usage Variation (Sigma)	Status
	Lower range	Average	Upper range	Lower usage	Average	Upper usage				
2013-09-09	-	60.69	156.22	18.93	81.01	143.1	1.02	0.75	3	Active
2013-09-09	-	60.69	156.22	18.93	81.01	143.1	0.46	0.36	3	Closed

Figure 4-1: Summary lists for detection condition and its criteria

4.2 Create new detection condition

New detection condition creation is the function used to create new criteria for subscriber's usage monitoring.

1. Click at the drop down list to select the desired price plan as figure 4-1.
2. The information displayed will refresh and change according to the selected price plan automatically after user changes to the desired price plan.
3. The application will display the detection criteria belong to the desired price plan

4. When user would like to create new detection condition, point the mouse over and click on the “Upload the new condition” as figure 4-1.
5. The system will display the step and application form with blank fields for condition detection criteria according desired price plan. Please refer to figure 4-2 for the example of price plan criteria shown.
6. Click the **Choose File** button to select the subscriber data for calculation.
7. Enter the desired values according to price plan and its conditions for subscriber monitoring and package advisory.
8. Click the **CALCULATE** button to run the detection condition after selected the desired value.
9. The detection condition will then display the criteria for subscriber detection with “Active” whereas the previous criteria will be automatically change status to “Closed” status as figure 4-1.

Please note that there will be only one “Active” criterion for each price plan at the same time.

🏠 > *condition* > *upload new condition*

CONDITION & PACKAGE CAPABILITY

Price Plan: **dtac voice 149**

Upload New Subscriber File : **Choose File** No file chosen

Usage Specification Limit :

Lower Usage Specification Limit (LSL) :

Upper Usage Specification Limit (USL) :

No. of Usage Variation Limit (Sigma) :

CALCULATE

Figure 4-2: Step to create condition and define criteria

5. How to use subscriber monitoring

The subscriber monitoring is designed to monitor and detect subscriber usage according to predefined criteria in each price plan. The conditions of subscriber monitoring is structured according to various market needs and individual campaign.

5.1 Create monitoring campaign

New monitoring campaign creation is the function used to create new campaign for subscriber's usage monitoring.

1. Click at the "Subscriber monitoring" from the menu bar, the system will navigate to package advisory function.
2. Click at the drop down list to select the desired price plan as figure 5-1.
3. The detection condition displayed will refresh and change according to the selected price plan automatically after user changes to the desired price plan.
4. The application will display the detection criteria belong to the desired price plan and step to create new subscriber monitoring campaign as figure 5-1.
5. Click the **Choose File** button to select the subscriber data for monitoring.
6. Enter the desired values according to price plan and its criteria for subscriber monitoring and package advisory. The followings are the criteria for subscriber usage monitoring and package advisory
 - a. Subscriber segmentation by considering on percent of voice usage trend
 - b. Offering condition for upsell offering by increasing of ARPU in term of percentage
7. Click the **CALCULATE** button to run the subscriber usage monitoring campaign after selected the desired value.
8. The subscriber monitoring campaign will then display the criteria for subscriber monitoring with criteria and status of the campaign in the campaign list as figure 5-2.

🏠 > subscriber monitoring

subscriber monitoring

PRICE PLAN : dtac voice 149 ▾

DATE	Subscriber usage (x-bar)			Subscriber usage range (MAX-MIN)			Cp	Cpk	Usage Variation (Sigma)
	Lower range	Average	Upper usage	Lower usage	Average	Upper usage			
2013-09-09	0	60.69	156.22	18.93	81.01	143.1	1.02	0.75	3

📌 UPLOAD NEW SUBSCRIBER FILE : **Choose File** No file chosen

Subscriber Segmentation:

Voice Usage Trend : (%)

Offering Condition:

ARPU Increase : (%)

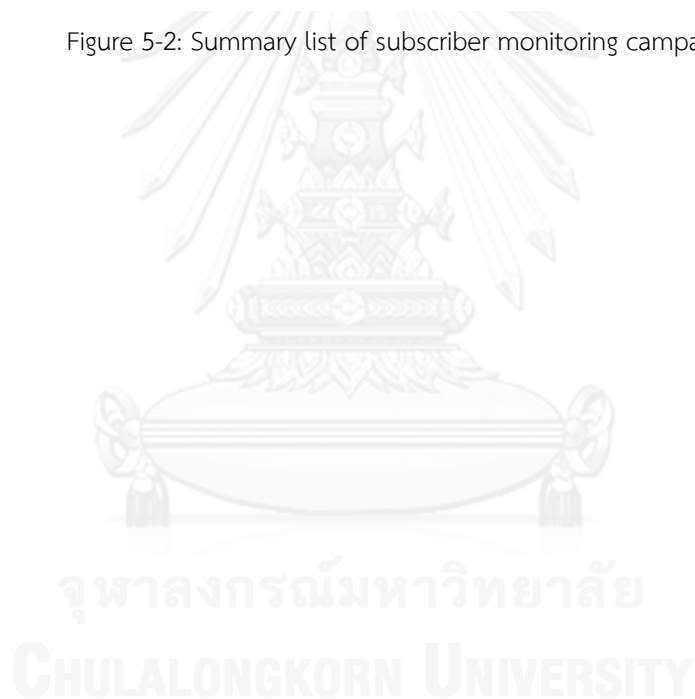
CALCULATE

Figure 5-1: Detection condition and monitoring criteria

subscriber monitoring summary

No.	Date	PRICE PLAN	VOICE USAGE TREND	ARPU INCREASE	Total	Remaining	Complete	Status	Manage
1	2013-09-12	dtac voice 149	30	20	571	569	2	In Progress	View
2	2013-09-12	dtac voice 149	30	20	571	569	2	In Progress	View
3	2013-09-12	dtac voice 149	30	20	571	541	30	In Progress	View
4	2013-09-16	dtac voice 149	30	10	720	653	67	In Progress	View
5	2013-09-16	dtac voice 149	30	10	721	668	53	In Progress	View
6	2013-09-16	dtac voice 149	30	10	721	681	40	In Progress	View
7	2013-09-16	dtac voice 149	30	10	721	686	35	In Progress	View
8	2013-09-16	dtac voice 149	30	10	720	696	24	In Progress	View
9	2013-09-16	dtac voice 149	30	10	720	719	1	In Progress	View

Figure 5-2: Summary list of subscriber monitoring campaign



6. How to use package advisory

The package advisory is designed to view status of subscriber usage monitoring campaign and provide needed information to agents for package advisory. There are two main type of package advisory which are company offering and customer preference.

Please note that once the subscriber monitoring campaign creation, it's not allowed to directly maintain or change the campaign. Its status will be automatically updated by offering process.

6.1 View subscriber usage monitoring campaign

Subscriber usage monitoring campaign view is the function used to display the criteria and status for individual campaign.

1. Click at the "Package advisory" from the menu bar to navigate to package advisory function.
2. Click at the drop down list to select the desired price plan as figure 6-1.
3. The subscriber monitoring campaign displayed will refresh and change according to the selected price plan automatically after user changes to the desired price plan.

🏠 > PACKAGE ADVISORY

PACKAGE ADVISORY

PRICE PLAN : dtac voice 149 ▼

No.	Date	PRICE PLAN	VOICE USAGE TREND	ARPU INCREASE	Total	Remaining	Complete	Status	Manage
1	2013-09-12	dtac voice 149	30	20	571	567	4	In Progress	View
2	2013-09-12	dtac voice 149	30	20	571	569	2	In Progress	View
3	2013-09-12	dtac voice 149	30	20	571	541	30	In Progress	View
4	2013-09-16	dtac voice 149	30	10	720	653	67	In Progress	View
5	2013-09-16	dtac voice 149	30	10	721	668	53	In Progress	View
6	2013-09-16	dtac voice 149	30	10	721	681	40	In Progress	View
7	2013-09-16	dtac voice 149	30	10	721	686	35	In Progress	View
8	2013-09-16	dtac voice 149	30	10	720	696	24	In Progress	View
9	2013-09-16	dtac voice 149	30	10	720	719	1	In Progress	View

Figure 6-1: Subscriber monitoring campaign and its status

6.2 Select subscriber usage monitoring campaign

Subscriber usage monitoring campaign selection is the function used to display the subscriber segmentation for individual campaign for offering suitable package to subscriber.

1. Refer to figure 6-1, when user would like to offer price plan to subscriber, point the mouse over and click on the “View” to display the subscriber segmentation.
2. The application will display the subscriber segmentation with number of subscribers belong to the desired monitoring campaign as figure 6-2. There are three main subscriber segmentations with total subscribers as following
 - a. Subscriber with low usage
 - b. Healthy subscriber
 - c. Risky subscriber
 - d. Total subscriber

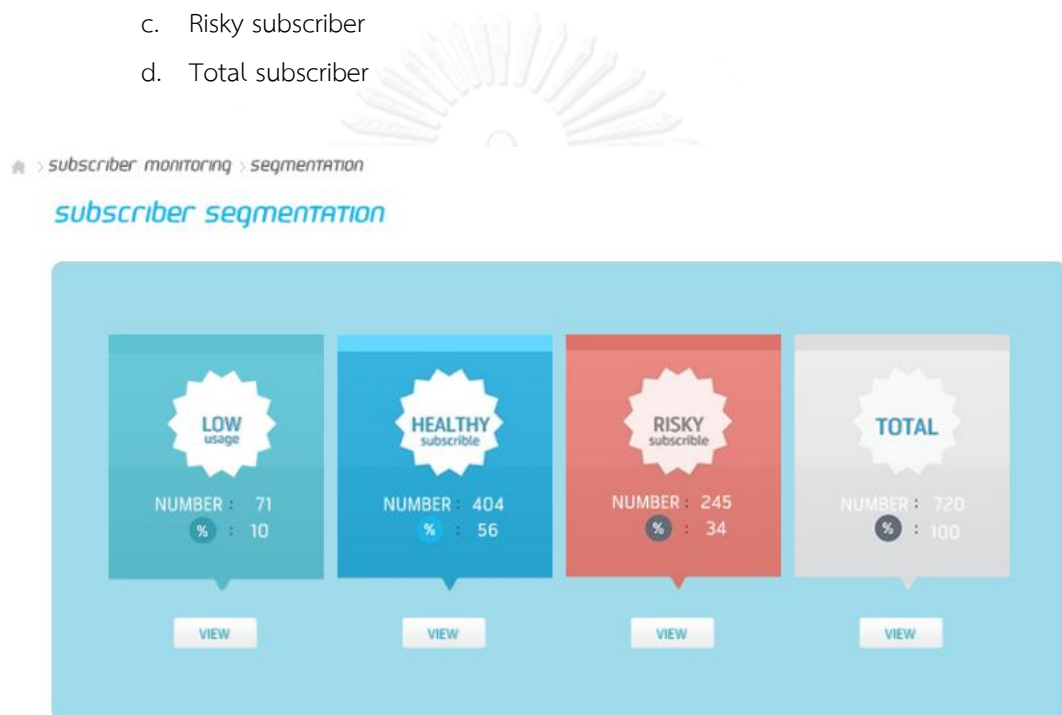


Figure 6-2: Subscriber segmentation with number of subscribers

3. Click **VIEW** button under desired subscriber segmentation to navigate to the list of subscriber for package advisory as figure 6-3.

Subscriber monitoring > segmentation

LOW USAGE

Export ↓

Search:

SUBSCRIBER NO.	CUSTOMER NAME	CURRENT MAIN PACKAGE	ADDITION PACKAGE	ARPU	VOICE USAGE (LAST MONTH)	VOICE USAGE (AVERAGE)	VOICE USAGE (PREDICT)	SUBSCRIBER STATUS	STATUS	MANAGE
66905482413	นาง อรัลกษณ์ โทกวัฒน์	dtac voice 149		149	5	288	358	Active	-	View
66894678659	น.ส. สุกนันทิ สรรพชาติ	dtac voice 149		149	13	114	237	Active	-	View
66817160968	นาย อรุณดา ทวีจล-วาท	dtac voice 149		149	1	97	226	Active	-	View
66805219595	นาง ทารกนา ทาพทวง	dtac voice 149		149	7	82	215	Active	-	View
66813487189	นาย ทรงกรณ จงจันทร์	dtac voice 149		149	0	71	208	Active	-	View
66896638953	นาย พันธ์ จันทร์สุข	dtac voice 149		149	5	67	205	Active	-	View
66859099812	น.ส. อมรมาหาฉวีจรุ่งโรจน์	dtac voice 149		149	1	58	199	Active	-	View
66875125626	น.ส. จิราพร ศรีวงค์	dtac voice 149		149	18	49	193	Active	-	View
66814548483	นาย อรุณศักดิ์ ประเสริฐ	dtac voice 149		149	5	44	189	Active	-	View
66835847722	น.ส. วรุตน์ ยลไพฑูริย์	dtac voice 149		149	18	42	188	Active	-	View

First Previous **1** 2 3 4 5 Next Last

Figure 6-3: Example of subscriber list for package advisory

4. Except “Risky subscriber” the system will navigate to sub-segmentation as figure 6-4 before going to the list of its subscriber as following
 - a. Proactive Bill Shock
 - b. Proactive Silent/Drop
 - c. Reactive Retention

☰ > subscriber monitoring > segmentation

segmentation

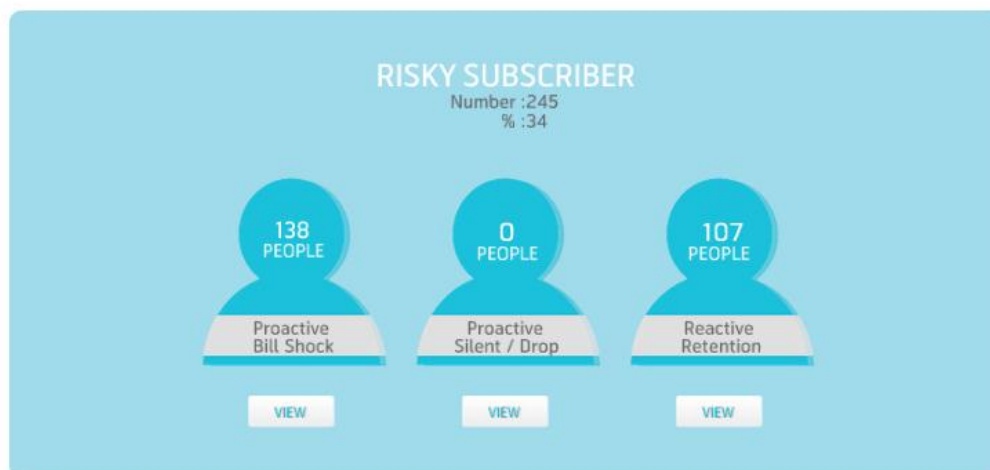


Figure 6-4: Sub-segmentation of Risky subscriber

6.3 Perform package advisory

Perform package advisory is the process to offer suitable price plan to subscribers according their segmentation.

1. When performing package advisory to subscriber e.g. Proactive Bill Shock segmentation as figure 6-5.

☰ > subscriber monitoring > segmentation

proactive bill shock

Export ↕
Search:

SUBSCRIBER NO.	CUSTOMER NAME	CURRENT MAIN PACKAGE	ADDITION PACKAGE	ARPU	VOICE USAGE (LAST MONTH)	VOICE USAGE (AVERAGE)	VOICE USAGE (PREDICT)	SUBSCRIBER STATUS	STATUS	MANAGE
66846683506	นาย สุทธิชัย คุ้มเกียรติธรรม	dtac voice 149		550	417	588	564	Active	-	View
66815302088	นาย วรณัฐ รัตนศักดิ์	dtac voice 149		485	374	633	595	Active	-	View
66876022929	นาง สุกัญญาภัค วัฒนาลัย	dtac voice 149		369	297	382	423	Active	-	View
66804762455	นาย ปณ-นทร สมนุญณ์	dtac voice 149		327	269	279	351	Active	-	View
66816217014	นาย สมรณ ปะหงษ์	dtac voice 149		324	266	355	404	Active	-	View
66814026848	น.ส. สุทธิชัย หอมนร	dtac voice 149		318	263	278	350	Active	-	View
66817197554	นาง ณัฐธยาณี วัฒนตั้งระฤก	dtac voice 149		314	260	330	386	Active	-	View
66851886951	น.ส. ชัยวัฒน์ งามพงษ์	dtac voice 149		269	230	217	308	Active	-	View
66896966080	น.ส. ธารา สอนาท	dtac voice 149		267	228	208	302	Active	-	View
66815412573	นาย เคนธรรพ์ คุ้มบุญ	dtac voice 149		262	225	239	323	Active	Sign up	View

First Previous **1** 2 3 4 5 Next Last

Figure 6-5: Example of subscriber list of “Proactive Bill Shock”

2. Select subscriber for package advisory, point the mouse over and click on the “View” to display the subscriber details.
3. The system will display the details of subscriber and his/her needed information as figure 6-6.

☰ > subscriber monitoring > advisory

subscriber information

CUSTOMER NO. : 502056893 SUBSCRIBER NO. : 66815710464 CUSTOMER NAME : นาย สุทธิชัย วัฒนธรรม
 CURRENT MAIN PACKAGE : dtac voice 149 CURRENT ADDITION PACKAGE : SUBSCRIBER STATUS : Active
 ARPU (LAST MONTH) : 1,097 ARPU (PREDICT) : 1,601 STATUS : -

TYPE OF SERVICE	USAGE (LAST MONTH)	USAGE (AVERAGE)	USAGE (PREDICT)	USAGE CHANGE (%)
Voice Usage (min)	782	1,392	1,118	336 (43%)
Internet (mb)	0	0		

Figure 6-6: Example of subscriber general information

4. Moreover, the **HISTORICAL USAGE** button enables agent to view the historical usage of subscriber both voice and internet usage as figure 6-7 and view current price plan characteristics by clicking at **Current Package** button as figure 6-8.



Figure 6-7: Example of current subscriber price plan

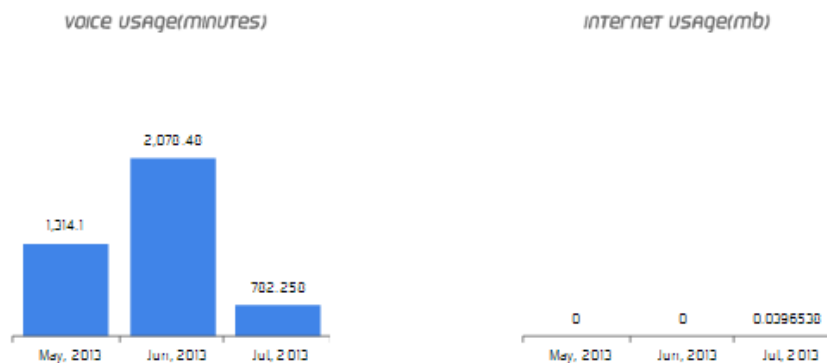


Figure 6-8: Example of subscriber usage

5. For performing advisory package, the best three choices in each category will be listed for subscriber offering as figure 6-9.

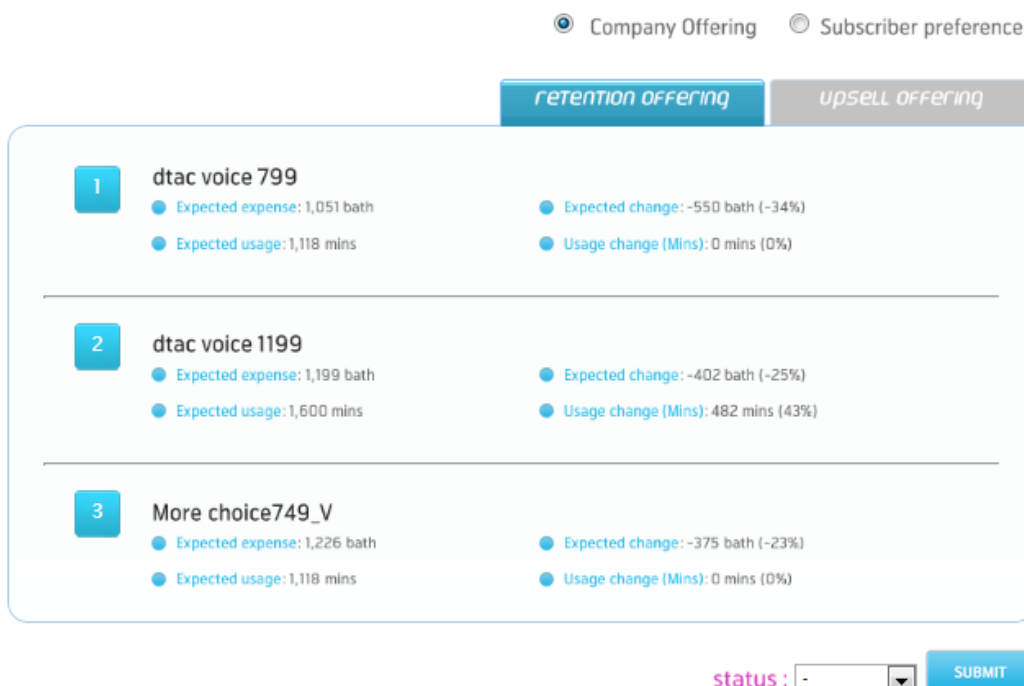


Figure 6-9: Example of best three choices for subscriber offering

6. Select the most suitable price plan, point the mouse over and click on the package name such as “dtac voice 799” to display the package details.
7. The system will display the details of the selected package as figure 6-10.

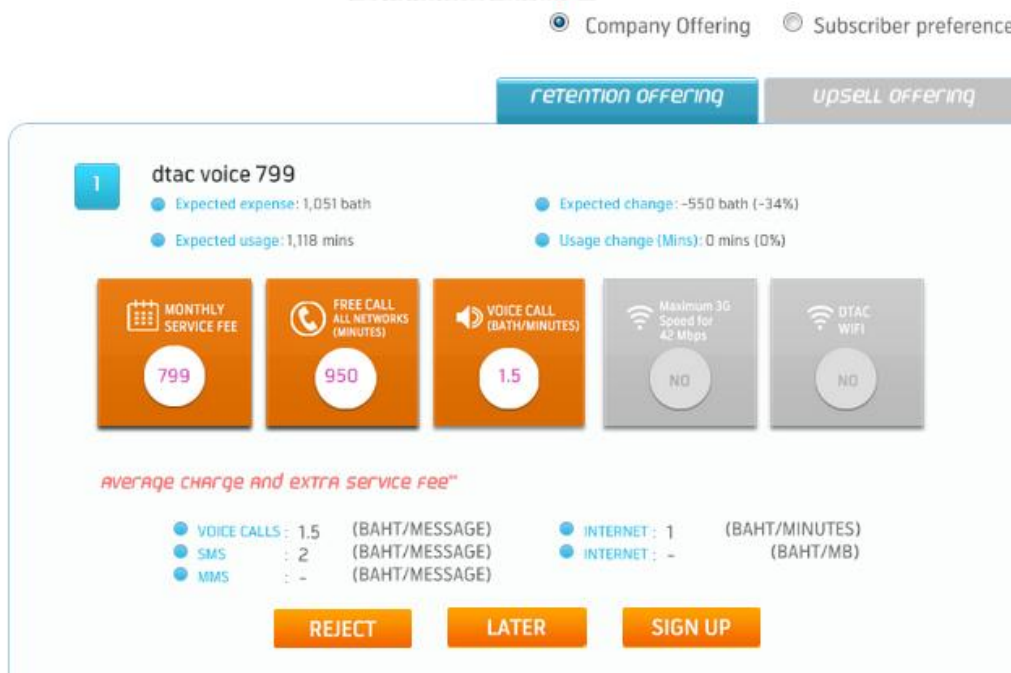


Figure 6-10: Example of price plan characteristics for offering

8. Recording the results of package advisory to the system as following

- a. In case of subscriber reject the offering, clicking **REJECT** and identify the reason of rejection. The result of this selection is illustrated in figure 6-11.

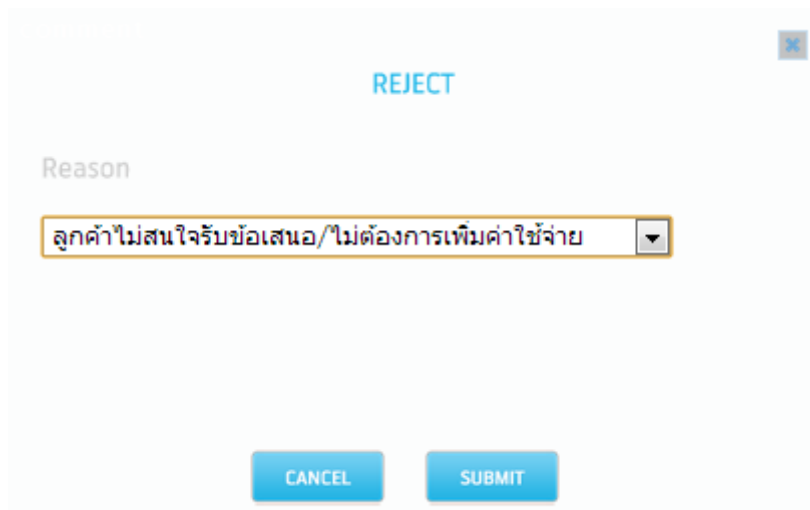


Figure 6-11: Example of rejection reason

- b. In case of subscriber reject the offering, clicking **LATER** and identify the reason of rejection. The result of this selection is illustrated in figure 6-12.

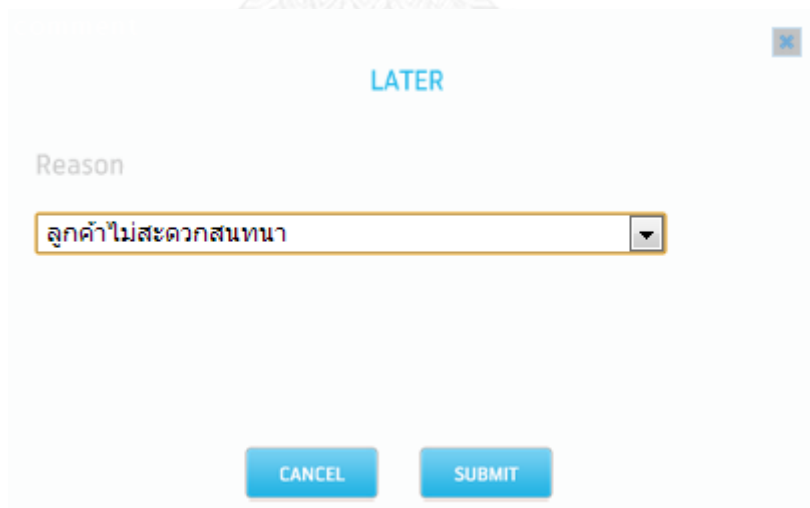


Figure 6-12: Example of later reason


- c. In case of subscriber accept the offering, clicking **SIGN UP** and preceding other activities accordingly.

7. How to use report

The report is designed for enabling marketing analysis and manager to view the subscriber status as well as tracking performance of package advisory campaign

7.1 Generate the package advisory report

Generate package advisory report is the function used to create the needed information as desired for package advisory and campaign monitoring.

1. Click at the “Reporting” from the menu bar to generate the report.
2. The system will then display the prompt values for user to select as figure 7-1.
3. You can access the report via the following views:
 - a. Price plan
 - b. Offering date
 - c. Agent name
 - d. Subscriber No.
 - e. Offering status
4. When you click on the  button, the system executes the selection run and displays the results list.
5. The result of the selection is illustrated in Figure 7-2.

🏠 > report

report

Price Plan	<input type="text"/>		
Offering Date	<input type="text"/>	to	<input type="text"/>
Agent Name	<input type="text"/>		
Subscriber No.	<input type="text"/>	Status	<input type="text"/>
<input type="button" value="SEARCH"/>			

Figure 7-1: The selected report will display as the prompt value on the viewer

OFFERING DATE	CURRENT MAIN PACKAGE	CUSTOMER NO.	SUBSCRIBER NO.	CUSTOMER NAME	STATUS	REASON	NEW PACKAGE	AGENT NAME
-	dtac voice 149	538460018	66803320303	นาง จิราภรณ์ ตั้งวิวัฒน์กุล	-	-	-	-
-	dtac voice 149	600108725	66804234774	น.ส. สุพัฒน์ตรา บัวดี	-	-	-	-
-	dtac voice 149	537925046	66804367111	นาย ทนพล มิ่งขวัญ	-	-	-	-
-	dtac voice 149	538136242	66804430066	น.ส. เกษศรีม บณิกำ	-	-	-	-
-	dtac voice 149	536157852	66804488209	นาง อรุณฯ จันทนพรชัย	-	-	-	-
-	dtac voice 149	600077571	66804547272	นาย อรุณฯ เป้าทอง	-	-	-	-
-	dtac voice 149	536281485	66804762455	นาย ปิยะ-มิตร สุนทรณ์	-	-	-	-
-	dtac voice 149	538491372	66804914546	น.ส. อติจันทร์ ปันคำ	-	-	-	-
-	dtac voice 149	537795856	66804992548	น.ส. พรรวรรักษ์ ยอดศรี	-	-	-	-
-	dtac voice 149	538327581	66805087286	น.ส. สิริมา ทองเจริญ	-	-	-	-


Export 

Figure 7-2: The example of report generated according to the selected value.

7.2 To export into other format

This package advisory report can be export into Microsoft Excel, which can be applying to Microsoft Excel 2010.

The steps to export to other formats are the following:

1. When user would like to create new report, point the mouse over and click on the “Export” as figure 7-2.
2. The system then generates the output as excel format and automatically saves to predefined location.
3. Select the file name as bottom of the screen or go to predefined location to view the output in excel format.

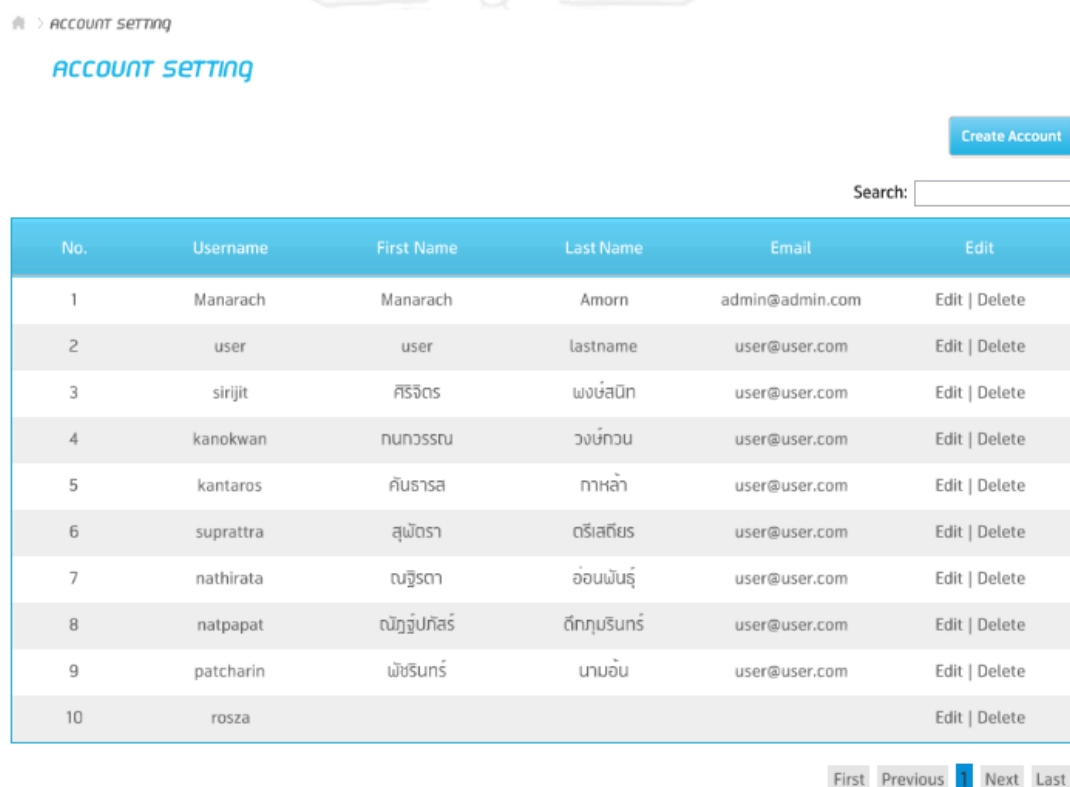
8. How to use account setting

The account setting is designed for user accounts creation and change to access in the Innovative Price Plan Monitoring and Advisory system.

8.1 Add new user

Add new user is the function used to create new user accounts and privilege to log-in to the Innovative Price Plan monitoring and Advisory system.

1. Click at the “Account setting” from the menu bar to access the account setting.
2. The system will then display the list of user as figure 8-1.



The screenshot shows the 'ACCOUNT SETTING' page. At the top right is a 'Create Account' button. Below it is a search bar labeled 'Search:'. The main content is a table with 10 rows of user data. At the bottom right are navigation buttons: 'First', 'Previous', '1', 'Next', and 'Last'.

No.	Username	First Name	Last Name	Email	Edit
1	Manarach	Manarach	Amorn	admin@admin.com	Edit Delete
2	user	user	lastname	user@user.com	Edit Delete
3	sirijit	ศิริจิต	พงษ์สันนิท	user@user.com	Edit Delete
4	kanokwan	กนกวรรณ	วงษ์ทวน	user@user.com	Edit Delete
5	kantaros	คันธารส	กาหาล้า	user@user.com	Edit Delete
6	suprattra	สุพัตรา	ตรีเสถียร	user@user.com	Edit Delete
7	nathirata	ณฐิรดา	อ่อนพันธุ์	user@user.com	Edit Delete
8	natpapat	ณัฐปภัทร์	ดิทกษรินทร์	user@user.com	Edit Delete
9	patcharin	พัชรินทร์	เกษมอัน	user@user.com	Edit Delete
10	rosza				Edit Delete

Figure 8-1: The list of account users

3. To add a new user, click on **Create Account** button.
4. The system will then display the dialog as figure 8-2, fill in the mandatory fields.
5. Click on **SUBMIT** button to create the user account with specified properties or Click on **BACK** when adding new user's cancellation.

🏠 > Add new ACCOUNT

Add new ACCOUNT

Username	:	<input type="text"/>
Password	:	<input type="text"/>
Confirm Password	:	<input type="text"/>
First Name	:	<input type="text"/>
Last Name	:	<input type="text"/>
Email	:	<input type="text"/>
		<input type="button" value="SUBMIT"/> <input type="button" value="BACK"/>

Figure 8-2: The prompt value on the viewer for adding new user

8.2 Change account user

Change account user is the function used to change or update user profiles and their privilege to access the system.

1. To change a user's profiles, click on the "Edit" to perform change the authentication method of users.
2. The system will then display the dialog as figure 8-3, fill in the mandatory fields.
3. Click on button to record the change of user account or Click on when changing new user's cancellation.

🏠 > CHANGE ACCOUNT

CHANGE ACCOUNT

Username	:	<input type="text" value="Manarach"/>
Password	:	<input type="text"/>
Confirm Password	:	<input type="text"/>
First Name	:	<input type="text" value="Manarach"/>
Last Name	:	<input type="text" value="Amorn"/>
Email	:	<input type="text" value="admin@admin.com"/>
		<input type="button" value="SUBMIT"/> <input type="button" value="BACK"/>

Figure 8-3: The prompt value on the viewer for changing user profiles

8.3 Delete account user

Delete account user is the function used to delete users who are no longer access to Innovative Price Plan Monitoring and Advisory system. When the user is deleted, the data stored in the system that are managed by the user will be deleted.

1. To delete a user, select the user profile to delete and click on the “Delete” to delete the user profile.
2. The system now displays the deletion confirmation dialog box as figure 8-4.
3. Click on **YES** button to confirm for user account deletion or click on **NO** when deleted user cancellation.

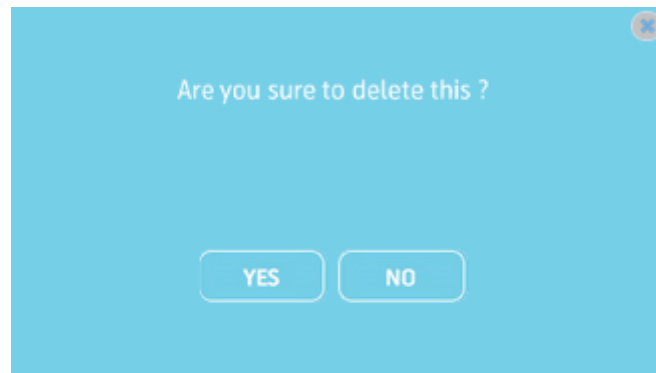


Figure 8-4: The dialogue for deleting users

VITA

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