

**FACTORS AFFECTED TO THE ACCEPTANCE AND USE OF
GLOBAL POSITIONING SYSTEM IN THE PUBLIC
TRANSPORTATION INDUSTRY OF THAILAND**

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OF THE REQUIREMENTS FOR
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Thesis
entitled

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TRANSPORTATION INDUSTRY OF THAILAND**

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FACTORS AFFECTED TO THE ACCEPTANCE AND USE OF GLOBAL POSITIONING SYSTEM IN THE PUBLIC TRANSPORTATION INDUSTRY OF THAILAND

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ABSTRACT

An advanced technology plays an important role in the transportation sector. Every country tries to support their entrepreneurs in using such technology. A research found that the factors affecting the acceptance and usage of GPS in Thailand public transportation industry were compatible with the Unified Theory of Acceptance and Use of Technology (UTAUT) model. The GPS acceptance and use behavior was influenced by the facilitating condition and the behavioral intention together with the Performance Expectancy (PE), Effort Expectancy (EE) and Social Influence (SI) as the root causes. The experience has also the positive effect toward the GPS acceptance while the technology barrier perception was found as the negative factor for this case. The important issues were about the benefit-cost comparison, the knowledge and experience for implementing the GPS. The most important factor was the limited resources and knowledge of the facilitating condition. The entrepreneurs do not take full advantages from GPS. They use the GPS only as the tracking system so they percept that it was unprofitable. In order to conquer these barriers, the financial supports and GPS application for managerial reason trainings are needed.

KEY WORDS: GPS / UTAUT MODEL / THAILAND'S PUBLIC INDUSTRY / BARRIERS

160 pages

ปัจจัยที่นำไปสู่การยอมรับและใช้งานระบบระบุตำแหน่งบนพื้นพิภพ ในอุตสาหกรรมขนส่ง
สาธารณะของไทย

FACTORS AFFECTED TO THE ACCEPTANCE AND USE OF GLOBAL POSITIONING
SYSTEM IN THE PUBLIC TRANSPORTATION INDUSTRY OF THAILAND

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บทคัดย่อ

ในยุคโลกาภิวัตน์ เทคโนโลยีที่ล้ำสมัยได้เข้ามามีบทบาทเป็นอย่างมากต่อกร
คมนาคมขนส่งของโลก ทุกประเทศต่างริเริ่มมาตรการสนับสนุนผู้ประกอบการให้นำเทคโนโลยีมา
ใช้ ผลการวิจัยฉบับนี้พบว่าปัจจัยที่นำไปสู่การยอมรับและใช้งานระบบ GPS ในอุตสาหกรรม
ขนส่งสาธารณะของไทยนั้นสอดคล้องกับทฤษฎี UTAUT โดยการยอมรับและใช้ GPS นั้น เป็นผล
มาจากสถานะที่เอื้ออำนวย (FC) และ ความตั้งใจที่จะใช้ (BI) ซึ่งเป็นผลมาจากความตระหนักใน
ประโยชน์ (PE) ความสะดวก (EE) และแรงกระตุ้นทางสังคม (SI) ทั้งนี้ประสบการณ์ (Exp) เป็น
ปัจจัยเสริมอีกอย่างหนึ่ง ในขณะเดียวกัน พบว่า การรับรู้อุปสรรค (BP) เป็นปัจจัยที่มีผลกระทบทาง
ลบต่อการยอมรับและใช้ GPS ประเด็นสำคัญที่สุดที่ส่งผลต่อการยอมรับและใช้ GPS คือ เรื่องความ
คุ้มค่าของการลงทุน ผู้ประกอบการบางส่วนต่างตระหนักในเงินทุนที่มีจำกัดของธุรกิจเมื่อ
เปรียบเทียบกับวงเงินลงทุนที่ค่อนข้างสูง ประกอบกับขาดความรู้และประสบการณ์ในการใช้ GPS
เพื่อการบริหารจัดการ ทุกวันนี้ผู้ประกอบการส่วนใหญ่ใช้ GPS เพียงเพื่อการติดตามรถฯ ตามที่
กฎหมายกำหนด จึงไม่ได้รับประโยชน์จาก GPS อย่างเต็มที่ และคิดว่าเป็นการลงทุนที่ไม่คุ้มค่า
ดังนั้นการจะเอาชนะความกังวลใจในอุปสรรคเหล่านั้นได้ จึงควรจัดให้มีการส่งเสริมการลงทุนใน
รูปแบบต่างๆ รวมทั้งการให้ความรู้ ให้ประสบการณ์ และ โน้มน้าวผู้ประกอบการให้ใช้ประโยชน์
GPS เพื่อการบริหารจัดการให้มากขึ้นด้วย

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CHAPTER I

INTRODUCTION

For consistency understanding in the overall views of this research, the background and the problem states for this research, including the objectives, scope of work and expected results were discussed in this chapter.

1.1 Background and problem statements.

Technology, widely accepted as one of the most important tools in many countries. Technologies help the businesses gain their success and superior their competitiveness over their competitors. Some of the business organizations may accept and use the technology themselves, and some are not. As we really know that the business succeed reflex to the national commercial succeed. So the governmental supports are always needed and welcomed no matter in what ways. There are many ways to conveying them to use the technology but which way should have the great impact to them still needed to explored.

Transportation, the logistics activity that plays the important roles in almost every types of business, shared the big portions in the total logistics cost. As we know that, the more logistics cost, the worse commercial competitiveness. The logistics cost of Thailand is about 19%, while the other developed countries is only about 7%. To reduce the logistics cost, the reduction of the transportation cost becomes the effective ways. GPS technology is one best friend as it always did in many countries. GPS was first used by Thai-transporters for more than 10 years, some transporters accept and use GPS as the effective tools, some still never use and some are reject. Why? For overall transportation industry, GPS wasn't used with its full functions because it does not accepted by all the transporters and there are the different in business characteristics among the users.

For the public transportation sector, the development in public transportation by implementing of the technology especially the GPS is the issue

stated in the report of the National Economics and Social Development Board (NSTDB) (Jarunee Wonglimpiyarat., 2007)

Technically, an advanced innovations or technologies are always better than it ever been, but in practical they might not be the best answer at all. Because it doesn't mean that they are accepted by the users. The implementing of any new launch always walks against the changed-resist of the users. The question of "how should we know the way to convey the users to accept and use that technology?" might be answered, if only we know the factors analyzed by the technology acceptance model. The evolution of technology-acceptance-model is described in chapter II (Literature Reviews).

Many times, we'll see that the technology-acceptance-model does not been used directly. It must be adopted by the researcher to make it more appropriate to each case. Like other technology-acceptance-model, the latest developed technology-acceptance-model, the UTAUT model, has been adopted to use in the study of the acceptance of several technologies. UTAUT could reveal the factors that lead to the acceptance of those technologies. The acceptance factors by UTAUT model should be clearly described in chapter II. In the same way, for this study, the UTAUT model was adopted and rebuilt into the more appropriate model which proper to use in predicting and explaining the factors of the GPS acceptance, especially for the case study of the Thailand's transportation industry.

So the main question for this research is "How the appropriate adopted-version of UTAUT model that could accurately explain the acceptance factors of GPS should be?" and "What are the factors affected to the GPS acceptance?"

The results from this research should let us know the factors that constructed in the acceptance model for GPS. The adopted version of UTAUT model for GPS acceptance, resulted from this research could accurately explain the factors affected to the GPS acceptance and use by Thai's public transportation industry.

1.2 Objectives.

The objectives of this research are the followings:

1.2.1 To build the appropriate adopted-version of UTAUT model that could accurately explain the acceptance factors of GPS by Thai's public transportation industry.

1.2.2 To know the factors that constructed in the acceptance model for GPS which affect to the GPS acceptance and use by Thai's public transportation industry.

1.2.3 To know the barriers against the adoption of GPS by Thai's public transportation industry.

1.3 Scope of work.

This research aimed to find the appropriate acceptance model in case of the GPS technology acceptance by Thai's public transportation industry. The factors influenced on the user decision to use GPS are first modeled based on the UTAUT theory. The well designed questionnaires are sent to the transporters. The response data were analyzed with the Lisrel program. The factors affected to the GPS acceptance and their relationships were determined and concluded.

1.4 Expected results.

The expected results from this research are:

1.4.1 The adopted version of UTAUT which is appropriate to use to predict and describe the GPS acceptance in the case of Thai's public transportation industry.

1.4.2 The acceptance factors which affect to the GPS acceptance and use by Thai's public transportation industry.

1.4.3 Know the barriers against the adoption of GPS by the Thai's public transportation industry.

Key words: GPS, UTAUT model, Thailand's Public Transportation Industry, Barriers

CHAPTER II

LITERATURE REVIEWS

The literature reviews were meticulously collected and presented in 8 topics of this chapter. Short brief about the GPS would be described first. The next topics were GPS applications especially for the transportation manner, Thailand's land transportation industry, Thai public transportation industry, theorem about technology acceptance, UTAUT model, technology acceptance barrier and technology acceptance by the organization respectively.

2.1 Global Positioning System (GPS).

The GPS (Global Positioning System) was first developed in 1970's by the department of military of USA in the name of NAVSTAR (Navigation Satellite Timing And Ranging System). Later, it was applied to use in various objectives. GPS works with the network of satellites orbiting in the space. There are 3 satellite-networks works with the GPS system, first is the network of 28 satellites of NAVSTAR (Navigation Satellite Timing and Ranging GPS), the second is the network of 27 satellites in the GALILEO of European Satellite Agency, and the GLONASS (Global Navigation Satellite) managed by Russia VKS (Russia Military Space Force). The Basic function of GPS is the real-time determination of the position of any objects around the world. In the manner of calculate the distances between the object and at least three satellites above the sky, GPS technology can specify the position of any objects around the world accurately in 3 dimensions on the flat plain (x-axis, y-axis) and height or depth (z-axis). With this ability, GPS was developed and applied for many applications especially for the transportation manners.

Now a day, GPS technology was successfully applied for many objectives, such as navigating, real-time tracking, mapping, land surveying, city landscaping, traveling, transportation, environments, agriculture, medical approach, mining, etc.

2.2 GPS applications.

GPS, known and accepted as the beneficial tools refer by many academic papers, is widely used for transportation and other applications in many countries. For the transportation, GPS is useful in many ways. In Greece, GPS was used in the land-transportation management both in the road and rail modes (Minsis et al.,2004). GPS was applied for bus scheduling and management in Australia (Bullock et al.,2005). The transportation data (such as road type, distance, speed, time) was effectively collected by GPS in Ireland (Devlin et al.,2007). In Korea, the postal activities were real-time tracked, controlled, monitored, analyzed and planned by the applies of GPS (Jung et al.,2006). In Sweden, the accurate transportation data were collected by the GPS and used in the study about travel planning, time controlling and fuel consumption forecasting (Hellstrom et al.,2009). The GPS, settle in the personal vehicles, act as the cost-saving tool that can quickly collect the precise data used in the design of the safety roads in Madrid, Spain (Castro.,2006). The GPS can make both the vendor and purchaser more confidential in the electronics commerce deals. The vendor can make a plan, control and monitor the delivery status real-time. In the other ways, the purchaser can real-time tracking the delivery status too (Alan Slater.,2002). GPS can work together with other technology such as GIS and web-based validation application in order to define target and traveling modal (Bohte and Maat.,2009).

Not only for the transportation, GPS is utilized for other manner also. For the medical research, GPS together with GIS and accelerometer was applied to collect data about the movement of people in the difference environment (Duncan et al.,2009).

In concluded, GPS gave 4 dimensions of advantage for the transportation as the following.

1. GPS as the navigating system.
2. GPS as the tracking system.
3. GPS as the fleet managing and monitoring system.
4. GPS as data collecting tool for the transportation infrastructure design.

2.3 The Transportation Industry of Thailand.

Transportation, one of the most important logistics activity especially for Thailand, the Gross Domestic Product (GDP) of Thailand depicted in table 2.1, shows that the GDP value of transportation industrial is about 611 million baths in 2007 and continuously grew up for the past 8 years.

Table 2.1 The Gross Domestic Product (GDP) of Thailand (2000 to 2007)

Industry	2000	2001	2002	2003	2004	2005	2006	2007
Agricultural	444,019	468,885	513,428	615,200	668,574	726,795	845,510	911,386
Mining	98,593	107,586	116,609	131,468	149,256	185,269	211,570	235,413
Manufacturing	1,432,009	1,468,884	1,550,603	1,755,117	1,946,058	2,150,032	2,360,720	2,629,914
Construction	142,731	147,525	157,385	164,908	182,541	199,009	217,268	231,586
Transportation and communication	392,286	420,648	443,246	443,063	483,144	495,184	539,983	611,515
Motorbike and house holding product	698,471	697,178	685,258	671,075	747,409	802,476	872,861	965,921
Others	1,232,310	1,309,978	1,396,558	1,461,257	1,612,712	1,766,215	1,914,731	2,051,320
Total GDP	4,440,419	4,620,684	4,863,087	5,242,088	5,789,694	6,324,980	6,962,643	7,637,037

(Data From : Office of the National Economics and Social Development Board (NESDB) , Prime Minister's Office)

While the GDP of transportation industry was expanded, transportation cost was expanded too. And it was one major problem that makes the national commercial competitiveness decreased. Moreover, the value of fuel, imported from other countries, was increased the deficit of balanced of trade and the deficit of balanced of payment of the country and finally decreased the national commercial competitiveness unavoidably.

Recently, office of the National Economic and Social Development Board of Thailand reported on February 2012 that the total value of logistics cost 2010 of Thailand was approximately 1.64 trillion bath or about 15.2% of GDP and remained unchanged for four years (2007-2010).

Thailand's total value of logistics cost in 2010 was approximately 1.64 Trillion baht, account for 15.2 percent of the Gross Domestic Product (GDP) at current prices.

Thailand's logistics cost structure was remained unchanged since 2007 until 2010. In 2010, the transportation cost was still the biggest component, accounted for 47.2 percent of total cost. Inventory holding cost and logistics administration cost constituted a share of 44.0 and 8.8 percent respectively. The following picture show that the transportation cost of Thailand constituted a share of almost a half (47%) of total logistics cost (Office of the National Economic and Social Development Board [NESDB], 2012) as shown in figure 2.1.

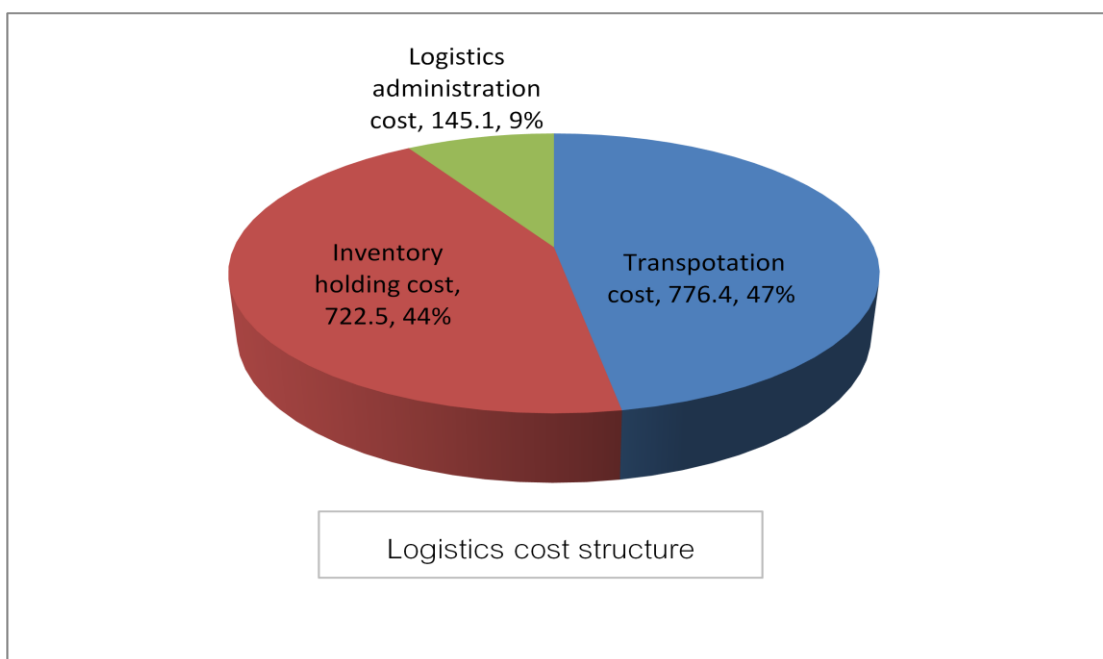


Figure 2.1 Logistics Cost Structure of Thailand

Comparing to the GDP, the value of transportation cost, inventory holding cost and the administration cost of Thailand are approximately 766.4, 722.5 and 145.1 billion baht or accounted to 7.2%, 6.7% and 1.3% of the GDP respectively.

2.3.1 Types of transportation modal in Thailand.

There are 4 models of transportation in Thailand: land transportation (road and rail), water transportation, air transportation and pipeline transportation which different in their characteristics.

Land transportation is the most important transportation modal and most closely used by Thai people. They can be classified in to two types: road transportation (such as truck, bus, etc.) and rail transportation (train)

Though it is the most expensive modal, road transportation is the most favorite transportation modal used in Thailand. Because it is easy to access and can covers thoroughly the country. It can serve for almost every type of goods, cover wide area of transport, satisfied to various needs. The weak point is that it can transfer with limited volume per round. And this is why the average transportation cost is higher than other modal.

Rail transportation was first used in Thailand since the reign of king Rama V. Normally it is slower than road transportation but unit cost is lower too. It is appropriate to use with heavy goods or high volume transportation.

Generally, water transportation is the lowest in unit cost comparatively but it is somewhat slowly. It is the appropriate way to transfer goods with high volume, and not serious in lead time. There are 3 types of water transportation in Thailand : river transportation, coastal transportation and overseas transportation.

Air transportation is the most costly modal but shortest in lead time needed. Today, there are 6 international airports and many domestic airports spread through out the country, available for transferring both passenger and goods.

In general, pipeline transportation is used only in specific case such as in the transportation of natural gas, petroleum product, oil, water, or other liquid products. And with the high value of the first investment together with the legally constraints, this modal is not much widespread in Thailand.

2.3.2 Percentage Volume of Transportation via Each Modal.

We may said that “road transportation” is the major modal for Thailand’s domestic transportation since 1999 – 2008 (and until now a days) with the percentage volume of more than 82% a year, as shown in figure 2.2 and 2.3

Table 2.2 The Volume of Domestic Transportation in Thailand via Each Modal (1999-2008). Adapt form table of the “Information Technology & Communication Center (ITCC)”

Transportation Modal	Year									
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Road	392,244	397,976	400,241	434,918	440,018	435,147	430,275	427,581	428,123	424,456
Rail	9,264	9,171	8,776	8,889	10,521	12,883	11,760	11,579	11,055	12,807
Water(River)	17,910	25,235	17,833	25,043	29,024	43,389	42,310	40,340	47,233	47,687
Water(Coastal)	21,970	23,347	19,657	24,795	24,628	36,975	34,253	31,574	31,216	29,615
Aircraft	97	104	110	107	103	114	120	122	110	106
Total	441,485	455,833	446,617	493,752	504,294	528,508	518,718	511,196	517,737	514,671

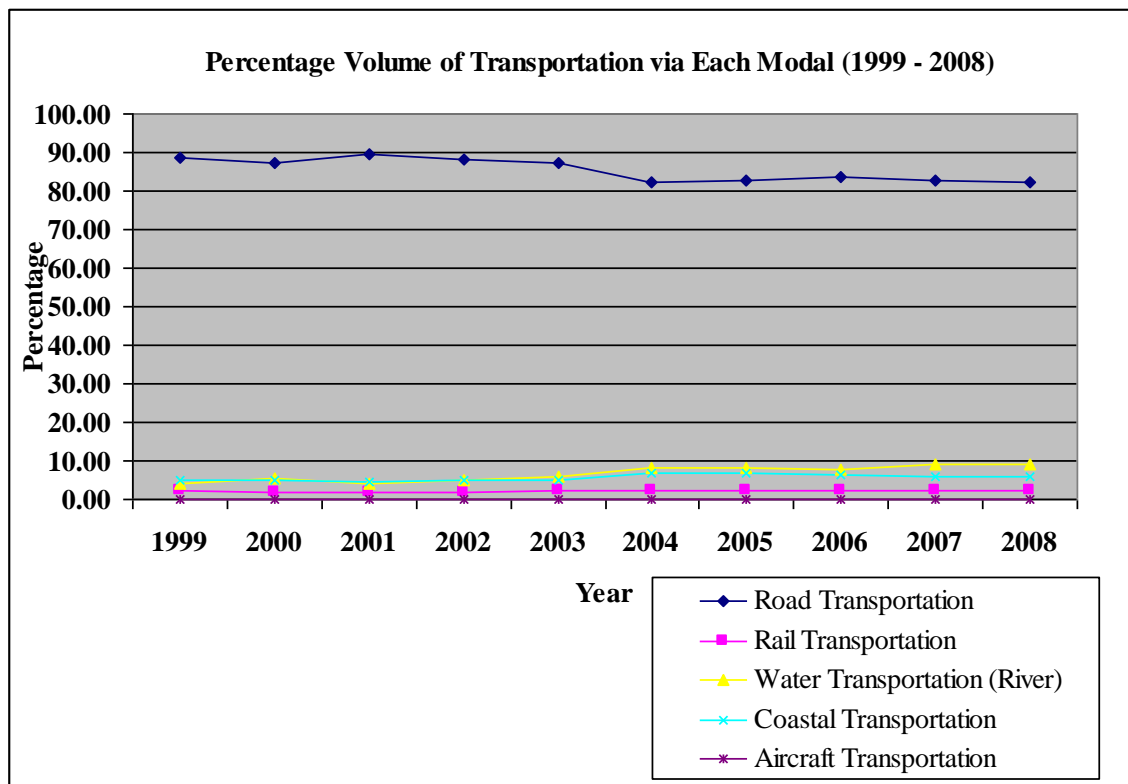


Figure 2.2 The Percentage Volume of Domestic Transportation in Thailand via Each Modal (1999-2008).

2.3.3 Road Transportation of Thailand

Road transportation is the main transportation modal for Thailand. There are 9,034 road-transportation entrepreneurs registered with the Ministry of Commerce (data from the Department of Business Development, Ministry of Commerce :

<http://knowledgebase.dbd.go.th/DBD/BRA/braTimeSeries.aspx>).

2.4 Thailand's Public Transportation.

There are many public transportation modals in Bangkok: Bus, Van, Taxi, ship, Train, Subway, BRT, MRT, etc. But the most widely used modal is road transportation which serves people in 3 styles: Bus, Van and Taxi, and these are three modals focus in this study.

The number of transportation entrepreneurs is shown in table 2.2 (Data from the department of Transportation, July 31, 2012).

Table 2.3 The number of transportation certificates and transportation entrepreneurs in Thailand (Data from the department of Transportation, July 31, 2012).

Transportation Types	Vehicle Types	Number of Transportation Certificates			Number of Transportation Entrepreneur		
		Central	Rural	Total	Central	Rural	Total
Fixed Routing	Bus (Or van, taxi,etc.)	1,236	1,776	3,012	339	1,127	1,466
	- Type 1	358	293	651	5	197	202
	- Type 2	203	-	203	1	-	1
	- Type 3	518	-	518	300	-	300
	- Type 4	148	1,483	1,631	32	930	962
	- Across country	9	-	9	1	-	1
Not Fixed Routing	Bus (Or van, taxi,etc.)	2,387	9,947	12,334	2,387	9,947	12,334
	Truck	1,819	11,212	13,031	1,819	11,212	13,031
	Across Country Bus	48	227	275	48	227	275
	Across Country Truck	174	472	646	174	472	646
Personal	Bus (Or van, taxi,etc.)	1,173	4,858	6,031	1,173	4,858	6,031
	Truck	13,391	333,416	346,807	13,391	333,416	346,807
	Across Country Bus	2	1	3	2	1	3
	Across Country Truck	47	101	148	47	101	148
Small Vehicle		-	83	83	-	46	46
Total		20,277	362,093	382,370	19,380	361,407	380,787

For this research, the public transportation entrepreneur (bus, van and taxi) in Bangkok are focused. Actually, the overall metropolitan transportation in Bangkok is managed by BMTA (Bangkok Metropolitan Transportation Association). BMTA serves Thai people by using her own vehicles and using the vehicles from other authorized entrepreneurs.

In case of bus and van, BMTA could serves in 108 routes herself and grants authorization in 445 routes to the entrepreneurs.

There are three types of taxi serve in Bangkok , that is company, group and individuals.

2.5 Technology acceptance theorem and its related theorem.

For the clearly understand in the root of acceptance factors in the UTAUT model, a short brief of the evolution and the idea of the acceptance model was presented in this topic.

Actually, there are many theories about the technology acceptance such as Innovation Diffusion Theory(IDT), Utilization Model, Social Cognitive Theory(SCT), Theory of Reasoned Action(TRA), Technology Acceptance Model(TAM), Extended Technology Acceptance Model(Extended TAM or TAM2), Theory of Planned Behavior(TPB) and the Unified theory of Acceptance and Use Technology(UTAUT). These theories have their roots on the Social science and Humanistic theorem which were used to describe the reasons of the human behavior, or in the backward, used to predict the feedback of human when they're in the controlled situations. With those theories, we can analyze the reasons of the human action, and/or the factors that lead them to do or not doing something. By this performance, these theories have developed to describe the human behavioral in accepting the technology and established many new theories later.

2.5.1 Theory of Reasoned Action (TRA)

The root concepts of the Technology acceptance theory come from the “Theory of Reasoned Action (TRA)”. TRA said that “any human actions caused by their intention, attitude or some reasons of the actors themselves, together with the social and environments factors”. From this concept, we can say that the reasons for the human action come from 3 factors; these are the intention, self attitudes and the social norms as depicted in the figure 2.4

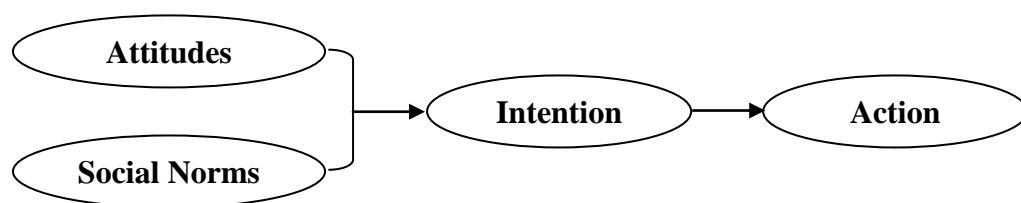


Figure 2.3 Model of Theory of Reasoned Action (TRA)

The human intentions caused by their personal attitudes, which would reflex to his/her overall behavior, and their environments. When, the social norms (or subjective norms) are the powerful influenced pushed-factors from outside (Rahul Khanna et al.,2009).

2.5.2 Theory of Planned Behavior (TPB)

In fact, the human actions do not only come from their real behavior at all, but the effect of controlled behavior included. Its means that the human perceive behavioral control (PBC) was the unforgettable factor too.

At this point, the PBC was considered as the factor that influenced on the human behavior together with other factors above. And the TRA was developed to be the new theory, named as the “Extended TRA” or the “Theory of Planned Behavior (TPB)”. This theory mentions that the factors influenced on the human behavior are the human intention, self attitudes, perceive behavioral control and the social norms, as showed in figure 2.5

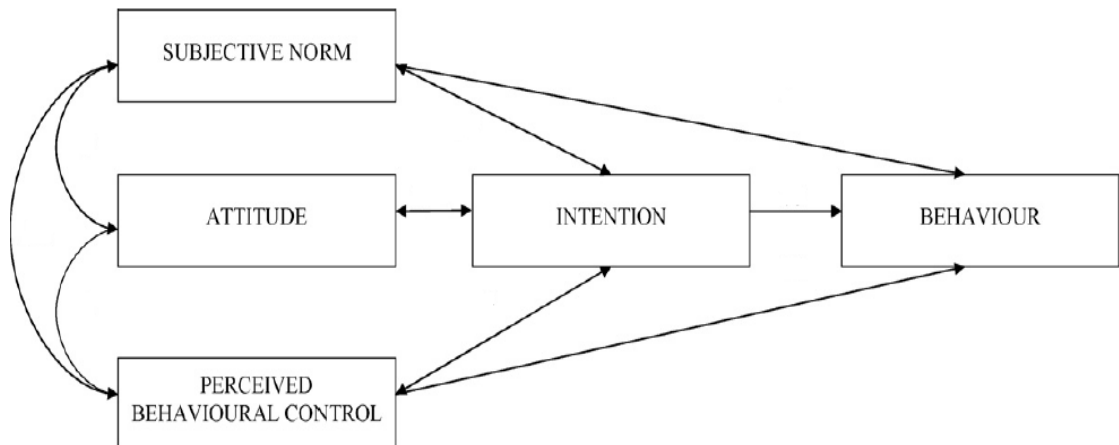


Figure 2.4 TPB Model for the truck driver behavior study by D.R. Poulter et al.2008

TRA and TPB had been tested to compare their accuracy, and the result is that both TRA and TPB are good enough in predicting the human behavior, but TPB is more accurate than TRA (Qian et al.,2007). It may confirms that the PBC has an effect on human behavior. And the human intention is the main factor influenced on their behavior directly (D.R. Poulter et al.,2008).

Now we realized that the human actions rely on their root factors. In the backward idea, we can predict the action of people or convey the people to take action as we need, if we control or serve them with the appropriate factors (Sonja E. Formard.,2009).

2.5.3 Technology Acceptance Model (TAM)

The theory about human behavior was applied to describe the reasons of technology accepting. The concept of TRA, TPB and other findings are adapted and rebuilt into new theory named the technology acceptance model (TAM) as described in figure 2.6.

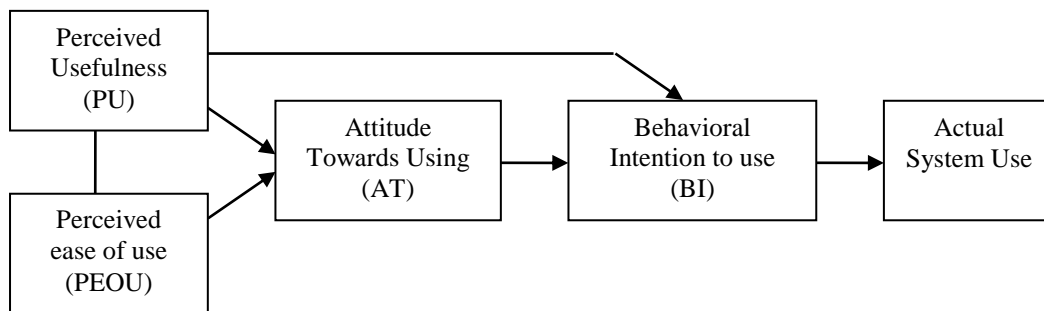


Figure 2.5 TAM Model (Davis et al.,1989)

The acceptance factors are structural related as shown in figure 2.4 . From the picture of TAM model, we can see that the major factors of the technology acceptance are user's attitude and user's intention respectively. While the roots of the user's attitude toward using the technology are "Perceived Usefulness (PU)" and "Perceived Ease Of Use (PEOU)" (Manolis et al.,2009), and PU relates to user intention to use that technology directly too.

Many case study, used TAM model, show that, actually, the deep root of PU and PEOU are organizational (or individual) traits, information and system (or technology) quality and the industry traits and tasks performed (Robert W. Stone et al.,2006). Or we may conclude that there are 3 groups of factor effect to technology acceptance these are technological factors, organizational factors and environmental factors (Patterson et al.,2003 , Scupola.,2003 and Chieh-Yu Lin et al.,2007) shown in figure 2.7.

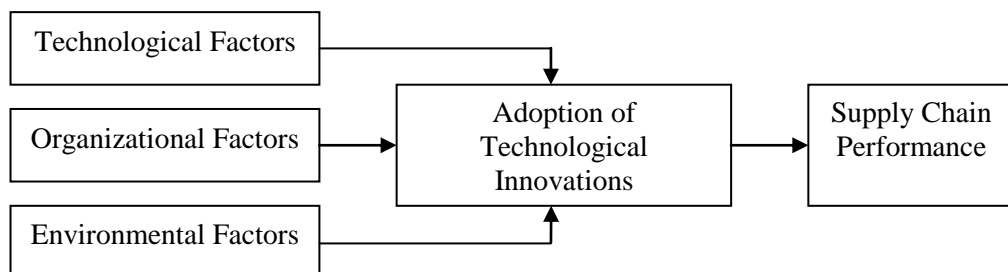


Figure 2.6 Technology Acceptance Factor by Chieh-Yu Lin et al.(2007)

2.5.4 Extended TAM

With the limited of TRA, TAM model stand on the assumption that the technology users are in the complete controlled environment. There're not any effects from user's characteristics and social influence. It was the weak point of TAM, because the technology acceptance could not take place without the effect of the personal behavior of users, who are the real decision makers.

TAM model was developed by add the social factors, environmental factors and other individuals characteristics as the variables in to the model and renamed new acceptance model as "Extended TAM (or TAM2)" (Venkatesh and Davis.,2000). For example, the Extended TAM model, shown in figure 2.8, was used in the study of the "Online Banking Acceptance" by users in Saudi Arabia. This figure is seem like the TAM model as the major structure together considered with the add in control variables which affect to PU (Social Influence , Awareness of services), PEOU (Self Efficacy, Quality of base technology supported) and user's attitude (Resistance to change, Trust, Age, Gender, Education, Income). (S.A. Al-Somali et al.,2009)

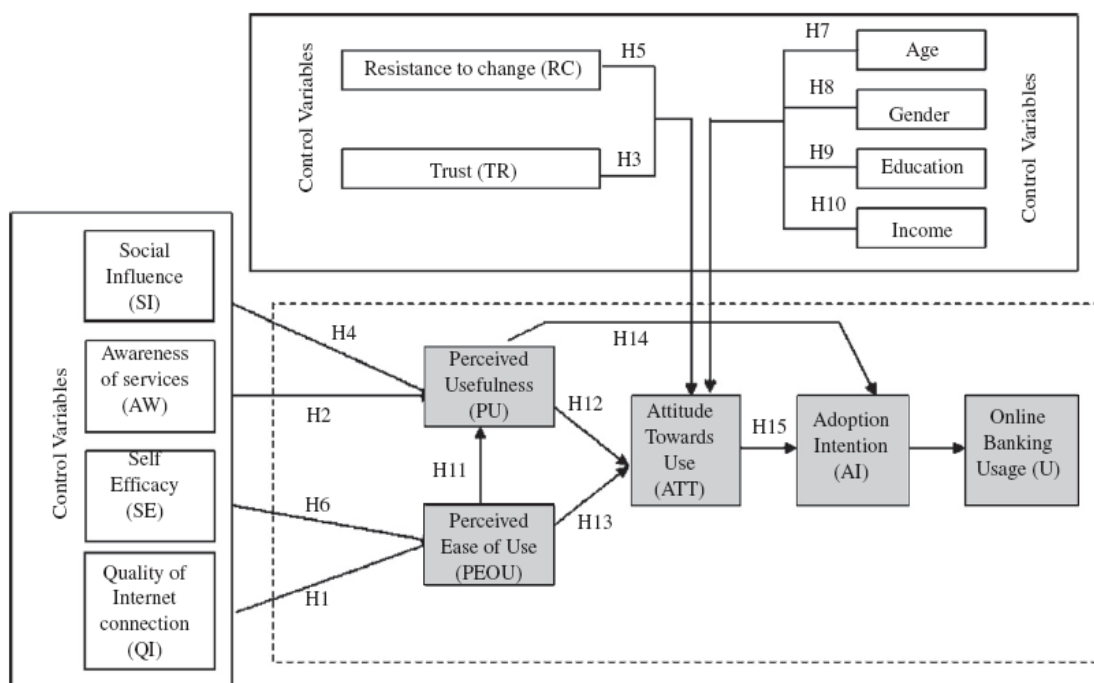


Figure 2.7 Extended TAM used in the study of Online Banking in Saudi Arabia by S.A. Al-Somali et al.(2009)

Though each technology acceptance theories start with the same original idea, but they have their own different strong points, weak points and limits. The output model structured with not exactly the same factors. Not any models cover all factors completely. By the way, there're some interesting theories related to the technology acceptance described in the next topics.

2.5.5 Innovation Diffusion Theory (IDT)

IDT said that people might accept the technology in various levels. So we can classified the people into 5 groups by the level of acceptance, from high to low, Innovators, Early Adopters, Early Majority, Late Majority and Laggards, as seen in figure 2.9

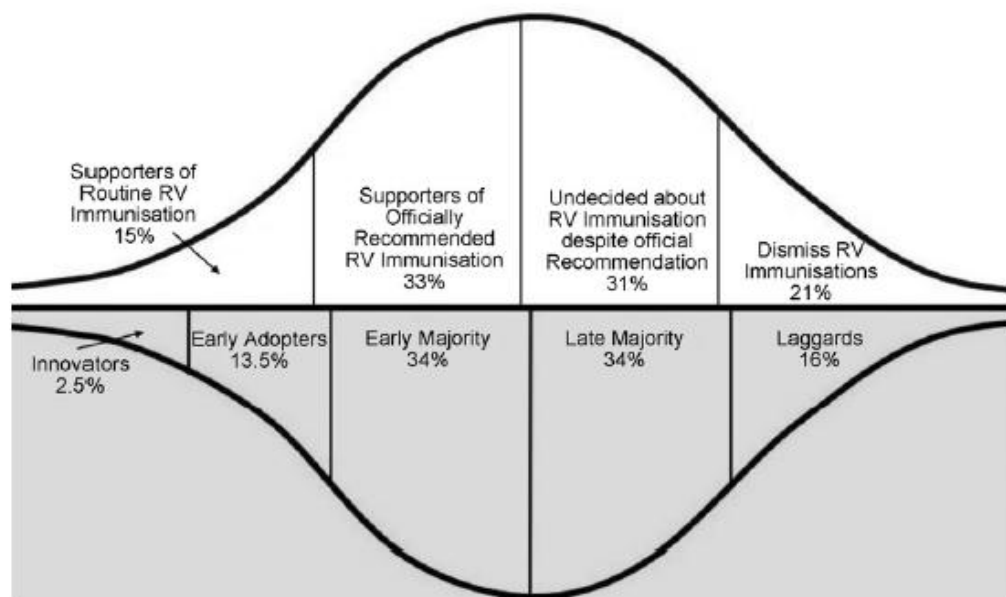


Figure 2.8 Technology Acceptance Level by Philipp Agyeman et al.(2009)

2.5.6 Social Cognitive Theory (SCT)

SCT can describe the reason of human and organization behavior with the relationships between 3 factors; Cognition Determinants, Behavioral Determinants and Environmental Determinants, as shown in figure 2.10

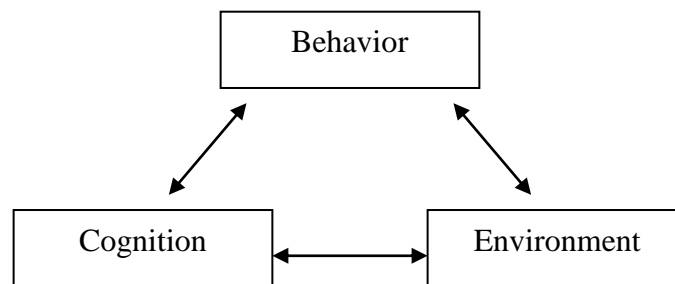


Figure 2.9 Social Cognitive Theory

In the manner of SCT, the cognition (the recognition, understanding and responsiveness to the environments, behavior and any motivators) and environment have an impact on behavior. In the other way, if we set the environments in controlled and motivate people with the appropriate supports, we may successfully convey people to take the action we need (Jeffrey S. Hornsby et al.,2009). In the opposite way, if you need to convey people to do something, SCT can tell you what's the proper climates should be.

2.5.7 Motivation Model (MM)

Not only the factors described above, the motivators are the factors that effect on the human behavior both in the way to let them doing something or to prohibit them from doing something. Motivators for each situation are not exactly the same but they are classified into 2 groups, internal and external motivators such as self protection recognitions (Angela A. Robertson et al.,2006), social motive (Angela A. Robertson et al.,2006, Cooper et al.1992, Heung-Pyo Lee et al.,2007), malicious or dangerous avoidance (Angela A. Robertson et al.,2006, Heung-Pyo Lee et al.,2007), amusement motive (Cooper et al.,1992, Heung-Pyo Lee et al.,2007), Coping Motive (Cooper et al.,1992), Excitement and Monetary motives (Heung-Pyo Lee et al.,2007), etc. In concluded, motivational model used in each case studies are different. In case of the organization's technology acceptance, the motivators might be determined in

three factors these are organizational leadership (organizational innovativeness or voluntary), organizational learning and Technology Resources (WU Chunming et al., 2008).

2.5.8 Unified Theory of Acceptance and Use Technology (UTAUT).

In order to describe the technology acceptance behavior, many theories in the field of social science and humanities which mention about the human behavior, such as Theory of Reason Action (TRA), Theory of Planned Behavior (TPB), Social Cognitive Theory (SCT), Innovation Diffusion Theory (IDT) and Utilization Theory, are developed into new theory, named Technology Acceptance Model (TAM), which applied to use in the study of technology acceptance successfully.

Technology acceptance model (TAM) has developed by increase some factors and modified into the new model named “Extended TAM (or TAM2)”. TAM, TAM2 and other theories are modified to use in many case study. And the results from each theory are some what differences. Because each theory has it own different ideas and different structural factors, the conclusions from those theories are differ. And no one is completely covers every factors. To make the model, cover all the factors referred by every theory, the UTAUT model has constructed.

First, TRA said that “any behaviors come from the intention” (Khanna et al.,2009 and Poulter et al.2008). The “behavioral intention” is influence by personal factors and environmental factors (Khanna et al.,2009). Actually, the human behavior does not come from their intention completely, but there are the effects of the planned behaviors included.

That’s why the idea of perceive behavioral control (PBC) is included in TRA (Guo et al,2007) and formed the more precisely model named Theory of Planned Behavior (TPB). TPB stand on the concept that the human actions come from their intention and rely on the planned behavior or their practicing behaviors. At this point, we can describe that any actions would happen whenever some behaviors are supported or prepared to be. On the other hand, we can conclude that we can realized the factors that lead to the actions also (Sonja E. Forward.2009).

In order to describe the technology acceptance factors, TRA and TPB has developed into new theory named as TAM (Manolis Tsiknakis and Angelina

Kouroubali.,2009). TAM mentions that the behavior of acceptance influence by the “Behavioral Intention(BI)” and “Attitude towards using technology(AT)” stepwise. While AT is influence by 2 factors, the “Perceived usefulness (PU)” and “User’s perceived ease of use (PEOU)”.

The social and environmental recognitions are also impact on the behaviors as mentions in SCT (Goldsby.,2009). As we seen that, traditional antecedents of behavioral intention, ease of use and perceived usefulness, was considered, related to the social influence and perceived benefits (Carolina Lopez-Nicolas et al,2008). So TAM has modified to be Extended TAM (Venkatesh and Davis.,2000).

In practical, the behaviors of acceptant are not equal. With the idea of IDT, the acceptance have to spilt into 5 levels : Innovators, Early Adopters, Early Majority, Late Majority and Laggards (Agyeman et al.,2009).

The idea of Motivation Model (MM) described that each behavior response to difference motivation also (Angela A. Robertson al., 2006, Cooper, M.L., Russell et al.,1992).

Each theory has its own points of analysis. In order to establish new theory that could cover as many dimensions of factor as possible, 8 acceptance theories, TRA, TAM, MM, TPB, Combined TAM-TPB (or Extended TAM), IDT, SCT and Model of PC Utilization (MPCU) are integrated into the new theoretical model named “Unified Theory of Acceptance and Use Technology” or “UTAUT”. The user-acceptance factors analyzed by UTAUT is more accurate than eight model alone (Yang and Fu., 2008). While several acceptance model can explain over 40 percent, the UTAUT model can explain at 70 percent of variance in the intention to accept the technology (F. D. Davis et al,1989., S. Taylor et al, 1995., Venkatesh et al, 2000., Vankatesh et al,2003.)

Though the factors constructed in UTAUT was differ from TAM model but the idea is almost the same. The technology acceptance comes from three groups of factors these are technological factors, organizational factors and environmental factors (Patterson et al.,2003 , Scupola.,2003 , Stone et al.,2006 and Lin& Ho.,2007).

With the idea of UTAUT, the “Behavioral Intention (BI)” is related to three main determinants: Performance expectancy, Effort expectancy and Social Influence. And BI together with Facilitating Conditions (FC) will lead to the behavioral intention to use that technology (Wang and Shih., 2009) as shown in figure 2.11

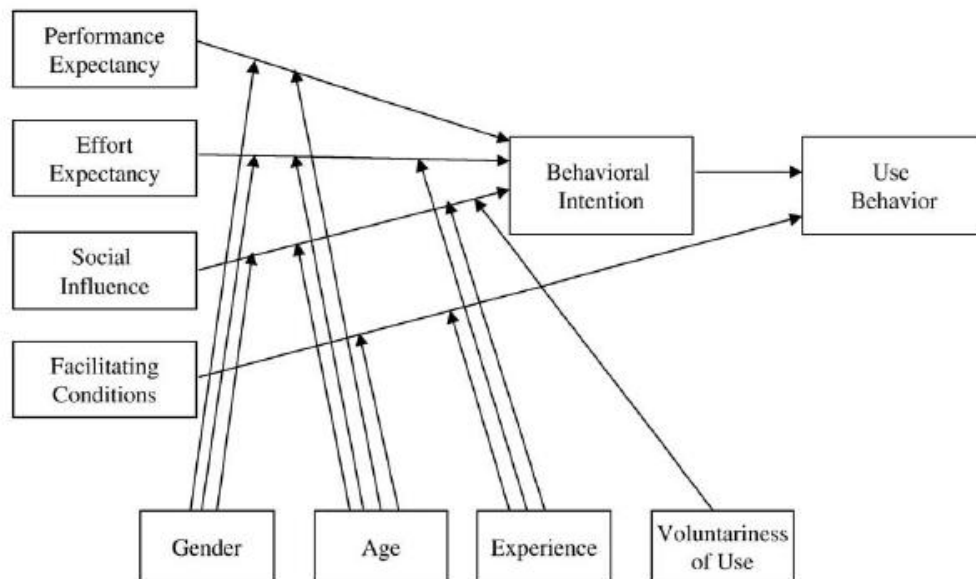


Figure 2.10 UTAUT Model (Venkatesh et al.,2003.)

As we'll see in figure 2.11, there're 4 mediators impacted on BI and BU. These are Gender, Age, Experience and Voluntariness (Wang et al.,2009, Yang et al.,2008) or we can said that they are the nature or tradition of the personal or of the organization as well (MIN Qingfei et al.,2008).

Because the UTAUT was developed and first applied on the study of the information technology acceptance which used the personal computer as the basic technology, the PC's utilizations are unavoidably considered. And that's why the Model of Personal Computer Utilization (MPCU) is included in the UTAUT also. Though the UTAUT is developed to used in the study of the acceptance of PC-based technology (Boonchai Kijsanayotin et al.,2009), but with only the adaptation in the part of based-technology details, it could be used in the study of any technology. For the example, UTAUT was adapted and used in the study of the acceptance of M-commerce which is mobile-based technology (MIN Qingfei et al.,2008).

2.6 Factors effect on the technology acceptance, according to the UTAUT model.

By the concept of UTAUT, the factor effects on the technology acceptance are classified into 3 groups: the behavioral intention (BI), the facilitating conditions (FC) and the mediators. When the behavioral intention has three root caused-factors, these are the performance expectancy (PE), the effort expectancy (EE) and the social influence (SI). To avoid the misunderstanding, the definition for each factors are reviewed here.

2.6.1 Behavioral Intention (BI)

According to the UTAUT model, behavioral intention (BI), the intention to make decision to accept-and-use any technology, can be determined by three antecedents these are performance expectancy, effort expectancy and social expectancy.(Dong Cheng et al.,2008.)

2.6.2 Performance Expectancy (PE)

PE, almost the same meaning to Perceive Usefulness (PU) used in TAM model or other theory, is defined as the degree to which a person believes that he or she can gains his or her job performance by using that technology. (Venkatesh et al,2003., Sabah Abdullah Al-Somali et al.,2009., Yi Shun Wang et al.,2009., Min Qingfei et al., 2009. Boonchai Kijsanayotin et al., 2009., Robert W. Stone et al.,2006., Indrawati et al.,2010). PE reflex to the recognition in the advantage the transporters should get from that technology.

For this study, PE is measured by transporter's ranking of the level of advantage the GPS provided for them. While the GPS advantage are considered in 4 dimensions : GPS as the navigating system, GPS as the tracking system, GPS as the fleet managing and monitoring system and GPS as the tool for the data collecting and mapping of the transportation infrastructure.

2.6.3 Effort Expectancy (EE)

Effort Expectancy (EE) is defined as the degree of ease or simplicity to use that technology, expected by an individual (Venkatesh et al.,2003). For this case, the simplicity to use GPS is considered in 4 dimensions these are the simplicity to use GPS tools, to use GPS application programs and other services, to learn how to use GPS and to get and understand the information from GPS provided data (whether it's accurate, clear and easy to understand or not).

2.6.4 Social Influence (SI)

SI is defined as the degree to which a person perceives that the others expect that he or she should use that technology (Venkatesh et al.,2003). Social and the others are influence on the behavioral intention to use that technology. In this case, we measure SI via the pushing level, the transporters received from customers, business alliances, sub-contractors, competitors and the government.

2.6.5 Facilitating Condition (FC)

Facilitating condition (FC) represent the degree of which a person believes that his or her existed-supported resources or infrastructures in using that technology (such as business resources, money supplies, other tools, knowledge, formerly system compatibility, help systems or the accessible resources of knowledge about the technology) are adequate (Venkatesh et al.,2003).

2.6.6 Mediators

In general, mediators are the personal factors. They have no direct impact on the acceptance or the decision to use technology. But they support the behavioral intention (BI) to use that technology via PE, EE, SI and FC.

There are 4 mediators theoretically: Age, Gender, Experience and Voluntariness. But in this case, the decision to use GPS does not take place by the person but in the name of the business organizations. So the Age and Gender could not included in this study. Voluntariness (VO) is the willingness to use or trial the new technologies or innovations themselves though without any forced or other motivations. Experience (Exp) is one factor that pushes forward to the technology

acceptance. For example, people will get more willing to use technology if they ever known or ever used that technology.

The UTAUT model, like the conceptual idea, must be modified into the appropriate versions, compatible to each case of use. The determinations for each factor for any case are different, and there're existed in many researches that some factors added into the models. For example, the price and technological content are considered to be the determinants of BI for 3G-MMS acceptance in Indonesia (Indrawati et al.,2010), TTF (Task Technology Fit Model) was added to the UTAUT model to determined the mobile banking user adoption in China (Tao Zhou et al.,2010).

2.7 Technology acceptance by the organization.

IT adoption in small business might be made by only single executive, or the business owner. So the technology-acceptance-behavior analyzed with the model constructed with both technology-acceptance and human-planned-behavior should provide more precise solution than with only TAM (Riemenschneider et al.,2003). We can mention that TAM2 is more accurate model than TAM incase of the decision made by the human. But in case that you need to know the factors influenced on the big organization, you may have to collect data from the chief executive or chair mans or someone who granted the authorization to make the decision for that case.

In this research, we study the GPS acceptance by the transportation industry. So the data must be collected from the organization, not from the individuals. Nevertheless, the decision to use or accept GPS is made by the business owner and not effect by the employee. So the data collected for this research must be come from the business owner or the authorized persons only.

2.8 Technology acceptance barrier.

From the literature reviews, the barriers of the technology adoption were defined in several approaches. According to the Innovation Diffusion Theory (IDT), barriers are defined as the differences between any levels of innovator (innovators, early adopters, early majority, late majority and laggards) (H.Bouwman et al. 2007, p.145-160).

Lukas Weber (1997) distinguishes barriers into 4 types: Institutional barriers (political barriers), Obstacles conditioned by the market (environmental barriers), Organizational barriers and Behavioral barriers (or Individuals barriers).

While Grisby et al. (1997) proposes three layers of barriers: the environmental barriers, socialization barriers (barriers due to organization, family or social) and psychological consequences (or behavioral barriers).

Athanasios Hadjimanolis. (1999) classified the barriers to innovation adoption into internal barriers (ie. Lack of time, facilities, financial means, long pay-off period, cost control, perceived risk, lack-of-information, lack-of-qualified workers, lack-of-experience, change resistance, lack-of-motivation) and external barriers (innovation, government, skilled labor, financial company, etc.)

Mc Creadie and Rice (1999) mention that barriers are closely related to all kinds of access issue both to the physical devices and services, And distinguish barriers into six types of accessibility: Physical accessibility (whether or not the physical devices are accessible), Cognitive accessibility (the understanding of how system work), Affective accessibility (relates to attitudes such as self confidence, self efficacy, self innovative and trustfulness and motivation with regard to the use of that technology), Economic accessibility (relates to benefits and cost comparatively), Social accessibility (relates to the cultural norms) and Political accessibility (relates to power, control, equity and participation).

Pagani (2004) mentions barriers as (lack of ease of use, security, functional usability, and privacy. While Vrechoupoulos et al. (2003) mentions that ease of use, security, technological quality (device and service quality), price, and lack of personalization are the barriers of the technology acceptance.

Perceived usefulness and perceived ease of use discussed in the TAM and UTAUT models, are closely related to the concept of relative advantage (or benefits), the degree to which the technology is perceived as being better than the another one it supersedes (Rogers.,2003).

Kleijnen et al. (2004) mentions that barriers are considered from perceived risks which are referred to lack of ease of use and lack of compatibility. While compatibility are affected by reliability, security and task-fit). The structure of barriers in the concept of Kleijnen et al. (2004) was described in figure 2.12.

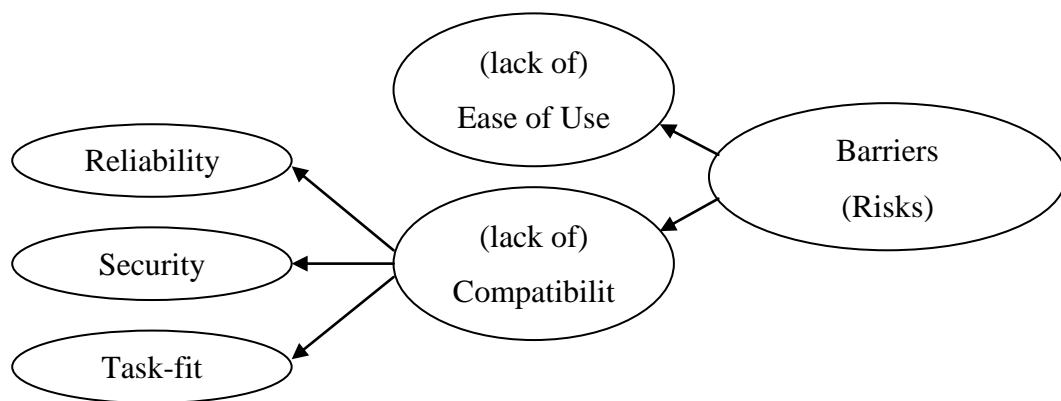


Figure 2.11 Behavioral barriers in the concept of Kleijnen et al. (2004)

Heres et al. (2004) mentions that two major groups of barriers are technological barriers (referred to technical infrastructure, available substitutions, prices, design of technology, usability, service availability, visibility and testability) and individual barriers (referred to personal skills, capabilities, and financial situation). The structure of barriers in the concept of Kleijnen et al. (2004) was described in figure 2.13.

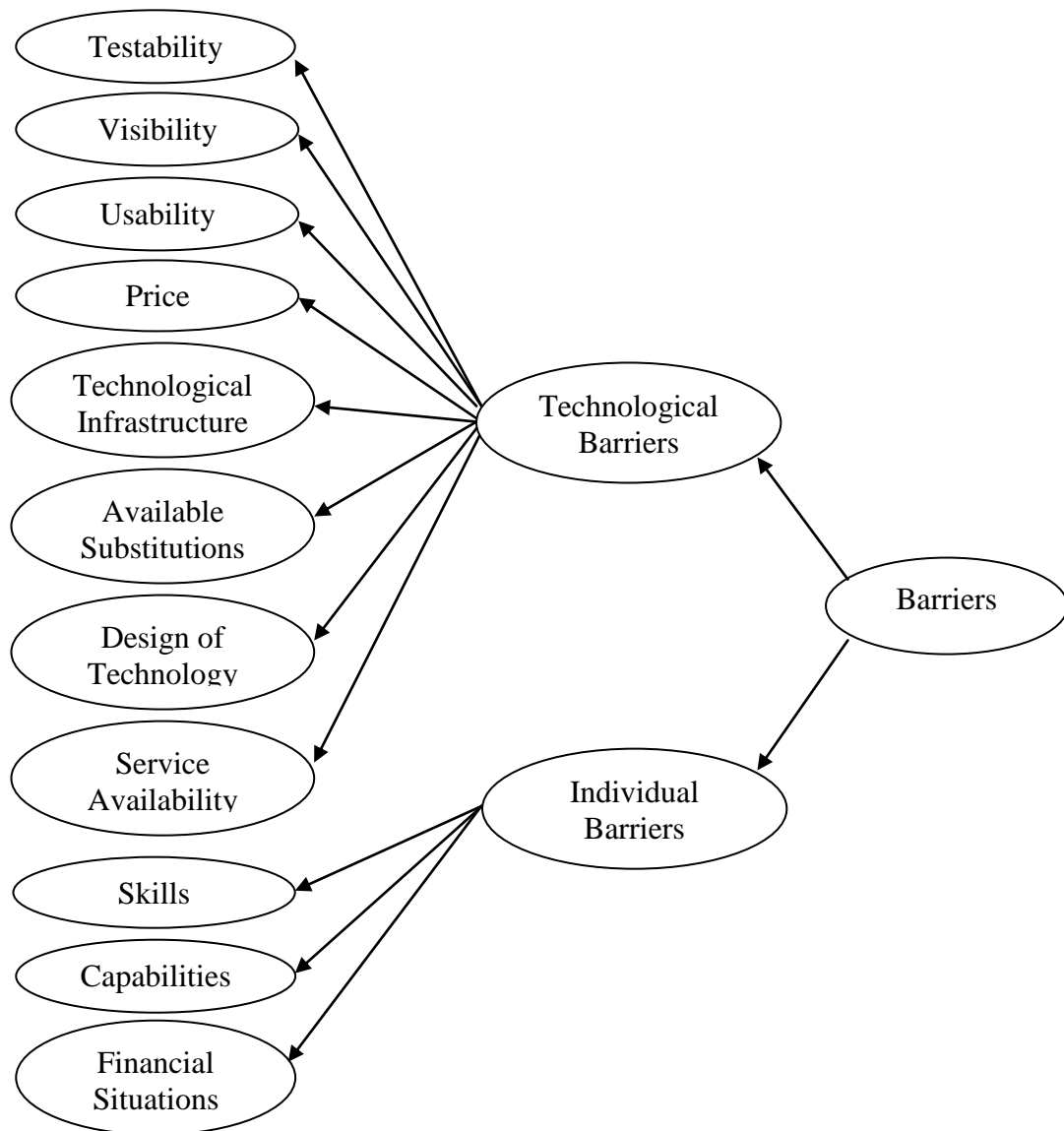


Figure 2.12 Behavioral barriers in the concept of Heres et al. (2004)

Theodore J. Kopcha. (2012) said that barriers to technology integration are lack-of-technology accessibility, vision, beliefs, time and professional development.

Albert Boonstra and Manda Broekhuis (2010) describe the barrier against technology adoption into 8 dimensions: Financial Barriers, Technical Barriers, Time Barriers, Psychological Barriers, Social Barriers, Legal Barriers, Organizational Barriers and Change Process.

As described above, the structure of barriers against technology acceptance are different due to the approach of the analysis. Lukas Weber (1997) focused on behavior effected by the environment, individuals, organization and organizational political culture. Behavioral barriers in the concept of Lukas Weber (1997) was described in figure 2.14

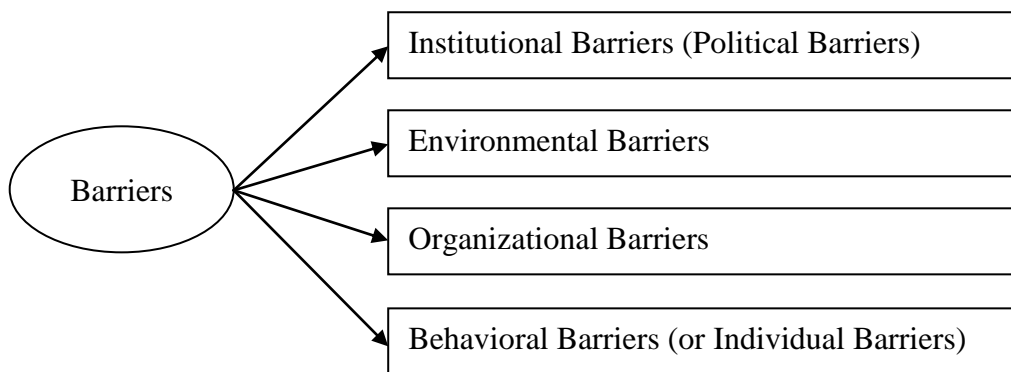


Figure 2.13 Behavioral barriers in the concept of Lukas Weber (1997)

Grisby et al. (1997) focused on the environmental, social and psychological barrier but not directly focus on technological characteristics. Behavioral barriers in the concept of Grisby et al. (1997) was described in figure 2.15

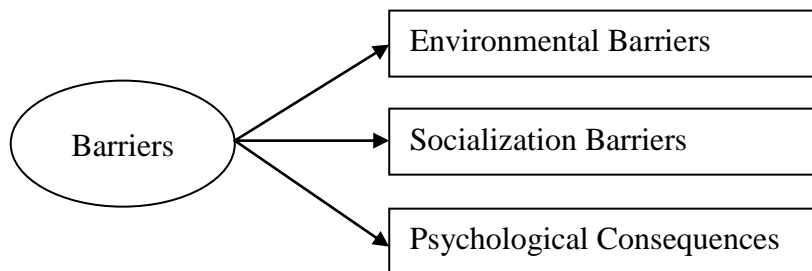


Figure 2.14 Behavioral barriers in the concept of Grisby et al. (1997)

Kleijnen et al (2004) mainly focus on technological characteristics. The barriers are considered from its performance and ease of implementing. Behavioral barriers in the concept of Kleijnen et al (2004) was described in figure 2.16

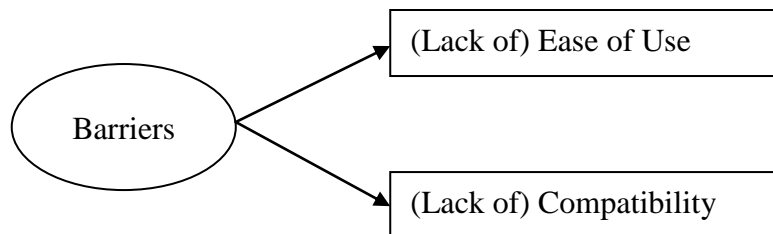


Figure 2.15 Behavioral barriers in the concept of Kleijnen et al (2004)

Heres et al. (2004) focused on technological characteristics together with the human behavior. Behavioral barriers in the concept of Heres et al. (2004) was described in figure 2.17.

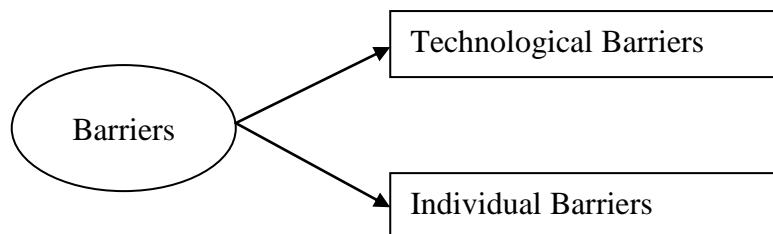


Figure 2.16 Behavioral barriers in the concept of Heres et al. (2004).

Pagani (2004) mainly point at technological manner which is compose of 4 issues : Ease of use, Functional usability, Security and Privacy. Behavioral barriers in the concept of Pagani (2004) was described in figure 2.18.

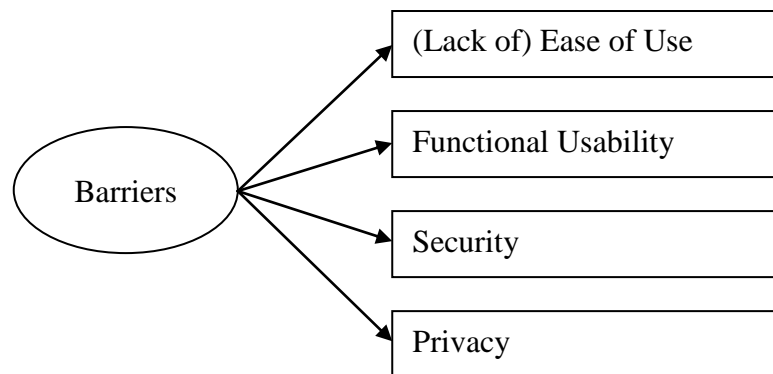


Figure 2.17 Behavioral barriers in the concept of Pagani (2004)

Though the structure of technology acceptance barrier (TAB) defined by each author are somewhat different but their elements are considerably similar. The elements of TAB from every concept are grouped and redefined into 20 issues of barrier as described in table 2.3.

Table 2.4 Elements of Barriers by several authors

No.	Barriers	Authors (references)										No. of References	
		McCreadie and Rice (1999)	Kleijnen et al.(2004)	Heres et al.(2004)	Pagani (2004)	Vrechoupoulos et al. (2003)	Paula et al. (2006)	Theodore J. Kopcha (2012)	Athanasios Hadjimanolis. (1999)	Boonstra and Broekhuis (2010)	Häyrynen et al. 2008		DesRoches et al. 2008
1	Cost (Set Up Cost) amount and controlability.	X		X		X			X	X	X	X	7
2	Cost (Ongoing Cost) amount and controlability.	X		X		X			X	X	X	X	7
3	Uncertainty of Return on Investment (ROI), Benefits and cost comparison or Pay-off Period.	X					X	X	X	X	X		6
4	Financial Resource			X					X	X			3
5	Shortage of skill, experience or skilled labour			X			X	X	X	X	X	X	7
6	Technical Training			X			X	X	X	X		X	6
7	Effort Expectancy (Perceived ease of use, complexity)	X	X	X	X	X	X	X	X	X	X		10
8	Performance Expectancy (Benefits or limitation)	X	X	X	X	X	X	X	X	X		X	10
9	Task Fit (Customizability)		X				X	X	X	X	X	X	7
10	Reliability visibility and testability		X	X				X		X		X	5
11	Technical Infrastructure	X		X			X	X	X	X			6
12	Time (Time for sourcing, learning and setting up the technology.)						X	X		X	X		4
13	Lack of belief in the technology (Self Confidence)	X	X				X	X		X			5
14	Motivation	X					X		X	X			4
15	Vendor or Service Uncertainty (Ability) and Expert Consult			X			X	X		X			4
16	External (government) Support						X		X	X		X	4
17	Customer Relationship or marketing need								X	X			2
18	Privacy and security		X		X	X	X		X	X	X	X	8
19	Organizational Culture, Executive Support	X					X		X	X		X	5
20	Change Resist	X					X		X	X			4

Table 2.5 Types of barriers classified by several authors.

		Authors										
Main Issue of Barrier		McCreadie and Rice (1999)	Lukas Weber (1997)	Grisby et al. (1997)	Kleijnen et al.(2004)	Heres et al.(2004)	Pagani (2004)	Vrechouponos et al. (2003)	Paula et al. (2006)	Theodore J. Kopcha (2012)	Athanasios Hadjimanolis. (1999)	Boonstra and Broekhuis (2010)
Financial Barriers	Economical Accessibility					Price		Price	Cost	Vision	Financial Means	Financial Barriers
Technical Barriers	Physical and Performance-Cognitive Accessibility				Technological Functional Characteristics	Technological Characteristics	Ease of Use and Functional Usability	Technological Quality and Ease of Use	Technical Usefulness, Complexity, Physical Space and Infrastructure.	Technological Accessibility	Technical characteristics	Technical Barriers
Time Barriers									Time	Time	Time	Time Barriers
Psychological Barriers	Affective Accessibility	Individual Behavior	Environment Behavior	Social and Environment Behavior		Human Behavior		Personalization	Fear of Change	Belief	Experience, Motivation and Innovation	Psychological Barriers
Social Barriers	Social Accessibility										External Support	Social Barriers
Legal Barriers							Security and Privacy	Security	Legality		Perceptive Risk	Legal Barriers
Organizational Barriers		Organization Behavior								Professional Development	Organization Support	Organizational Barriers
Change Resistance	Political Accessibility	Political									Change Resistance	Change Resistance

The taxonomy of Technology Acceptance Barrier (TAB) for this research was described follow the concept of Boonstra and Broekhuis (2010) and the conclusion found from table 2.4. Barriers are classified into 8 main factors : Financial Barriers, Technical Barriers, Time Barriers, Psychological Barriers, Social Barriers, Legal Barriers, Organizational Barriers and Change Process) as show in picture 2.19. Technology Acceptance Barrier Model (TAB model) which will be used as the another research model for barriers against technology acceptance analysis.

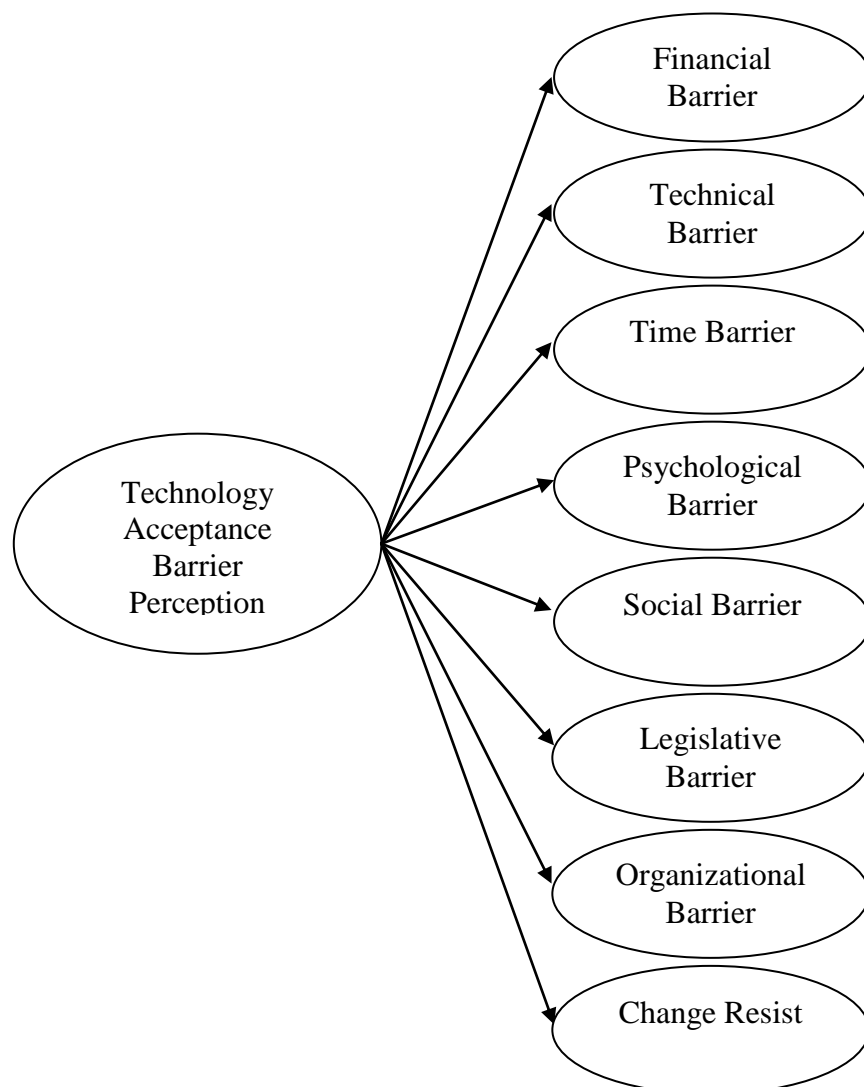


Figure 2.18 Technology Acceptance Barrier Model

To avoid misunderstanding on this model, the definitions of eight main factors of Technology Acceptance Barrier Perception were described as follows.

Financial Barriers

Financial Barriers is defined as financial resources, set-up cost, ongoing cost and return on investment. Conceptually, financial barriers mainly focus on the financial resources and the cost-benefit comparison. So there are four interesting component barriers which are financial resource available, cost (set up cost and ongoing cost) and the return-on-investment (ROI or benefit-cost comparison or pay-off period) (McCreadie and Rice (1999), Heres et al.(2004), Vrechoupoulos et al.(2003), Paula et al. (2006), Theodore J. Kopcha (2012), Athanasios Hadjimanolis(1999), Boonstra and Broekhuis (2010)).

Technical Barriers

Technical Barriers defined as the inadequate of technical characteristics and infrastructure supported. So it would be view as lack of skilled labor, lack of technical training and support, complexity of the system (Difficulty of using that technology, limitation of the system (or technology usability, lack of customizability (does not fitted to task), lack of reliability, standardization and sack of hardware or basic infrastructures. (McCreadie and Rice (1999), Heres et al.(2004), Vrechoupoulos et al.(2003), Paula et al. (2006), Theodore J. Kopcha (2012), Athanasios Hadjimanolis(1999), Boonstra and Broekhuis (2010)).

Time Barriers.

Time Barriers is the length of period of time spent for technology sourcing, setting, learning and training before actually implementation. (Paula et al. (2006), Theodore J. Kopcha (2012), Athanasios Hadjimanolis(1999), Boonstra and Broekhuis (2010)).

Psychological Barriers.

Psychological Barriers referred to lack of belief in the technology. Self Confidence) (McCreadie and Rice (1999), Heres et al.(2004), Vrechoupoulos et al.(2003), Paula et al. (2006), Theodore J. Kopcha (2012), Athanasios Hadjimanolis(1999), Boonstra and Broekhuis (2010)).

Social Barriers

Social Barriers referred to effects from external supply chain member such as uncertainty of vendor (GPS vendor and supported server), lack of support from external parties (bank, government, etc.), Customer relationship and lack of external supports. (McCreadie and Rice (1999), Lukas Weber (1997), Grisby et al. (1997), Athanasios Hadjimanolis. (1999), Boonstra and Broekhuis (2010)).

Legislation Barriers.

Legislation Barriers defined as privacy or security concerns. (Pagani (2004), Vrechoupoulos et al. (2003), Paula et al. (2006), Athanasios Hadjimanolis. (1999), Boonstra and Broekhuis (2010)).

Organizational Barriers.

Organizational Barriers defined as organizational characteristics, organizational culture, executive support. (Lukas Weber (1997), Theodore J. Kopcha (2012), Athanasios Hadjimanolis. (1999), Boonstra and Broekhuis (2010)).

Change Resistance.

Change Resistance defined as self efficacy, innovativeness and politics accessibility. (McCreadie and Rice (1999), Athanasios Hadjimanolis. (1999), Boonstra and Broekhuis (2010))

CHAPTER III

RESEARCH METHODOLOGY

This chapter will describe about 7 steps of this research methodology shown in picture 3.1. To do this research, the literature was meticulously reviewed first. After the scope of the study, the research framework and the research hypothesis were clearly defined; the questionnaires which would be used as the tools for this research were designed, tested and developed. The questionnaires were copied and spread out to the research targets. Data collected from the respondents would be statistically analyzed by the LISREL program. Then the statistic results were interpreted to answer the research questions. Finally, all the information was documented in this thesis book.

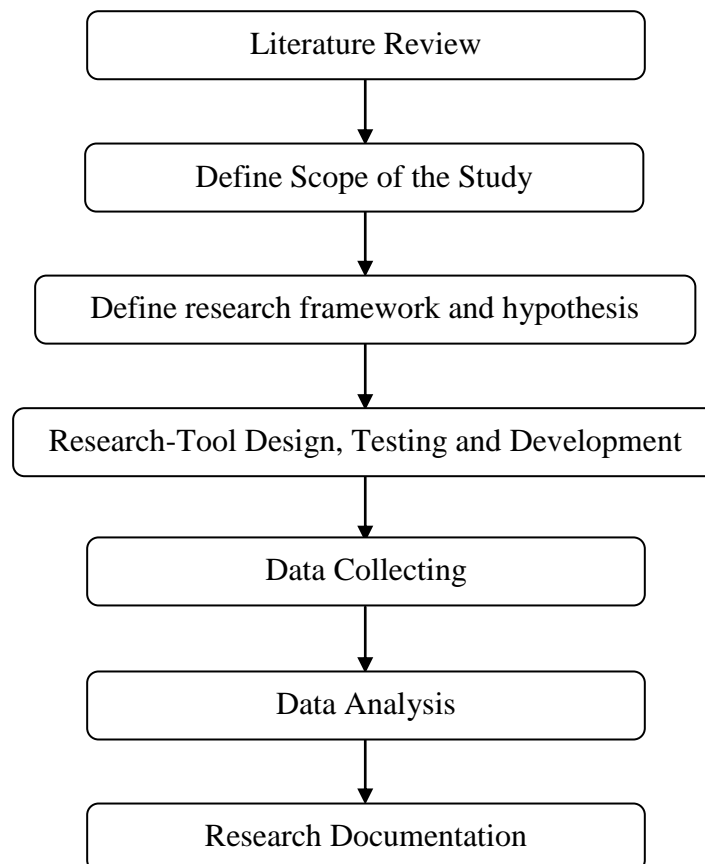


Figure 3.1 Research Methodology.

3.1 Literature review

In this process, the theory, researches and articles related to the GPS acceptance by Thai public transportation industry are meticulously reviewed and documented in Chapter II in order to describe the issue about GPS technology, technology acceptance theory, UTAUT, technology acceptance barriers and Thai public transportation industry.

3.2 Scope of the study

This research aimed to find out the factors affects to the GPS acceptance and barriers against the decision making to use GPS with the adopted version of UTAUT model that is appropriate to use to predict or described the behavior of GPS acceptance by Thai's public transportation. The factors and barrier affects to the acceptance are revealed in this research also. The department of transportation, the governmental organization, takes the key role of transportation management for overall country. She directs, serves and manages the Thai's public transportation (focus on road public transportation model) via two main state enterprises as the players those are BMTA (Bangkok Metropolitan Transportation Association) and the Transportation Co., Ltd (manage between-province transportation). But in order to serve the public service as much as possible, the other entrepreneurs are authorized to join as the concession holders. So the target for this study would be focused on the BMTA, the Transportation Co., Ltd, the concession holders and other entrepreneurs as the populations.

Populations

Populations for this research, focused on two main categories public-transportation described above. Table 3.1 shows that the number of the authorized public transportation is about 19,594 and the number of authorized entrepreneur is about 19,557 respectively.

Table 3.1 Number of certified and authorized transportation entrepreneur in Thailand.

Transportation Mode	Service Type	Number of transportation certificates			Number of authorized transportation entrepreneurs		
		Metropolitan	Between Province	Overall	Metropolitan	Between Province	Overall
Fixed Route	Inlanded	1,260	1,762	3,022	346	1,117	1,463
Not-fixed Route	Inlanded	2,487	10,621	13,108	2,487	10,621	13,108
	Overboard	50	220	270	50	220	270
Personal	Inlanded	1,173	4,963	6,136	1,173	4,963	6,136
	Overboard	2	1	3	2	1	3
Small Vehicle		-	77	77	-	40	40
Total		3,712	15,882	19,594	3,712	15,845	19,557

Source of data : The Department of Transportation of Thailand. (available on website : http://apps.dlt.go.th/statistics_web/statistics.html , data on February 28, 2013.)

In practical service, the public transportation services model are separated into three models these are bus, van and taxi. So the surveying would target on those entrepreneurs as depicted by Figure 3.2.

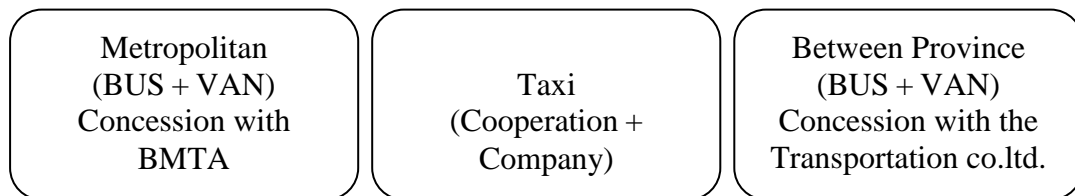


Figure 3.2: Categories of transportation service mode.

So the surveying were taken on those group of transportation described above.

Sample Size

The sample size for this research was determined by several concepts. The population for this research is about 19,594 certified entrepreneurs as described above.

For this thesis, the sample size for multiple regression analysis, determined by the rule of thumb, is ten times to the number of interesting variables (Nonglak., 2003;). There are 31 variables state in the research model, so the sample size is 310.

By the concept of Yamane (1967), the sample size determined by the Yamane table is approximately 392 (at 95% confidence level).

And by the concept of R.V. Krejcie and D.M. Morgan, the sample size is approximately 377.

So the sample size for this research was better not less than 310 samples.

3.3 Research framework and hypothesis

The research framework was mainly focus on two themes. First is to reveals the factors influenced to the GPS acceptance. For this part, the UTAUT model was adopted to use as the research model here. Second, the barrier perception was experimentally filled in the model as the new factor. The UTAUT model with Barrier factor are now again be analyzed to find the answer that whether the barrier perception is another factor affect to the GPS acceptance. The original UTAUT-based research model and Modified UTAUT-based with barriers model would be analyzed and compared whether which one are better model.

The UTAUT-based research model and the modified model are now shown in picture 3.3 and 3.4. And then the meaning of each factor and the hypothesis was described in the following parts.

3.3.1 UTAUT-based research model for GPS acceptance factors analysis.

First, the UTAUT-based research model for GPS acceptance factors analysis, shown in figure 3.3, was analyzed. According to the UTAUT concept, each factors and mediators was proved, for this case, which one actually affected to the GPS acceptance.

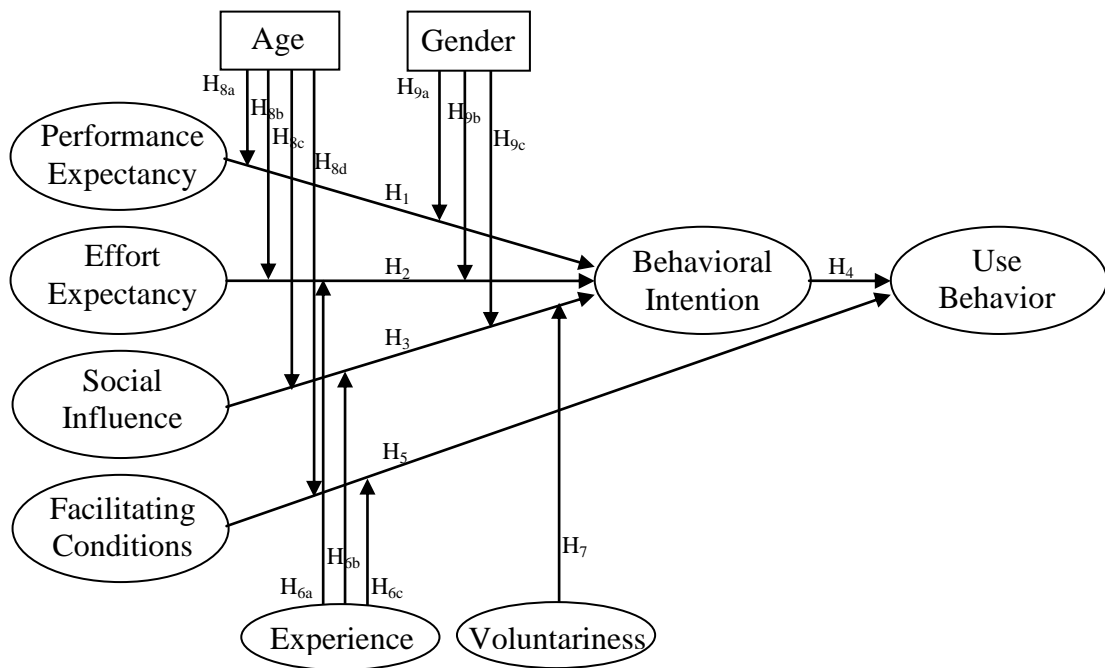


Figure 3.3 UTAUT-based Research Model for GPS Acceptance Study.

In order to proof, whether the barrier perception has directly affected to the GPS acceptance or not, the UTAUT-based model was considered again. The model was added with “Barrier Perception” factor at BI and Use as shown in figure 3.4 - 3.5 and then it was analyzed again.

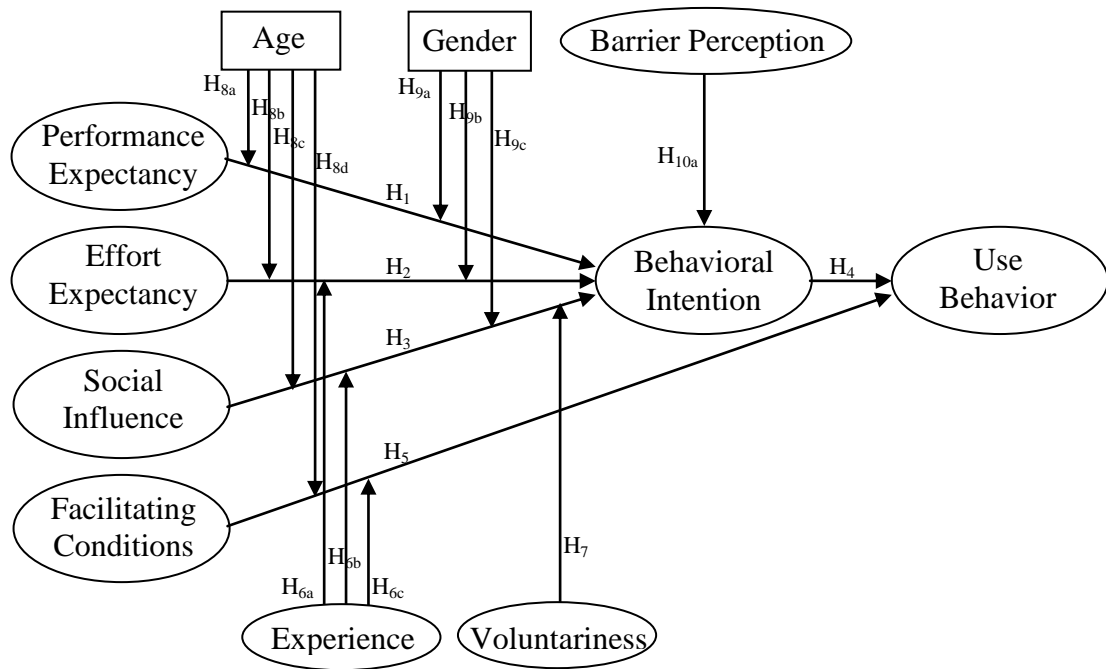


Figure 3.4 UTAUT-based Research Model with Barrier perception at Behavioral Intention.

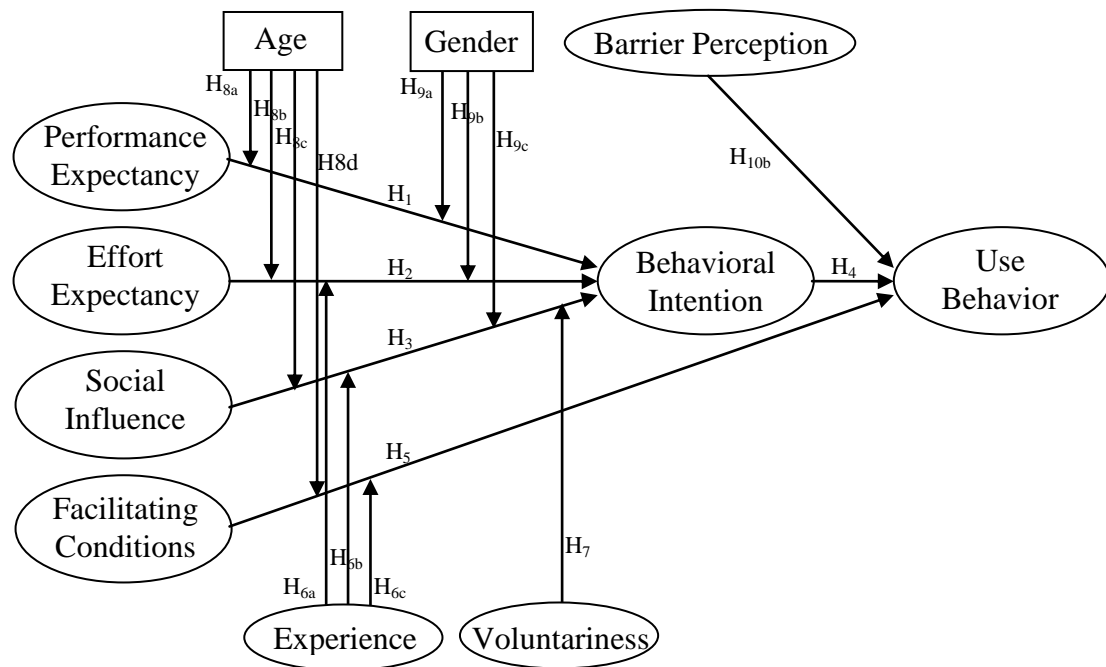


Figure 3.5 UTAUT-based Research Model with Barrier perception at Use Behavior.

The model was analyzed again to proof that whether the barrier perception (BP) has the interactive effect with other factors or not. In this step the “Barrier Perception” was added to the model as the interactive effect with PE, EE, SI, FC and BI as shown in figure 3.6 and then it was analyzed again.

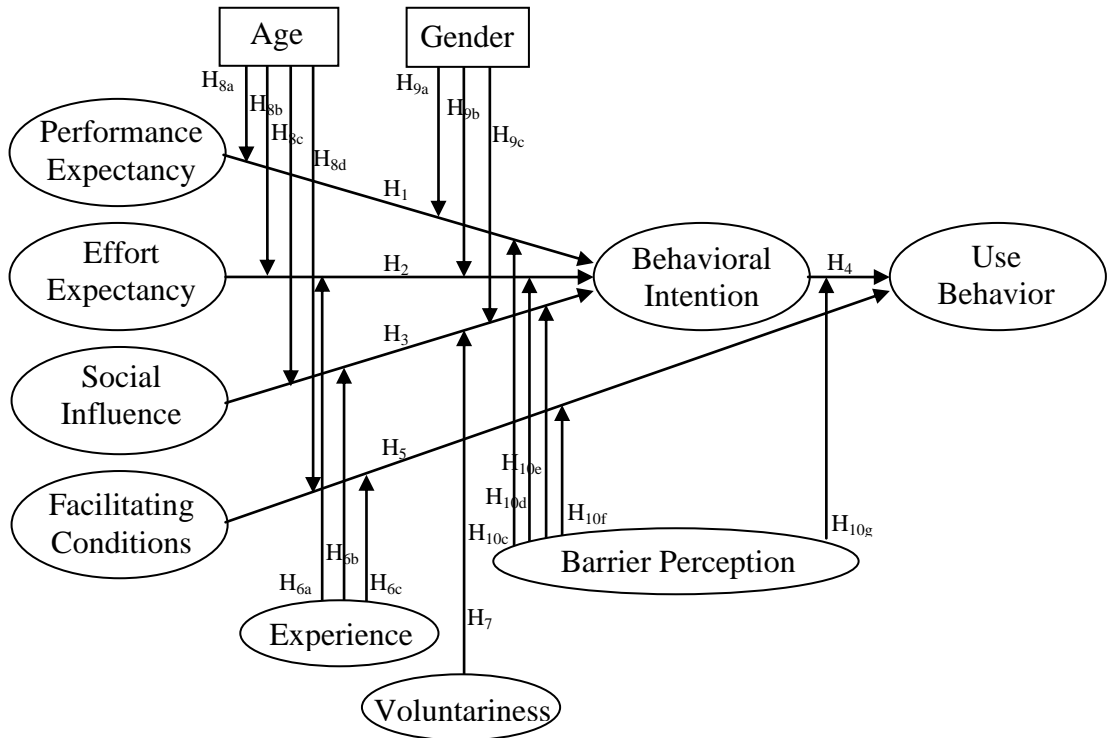


Figure 3.6 UTAUT-based Research Model with Barrier perception as Mediator.

Hypothesis for the UTAUT-based research model for GPS acceptance are described as in table 3.2.

Table 3.2 Research hypothesis for GPS acceptance factors analysis.

Code.	Hypothesis
H ₁	Performance expectancy has the positive effects to the behavioral intention of the user.
H ₂	Effort expectancy has the positive effects to the behavioral intention of the user.
H ₃	Social Influence has the positive effects to the behavioral intention of the user.
H ₄	Behavioral intention to use technology has the positive effects to the GPS acceptance by the user.
H ₅	Facilitating condition cause the positive effects to the GPS acceptance by the user.
H ₆	User's experience has the positive effects to the GPS acceptance H _{6a} : User's experience has the positive interaction effects to the effort expectancy of the user. H _{6b} : User's experience has the positive interaction effects to the social influence of the user. H _{6c} : User's experience has the positive interaction effects to the facilitating conditions of the user.
H ₇	User's voluntariness has the positive effects to the social influence of the user.
H ₈	Age has the positive effects to the GPS acceptance. H _{8a} : Age has the positive interaction effects to the performance expectancy. H _{8b} : Age has the positive interaction effects to the effort expectancy. H _{8c} : Age has the positive interaction effects to the social influence. H _{8d} : Age has the positive interaction effects to the facilitating conditions.

Table 3.2 Research hypothesis for GPS acceptance factors analysis. (continues)

Code.	Hypothesis
H ₉	Different gender has difference interaction effects on the GPS acceptance H _{9a} : Male and female has difference interaction effects on the performance expectancy. H _{9b} : Male and female has difference interaction effects on the effort expectancy. H _{9c} : Male and female has difference interaction effects on the social influence.
H ₁₀	Barrier perception has the negative effects on the GPS acceptance H _{10a} : Barrier perception has the negative effects on the user's behavioral intention H _{10b} : Barrier perception has the negative effects on the use behavior H _{10c} : Barrier perception has the negative interaction effects on the PE H _{10d} : Barrier perception has the negative interaction effects on the EE H _{10e} : Barrier perception has the negative interaction effects on the SI H _{10f} : Barrier perception has the negative interaction effects on the FC H _{10g} : Barrier perception has the negative interaction effects on the BI

The set of hypothesis 6, 8 and 9 was tested for whether which one was the affective interaction effect. While the set of hypothesis 10 was tested for which one was the best determination of the interaction effect of BP on the GPS accepting. The results for all the hypothesis testing was presented in chapter IV.

3.3.2 Technology Acceptance Barrier Perception for GPS acceptance barriers analysis.

This research model aims to study the barrier against GPS acceptance. Data are analyzed again by LISREL with the structural concept depicted in the research model shown in figure 3.7 and with the set of hypothesis described in table 3.3.

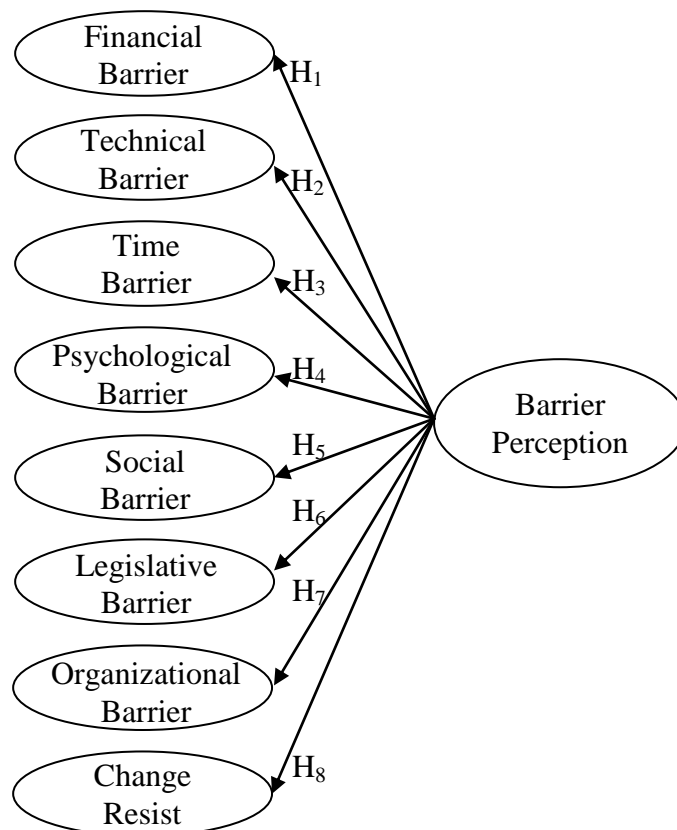


Figure 3.7 Barrier Perceptions for GPS Acceptance.

In order to evaluate the barrier perception for GPS acceptance, the set of hypothesis described in table 3.3 are needed to test.

Table 3.3 Research hypothesis for GPS acceptance barriers.

Code	Hypothesis
H ₁	Financial Barrier has the positive effect on the barrier perception.
H ₂	Technical Barrier has the positive effect on the barrier perception.
H ₃	Time Barrier has the positive effect on the barrier perception.
H ₄	Psychological Barrier has the positive effect on the barrier perception.
H ₅	Social Barrier has the positive effect on the barrier perception.
H ₆	Legislation Barrier has the positive effect on the barrier perception.
H ₇	Organizational Barrier has the positive effect on the barrier perception.
H ₈	Change Resistance has the positive effect on the barrier perception.

3.4 Research-tool design, testing and development

The questionnaires are created by follows along the theory about technology acceptance and about barriers against technology acceptance. In this research, the UTAUT will used as the core concept for understanding the factors lead to the GPS acceptance. There are several factors constructed in the UTAUT model. Actually, they are unmeasurable variables. So the measurable items reflected to each of them are required. Those items, reviewed from many literatures, are used as the questions in the questionnaires. The questionnaires design, test and development are described in the following parts.

3.4.1 Research questionnaires.

Research questionnaires are separated in to 4 parts. Before all, the short brief of the research with the objective and description of how the questionnaires should be are described. First part of questionnaires composed of a few questions about the general information of the respondents. The second part will ask about the factors affected to the GPS acceptance. Next part, the questions about the level of GPS

using are placed. The questions about GPS acceptance barrier are stated in the last part of the questionnaires.

To understanding the measurement items for each factor, the questions in the questionnaires would be presented here.

Questionnaire for measures the factors affect to GPS Acceptance.

Performance Expectancy (PE)

PE is defined as the degree to which a person believes that he or she can gains his or her job performance by using that technology. (Venkatesh et al,2003., Sabah Abdullah Al-Somali et al.,2009., Yi Shun Wang et al.,2009., Min Qingfei et al., 2009. and Boonchai Kijsanayotin et al., 2009., Robert W. Stone et al.,2006., Indrawati et al.,2010). So PE reflexs to the recognition in the advantage the transporters should get from that technology. And it would be measured by transporter's ranking of the level of advantage they could receive from GPS in 4 dimensions: GPS as the navigating system, GPS as the tracking system, GPS as the fleet managing and monitoring system and GPS as the tool for the data collecting and mapping of the transportation infrastructure. The question items stated for this factor are shown in table 3.4

Table 3.4 Measurement Items for Performance Expectancy (PE).

Factor	Measurement Items (Questions).
PE1	With GPS, I could better in transportation fleet management.
PE2	With GPS, the time used in the transportation could be shortened.
PE3	With GPS, I can reduce the transportation cost.
PE4	With GPS, the rate of on-time delivery is increase.
PE5	GPS provides the better navigated systems.
PE6	GPS provides the useful information for the best routing selection and decision making.
PE7	The position of vehicles and driving behavior could be real time reported by GPS.

Effort Expectancy (EE)

Effort Expectancy (EE), the degree of ease or simplicity to use that technology, expected by an individual (Venkatesh et al.,2003), is considered in 4 dimensions these are the simplicity to use GPS tools, to use GPS application programs and other services, to learn how to use GPS and to get and understand the information from GPS provided data. The question items for this factor are shown in table 3.5

Table 3.5 Measurement Items for Effort Expectancy (EE).

Factor	Measurement Items (Questions).
EE1	GPS system is easily used.
EE2	GPS Application programs are easily used.
EE3	Learning for the GPS system use is easy for me.
EE4	Data and information provided by GPS are clear and easy to understand.

Social Influence (SI)

SI, defined as the degree of which a person perceives that the others expect that he or she should use that technology (Venkatesh et al.,2003), In this case, SI was measured via the pushing level from customers, business alliances, sub-contractors, competitors and the government supports. The question items stated for this factor are shown in table 3.6

Table 3.6 Measurement Items for Social Influence (SI).

Factor	Measurement Items (Questions).
SI1	The customers think that I should use the GPS.
SI2	The business alliances think that I should use the GPS.
SI3	I feel that I should use the GPS because my sub-contractors have already used.
SI4	I feel that I should use the GPS because many of the competitors have already used it.
SI5	I feel that I should use the GPS because there are the governmental supports.

Behavioral Intention (BI)

Behavioral intention (BI) to make decision to accept-and-use GPS technology, can be determined by three antecedents these are performance expectancy, effort expectancy and social expectancy.(Dong Cheng et al.,2008). The question items stated for this factor are shown in table 3.7

Table 3.7 Measurement Items for Behavioral Intention (BI).

Factor	Measurement Items (Questions).
BI1	I intended to use the GPS in the future.
BI2	I think that I will use the GPS in the future.
BI3	I have already planned for using the GPS.
BI4	I have studied and prepared myself and my business to implement the GPS.

Facilitating Condition (FC)

Facilitating condition (FC) is the degree of which a person believes that he or she has already got the adequate supported resources or infrastructures in using that technology (Venkatesh et al.,2003), The question items for this factor are shown in table 3.8

Table 3.8 Measurement Items for Facilitating Condition (FC).

Factor	Measurement Items (Questions).
FC1	I have already got the resources needed for the GPS implementation.
FC2	I have got adequate knowledge required for implementing the GPS.
FC3	GPS system was compatible implemented along with the present run systems.
FC4	My employee can use the GPS system perfectly.
FC5	I can easily find the advanced knowledge or any advisement about GPS.

Questionnaire for barrier perception measurement.

To measure the barrier perception, the questions for each barrier issues as constructed as in the picture 3.5 shown in the previous parts. described in table 3.9.

Table 3.9 Measurement items for barrier perception.

Barrier Issues	Measurement Items (“Do the following issues are the barriers against the GPS acceptance in your company?”)
Financial Barrier	Fin1 I think that start up cost or first expense for using GPS is very high.
	Fin2 I think that the GPS services monthly expenses are very high.
	Fin3 I’m not sure in the return on the investment. (Or benefit-cost comparison)
	Fin4 I have limited budget or limited financial resources.
Technological Barrier	Tech1 It was shortage of skilled labor to use GPS.
	Tech2 Technical training is not easy to be done.
	Tech3 GPS is hard to use.
	Tech4 GPS does not provide as much advantage as I need.
	Tech5 GPS does not fit with my business.
	Tech6 Data tracing from GPS is inaccurate.
	Tech7 There are not enough basic supported technologies.
Time Barrier	Time1 It takes so long time in GPS purchasing process.
	Time2 It takes so long time in GPS system learning.
	Time3 It takes so long time in GPS set up.
Psychological Barrier	Psy1 I’m not sure that the GPS could work with properly function or durability.
	Psy2 I feel that it’s not necessary to trial new technology. (Lack of self innovativeness)
	Psy3 There are nothing motivate me to use the GPS.

Table 3.9 Measurement items for barrier perception. (Continued)

Barrier Issues	Measurement Items (“Do the following issues are the barriers against the GPS acceptance in your company?”)	
Social Barrier	Soc1	I don’t trust in the GPS service providers.
	Soc2	There are no (or not enough) government supported.
	Soc3	I’m not sure whether the customer feels that using GPS would disturb their privacy or not.
Legislative Barrier	Leg1	I might loss my privacy.
	Leg2	My business confidences might be in danger.
	Leg3	My business technical confidences might be in danger.
Organizational Barrier	Org1	My business tradition or culture might resist to the GPS use.
	Org2	The complexity of organizational hierarchy against to the decision making.
	Org3	Lack of executive supports.
Change resistance	Chg1	Organization change resistance.
	Chg2	The recommendations are not allowed in my company.
	Chg3	Some stake holders are prohibited to join in the decision making.

3.4.2 Questionnaires testing and development.

To make sure that research tools (questionnaires) are well designed. The questionnaires are tested for validity and reliability before actually use in the data collecting.

To test for validity, Item-Objective Congruence (IOC) testing technics has been done. The questionnaire items was evaluated by three experts. According to the IOC concepts, the questions that get the IOC score of greater than 0.50 are declared to be “passed”. And then the unpassed items might be cut off or developed by the comments of the experts. According to the IOC technics, the questionnaires used in this research has been tested and developed by three experts. Every question items could get the IOC score of greater than 0.50 and declared to be “passed”.

To test for reliability, the questionnaires are pre-test whether the questions are understandable or not. The questionnaires are spread out to 30 respondents. The data received were analyzed and declared of reliability by the cronbach’s alpha coefficient consideration which must nearly or exceed 0.70 for each group of the factors and for overall questionnaires. The Cronbach’s alpha coefficient testing results of overall questionnaires are 0.9526 and 0.8245 for UTAUT part and Barrier Perception part respectively. The Cronbach’s alpha coefficient testing results for each factors in UTAUT construct are shown in table 3.10.

Table 3.10 Reliability testing results for UTAUT model partial questionnaires.

Factors	Number of Measurement Items	Reliability (Cronbach Alpha Coefficient).
Performance Expectancy.	7	0.86
Effort Expectancy.	4	0.77
Social Influency	5	0.75
Behavioral Intention.	4	0.81
Facilitating Conditions	5	0.73
Knowledge and Experience.	3	0.80
Voluntariness	3	0.80

And the Cronbach's alpha coefficient testing results for each type of barriers in technology acceptance barrier model are shown in table 3.11 respectively.

Table 3.11 Questionnaires reliability testing results for Technology Acceptance Barrier model part.

Type of Barriers	Number of Measurement Items	Reliability (Cronbach Alpha Coefficient).
Financial Barrier.	4	0.74
Technical Barrier.	7	0.72
Time Barrier.	3	0.75
Psychological Barrier.	3	0.75
Social Barrier.	3	0.77
Legislative Barrier.	3	0.77
Organizational Barrier.	3	0.77
Change Resistances.	3	0.78

The questionnaires are now declared valid and reliable. Look back to the step of conceptual thinking, the questions stated in the questionnaires are derived from the theoretical model constructed. To make sure that those questions are exactly related to each factor in the model, the Confirmatory Factor Analysis (CFA) are needed to be taken.

3.5 Data collecting

Data gathering are taken in two styles, walk-in survey and via telephone interviewing. In conclusion, The questionnaires will be spreaded out to the targets discussed in topic 3.2, the bus, van and taxi services (both concession with the BMTA and the transportation company).

3.6 Data analysis

Research questionnaires composed of two styles of question, the check boxes and Linkert scales. The questions with five Linkert scales (1-5) are interpreted by the concepts stated in table 3.12.

Table 3.12 Linkert Scale and level of agreement.

Level of Agreement	The weight of score
Strongly Agree	The score is equal to 5
Agree	The score is equal to 4
Moderately Agree	The score is equal to 3
Disagree	The score is equal to 2
Strongly disagree	The score is equal to 1

The collected data are statistically analyzed in three stages. The descriptive statistical analysis was taken first. The means and standard deviations are calculated and interpreted to describe the basic characteristics of data and to preliminary describe the respondent demographics. The level for any issues are declarable by the criteria shown in table 3.13.

Table 3.13 Mean and the level-declaration criteria for any issues

The value of arithmetics mean.	Level declared
4.50 – 5.00	Very high level
3.50 – 4.49	High level
2.50 – 3.49	Medium level
1.50 – 2.49	Low level
1.00 – 1.49	Very low level

In the second stage, the confirmatory factor analysis (CFA) was taken in order to make sure that the observed data (variables) were comparatively fitted to the theoretical construct. By LISREL program, the data were statistically analyzed. And the level of “fit” are declarable by the criteria show in table 3.14.

Table 3.14 Overall fits of the research model

Fit index	Recommended value
Chi-square / d.f.	≤ 3
Goodness of fit index	≥ 0.90
Adjusted GFI (AGFI)	≥ 0.80
Normed fit index (NFI)	≥ 0.90
Non-normed fit index (NNFI)	≥ 0.90
Relative fit index (RFI)	≥ 0.90
Incremental fit index (IFI)	≥ 0.90
Root mean square residual (RMR)	≤ 0.05
Root mean square error of approximation (RMSEA)	≤ 0.08
Critical N	≥ 200

The third stage, the structural equation modeling (SEM) analysis was taken to illustrate the relationship between every factor in the research model.

3.7 Conclusion and discussion

After all, the results are conclude and discuss in order to answer the research questions which are follows the research objectives, to reveals the appropriate adopted-version of UTAUT model that could accurately explain the acceptance factors of GPS by Thai’s public transportation industry, to describes the factors that affect to the GPS acceptance and use by Thai’s public transportation industry and what is/are the barriers against the GPS acceptance by Thai’s public transportation industry

3.8 Research Scheduling.

Table 3.15 Research Scheduling

Research Steps	Week											
	1	2	3	4	5	6	7	8	9	10	11	12
Literature Review	■	■										
Define scope of study		■										
Define hypothesis		■										
Create questionnaires			■									
Test and develop the questionnaires				■								
Data collecting					■	■	■	■				
Data analyze									■			
Conclusion and discussion										■	■	■

CHAPTER IV

RESEARCH RESULTS

In this chapter, the research results were partially described in three parts, respondent demographics, result for the confirmatory factor analysis (CFA) and result for the causal relationships analysis (SEM) respectively.

4.1 Respondent Demographics.

The questionnaires are spread out to the public transportation service entrepreneurs. And there are 377 responses from GPS users. The collected data are preliminary determined by the descriptive statistics.

About 89.12% of the respondents were men and only 10.88% were women. The public transportation entrepreneur response to this surveying are van servicers, taxi servicers and bus servicers with the percentage of 50.93%, 24.67% and 24.40% respectively. Table 4.1 shows the respondent demographic for this surveying.

Table 4.1 Respondent demographics.

Characteristics		no. of respondents	Percentage
Total number of respondents		377	100.00
Gender	Male	336	89.12
	Female	41	10.88
Age	<30	0	0.00
	31-40	15	3.98
	41-50	92	24.40
	51-60	269	71.35
	>60	1	0.27
Service Model	Taxi	93	24.67
	Bus	92	24.40
	Van	192	50.93

4.2 Acceptance factor’s perception level

4.2.1 Performance Expectation

The expectation level of each PE measurement items shown in table 4.2 illustrated that Thai public transportation entrepreneur have the very high level of expectation on PE1, PE2, PE6 and PE7. And their expectation on PE3, PE4 and PE5 was declared high level.

Table 4.2 PE measurement item perceptions.

Performance Expectancy	Mean	S.D.	Max	Min	Level Declared
PE1	4.81	0.40	5	2	Very high level
PE2	4.63	0.49	5	1	Very high level
PE3	4.44	0.51	5	1	High level
PE4	4.38	0.52	5	1	High level
PE5	4.42	0.53	5	1	High level
PE6	4.53	0.50	5	1	Very high level
PE7	4.73	0.45	5	1	Very high level

Data observed via questionnaires explain that Thai transporters have very strong expectation that GPS could enhance their ability to develop the fleet management, to reduce during time, to provide information for the best routing selection and decision making and to monitored fleet real-timely. And they have strong expectation that GPS could help them reducing cost, increase on-time delivery rating and conduct good fleet navigating system.

However, information gain from the paralleled interviewing could give more clearly explanation. The transporters were exactly know the performance of GPS and expected that it could enhance their business ability but in practical they need only some features of GPS application. So the interpretation for this part were making in the manner of GPS performance expectation. The level of benefits practically gain from GPS using was measured and reported in part 4.2.8.

4.2.2 Effort Expectation

The expectation level of each EE measurement items shown in table 4.3 illustrated that Thai public transportation entrepreneur have the very high level of expectation on EE1 (GPS system is easily used) and EE2 (GPS application programs are easily used.). And their expectation on EE3 (Learning for the GPS system use) and EE4 (Data and information provided by GPS are clear and easy to understand) was declared high level.

Table 4.3 EE measurement item perceptions.

Effort Expectancy	Mean	S.D.	Max	Min	Level Declared
EE1	4.78	0.41	5	1	Very high level
EE2	4.60	0.49	5	1	Very high level
EE3	4.42	0.50	5	1	High level
EE4	4.40	0.52	5	1	High level

The result described above indicated that if we needed to convey the Thai transportation entrepreneurs to use GPS, first, we need to let them feeling that the GPS system and application program is easy to use. Learning to use GPS is not difficult. Data and information provided by GPS are clear and easy to understand. So the effective and simplicity training for using GPS may be needed to take place here.

4.2.3 Social Influence Perception.

The perception level of each SI measurement items shown in table 4.4 illustrated that Thai public transportation entrepreneur have the very high level of influence perception from customers (SI1). And their influence perception from business-alliances (SI2) and the government (SI5) were declared high level. While their influence perception from competitors (SI4) and sub-contractors (SI3) were declared low level.

Table 4.4 SI measurement item perceptions.

Social Influence	Mean	S.D.	Max	Min	Level Declared
SI1	4.64	0.50	5	1	Very high level
SI2	4.32	0.50	5	1	High level
SI3	1.15	0.36	5	1	Low level
SI4	1.81	0.49	5	1	Low level
SI5	3.82	0.86	5	1	High level

Thai transportation entrepreneur feel that customer (SI1) is the most powerful person on social influence perception. Business alliances (SI2) and governmental support policy (SI5) have the big influence for this case while competitors (SI4) and sub-contractors (SI3) have not much influence on social influence perception. The result described above was agreeable with the interviewing result that the most powerful persons influence on the GPS using decision are customers, business alliances (the BMTA and the Transport co., Ltd.) and governmental support policy. Because the public transportation of Thailand was controlled by the government via two organizations, the BMTA (manages the metropolitan public transportation) and the Transport co., Ltd. (manages the between-province public transportation). Actually, the customers do not directly need the entrepreneurs to use the GPS but they need the better service quality and safety. So the government, the most powerful person who control the overall policy for the transportation, must play the roles of propeller. Recently, the government have already launched the policy to force the entrepreneurs to use GPS in every serviced vehicle.

4.2.4 Voluntariness

Every voluntariness measurement items were declared “high level” as shown in table 4.5. It illustrated that Thai public transportation entrepreneur have their own voluntariness in decision making to use GPS. It was harmonious with the opinion feedback from the interviewing that although there have not any influence by other persons, not any pressured by business needed and not ruled by anyone, the entrepreneur may decide to use GPS by themselves.

Table 4.5 VO measurement item perceptions.

Voluntariness	Mean	S.D.	Max	Min	Level Declared
VO1	4.48	0.67	5	1	High level
VO2	4.13	0.69	5	1	High level
VO3	3.94	0.57	5	1	High level

4.2.5 Behavioral Intention

The perception level of each BI measurement items shown in table 4.6 illustrated that Thai public transportation entrepreneur have very high level of perception on BI1. And their perception on BI2, BI3 and BI4 was declared high level. The result indicated that the entrepreneurs intend to use the GPS in the future. And some of them need to plan and prepare themselves for GPS implementation.

Table 4.6 BI measurement item perceptions.

Behavioral Intention	Mean	S.D.	Max	Min	Level Declared
BI1	4.86	0.35	5	1	Very high level
BI2	4.45	0.50	5	1	High level
BI3	4.49	0.50	5	1	High level
BI4	4.32	0.50	5	1	High level

4.2.6 Facilitating Conditions

The perception level of each FC measurement items shown in table 4.7 illustrated that Thai public transportation entrepreneur have very high level of perception on the resources needed for the GPS implementation (FC1). And they've got high level perception on knowledge-required (FC2), implementation compatibility (FC3), GPS-user's ability (FC4) and advisement-supported (FC5). The result indicated that the most important thing the entrepreneurs pay attention to is the resource needed or the budget needed. GPS basic knowledge provided, user training, system compatibility concern and advisement-and-information supported are the unavoidable facilities.

Table 4.7 FC measurement item perceptions.

Facilitating Condition	Mean	S.D.	Max	Min	Level Declared
FC1	4.57	0.50	5	1	Very high level
FC2	4.14	0.58	5	1	High level
FC3	3.87	0.69	5	1	High level
FC4	4.27	0.55	5	1	High level
FC5	3.67	0.80	5	1	High level

4.2.7 Experience and basic knowledge needed perception. (EXP)

The experience needed perception levels for each EXP measurement items, illustrated in table 4.8, indicated that Thai public transportation entrepreneur have high level of needed perception on every item. The entrepreneurs feel that the basic knowledge about GPS system (EXP1) and using guide or training are needed (EXP2). The GPS using experiences (EXP3) are also the important things so the demonstration and trial suits may be needed the training.

Table 4.8 EXP measurement item perceptions.

Experience	Mean	S.D.	Max	Min	Level Declared
EXP1	4.28	0.52	5	1	High level
EXP2	4.45	0.54	5	1	High level
EXP3	4.34	0.58	5	1	High level

4.2.8 Level of GPS use by Thai public transportation

Normally, there are four dimensions of benefits of GPS. The GPS was always used as the real-time tracking, incident monitoring and management, navigation and data collecting systems. In case of Thai public transportation entrepreneur, the GPS was used only for real-time tracking and incident monitoring. The GPS use level was presented in table 4.9.

Table 4.9 GPS benefit level for Thai public transportation entrepreneurs.

Benefits of GPS	Mean	S.D.	Max	Min	Level Declared
Real Time Tracking	4.67	0.47	5	1	Very high level
Incident Management and monitoring	3.68	0.63	5	1	High level
Navigation	1.16	0.37	3	1	Very Low Level
Data collection and mapping of the transport infrastructure	1.17	0.37	3	1	Very Low Level

GPS was not implemented with full capacity. Thai public transportation entrepreneurs use GPS for only two reasons, as the real-time tracking and as the incident-management-and-monitoring system. Some GPS performance features still not widely used such as the navigating performance and the data collecting performance. Said that, Thai transportation entrepreneur used GPS just for the vehicle monitoring not for transportation management. GPS benefits gain from accident reduction and risk management but not come from better management or cost reduction because GPS was not used for transportation planning, routing, mapping, resource allocation or decision making for the transport infrastructure.

4.2.9 The perception for overall constructed factors model.

There are widely different opinions about the perception for each acceptance factor among the respondents. Table 4.10 show the average score of the acceptance factor perception level. The perception level for PE, EE, BI and FC are declared to be “very high” level. While the perception level for SI, VO and Experience are declared to be “high” level.

Table 4.10 Overall acceptance factor perception level.

Acceptance factor	Mean	S.D.	Level Declared
Performance Expectancy	4.56	0.34	Very high level
Effort Expectancy	4.55	0.35	Very high level
Social Influence	4.28	0.38	High level
Voluntariness	4.11	0.58	High level
Behavioral Intention	4.53	0.33	Very high level
Facilitating Condition	4.53	0.47	Very high level
Experience	4.36	0.45	High level

4.3 Level of the technology acceptance barrier perception.

There are several issues of anxiety about accepting of the technology the entrepreneur percepts. Table 4.11 show score of the technology acceptance barrier perceptions.

Table 4.11 Technology acceptance barrier perceptions.

Types of barrier perception		Mean	S.D.	Max	Min	Level Declared
Financial Barrier Perception						
Fin1	I think that start up cost or first expense for using GPS is very high.	4.72	0.47	5	2	Very high level
Fin2	I think that the GPS services monthly expenses are very high.	3.81	0.62	5	1	High level
Fin3	I'm not sure in the return on the investment. (Benefit-cost comparison)	3.10	1.41	5	1	Medium level
Fin4	I have limited budget or limited financial resources.	4.29	0.92	5	1	High level
Technological Barrier Perception						
Tech1	It was shortage of skilled labor to use GPS.	1.41	0.59	5	1	Very low level
Tech2	Technical training is not easy to be done.	1.33	0.52	4	1	Very low level
Tech3	GPS is hard to use.	1.29	0.50	3	1	Very low level
Tech4	GPS does not provide as much advantage as I need.	1.81	1.26	5	1	Low level
Tech5	GPS does not fit with my business.	1.33	0.69	5	1	Very low level
Tech6	Data tracing from GPS is inaccurate.	1.11	0.32	4	1	Very low level
Tech7	There are not enough basic supported technologies.	1.08	0.28	3	1	Very low level

Table 4.11 Technology acceptance barrier perceptions. (continues)

Types of barrier perception		Mean	S.D.	Max	Min	Level Declared
Time Barrier Perception						
Time1	It takes so long time in GPS purchasing process.	3.22	0.84	5	1	Medium level
Time2	It takes so long time in GPS system learning.	2.15	0.80	4	1	Low level
Time3	It takes so long time in GPS set up.	1.93	0.88	4	1	Low level
Psychological Barrier Perception						
Psy1	I'm not sure that the GPS could work with properly function or durability.	1.30	0.81	5	1	Very low level
Psy2	I feel that it's not necessary to trial new technology. (Lack of self innovativeness)	3.12	0.68	5	1	Medium level
Psy3	There are nothing motivate me to use the GPS.	1.72	1.20	5	1	Low level
Social Barrier Perception						
Soc1	I don't trust in the GPS service providers.	2.93	0.51	5	1	Medium level
Soc2	There are no (or not enough) government supported.	4.36	0.49	5	2	High level
Soc3	I'm not sure whether the customer privacy would disturb by using GPS or not.	1.14	0.37	4	1	Very low level
Legislative Barrier Perception						
Leg1	I might loss my privacy.	1.86	0.62	4	1	Low level
Leg2	My business confidences might be in danger.	1.92	0.65	4	1	Low level
Leg3	My business technical confidences might be in danger.	1.98	0.91	4	1	Low level

Table 4.11 Technology acceptance barrier perceptions. (continues)

Types of barrier perception		Mean	S.D.	Max	Min	Level Declared
Organizational Barrier Perception						
Org1	My business tradition or culture might resist to the GPS use.	1.25	0.44	3	1	Very low level
Org2	The complexity of organizational hierarchy against to the decision making.	1.40	0.68	4	1	Very low level
Org3	Lack of executive supports.	1.53	0.51	3	1	Low level
Change resistance						
Chg1	Organization change resistance.	1.37	0.53	3	1	Very low level
Chg2	The recommendations are not allowed in my company.	1.40	0.50	3	1	Very low level
Chg3	Some stake holders are prohibited to join in the decision making.	1.31	0.48	3	1	Very low level

The most important barriers issues against the GPS acceptance, Thai public transportation entrepreneurs mostly worried, declared “Very high level” in table 4.11 (and shown in picture 4.1), is the expensive “start up cost” for using GPS. The entrepreneur feels that it was very big investment. So in order to achieves the government requirement of 100% GPS -implementation, they need such a period of time to avoid the business financial shortage. The other important barriers which are declared “high level” are the cost for GPS monthly services, limited budget and lacking of government supports. The primary facts found here is that the entrepreneurs mostly worried in the financial barrier. Moreover they feel that implementing for the GPS was highly cost and they are not confident in the return on investment. But whether it was forced by the governmental policy, they also need time for step-by-steps implementation and ask for the governmental supports.

The level of the technology acceptance barrier perceptions, reported again in picture 4.1, was more clearly classified the level of GPS technology acceptance barrier perception by Thai transportation entrepreneur.

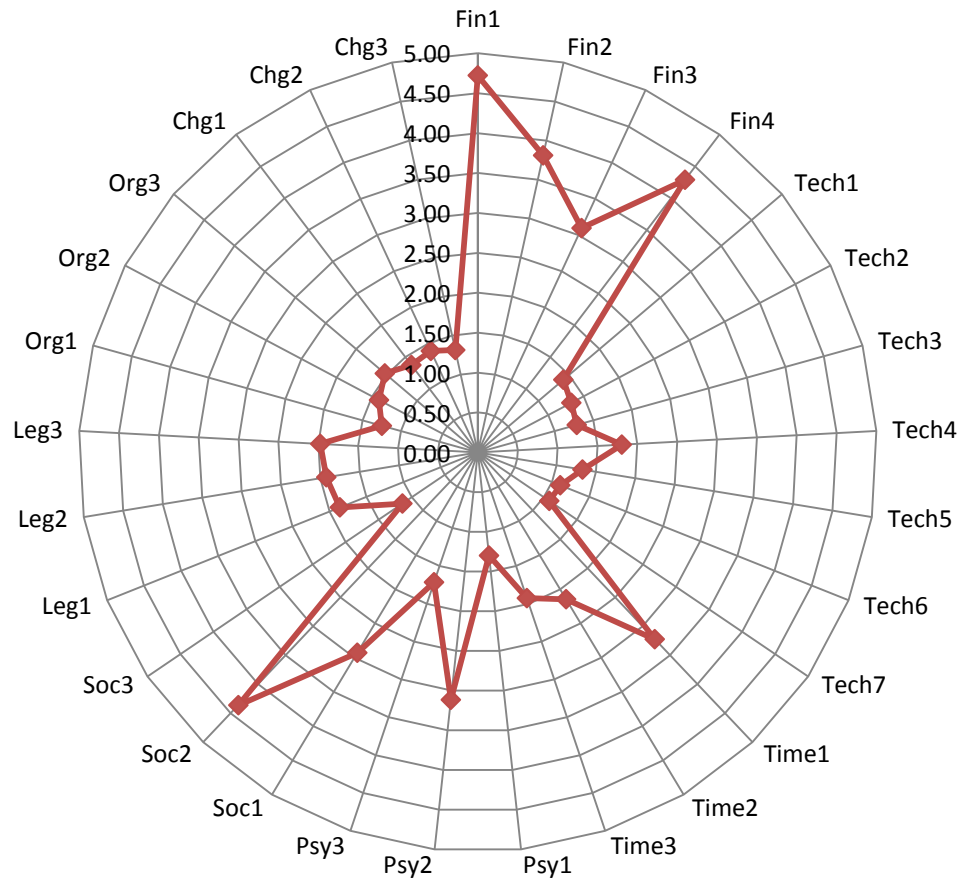


Figure 4.1 The level of GPS technology acceptance barrier perception by Thai transportation entrepreneur.

4.4 Confirmatory Factor Analysis (CFA) for UTAUT and Barrier Perception

4.4.1 Confirmatory Factor Analysis (CFA) for UTAUT.

As described in chapter II, the factors constructed in the UTAUT model are latent variable which could not directly measured itself. The set of measurement items needed to evaluate the value for each factor. By literature reviewing, the measurement items for each factor are theoretically collected. The Confirmatory Factor Analysis (CFA) was taken in order to confirmed whether the observed data from the questionnaires consistent with the theoretical concepts or not. The CFA for each factor was results in this following part factor-by-factor.

Table 4.12 Results for the CFA of the UTAUT factor perception.

UTAUT factor perceptions		Factor loading	Percentage Approximation (%)
Performance Expectancy			
PE1	With GPS, I could better in transportation fleet management.	0.21 ^{**}	10.10
PE2	With GPS, the time used in the transportation could be shortened.	0.32 ^{**}	15.38
PE3	With GPS, I can reduce the transportation cost.	0.37 ^{**}	17.79
PE4	With GPS, the rate of on-time delivery is increase.	0.33 ^{**}	15.87
PE5	GPS provides the better navigated systems.	0.28 ^{**}	13.46
PE6	GPS provides the useful information for the best routing selection and decision making.	0.31 ^{**}	14.90
PE7	The position of vehicles and driving behavior could be real time reported by GPS.	0.26 ^{**}	12.50
Effort Expectancy			
EE1	GPS system is easily used.	0.30 ^{**}	25.21
EE2	GPS Application programs are easily used.	0.38 ^{**}	31.93
EE3	Learning for the GPS system use is easy for me.	0.28 ^{**}	23.53
EE4	Data and information provided by GPS are clear and easy to understand.	0.23 ^{**}	19.33

(* significant at 0.05, ** significant at 0.01)

Table 4.12 Results for the CFA of the UTAUT factor perception. (continues)

UTAUT factor perceptions		Factor loading	Percentage Approximation (%)
Social Influence			
SI1	The customers think that I should use the GPS.	0.33**	18.64
SI2	The business alliances think that I should use the GPS.	0.40**	22.60
SI3	I feel that I should use the GPS because my sub-contractors have already used.	not significant	-
SI4	I feel that I should use the GPS because many of the competitors have already used it.	0.06**	3.39
SI5	I feel that I should use the GPS because there are the governmental supports.	0.98**	55.37
Voluntariness			
VO1	I intend to use GPS though without any request from anyone.	0.50**	31.06
VO2	I know that there have no defect in my service quality though without GPS. But I still intend to use GPS.	0.66**	40.99
VO3	Using GPS does not influenced by rules or laws.	0.45**	27.95
Behavioral Intention			
BI1	I intended to use the GPS in the future.	0.13**	12.04
BI2	I think that I will use the GPS in the future.	0.21**	19.44
BI3	I have already planned for using the GPS.	0.39**	36.11
BI4	I have studied and prepared myself and my business to implement the GPS.	0.35**	32.41
Facilitating Condition			
FC1	I have already got the resources needed for the GPS implementation.	0.42**	24.56
FC2	I have got adequate knowledge required for implementing the GPS.	0.35**	20.47
FC3	GPS system was compatible implemented along with the present run systems.	0.28**	16.37
FC4	My employee can use the GPS system perfectly.	0.38**	22.22
FC5	I can easily find the advanced knowledge or any advisement about GPS.	0.28**	16.37

(* significant at 0.05, ** significant at 0.01)

Table 4.12 Results for the CFA of the UTAUT factor perception. (continues)

UTAUT factor perceptions	Factor loading	Percentage Approximation (%)
Experience and basic knowledge		
EXP1 I have basic knowledge about GPS system.	0.35**	30.17
EXP2 I know how to use the GPS	0.41**	35.34
EXP3 I ever use GPS.	0.40**	34.48

(* significant at 0.05, ** significant at 0.01)

Results for the CFA of the UTAUT factor perception presented in table 4.12 illustrated how to calculate value of each latent factor constructed in UTAUT model by the list of measurement items. And indicated which item in the set of measurement items the entrepreneur most perceived or expected.

In case of the performance expectancy, the entrepreneurs mostly expect that the GPS could help them in cost reduction, increasing on-time delivery rating and traveling time reduction which directly related to the transportation quality. However they also expect in the managerial features such as tracking, navigation, information gathering and fleet management.

About effort expectancy, the entrepreneurs expects that the GPS (both hardware and software manner) is easy to implemented, understand and learned.

The most powerful persons influenced on the GPS use decision making was the government, transportation-alliances and the customers. According to improved the transportation service especially for the safety provided for the customer, the government can convey the entrepreneur to implement the GPS by her policy which would practically forced by the BMTA and the Transportation co.ltd. (both are the governmental cooperative organizations) as the mechanisms.

The most important facilitating conditions for the entrepreneur are the resources, knowledge and skill for using GPS. However the advisement and compatibility are also needed.

4.4.2 Confirmatory Factor Analysis (CFA) for technology acceptance barrier issues.

In order to determine technology acceptance barrier, data observed are analyzed. The factor loading for each measurement items, result from the factor analysis, reported in table 4.13, illustrated how to calculate value of each latent factor constructed in technology acceptance barrier model by the list of measurement items.

Table 4.13 Factor loading of each measurement items related to 8 factors of the technology acceptance barriers.

Types of barrier perception		Factor loading	Percentage Approximation (%)
Financial Barrier Perception			
Fin1	I think that start up cost or first expense for using GPS is very high.	0.20**	9.21
Fin2	I think that the GPS services monthly expenses are very high.	0.18**	8.39
Fin3	I'm not sure in the return on the investment. (Benefit-cost comparison)	1.16**	52.90
Fin4	I have limited budget or limited financial resources.	0.65**	29.50
Technological Barrier Perception			
Tech1	It was shortage of skilled labor to use GPS.	0.51**	17.04
Tech2	Technical training is not easy to be done.	0.45**	15.16
Tech3	GPS is hard to use.	0.30**	10.22
Tech4	GPS does not provide as much advantage as I need.	1.06**	35.66
Tech5	GPS does not fit with my business.	0.48**	16.17
Tech6	Data tracing from GPS is inaccurate.	0.11**	3.70
Tech7	There are not enough basic supported technologies.	0.06**	2.05
Time Barrier Perception			
Time1	It takes so long time in GPS purchasing process.	0.45**	24.30
Time2	It takes so long time in GPS system learning.	0.62**	33.26
Time3	It takes so long time in GPS set up.	0.79**	42.44

(* significant at 0.05, ** significant at 0.01)

Table 4.13 Factor loading of each measurement items related to 8 factors of the technology acceptance barriers. (continues)

Types of barrier perception		Factor loading	Percentage Approximation (%)
Psychological Barrier Perception			
Psy1	I'm not sure that the GPS could work with properly function or durability.	0.70 ^{**}	30.53
Psy2	I feel that it's not necessary to trial new technology. (Lack of self innovativeness)	0.55 ^{**}	24.16
Psy3	There are nothing motivate me to use the GPS.	1.04 ^{**}	45.31
Social Barrier Perception			
Soc1	I don't trust in the GPS service providers.	0.20 ^{**}	29.85
Soc2	There are no (or not enough) government supported.	0.32 ^{**}	47.76
Soc3	I'm not sure whether the customer feels that using GPS would disturb their privacy or not.	0.15 ^{**}	22.39
Legislative Barrier Perception			
Leg1	I might loss my privacy.	0.20 ^{**}	16.23
Leg2	My business confidences might be in danger.	0.25 ^{**}	20.59
Leg3	My business technical confidences might be in danger.	0.77 ^{**}	63.18
Organizational Barrier Perception			
Org1	My business tradition or culture might resist to the GPS use.	0.41 ^{**}	33.92
Org2	The complexity of organizational hierarchy against to the decision making.	0.56 ^{**}	46.45
Org3	Lack of executive supports.	0.24 ^{**}	19.63
Change resistance			
Chg1	Organization change resistance.	0.46 ^{**}	35.32
Chg2	The recommendations are not allowed in my company.	0.46 ^{**}	35.48
Chg3	Some stake holders are prohibited to join in the decision making.	0.38 ^{**}	29.20

(* significant at 0.05, ** significant at 0.01)

The CFA was taken again to find the factor loading for each factor directly related to overall technology acceptance barrier perception. The barrier perception item selection, measured from the result of CFA for overall technology acceptance barrier perception was reported in table 4.14.

Table 4.14 The result for barrier perception items selection for GPS acceptance.

Barrier Perception	Factor loading	BP selection result
Financial Barrier	0.2623 ^{**}	Selected
Technological Barrier	0.2532 ^{**}	Selected
Psychological Barrier	0.5762 ^{**}	Selected
Sociological Barrier	0.1033 ^{**}	Selected

(* significant at 0.05, ** significant at 0.01)

Theoretically, the technology acceptance barrier perception was determined from 8 dimension of barrier perception these are financial barrier, technological barrier, time barrier, psychological barrier, sociological barrier, legislative barrier, organizational barrier and change resistance. But the result which was analyzed from the observed data shown in table 4.14 and the hypothesis testing result shown in table 4.15, illustrated that, actually, there are only four dimensions of selected barrier perception that significantly related to the GPS technology acceptance barrier perception for Thai public transportation entrepreneurs. These four barrier perception dimensions are Financial Barrier, Technological Barrier, Psychological Barrier and Sociological Barrier.

4.4.3 Confirmatory Factor Analysis (CFA) for overall technology acceptance barrier perception.

Four selected barrier perception items are re-analyzed to find the exact factor loading for each factor significantly related to overall technology acceptance barrier perception. The result of CFA for overall technology acceptance barrier perception was reported in table 4.15. Every barrier perception items are significantly related to the overall barrier perception with the significant level of 0.01.

Table 4.15 The CFA result for the overall GPS acceptance barrier perception.

Factors	Barrier Perception		
	Factor loadings	% Factor loading	t-value
Financial Barrier	0.2991**	25.42	10.2272
Technological Barrier	0.2919**	24.58	17.1563
Psychological Barrier	0.5003**	42.37	13.4545
Sociological Barrier	0.0867**	7.63	5.4110

(* significant at 0.05, ** significant at 0.01)

Psychological Barrier was the greatest effective barrier issue among four of them with the factor loading of 0.5003. Financial Barrier and Technological Barrier were the second most effective barrier while the sociological Barrier has just a little significant effective with the factor loadings of 0.2991, 0.2919 and 0.0867 respectively.

Again for more clearly understanding, by the Lisrel program, the model for GPS acceptance barrier perception with the percentage approximation of loading factors was determined and depicted in figure 4.2. It illustrated that the GPS acceptance barrier perception was significantly caused by four selected dimensions of barrier, these are psychological barrier financial barrier, technological barrier, sociological barrier with the percentage approximation loading factors of 42.37%, 25.42%, 24.58% and 7.63% respectively.

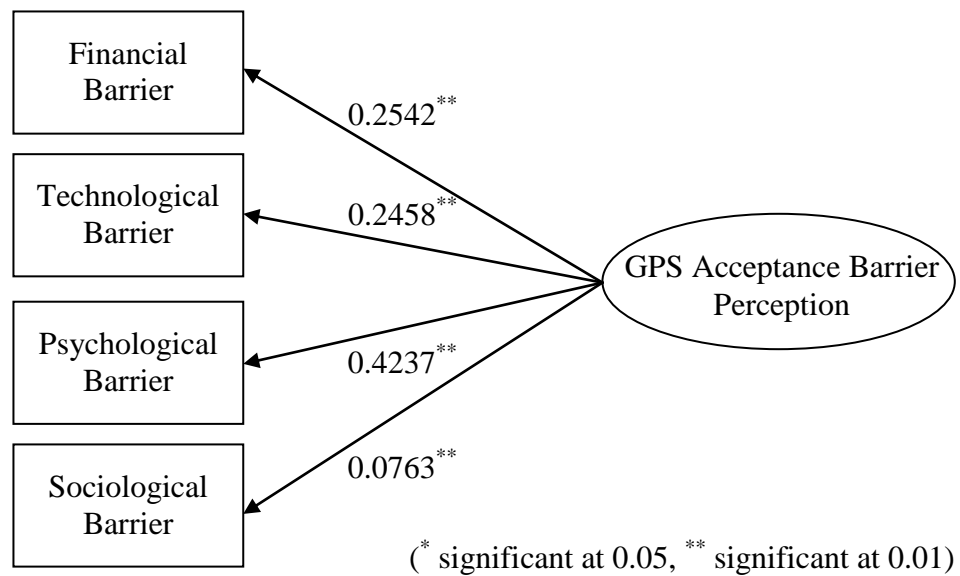


Figure 4.2 Model for the GPS acceptance barrier perception with the percentage approximation of loading factors.

Psychological Barrier was the greatest effective barrier issue among four of them with the factor loading of 0.5003 (42.37%). Financial Barrier and Technological Barrier were the second most effective barrier while the sociological Barrier has just a little significant effective with the factor loadings of 0.2991 (25.42%), 0.2919 (24.58%) and 0.0867 (7.63%) respectively.

Psychological Barrier

Psychological barrier perception causes by lacking of belief in the technology. The entrepreneurs still not belief in benefits they gain from using GPS. They feel that there is nothing to motivates them to use the GPS. They still not believe in GPS quality. And they do not feel that using GPS is necessary.

Financial Barrier

Financial barrier perception is mainly focus on the financial resources and the cost-benefit comparison. The entrepreneur does not confident in the return on the investment. By benefit-cost comparison, they feel that investment for GPS may unprofitable. Moreover, they have limited budget while the expense they have to loose their cash for the big amount of start-up cost and monthly service expenses.

Technological Barrier

Technological barrier defined as the difference between needed technological characteristics and infrastructure supported. It would be view as lack of skilled labor, lack of technical training and support, complexity of the system (Difficulty of using that technology, limitation of the system. The percentage approximation loading factors for Tech₄, Tech₁, Tech₅, Tech₂, Tech₃, Tech₆ and Tech₇ are 35.66%, 17.04%, 16.17% , 15.16%, 10.22%, 3.70% and 2.05%% respectively.

Sociological barrier

In the view of sociological barrier, the persons who the entrepreneur worried about are the government (47.76%), GPS service providers (29.85%) and customer privacy (22.39%). For the government, they worried about the government support. As described above that to invest the GPS, the entrepreneur may be faced with the financial problem, so they may need the financial supports from the government. But if they need to invest in the low cost GPS provider, they may be faced with the irresponsibility service provider. And that why the trustfulness in the GPS service provider become the anxieties.

4.5 Structural Equation Modeling (SEM) for UTAUT-based GPS acceptance model and Barrier perception.

With the LISREL 9.1, the observed data are tested by to realized that whether the observe model was harmonious with the theoretical model or not, and to determined the relationship between the factors constructed in that model.

In this case, the model was analyzed in three steps. First step, the major constructed of UTAUT was tested. The result for this test will illustrate the core factor related to the behavioral intention (BI) and use behavior (USE). Second times, the structure model from 1st round was reanalyzed by add the mediators into the consideration. This step will let us know which mediator effect to the overall model. And for the 3rd round, structure model with mediators resulted from 2nd round was reanalyzed again by add the barrier perception into the model.

The result for each step was reported in the following three parts respectively.

Table 4.16 The result of correlation analysis of variables

Var.	BI	Use	PE	EE	SI	FC	ExpFC	BPFC
BI	1							
Use	0.935**	1						
PE	0.738**	0.748**	1					
EE	0.693**	0.713**	0.923**	1				
SI	0.963**	0.854**	0.664**	0.611**	1			
FC	0.923**	0.983**	0.740**	0.710**	0.844**	1		
ExpFC	0.851**	0.879**	0.754**	0.709**	0.786**	0.877**	1	
BPFC	-0.751**	-0.803**	-0.635**	-0.635**	-0.651**	-0.773**	-0.723**	1

** correlation is significant at level 0.01 (two tailed)

4.6 SEM for main structural UTAUT-based GPS acceptance model.

Before all, the value of each latent structural factor was determined by the observe data and its loading factors (which was already calculated and report in table 4.12 described above). At this step, the latent variables were already modified into measurable factors and ready to be analyzed.

Direct and indirect standardized effect of each structural factor influenced on the Behavioral Intention and Use Behavior shown in table 4.17 illustrated that PE, EE and SI have the direct effect on BI. While FC and BI have the direct effect on USE. And we can predict the behavioral intention to use GPS from the value of PE, EE and SI with the 97.21% accuracy. While we can predict the GPS use behavior from the value of BI and FC with the 98.54% accuracy. Or in the other way PE, EE and SI was absolutely affects to the BI. And FC together with BI was absolutely affects to the GPS use behavior too.

Table 4.17 Direct and indirect standardized effect of each structural factor influenced on the Behavioral Intention and Use Behavior. (main model)

Factors	Behavioral Intention			USE behavior		
	TE	IE	DE	TE	IE	DE
Behavioral Intention	-	-	-	0.230** (0.028) 8.102	-	0.230** (0.029) 8.059
Performance Expectancy	0.091** (0.034) 2.692	-	0.091** (0.034) 2.678	0.021** (0.008) 2.564	0.021** (0.008) 2.564	-
Effort Expectancy	0.095** (0.032) 2.994	-	0.095** (0.032) 2.978	0.022** (0.008) 2.824	0.022** (0.008) 2.824	-
Social Influence	0.477** (0.009) 52.673	-	0.477** (0.009) 52.393	0.110** (0.014) 7.875	0.11** (0.014) 7.875	-
Facilitating Conditions	-	-	-	0.814** (0.023) 35.709	-	0.814** (0.023) 35.519
R2	0.945			0.971		

(* significant at 0.05, ** significant at 0.01)

However, before discussion, we need to check whether the model was fit with the theoretical model. Fortunately, Lisrel 9.1 could determine the fit indices automatically. And the result for model fitted index (for mail model) was reported in table 4.18.

Table 4.18 Structural model fit measurement. (main model)

Fit indices	Recommended Value	Model Fit Indices Value
Chi Square	N/A	3.68
Degree of freedom (df)	N/A	2
Chi-square / df	≤ 3	1.84
p-value	≥ 0.05	0.15912
Goodness of fit index (GFI)	≥ 0.90	0.997
Adjusted GFI (AGFI)	≥ 0.80	0.966
Normed fit index (NFI)	≥ 0.90	0.999
Non-normed fit index (NNFI)	≥ 0.90	0.997
Comparative Fit index (CFI)	≥ 0.90	1.00
Root mean square residual (RMR)	≤ 0.05	0.000523
Root mean square error of approximation (RMSEA)	≤ 0.08	0.047

The result in table 4.18 illustrates that every model fit indices pass the recommendation criteria. The Chi-square/df ratio was less than 3. The p-value was greater than 0.05. The values of GFI, AGFI, NFI, NNFI and CFI was greater than 0.90. While the RMR and RMSEA was not exceeds 0.05 and 0.08 respectively. So we can conclude that the observed model was fit to the theoretical model.

For more clearly determination of factors relationship, the main structural model of UTAUT-based GPS acceptance model was presented in figure 4.3. The model illustrates the relationships between factors and weight of each factor effect. The BI was most affected from SI with the weight of 0.72 while affected from PE and EE with the weight of 0.137 and 0.143 respectively. FC was the most influenced factor on GPS use behavior with the weight of 0.780 (78%)

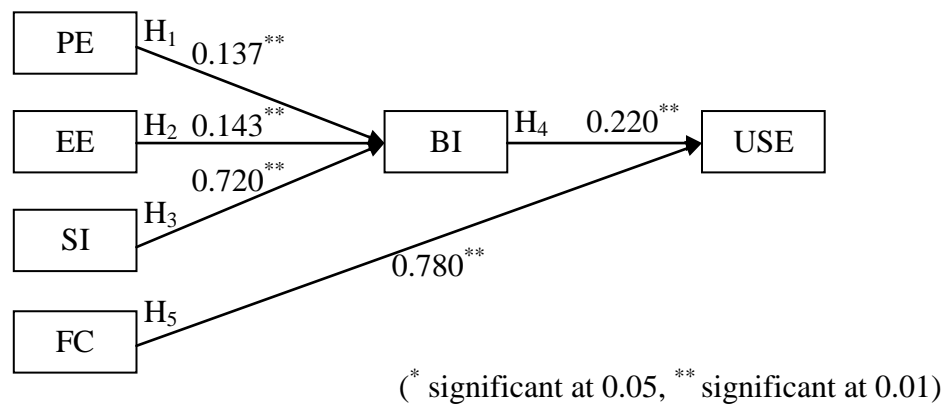


Figure 4.3 Main structural model of UTAUT-based GPS acceptance model

The factor loading of the factors affected to the behavioral intention to use GPS and the GPS use behavior. The factor loading value of PE, EE and of SI are 0.091 (or 13.725%), 0.095 (or 14.329%) and 0.477 (or 71.946%). The factor loading value of FC and BI are 0.814 (or 77.969%) and 0.230 (or 22.031%) respectively. It could indicate that, actually, which factors are more affect to the entrepreneur’s behavior. The most affective factors influenced on BI is SI. And the most affective factors influenced on GPS Use behavior is FC.

Now the main factor of the UTAUT-based GPS acceptance model was already evaluated. Every main factor, depicted in figure 4.3, was significantly affected to the GPS acceptance and use. The hypothesis testing result was presented in the next part.

4.7 SEM for main structural UTAUT-based GPS acceptance model mediated by the experience.

In this step, the mediators are added one-by-one to the main model resulted from step one (topic 4.5). The analysis results would indicate whether those mediators fit with the theoretical model. After every mediators have already tested. Found that Experience-mediated-via-FC (ExpFC) is the only one factor fit to the model. The result of model analysis was reported in table 4.19.

Table 4.19 Direct and indirect standardized effect of each structural factor influenced on the Behavioral Intention and Use Behavior.(main model with mediator)

Factors	BI			USE		
	TE	IE	DE	TE	IE	DE
BI	-	-	-	0.239** (0.029) 8.247	-	0.239** (0.029) 8.193
PE	0.097** (0.034) 2.882	-	0.097** (0.034) 2.862	0.023** (0.009) 2.719	0.023** (0.009) 2.719	-
EE	0.093** (0.032) 2.954	-	0.093** (0.032) 2.934	0.022** (0.008) 2.801	0.022** (0.008) 2.801	-
SI	0.476** (0.009) 52.881	-	0.476** (0.009) 52.529	0.113** (0.014) 8.018	0.113** (0.014) 8.018	-
FC	-	-	-	0.734** (0.033) 22.058	-	0.734** (0.034) 21.912
ExpFC	-	-	-	0.096** (0.023) 4.179	-	0.096** (0.023) 4.151
R2	0.946			0.971		

(* significant at 0.05, ** significant at 0.01)

Like the result for the main model described in part 4.5, the PE, EE and SI were still have the directed effects on BI, while BI, FC and ExpFC have the directed effects on GPS use behavior. The level of prediction accuracy was just a little better with the BI prediction accuracy level of 97.26% and USE prediction accuracy level of 98.54% respectively.

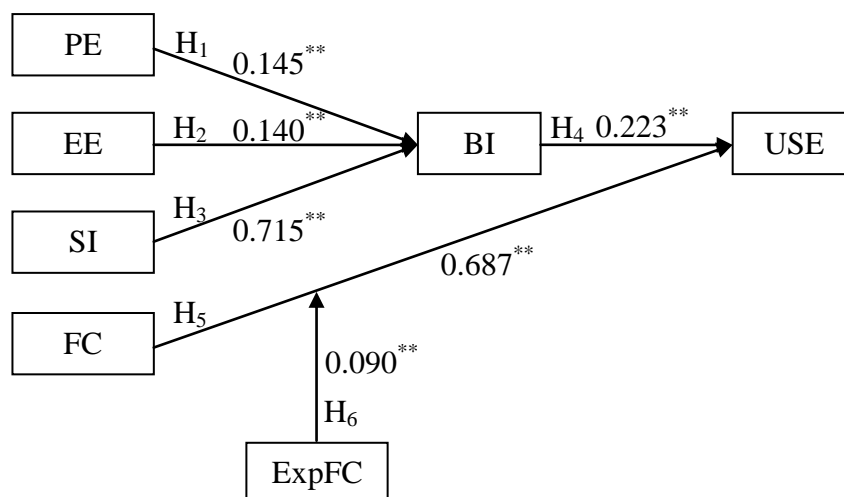
Table 4.20 Structural model fit measurement.(main model with mediator)

Fit indices	Recommended Value	Model Fit Indices Value
Chi Square	N/A	0.14
Degree of freedom (df)	N/A	2
Chi-square / df	≤ 3	0.07
p-value	≥ 0.05	0.9344
Goodness of fit index (GFI)	≥ 0.90	1.000
Adjusted GFI (AGFI)	≥ 0.80	0.999
Normed fit index (NFI)	≥ 0.90	1.000
Non-normed fit index (NNFI)	≥ 0.90	1.004
Comparative Fit index (CFI)	≥ 0.90	1.000
Root mean square residual (RMR)	≤ 0.05	0.000
Root mean square error of approximation (RMSEA)	≤ 0.08	0.000

The result in table 4.20 illustrates that every model fit indices still pass the recommendation criteria. The Chi-square/df ratio was still less than 3 (Chi-square/df = 0.07). The p-value was greater than 0.05 (p-value = 0.9344). The values of GFI, AGFI, NFI, NNFI and CFI was greater than 0.90. While the RMR and RMSEA was not exceeds 0.05 and 0.08 respectively. So we can conclude that the observed model was still fit to the theoretical model.

The factor loading of the factors affected to the behavioral intention to use GPS and the GPS use behavior. The factor loading value of PE, EE and of SI are 0.097 (or 14.565%), 0.093 (or 13.964%) and 0.476 (or 71.471%). The factor loading value of FC, BI and ExpFC are 0.734 (68.662%), 0.239 (22.357%) and 0.096 (8.980%) respectively. It could indicate that, actually, which factors are more affect to the entrepreneur's behavior. The most affective factors influenced on BI is SI. And the most affective factors influenced on GPS Use behavior is still FC.

Again for more easily understanding, the main structural model with mediator (ExpFC) was presented in figure 4.4. The model illustrates the relationships between factors and weight of each factor effect. SI still the most powerful factor influenced on BI with the factor loading of 0.476 (71.50%) while affected from PE and EE with the factor loading of 0.097 (14.50%) and 0.093 (14.00%) respectively. FC still the most powerful factor leads to the GPS use behavior with the important factor loading of 0.734 (68.662%) (just a little decrease from the pure main model). BI still affects to the use behavior with the factor loading of 0.239 (22.30%). While Exp-FC was another factor leads to the use behavior with the factor loading of 0.096 (8.980%).



(* significant at 0.05, ** significant at 0.01)

Figure 4.4 Main structural model of UTAUT-based GPS acceptance with ExpFC

4.8 SEM for mediated UTAUT-based GPS acceptance model with barrier perception effect.

For the last case, the model was tested again to find the answer that whether the barrier perception would be another one factor affected to the model or not. The barrier perception was added to the model for the tested. The Barrier perception (BP) was trialed added to the model in 7 cases. First two cases, BP was added to the model as the factor directed affected to BI and Use respectively. Then the BP was added as the mediator which has the interactive effect to the model through PE, EE, SI, FC and BI.

After the tests have already done, the best testing results indicated that BP effects to "USE" by having the positive interactive with FC. The direct and indirect standardized effect of each structural factor influenced on the Behavioral Intention and Use Behavior (add mediator and barrier perception) was reported in table 4.21.

Other factors still affect to the BI and USE in the same way they ever be. Every factors affect to the BI and BI were almost unchanged. The factors affect to the USE behavior has a little change in their weight. The Barrier Perception was significantly effects to the USE behavior in the negative way. The level of prediction accuracy of the model was just a little changed too. The level of prediction accuracy for BI and USE were 97.21% and 98.74% respectively.

Table 4.21 Direct and indirect standardized effect of each structural factor influenced on the Behavioral Intention and Use Behavior. (mediated model with barrier perception)

Factors	BI			USE		
	TE	IE	DE	TE	IE	DE
BI	-	-	-	0.227** (0.029) 7.959	0.227** (0.029) 7.959	-
USE	-	-	-	-	-	-
PE	0.096** (0.034) 2.832	-	0.096** (0.034) 2.809	0.022** (0.008) 2.666	0.022** (0.008) 2.666	-
EE	0.095** (0.032) 2.999	-	0.095** (0.032) 2.976	0.022** (0.008) 2.826	0.022** (0.008) 2.826	-
SI	0.476** (0.009) 52.887	-	0.476** (0.009) 52.464	0.108** (0.014) 7.76	0.108** (0.014) 7.76	-
FC	-	-	-	0.723** (0.032) 22.307	-	0.732** (0.033) 22.129
ExpFC	-	-	-	0.088** (0.022) 3.898	-	0.088** (0.023) 3.867
BPFC	-	-	-	-0.062** (0.016) -3.876	-	-0.062** (0.016) -3.845
R2	0.946			0.974		

(* significant at 0.05, ** significant at 0.01)

The result in table 4.22 illustrates that every model fit indices still pass the recommendation criteria. The Chi-square/df ratio was still less than 3 (Chi-square/df = 0.50). The p-value was greater than 0.05 (p-value = 0.607980). The values of GFI, AGFI, NFI, NNFI and CFI was greater than 0.90. While the RMR and RMSEA was not exceeds 0.05 and 0.08 respectively. So we can conclude that the observed model was still fit to the theoretical model.

Table 4.22 Structural model fit measurement. (mediated model with barrier perception)

Fit indices	Recommended Value	Model Fit Indices Value
Chi Square	N/A	0.320
Degree of freedom (df)	N/A	2
Chi-square / df	≤ 3	0.160000
p-value	≥ 0.05	0.851300
Goodness of fit index (GFI)	≥ 0.90	1.000000
Adjusted GFI (AGFI)	≥ 0.80	0.996000
Normed fit index (NFI)	≥ 0.90	1.000000
Non-normed fit index (NNFI)	≥ 0.90	1.004000
Comparative Fit index (CFI)	≥ 0.90	1.000000
Root mean square residual (RMR)	≤ 0.05	0.000000
Root mean square error of approximation (RMSEA)	≤ 0.08	0.000000

The factor loading of the factors affected to the behavioral intention to use GPS and the GPS use behavior. The factor loading value of PE, EE and of SI are 0.095 (or 14.222%), 0.097 (or 14.5214%) and 0.476 (or 71.257%). The factor loading value of FC, BI and ExpFC are 0.664 (68.172%), 0.232 (23.820%) and 0.078 (8.008%) respectively. And the Barrier Perception has the negative affective to the USE behavior with the weight of -7.187%. Said that the Use behavior of the entrepreneurs would be 7.187% reduced by the obstruction of the anxiety from the barriers they perceived.

Again for more easily understanding, the main structural model with mediator (ExpFC) and Barrier Perception (BP) was presented in figure 4.5. The model illustrates the relationships between factors and weight of each factor effect. SI still the most powerful factor influenced on BI with the weight of 0.713, next are the affective from PE and EE with the weight of 0.145 and 0.142 respectively. FC still the most powerful factor leads to the GPS use behavior with the important weight of 68.17%. BI still affects to the use behavior with the remained weight. While Exp-FC was another factor leads to the use behavior with the weight of 8.980%.

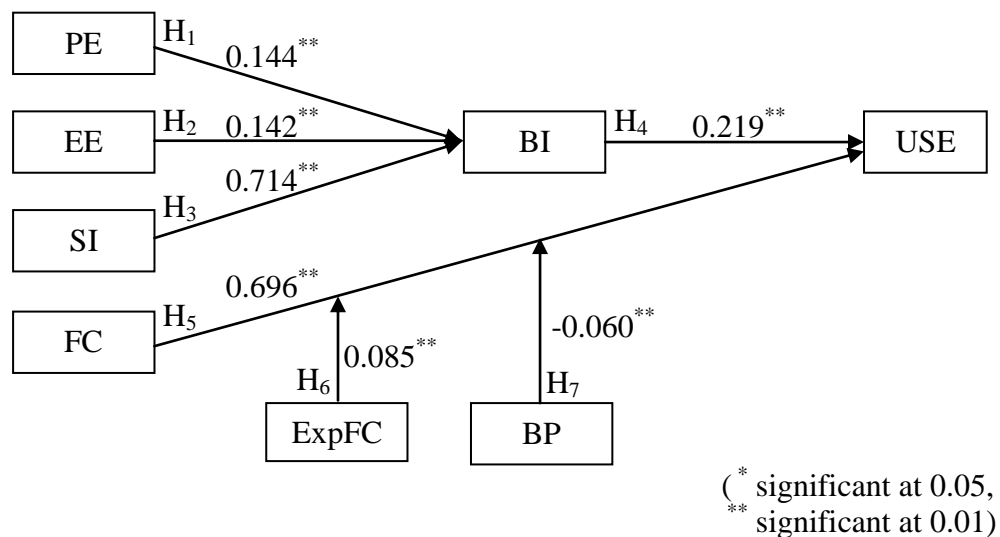


Figure 4.5 Main structural model of UTAUT-based GPS acceptance model (mediated model with barrier perception)

The hypothesis testing result for UTAUT-based GPS acceptance was reported in table 4.23.

Table 4.23 Research hypothesis for GPS acceptance factors analysis.(main model)

	Hypothesis	Result
H ₁	Performance expectancy has the positive effects to the behavioral intention of the user.	Accepted
H ₂	Effort expectancy has the positive effects to the behavioral intention of the user.	Accepted
H ₃	Social Influence has the positive effects to the behavioral intention of the user.	Accepted
H ₄	Behavioral intention to use technology has the positive effects to the GPS acceptance by the user.	Accepted
H ₅	Facilitating conditions causes the positive effects to the GPS acceptance by the user.	Accepted
H ₆	User's experience has the positive interaction effects through the facilitating conditions to the use behavior.	Accepted
H ₇	Barrier Perception has the negative interaction effects through the facilitating conditions to the use behavior.	Accepted
H ₈	Age has the positive effects to the GPS acceptance.	Rejected
H ₉	Gender has the positive effects to the GPS acceptance.	Rejected

Hypothesis evaluation result indicated that Performance Expectancy (PE), Effort Expectancy (EE) and Social Influence (SI) have the positive effects to the Behavioral Intention (BI) of the user. While Behavioral Intention (BI) and Facilitating Conditions (FC) causes the positive effect to the GPS acceptance by the user.

4.9 Factors affect to the GPS acceptance by Thai public transportation industry

The UTAUT-based GPS acceptance model was compatible with the theoretical model. GPS use behavior was affected by three groups of factor; Facilitating Conditions (FC), Behavioral Intention (BI) and the Barrier Perception (BP). FC and BI have the positive effect on the use behavior, while BP has the negative effect.

In the overall viewing, the use behavior could be explained by the BI, FC, ExpFC and BPFC. The use behavior was affected by three positive influenced factors (FC, BI and ExpFC-mediator) and one obstructive factor (BP). BI could be calculated from PE, EE and SI. The meaning of each factor has been described in chapter 3. And the measurement items for each factor has been proofed and reported in part 4.3 of this chapter. However, each factor was discussed again here for more clearly understanding in the factors affected to the GPS use behavior.

4.9.1 Facilitating Conditions (FC) and the Experience (ExpFC)

Facilitating condition (FC), the degree of which a person believes that he or she has already got the adequate supported resources or infrastructures in using that technology, has the greatest effective on the use behavior. Practically, the FC was caused by 5 issues as indicated by FC1, FC2, FC3, FC4 and FC5. Resource needed (FC1) is the greatest effective factor. Next are the User-training (FC4), Knowledge and information required (FC2), Technological Compatibility (FC3) and Help-and-advisement provided (FC5) respectively.

Said that, one most important thing the entrepreneur concerns is the resource needed for the GPS implementation. Most of the entrepreneurs have worried about the resources especially the financial resources they have to spend. They are unwilling to spend much money for the GPS implementation. That's why they request for the financial supports and the time for steps-by-steps investment. Not only financial support providing, they are big concern about using demonstration or user training provided. As well as the GPS knowledge and information accessibility, they also concern in technological compatibility and advisement provided too.

By the way, the ExpFC, the factor about the basic knowledge and experience, was absolutely support and agreeable with the FC especially in the manner of the basic knowledge and experience on using GPS. The entrepreneurs concern about the basic knowledge about the GPS, about how to use it effectively and finally the experience on using GPS.

4.9.2 Behavioral Intention (BI)

The Behavioral Intention (BI) was the intention of the entrepreneur to make the decision to accept-and-use GPS technology. The entrepreneur may intent to use GPS by their thoughts, plans or active preparation. The BI can be determined by these three antecedents; Performance Expectancy (PE), Effort Expectancy (EE) and Social Influence (SI).

Behavioral Intention (BI) was 71.30% caused by Social Influence (SI), while affected from EE and PE with the percentage of 14.50% and 14.20% respectively.

Performance expectancy (PE)

Thai public transportation entrepreneurs has perceived in every dimension of the advantages of GPS in the almost equivalent portion. The entrepreneurs think that GPS could enable them to improve their transportation fleet management, reduce traveling time, reduce business cost, increase on-time-delivery rate, improve the routing selection and selection making, and to monitor the fleet real-timely. They do know that GPS was a good navigating system.

But in practical, the entrepreneurs do not use the GPS in full capacity but implement only by some features. All of them use the GPS as the real-time tracking system (as required by governmental policies). The second most objective, they used GPS, is for the incident management and/or accidental monitoring. Thai entrepreneur still use GPS for the fleet management in the low level.

Effort Expectancy

Effort Expectancy (EE), the degree of ease of using the GPS, was determined from the simplicity of using GPS hardware (EE1), the simplicity of using GPS applications (EE2), the ease of learning for the GPS system (EE3) and the

precision and understandable information provided by GPS (EE4). The entrepreneur perceived that it is easy to use the GPS, to run the application and to train for GPS system. And the information taken from GPS is clear and understandable.

Social Influence (SI)

Social Influence (SI), the degree of which a person perceives that the others expect that he or she should use that technology, was measured by the pressures of customers (SI1), business alliances (SI2), competitors (SI4) and the government policy or supports (SI5).

The competitor has just a little influence. While the most powerful persons for the entrepreneurs were the government, the business alliances and the customer. The observe data was compatible with the information from the interviewing and the actually evidences. The government has launches the policy to let every transporters to set the GPS tracking in their serviced vehicle. BMTA and the Transportation co., ltd who are the mechanism of the department of transportation and the business alliance for every transporter, empower those policy by forces their cooperative entrepreneur. So it would be the pressure from the governmental policy that forces the entrepreneur to implement the GPS.

4.9.3 Technology Acceptance Barrier Perception (TAB perception)

Technology Acceptance Barrier Perception (TAB perception) or Barrier Perception (BP) was theoretically determined from 8 dimension of barrier perception these are financial barrier, technological barrier, time barrier, psychological barrier, sociological barrier, legislative barrier, organizational barrier and change resistance. But in practical, there are only four dimensions that significantly related to the GPS acceptance barrier perception for Thai public transportation entrepreneurs, these are Financial Barrier (25.42%), Technological Barrier (24.58%), Psychological Barrier (42.37%), and Sociological Barrier (7.63%) respectively.

Psychological barrier

Psychological barrier causes by lacking of belief in the technology. The entrepreneurs still not belief in benefits they gain from using GPS. And they still not believe in GPS quality. And they do not feel that using GPS is necessary.

Financial barrier

For the financial barrier perception, the entrepreneur does not confident in the return on the investment. They feel that investment for GPS was the expense and may unprofitable. Moreover, they have limited budget while the expense they have to loose their cash for the big amount of start-up cost and monthly service expenses.

Technological Barrier

Technological barrier defined as the difference between needed technological characteristics and infrastructure supported. It would be view as lack of skilled labor, lack of technical training and support, complexity of the system, limitation of the system.

Sociological barrier

In the view of sociological barrier, the persons who the entrepreneur worried about are the government, GPS service providers and customer privacy. For the government, they worried about the government support. The entrepreneur may need the financial supports from the government. But if they need to invest in the low cost GPS provider, they may be faced with the irresponsibility service provider. And that why the trustfulness in the GPS service provider become the anxieties.

CHAPTER V

CONCLUSION AND DISCUSSION

The acceptance model for GPS acceptance by Thai public transportation industry was compatible with the theoretical UTAUT model. Every core factors constructed in the model was significantly affects to the GPS acceptance as stated in the UTAUT theory.

FC is the most important affected to the GPS use behavior. Next is the Behavioral Intention (BI). Exp-FC and BP has a little effect.

In the manner of Facilitating Condition (FC) and Experience (Exp-FC), the Exp-FC was totally supported and agreed with the FC. The entrepreneur was mostly concern and worry about the resource needed for the GPS implementation, especially the financial resources, they have to spend. They are unwilling to spend much money for the GPS implementation. Not only the financial supports, the other issues, they concern, are about user training provided and the GPS knowledge, information accessibility, technological compatibility and advisement provided as well. So, in order to convey the entrepreneur to implement GPS, Loan for investment or any financial supports were the most wanted. The user guidance, training, demonstration or trialed-training were the advantageous and effective activities. Because it does not only lead the entrepreneur to make decision to implement the GPS but it will enable them to gain more benefits from using GPS for the fleet management or transportation planning also.

The Behavioral Intention (BI), the intention of the entrepreneur to make the decision to accept-and-use GPS technology, could be determined by Performance Expectancy (PE), Effort Expectancy (EE) and Social Influence (SI). BI for Thai public transportation entrepreneurs was mainly caused by Social Influence (SI), while EE and PE stay the miner components.

For the Performance Expectancy, the entrepreneurs perceive that GPS could enable them to improve their transportation fleet management, reduce traveling time, reduce business cost, increase on-time-delivery rate, improve the routing

selection and selection making, and to monitor the fleet real-timely. They also know that GPS was a good navigating system. But in practical, the entrepreneurs do not use the GPS in full capacity but implement only by some features. All of them use the GPS as the real-time tracking system (as required by governmental policies). The second most objective, they used GPS, is for the incident management and/or accidental monitoring. Thai entrepreneur still not much use GPS for the fleet management.

Effort Expectancy (EE), the degree of ease of using the GPS, was determined from the simplicity of using GPS hardware, the simplicity of using GPS applications, the ease of learning for the GPS system and the precision and understandable information provided by GPS. And The entrepreneur perceived that it is easy to use the GPS, to the run the application and to train for GPS system. And the information taken from GPS is clear and understandable.

Social Influence (SI), the degree of which a person perceives that the others expect that he or she should use that technology, was measured by the pressures from customers, business alliances, competitors and the government policy or supports. The competitor has just a little influence. The government has launches the policy to let every transporters to set the GPS tracking in their serviced vehicle. BMTA and the Transportation co., Ltd who are the mechanisms of the department of transportation and the business alliance for every transporter, empower those policy by practically forces their cooperative entrepreneur. So it would be the pressure from the governmental policy that forces the entrepreneur to implement the GPS. However, the entrepreneurs were only forced to implement the GPS tracking systems which could enable the user to knows the position of their vehicles real-timely and could enable the user for the incident monitoring and management. That's why most of the entrepreneurs use GPS only for the fleet monitoring, not for the business management reasons.

Technology Acceptance Barrier Perception (TAB perception) or Barrier Perception (BP) was theoretically determined from 8 dimension of barrier perception these are financial barrier, technological barrier, time barrier, psychological barrier, sociological barrier, legislative barrier, organizational barrier and change resistance.

In practical, the barrier perception comes from Financial Barrier, Technological Barrier, Psychological Barrier and Sociological Barrier, that significantly related to the GPS acceptance barrier perception for Thai public transportation entrepreneurs. The entrepreneur was not confident in the benefits they gain from implementing GPS. The entrepreneurs do not believe in GPS quality. Though, they think that using GPS could decrease the risk from accidents and crimes, but they still feel that using GPS is unnecessary. But they are not sure in the return on the investment. Moreover, they have limited budget but they have to pay for the big amount of start-up cost and monthly service expenses.

The GPS acceptance by Thai public transportation entrepreneur was mainly influenced by the facilitating condition while the government was the powerful person for the decision making of the entrepreneur. To achieve the goal for the conveying the entrepreneurs to implement the GPS, the government would be the very important and powerful person to make it success. The methods to make it success are by using legislative-force, providing the financial support and promoting the GPS benefit altogether.

Because the intention to use GPS of the entrepreneur was mainly positive influence by the budget and knowledge about GPS the first things to do is to let them exactly know the advantage of GPS especially for the business management, service improvement and the cost reduction issues.

If the entrepreneurs use the GPS just only for the tracking systems, they will find that there is only the risk management they gain from GPS. Therefore the return on the investment would be unclear. And therefore the entrepreneur still unconfident in the ROI or feel that it was only the unprofitable investment. Finally, they would lose their money with the unwillingness to use the GPS. So we must let the entrepreneur gain financial benefit from using GPS not only cost saving or risk management.

To success in conveying the entrepreneur to use GPS are the following method altogether.

1. The government should use the legislative mechanism to established rules or laws to forces the entrepreneur to implement the GPS within the appropriate period of time. (Already implemented in present)

2. The government should provide the investment supports for the entrepreneur altogether. (needed by the entrepreneur but still not any support provided)
3. Set up the seminar projects to give the knowledge about GPS to the entrepreneur, especially in the following topics.
 - a. GPS using for the better service and management
 - b. How the business cost should be reduced by implementing the GPS.
 - c. Benefit-cost-comparison for the GPS implementation project.
 - d. Demonstration or give them an experience on using GPS let the entrepreneur try using GPS for business control and management.

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APPENDICES

APPENDIX A

RESEARCH QUESTIONNAIRES



แบบสอบถามเพื่อการวิจัย

เรื่อง ปัจจัยที่นำไปสู่การยอมรับและใช้ระบบบอกพิกัดหรือระบุตำแหน่งบนพื้นพิภพ
(Global Positioning Systems; GPS) ในอุตสาหกรรมการขนส่งสาธารณะของไทย

เรียน ท่านผู้ตอบแบบสอบถาม

แบบสอบถามนี้เป็นส่วนหนึ่งของการทำวิทยานิพนธ์ในระดับปริญญาโท สาขาวิชาวิศวกรรมศาสตรอุตสาหกรรม คณะวิศวกรรมศาสตร์ มหาวิทยาลัยมหิดล ในหัวข้อวิจัยเรื่อง "ปัจจัยที่นำไปสู่การยอมรับและใช้ระบบบอกพิกัดหรือระบุตำแหน่งบนพื้นพิภพ (GPS) ในอุตสาหกรรมการขนส่งมวลชนของไทย" เพื่อสำรวจความคิดเห็นเกี่ยวกับการใช้บริการระบบ GPS ทุกคำตอบของท่านมีค่าอย่างยิ่งต่อวิจัย ข้อมูลที่สมบูรณ์และตรงตามความเป็นจริง จะนำไปสู่ผลงานวิจัยที่ถูกต้อง และนำไปสู่การปรับปรุงบริการด้านเทคโนโลยี GPS ต่ออุตสาหกรรมการขนส่งของประเทศไทย ผู้วิจัยจึงใคร่ขอความอนุเคราะห์จากท่าน โปรดตอบแบบสอบถามอย่างรอบคอบให้ครบทุกข้อ ผู้วิจัยจะเก็บข้อมูลของท่านไว้เป็นความลับ และข้อมูลดังกล่าวจะถูกใช้เพื่อประโยชน์ทางการศึกษาเท่านั้น

หมายเหตุ

แบบสอบถามนี้แบ่งออกเป็น 4 ตอน

- ตอนที่ 1 การสอบถามข้อมูลเกี่ยวกับข้อมูลทั่วไปของผู้ตอบแบบสอบถาม
- ตอนที่ 2 การสอบถามข้อมูลเกี่ยวกับปัจจัยที่มีผลต่อการตัดสินใจในระบบ GPS มาใช้ในการขนส่ง
- ตอนที่ 3 ประเมินประโยชน์ที่ได้รับจากการใช้งานระบบ GPS
- ตอนที่ 4 คำถามเกี่ยวกับอุปสรรคในการนำ GPS มาใช้

แบบสอบถามส่วนที่ 1 เป็นแบบสอบถามลักษณะตรวจสอบรายการ (Check List) และแบบสอบถามส่วนที่ 2 3 และ 4 เป็นแบบสอบถามลักษณะมาตราส่วนประเมินค่า (Ranking Scale)

ขอขอบพระคุณในความอนุเคราะห์ของท่านมา ณ โอกาสนี้

ด้วยความเคารพอย่างสูง

นายกิตติภักดิ์ สัทธิตสมบุญ

นักศึกษาระดับปริญญาโท สาขาวิชาวิศวกรรมศาสตรอุตสาหกรรม

คณะวิศวกรรมศาสตร์ มหาวิทยาลัยมหิดล

ตอนที่ 1 ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม

1. เพศ ชาย หญิง
2. อายุ ปี
3. ผู้ประกอบการ รถประจำทาง,รถทัวร์ (ขสมก., บ.ข.ส.)
 รถตู้ (ขสมก., บ.ข.ส.)
 รถแท็กซี่ (สหกรณ์, บริษัท, ส่วนบุคคล)

ตอนที่ 2 ปัจจัยที่มีผลต่อการตัดสินใจนำระบบ GPS มาใช้

Item	ปัจจัยที่มีผลต่อการตัดสินใจนำระบบ GPS มาใช้ คำถาม	ระดับคะแนน				
		5	4	3	2	1
	ประโยชน์ที่คาดว่าจะได้รับจากระบบ GPS					
PE1	GPS ช่วยให้บริหารจัดการการขนส่งได้ดีขึ้น (ดีขึ้น = 5 >> ไม่ดีขึ้น = 1)	5	4	3	2	1
PE2	GPS ช่วยลดระยะเวลาในการเดินทางได้ (ช่วยได้ = 5 >> ช่วยไม่ได้ = 1)	5	4	3	2	1
PE3	GPS ช่วยให้ค่าใช้จ่ายในการเดินทางต่ำลง (ต่ำลง = 5 >> ไม่ต่ำลง = 1)	5	4	3	2	1
PE4	GPS ช่วยให้การขนส่งตรงต่อเวลาขึ้น (ช่วยได้ = 5 >> ช่วยไม่ได้ = 1)	5	4	3	2	1
PE5	GPS ช่วยนำทางไปสู่จุดหมายได้โดยไม่หลง (ช่วยได้ = 5 >> ช่วยไม่ได้ = 1)	5	4	3	2	1
PE6	GPS ช่วยให้ท่านเลือกเส้นทางการเดินทางที่ดีที่สุดได้ (ช่วยได้ = 5 >> ช่วยไม่ได้ = 1)	5	4	3	2	1
PE7	GPS ช่วยระบุตำแหน่งรถ และพฤติกรรมการขับขี่แบบ real time (ได้=5 >> ไม่ได้=1)	5	4	3	2	1
	ระบบ GPS ใช้งานง่าย หรือสะดวกเพียงใด					
EE1	อุปกรณ์ GPS ใช้งานได้ง่าย (ง่าย 5.....>>...ยาก 1)	5	4	3	2	1
EE2	โปรแกรมประยุกต์ต่างๆของระบบ GPS ใช้งานง่าย (ง่าย 5>>ยาก 1)	5	4	3	2	1
EE3	ท่านสามารถเรียนรู้วิธีการใช้งานระบบ GPS ได้ง่าย (ง่าย 5.....>>...ยาก 1)	5	4	3	2	1
EE4	ระบบ GPS ให้ข้อมูลที่ชัดเจนและเข้าใจได้ง่าย (เห็นด้วย = 5 >> ไม่เห็นด้วย=1)	5	4	3	2	1
	ผู้อื่น (เช่น ผู้ว่าจ้าง คู่แข่ง ฯลฯ) มีอิทธิพลต่อการยอมรับ GPS เพียงใด					
SI1	ลูกค้าต้องการให้ข้าพเจ้าใช้ GPS เพียงใด (มาก = 5 >> น้อย = 1)	5	4	3	2	1
SI2	พันธมิตรทางธุรกิจต้องการให้ข้าพเจ้านำระบบ GPS มาใช้ (มาก=5 >> น้อย=1)	5	4	3	2	1
SI3	ผู้รับช่วงขนส่งนำ GPS มาใช้แล้ว ข้าพเจ้าจึงต้องการใช้ GPS บ้าง (มาก=5 >> น้อย=1)	5	4	3	2	1
SI4	การที่คู่แข่ง หรือบริษัทคู่แข่ง มีการนำระบบ GPS มาใช้ (มาก = 5 >> น้อย = 1)	5	4	3	2	1
SI5	นโยบายภาครัฐ ต้องการให้ข้าพเจ้านำระบบ GPS มาใช้ (มาก = 5 >> น้อย = 1)	5	4	3	2	1

ตอนที่ 2 ปัจจัยที่มีผลต่อการตัดสินใจนำระบบ GPS มาใช้ (ต่อ)

Item	ปัจจัยที่มีผลต่อการตัดสินใจนำระบบ GPS มาใช้ คำถาม	ระดับคะแนน				
		5	4	3	2	1
	ความสนใจในการนำระบบ GPS มาใช้					
VO1	ท่านเต็มใจนำระบบ GPS มาใช้ แม้จะ ไม่มีใครเรียกร้องหรือบังคับ	5	4	3	2	1
VO2	ท่านเต็มใจนำระบบ GPS มาใช้ แม้จะรู้ว่าถึงไม่ใช้ก็ไม่ได้ทำให้การบริการบกพร่อง	5	4	3	2	1
VO3	การตัดสินใจใช้หรือไม่ใช้ ไม่ได้เกิดจากกฎหมาย ระเบียบ หรือข้อบังคับ	5	4	3	2	1
	ความตั้งใจในการนำระบบ GPS มาใช้					
BI1	ท่านมีความตั้งใจจะนำ GPS มาใช้ ในไม่ช้านี้	5	4	3	2	1
BI2	ท่านคาดว่าจะนำ GPS มาใช้ในอนาคต	5	4	3	2	1
BI3	ท่านได้วางแผนจะนำระบบ GPS มาใช้แล้ว	5	4	3	2	1
BI4	ท่านมีการศึกษาและเตรียมตัวจะนำระบบ GPS มาใช้แล้ว	5	4	3	2	1
	ปัจจัยสนับสนุนหรือสิ่งอำนวยความสะดวกอื่นๆ ที่มีผลต่อการตัดสินใจนำระบบ GPS มาใช้					
FC1	ท่านมีทรัพยากรเพียงพอสำหรับการนำ GPS มาใช้	5	4	3	2	1
FC2	ท่านมีความรู้เพียงพอสำหรับการนำ GPS มาใช้	5	4	3	2	1
FC3	ระบบ GPS ทำงานร่วมกับอุปกรณ์หรือระบบต่างๆ ที่มีอยู่เดิมได้	5	4	3	2	1
FC4	พนักงานสามารถใช้งานระบบ GPS ได้	5	4	3	2	1
FC5	สามารถค้นหาความรู้หรือคำแนะนำเพิ่มเติมเกี่ยวกับระบบ GPS ได้	5	4	3	2	1
	ความรู้พื้นฐานและประสบการณ์ในการใช้งานระบบ GPS					
Exp1	ท่านมีความรู้ หรือรู้จักระบบ GPS เป็นอย่างดี	5	4	3	2	1
Exp2	ท่านเข้าใจวิธีการใช้งานระบบ GPS เป็นอย่างดี	5	4	3	2	1
Exp3	ท่านเคยใช้ระบบ GPS มาแล้ว (เคยใช้นานแล้ว 5 ..>>.. ไม่เคย 1)	5	4	3	2	1

ตอนที่ 3 ประเมินระดับการใช้งานระบบ GPS (จากประโยชน์ที่ได้รับ)

Item	ระดับการใช้งานระบบ GPS (ประเมินจากประโยชน์ที่ได้รับ) คำถาม	ระดับคะแนน				
		5	4	3	2	1
	Real Time Tracking					
RT	ท่านสามารถติดตามความเคลื่อนไหวของรถฯ ณ เวลาปัจจุบัน (Real Time)	5	4	3	2	1
	Incident Management and monitoring					
MM1	ท่านสามารถบันทึกข้อมูลและควบคุมพฤติกรรมจราจรของพนักงานขับรถ	5	4	3	2	1
MM2	ท่านสามารถบันทึกข้อมูลสภาพการใช้งานรถฯ (สภาพเครื่องยนต์) ได้	5	4	3	2	1
MM3	ท่านสามารถรับทราบ และแก้ปัญหา กรณีที่เกิดอุบัติเหตุได้ทันที	5	4	3	2	1
MM4	ท่านสามารถทราบปริมาณเชื้อเพลิงที่ใช้ และปริมาณที่สมควรต้องใช้ได้	5	4	3	2	1
	Navigation					
NAV	ระบบ GPS แสดงเส้นทาง (เป็นระบบนำทาง) ให้ท่านได้ดีเพียงใด	5	4	3	2	1
	Data collection and mapping of the transport infrastructure					
DCM	ท่านสามารถใช้ระบบ GPS ในการบันทึกข้อมูล เพื่อจัดทำแผนที่ วางแผนการใช้เส้นทาง วางแผนการบริการ หรือวางแผนการใช้ทรัพยากรต่างๆ ได้ดี	5	4	3	2	1

ตอนที่ 4 คำถามเกี่ยวกับอุปสรรคในการนำ GPS มาใช้

No.	ท่านคิดว่าประเด็นต่อไปนี้ เป็นอุปสรรค ต่อการตัดสินใจใช้ GPS ของท่านเพียงใด (มาก[5] >> น้อย[1])	ระดับคะแนน				
		5	4	3	2	1
1	ค่าใช้จ่ายเริ่มต้น สำหรับการติดตั้งและนำ GPS มาใช้ค่อนข้างสูง					
2	ค่าใช้จ่ายรายเดือน สำหรับบริการของ GPS ค่อนข้างสูง					
3	ไม่มั่นใจ ว่าถ้านำ GPS มาใช้แล้วจะคุ้มค่ากับการลงทุนหรือไม่					
4	มีเงินทุนจำกัด					
5	ขาดแคลนพนักงานที่ใช้งาน GPS เป็น					
6	การจัดฝึกอบรมหรือสอนพนักงานให้รู้วิธีใช้ GPS นั้นทำได้ยาก					
7	GPS ใช้งานยาก					
8	GPS ไม่ได้มีประโยชน์อย่างที่ต้องการ					
9	GPS ไม่เหมาะกับกิจการที่ทำอยู่					
10	ข้อมูลจาก GPS ไม่แน่นอน หรือไม่แม่นยำเพียงพอ					
11	ขาดแคลนเทคโนโลยีหรืออุปกรณ์พื้นฐาน เช่น คอมพิวเตอร์ อินเทอร์เน็ต					

ตอนที่ 4 คำถามเกี่ยวกับอุปสรรคในการนำ GPS มาใช้ (ต่อ)

No.	ท่านคิดว่าประเด็นต่อไปนี้ เป็นอุปสรรค ต่อการตัดสินใจใช้ GPS ของท่านเพียงใด (มาก[5] >> น้อย[1])	ระดับคะแนน				
		5	4	3	2	1
12	ต้องใช้เวลาในการจัดซื้อ GPS ก่อนชำนาน					
13	ต้องใช้เวลาในการเรียนรู้ระบบ GPS ก่อนชำนาน					
14	ต้องใช้เวลาในการติดตั้งระบบ GPS ก่อนชำนาน					
15	ไม่มั่นใจว่าระบบ GPS จะใช้การได้ดี					
16	ท่านไม่รู้สึกลอยจากแสวงหานวัตกรรมใหม่ๆมาใช้ (Self Innovativeness)					
17	ไม่มีแรงกระตุ้น หรือจูงใจ ต่อการนำ GPS มาใช้					
18	ไม่มั่นใจในผู้แทนจำหน่ายและบริการหลังการขาย					
19	ขาดมาตรการสนับสนุนจากภาครัฐ					
20	กังวลว่าการใช้ GPS อาจเป็นการรบกวนหรือกระทบต่อความรู้สึกของผู้โดยสาร					
21	กังวลว่าการใช้ GPS จะทำให้สูญเสียความเป็นส่วนตัว					
22	ความต้องการรักษาความลับทางธุรกิจ					
23	ความต้องการรักษาความลับทางเทคนิคขององค์กร					
24	วัฒนธรรมหรือลักษณะเฉพาะขององค์กรของท่าน อาจไม่เกื้อหนุนต่อการยอมรับ GPS					
25	ความสลับซับซ้อนของสายการบังคับบัญชาทำให้การตัดสินใจล่าช้า และไม่เป็นเอกภาพ					
26	การขาดการสนับสนุนจากผู้ถือหุ้น ผู้บริหารระดับสูง หรือการไม่ให้ความร่วมมือของพนักงานขับรถ					
27	การต่อต้านการนำ GPS มาใช้ขององค์กรโดยรวม					
28	การปิดกั้นการแสดงความเห็นของคนในองค์กร					
29	การปิดกั้นไม่ให้สมาชิกอื่นในองค์กรเข้ามามีส่วนร่วมในการตัดสินใจ					

APPENDIX B

IOC TEST RESULTS

Table B1: IOC test results for the questionnaires in part UTAUT.

Item	IOC test for UTAUT questionnaires. Questionnaire Item.	Expert Evaluation			IOC Score
		#1	#2	#3	
PE1	With GPS, I could better in transportation fleet management.	1	1	1	1.00
PE2	With GPS, the time used in the transportation could be shortened.	0	1	1	0.67
PE3	With GPS, I can reduce the transportation cost.	1	1	1	1.00
PE4	With GPS, the rate of on-time delivery is increase.	1	1	1	1.00
PE5	GPS provides the better navigated systems.	1	1	1	1.00
PE6	GPS provides the useful information for the best routing selection and decision making.	1	1	1	1.00
PE7	The position of vehicles and driving behavior could be real time reported by GPS.	1	1	1	1.00
EE1	GPS system is easily used.	1	1	1	1.00
EE2	GPS Application programs are easily used.	1	1	1	1.00
EE3	Learning for the GPS system use is easy for me.	1	1	1	1.00
EE4	Data and information provided by GPS are clear and easy to understand.	1	1	1	1.00
SI1	The customers think that I should use the GPS.	1	1	1	1.00
SI2	The business alliances think that I should use the GPS.	1	1	1	1.00
SI3	I feel that I should use the GPS because my sub-contractors have already used.	0	1	1	0.67
SI4	I feel that I should use the GPS because many of the competitors have already used it.	1	1	1	1.00
SI5	I feel that I should use the GPS because there are the governmental supports.	1	1	1	1.00
VO1	Though there no one requests, I intend to use the GPS.	1	1	1	1.00
VO2	Though I do know that, without GPS, my service quality never fall down, I intend to use the GPS.	1	1	1	1.00
VO3	Decision to use the GPS does not forced by any rules, laws or regulations.	1	1	1	1.00

Table B1: IOC test results for the questionnaires in part UTAUT. (cont.)

Items	IOC test for UTAUT questionnaires. Questionnaire Item	Expert Evaluation			IOC Score
		#1	#2	#3	
BI1	I intended to use the GPS in the future.	1	1	1	1.00
BI2	I think that I will use the GPS in the future.	1	1	1	1.00
BI3	I have already planned for using the GPS.	1	1	1	1.00
BI4	I have studied and prepared myself and my business to implement the GPS.	1	1	1	1.00
FC1	I have already got the resources needed for the GPS implementation.	1	1	1	1.00
FC2	I have got adequate knowledge required for implementing the GPS.	1	1	1	1.00
FC3	GPS system was compatible implemented along with the present run systems.	1	1	1	1.00
FC4	My employee can use the GPS system perfectly.	1	1	1	1.00
FC5	I can easily find the advanced knowledge or any advisement about GPS.	0	1	1	0.67
Exp1	I've already got knowledge about GPS system. (expertised 5 ..>>..never knew 1)	1	1	1	1.00
Exp2	I absolutely know how to use GPS. (expertised 5 ..>>..never knew 1)	1	1	1	1.00
Exp3	I ever use the GPS before. (expertised 5 ..>>..never use 1)	1	1	1	1.00

Table B2: IOC test results for the questionnaires in part Barrier Perception.

Items	IOC test for Technology Acceptance Barrier Perception questionnaires. Questionnaire Item	Expert Evaluation			IOC Score
		#1	#2	#3	
Fin1	I think that start up cost or first expense for using GPS is very high.	1	1	1	1.00
Fin2	I think that the GPS services monthly expenses are very high.	1	1	1	1.00
Fin3	I'm not sure in the return on the investment. (Or benefit-cost comparison	1	1	1	1.00
Fin4	I have limited budget or limited financial resources.	1	1	1	1.00
Tech1	It was shortage of skilled labor to use GPS.	1	1	1	1.00
Tech2	Technical training is not easy to be done.	1	1	1	1.00
Tech3	GPS is hard to use.	1	1	1	1.00
Tech4	GPS does not provide as much advantage as I need.	0	1	1	0.67
Tech5	GPS does not fit with my business.	1	1	1	1.00
Tech6	Data tracing from GPS is inaccurate.	1	1	1	1.00
Tech7	There are not enough basic supported technologies.	1	1	1	1.00
Time1	It takes so long time in GPS purchasing process.	1	1	1	1.00
Time2	It takes so long time in GPS system learning.	1	1	1	1.00
Time3	It takes so long time in GPS set up.	1	1	1	1.00
Psy1	I'm not sure that the GPS could work with properly function or durability.	1	1	1	1.00
Psy2	I feel that it's not necessary to trial new technology. (Lack of self innovativeness)	1	1	1	1.00
Psy3	There are nothing motivate me to use the GPS.	1	1	1	1.00
Soc1	I don't trust in the GPS service providers.	0	1	1	0.67
Soc2	There are no (or not enough) government supported.	0	1	1	0.67
Soc3	I'm not sure whether the customer feels that using GPS would disturb their privacy or not.	1	1	1	1.00
Leg1	I might loss my privacy.	1	1	1	1.00
Leg2	My business confidences might be in danger.	1	1	1	1.00
Leg3	My business technical confidences might be in danger.	1	1	1	1.00

Table B2: IOC test results for the questionnaires in part Barrier Perception.(cont)

Items	IOC test for Technology Acceptance Barrier Perception questionnaires. Questionnaire Item	Expert Evaluation			IOC Score
		#1	#2	#3	
Org1	My business tradition or culture might resist to the GPS use.	0	1	1	0.67
Org2	The complexity of organizational hierarchy against to the decision making.	1	1	1	1.00
Org3	Lack of executive supports.	1	1	1	1.00
Chg1	Organization change resistance.	1	1	1	1.00
Chg2	The recommendations are not allowed in my company.	1	1	1	1.00
Chg3	Some stake holders are prohibited to join in the decision making.	1	1	1	1.00

APPENDIX C
RESULTS OF CRONBACH'S ALPHA TESTING FOR
UTAUT-BASED QUESTIONNAIRES

Appendix C1: UTAUT questionnaires item analysis: PE (7 items, 30 respondents)

EXAMINEES	PE1	PE2	PE3	PE4	PE5	PE6	PE7	Sum	Mean Indiv	Stdev Indiv	z- score	t- score
PERSON 1	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 2	4	4	4	4	4	4	4	28	4.00	0.00	-2.44	26
PERSON 3	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 4	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 5	5	5	5	4	5	5	5	34	4.86	0.38	0.06	51
PERSON 6	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 7	4	4	4	4	4	4	4	28	4.00	0.00	-2.44	26
PERSON 8	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 9	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 10	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 11	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 12	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 13	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 14	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 15	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 16	4	4	4	4	4	4	4	28	4.00	0.00	-2.44	26
PERSON 17	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 18	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 19	5	5	5	4	5	5	5	34	4.86	0.38	0.06	51
PERSON 20	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 21	4	4	4	4	4	4	4	28	4.00	0.00	-2.44	26
PERSON 22	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 23	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 24	5	5	5	5	5	4	4	33	4.71	0.49	-0.36	46
PERSON 25	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 26	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 27	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 28	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 29	5	5	5	5	5	5	5	35	5.00	0.00	0.47	55
PERSON 30	5	5	4	5	4	5	5	33	4.71	0.49	-0.36	46

Item Means	4.87	4.87	4.83	4.80	4.83	4.83	4.83
Item St.Devs.	0.35	0.35	0.38	0.41	0.38	0.38	0.38
Item Vars.	0.12	0.12	0.14	0.17	0.14	0.14	0.14

Sum Item Vars	0.98
Test mean	33.87
Test Std. Dev.	2.40
Test Var.	5.77
K (# Items)	30.00
K-1	29.00

Cronbach's Alpha 0.8590

Standard Error of Measurement = (Std.Dev. Of Test)(Sq. Root of 1-Cronbach's alpha)

Standard Error of Measurement = 0.90

95% C.I. for 1st person (upper limit) =	36.77
95% C. I. for 1st person (lower limit) =	33.23
95% C.I. for 10th person (upper limit) =	36.77
95% C. I. for 10th person (lower limit) =	33.23
95% C.I. for 20th person (upper limit) =	36.77
95% C. I. for 20th person (lower limit) =	33.23
95% C.I. For a person scoring at the test mean (upper limit) =	35.63
95% C.I. For a person scoring at the test mean (lower limit) =	32.10

Appendix C2: UTAUT questionnaires item analysis: EE (4 items, 30 respondents)

EXAMINEES	EE1	EE2	EE3	EE4	Sum Score	Mean Indiv	Stdev Indiv	z-score	t-score
PERSON 1	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 2	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 3	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 4	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 5	4	4	4	5	17	4.25	0.50	-0.68	43
PERSON 6	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 7	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 8	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 9	4	4	4	5	17	4.25	0.50	-0.68	43
PERSON 10	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 11	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 12	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 13	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 14	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 15	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 16	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 17	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 18	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 19	4	4	4	5	17	4.25	0.50	-0.68	43
PERSON 20	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 21	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 22	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 23	4	4	4	5	17	4.25	0.50	-0.68	43
PERSON 24	1	1	1	1	4	1.00	0.00	-4.98	0
PERSON 25	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 26	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 27	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 28	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 29	5	5	5	5	20	5.00	0.00	0.31	53
PERSON 30	5	5	5	5	20	5.00	0.00	0.31	53

Item Means	4.73	4.73	4.73	4.87
Item St.Devs.	0.78	0.78	0.78	0.73
Item Vars.	0.62	0.62	0.62	0.53

Sum Item Vars	2.38
Test mean	19.07
Test Std. Dev.	3.03
Test Var.	9.17
K (# Items)	30.00
K-1	29.00

Cronbach's Alpha 0.7657

Standard Error of Measurement = (Std.Dev. Of Test)(Sq. Root of 1-Cronbach's alpha)

Standard Error of Measurement = 1.47

95% C.I. for 1st person (upper limit) = 22.87

95% C. I. for 1st person (lower limit) = 17.13

95% C.I. for 10th person (upper limit) = 22.87

95% C. I. for 10th person (lower limit) = 17.13

95% C.I. for 20th person (upper limit) = 22.87

95% C. I. for 20th person (lower limit) = 17.13

95% C.I. For a person scoring at the test mean(upper limit) = 21.94

95% C.I. For a person scoring at the test mean(lower limit) = 16.19

Appendix C3: UTAUT questionnaires item analysis: SI (5 items, 30 respondents)

EXAMINEES	SI1	SI2	SI3	SI4	SI5	Sum Score	Mean Indiv	Stdev Indiv	z- score	t- score
PERSON 1	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 2	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 3	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 4	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 5	4	5	5	4	3	21	4.20	0.84	-1.39	36
PERSON 6	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 7	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 8	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 9	5	5	4	4	5	23	4.60	0.55	-0.48	45
PERSON 10	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 11	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 12	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 13	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 14	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 15	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 16	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 17	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 18	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 19	4	5	5	4	3	21	4.20	0.84	-1.39	36
PERSON 20	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 21	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 22	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 23	5	5	4	4	5	23	4.60	0.55	-0.48	45
PERSON 24	3	3	3	4	4	17	3.40	0.55	-3.20	18
PERSON 25	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 26	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 27	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 28	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 29	5	5	5	5	5	25	5.00	0.00	0.42	54
PERSON 30	4	4	3	3	3	17	3.40	0.55	-3.20	18

Item Means	4.83	4.90	4.80	4.77	4.77
Item St.Devs.	0.46	0.40	0.55	0.50	0.63
Item Vars.	0.21	0.16	0.30	0.25	0.39

Sum Item Vars	1.32
Test mean	24.07
Test Std. Dev.	2.21
Test Var.	4.89
K (# Items)	30.00
K-1	29.00

Cronbach's Alpha 0.7545

Standard Error of Measurement = (Std.Dev. Of Test)(Sq. Root of 1-Cronbach's alpha)

Standard Error of Measurement = 1.10

95% C.I. for 1st person (upper limit) = 27.15

95% C. I. for 1st person (lower limit) = 22.85

95% C.I. for 10th person (upper limit) = 27.15

95% C. I. for 10th person (lower limit) = 22.85

95% C.I. for 20th person (upper limit) = 27.15

95% C. I. for 20th person (lower limit) = 22.85

95% C.I. For a person scoring at the test mean (upper limit) = 26.21

95% C.I. For a person scoring at the test mean (lower limit) = 21.92

Appendix C4: UTAUT questionnaires item analysis: FC (5 items, 30 respondents)

EXAMINEES	FC1	FC2	FC3	FC4	FC5	Sum Score	Mean Indiv	Stdev Indiv	z- score	t- score
PERSON 1	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 2	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 3	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 4	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 5	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 6	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 7	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 8	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 9	4	4	5	4	5	22	4.40	0.55	-2.00	30
PERSON 10	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 11	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 12	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 13	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 14	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 15	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 16	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 17	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 18	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 19	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 20	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 21	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 22	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 23	4	4	5	4	5	22	4.40	0.55	-2.00	30
PERSON 24	3	4	5	3	4	19	3.80	0.84	-4.30	7
PERSON 25	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 26	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 27	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 28	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 29	5	5	5	5	5	25	5.00	0.00	0.31	53
PERSON 30	5	5	5	5	5	25	5.00	0.00	0.31	53

ITEM MEANS	4.87	4.90	5.00	4.87	4.97
ITEM ST.DEVS.	0.43	0.31	0.00	0.43	0.18
ITEM VARS.	0.19	0.09	0.00	0.19	0.03

SUM ITEM VARS	0.50
TEST MEAN	24.60
TEST STD. DEV.	1.30
TEST VAR.	1.70
K (# ITEMS)	30.00
K-1	29.00

Cronbach's Alpha 0.7275

Standard Error of Measurement = (Std.Dev. Of Test)(Sq. Root of 1-Cronbach's alpha)

Standard Error of Measurement = 0.68

95% C.I. for 1st person (upper limit) = 26.33

95% C. I. for 1st person (lower limit) = 23.67

95% C.I. for 10th person (upper limit) = 26.33

95% C. I. for 10th person (lower limit) = 23.67

95% C.I. for 20th person (upper limit) = 26.33

95% C. I. for 20th person (lower limit) = 23.67

95% C.I. For a person scoring at the test mean (upper limit) = 25.93

95% C.I. For a person scoring at the test mean (lower limit) = 23.27

Appendix C5: UTAUT questionnaires item analysis: BI (4 items, 30 respondents)

EXAMINEES	BI1	BI2	BI3	BI4	Sum Score	Mean Indiv	Stdev Indiv	z- score	t- score
PERSON 1	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 2	5	4	5	4	18	4.50	0.58	-0.83	42
PERSON 3	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 4	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 5	4	4	4	3	15	3.75	0.50	-2.60	24
PERSON 6	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 7	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 8	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 9	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 10	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 11	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 12	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 13	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 14	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 15	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 16	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 17	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 18	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 19	4	4	4	4	16	4.00	0.00	-2.01	30
PERSON 20	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 21	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 22	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 23	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 24	3	4	3	3	13	3.25	0.50	-3.78	12
PERSON 25	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 26	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 27	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 28	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 29	5	5	5	5	20	5.00	0.00	0.35	54
PERSON 30	5	5	5	5	20	5.00	0.00	0.35	54

ITEM MEANS	4.87	4.87	4.80
ITEM ST.DEVS.	0.43	0.35	0.55
ITEM VARS.	0.19	0.12	0.30

SUM ITEM VARS	0.61
TEST MEAN	19.40
TEST STD. DEV.	1.69
TEST VAR.	2.87
K (# ITEMS)	30.00
K-1	29.00

CRONBACH'S ALPHA 0.8140

Standard Error of Measurement = (Std.Dev. Of Test)(Sq. Root of 1-Cronbach's alpha)

Standard Error of Measurement = 0.73

95% C.I. for 1st person (upper limit) = 21.43

95% C. I. for 1st person (lower limit) = 18.57

95% C.I. for 10th person (upper limit) = 21.43

95% C. I. for 10th person (lower limit) = 18.57

95% C.I. for 20th person (upper limit) = 21.43

95% C. I. for 20th person (lower limit) = 18.57

95% C.I. For a person scoring at the test mean (upper limit) = 20.83

95% C.I. For a person scoring at the test mean (lower limit) = 17.97

Appendix C6: UTAUT questionnaires item analysis: VO (3 items, 30 respondents)

EXAMINEES	VO1	VO2	VO3	Sum Score	Mean Indiv	Stdev Indiv	z-score	t-score
PERSON 1	5	5	5	15	5.00	0.00	0.36	54
PERSON 2	5	5	5	15	5.00	0.00	0.36	54
PERSON 3	5	5	5	15	5.00	0.00	0.36	54
PERSON 4	5	5	5	15	5.00	0.00	0.36	54
PERSON 5	2	2	2	6	2.00	0.00	-3.23	18
PERSON 6	5	5	5	15	5.00	0.00	0.36	54
PERSON 7	5	5	5	15	5.00	0.00	0.36	54
PERSON 8	5	5	5	15	5.00	0.00	0.36	54
PERSON 9	5	5	5	15	5.00	0.00	0.36	54
PERSON 10	5	5	5	15	5.00	0.00	0.36	54
PERSON 11	5	5	5	15	5.00	0.00	0.36	54
PERSON 12	5	5	5	15	5.00	0.00	0.36	54
PERSON 13	5	5	5	15	5.00	0.00	0.36	54
PERSON 14	5	5	5	15	5.00	0.00	0.36	54
PERSON 15	5	5	5	15	5.00	0.00	0.36	54
PERSON 16	5	5	5	15	5.00	0.00	0.36	54
PERSON 17	5	5	5	15	5.00	0.00	0.36	54
PERSON 18	5	5	5	15	5.00	0.00	0.36	54
PERSON 19	2	2	2	6	2.00	0.00	-3.23	18
PERSON 20	5	5	5	15	5.00	0.00	0.36	54
PERSON 21	5	5	5	15	5.00	0.00	0.36	54
PERSON 22	5	5	5	15	5.00	0.00	0.36	54
PERSON 23	5	5	5	15	5.00	0.00	0.36	54
PERSON 24	4	4	4	12	4.00	0.00	-0.84	42
PERSON 25	5	5	5	15	5.00	0.00	0.36	54
PERSON 26	5	5	5	15	5.00	0.00	0.36	54
PERSON 27	5	5	5	15	5.00	0.00	0.36	54
PERSON 28	5	5	5	15	5.00	0.00	0.36	54
PERSON 29	5	5	5	15	5.00	0.00	0.36	54
PERSON 30	3	3	3	9	3.00	0.00	-2.03	30

ITEM MEANS	4.70	4.70	4.70
ITEM ST.DEVS.	0.84	0.84	0.84
ITEM VARS.	0.70	0.70	0.70

SUM ITEM VARS	1.40
TEST MEAN	14.10
TEST STD. DEV.	2.51
TEST VAR.	6.30
K (# ITEMS)	30.00
K-1	29.00

Cronbach's Alpha 0.80

Standard Error of Measurement = (Std.Dev. Of Test)(Sq. Root of 1-Cronbach's alpha)

Standard Error of Measurement = 1.11

95% C.I. for 1st person (upper limit) = 17.17

95% C. I. for 1st person (lower limit) = 12.83

95% C.I. for 10th person (upper limit) = 17.17

95% C. I. for 10th person (lower limit) = 12.83

95% C.I. for 20th person (upper limit) = 17.17

95% C. I. for 20th person (lower limit) = 12.83

95% C.I. For a person scoring at the test mean (upper limit) = 16.27

95% C.I. For a person scoring at the test mean (lower limit) = 11.93

Appendix C7: UTAUT questionnaires item analysis: Exp (3 items, 30 respondents)

EXAMINEES	BK1	BK2	Exp	Sum Score	Mean Indiv	Stdev Indiv	z-score	t-score
PERSON 1	5	5	5	15	5.00	0.00	0.49	55
PERSON 2	5	5	5	15	5.00	0.00	0.49	55
PERSON 3	5	5	5	15	5.00	0.00	0.49	55
PERSON 4	5	5	5	15	5.00	0.00	0.49	55
PERSON 5	4	4	4	12	4.00	0.00	-1.97	30
PERSON 6	5	5	5	15	5.00	0.00	0.49	55
PERSON 7	5	5	5	15	5.00	0.00	0.49	55
PERSON 8	5	5	5	15	5.00	0.00	0.49	55
PERSON 9	4	4	4	12	4.00	0.00	-1.97	30
PERSON 10	5	5	5	15	5.00	0.00	0.49	55
PERSON 11	5	5	5	15	5.00	0.00	0.49	55
PERSON 12	5	5	5	15	5.00	0.00	0.49	55
PERSON 13	5	5	5	15	5.00	0.00	0.49	55
PERSON 14	5	5	5	15	5.00	0.00	0.49	55
PERSON 15	5	5	5	15	5.00	0.00	0.49	55
PERSON 16	5	5	5	15	5.00	0.00	0.49	55
PERSON 17	5	5	5	15	5.00	0.00	0.49	55
PERSON 18	5	5	5	15	5.00	0.00	0.49	55
PERSON 19	4	4	4	12	4.00	0.00	-1.97	30
PERSON 20	5	5	5	15	5.00	0.00	0.49	55
PERSON 21	5	5	5	15	5.00	0.00	0.49	55
PERSON 22	5	5	5	15	5.00	0.00	0.49	55
PERSON 23	4	4	4	12	4.00	0.00	-1.97	30
PERSON 24	4	4	4	12	4.00	0.00	-1.97	30
PERSON 25	5	5	5	15	5.00	0.00	0.49	55
PERSON 26	5	5	5	15	5.00	0.00	0.49	55
PERSON 27	5	5	5	15	5.00	0.00	0.49	55
PERSON 28	5	5	5	15	5.00	0.00	0.49	55
PERSON 29	5	5	5	15	5.00	0.00	0.49	55
PERSON 30	4	4	4	12	4.00	0.00	-1.97	30

ITEM MEANS	4.80	4.80	4.80
ITEM ST.DEVS.	0.41	0.41	0.41
ITEM VARS.	0.17	0.17	0.17

SUM ITEM VARS	0.33
TEST MEAN	14.40
TEST STD. DEV.	1.22
TEST VAR.	1.49
K (# ITEMS)	30.00
K-1	29.00

Cronbach's Alpha 0.8046

Standard Error of Measurement = (Std.Dev. Of Test)(Sq. Root of 1-Cronbach's alpha)

Standard Error of Measurement = 0.54

95% C.I. for 1st person (upper limit) = 16.06

95% C. I. for 1st person (lower limit) = 13.94

95% C.I. for 10th person (upper limit) = 16.06

95% C. I. for 10th person (lower limit) = 13.94

95% C.I. for 20th person (upper limit) = 16.06

95% C. I. for 20th person (lower limit) = 13.94

95% C.I. For a person scoring at the test mean (upper limit) = 15.46

95% C.I. For a person scoring at the test mean (lower limit) = 13.34

Appendix C8: UTAUT questionnaires item analysis: Overall questionnaires (3 items, 30 respondents)

UTAUT Construct	Cronbach's Alpha	Number of Items
Performance Expectancy	0.8590	7
Effort Expectancy	0.7657	4
Social Influency	0.7545	5
Facilitating Condition	0.7275	5
Behavioral Intention to use	0.8140	4
Voluntariness of use	0.8046	3
Knowledge and Experience	0.8046	3
Overall Cronbach's Alpha	0.9526	31

APPENDIX D

RESULTS OF CRONBACH'S ALPHA TESTING FOR

TECHNOLOGY ACCEPTANCE BARRIER PERCEPTION

QUESTIONNAIRES

Appendix D1: TAB perception questionnaires item analysis: Financial Barrier Perceptions (4 items, 30 respondents)

EXAMINEES	Fin1	Fin2	Fin3	Fin4	Sum Score	Mean Indiv	Stdev Indiv	z-score	t-score
PERSON 1	5	4	5	5	19	4.75	0.50	0.96	60
PERSON 2	5	4	5	5	19	4.75	0.50	0.96	60
PERSON 3	5	4	5	5	19	4.75	0.50	0.96	60
PERSON 4	5	3	5	5	18	4.50	1.00	0.64	56
PERSON 5	5	3	5	5	18	4.50	1.00	0.64	56
PERSON 6	5	4	5	5	19	4.75	0.50	0.96	60
PERSON 7	5	5	5	5	20	5.00	0.00	1.27	63
PERSON 8	5	4	5	5	19	4.75	0.50	0.96	60
PERSON 9	5	4	5	5	19	4.75	0.50	0.96	60
PERSON 10	5	3	5	5	18	4.50	1.00	0.64	56
PERSON 11	4	3	4	4	15	3.75	0.50	-0.32	47
PERSON 12	3	2	3	4	12	3.00	0.82	-1.27	37
PERSON 13	3	3	3	3	12	3.00	0.00	-1.27	37
PERSON 14	4	2	4	4	14	3.50	1.00	-0.64	44
PERSON 15	4	3	4	4	15	3.75	0.50	-0.32	47
PERSON 16	4	2	3	4	13	3.25	0.96	-0.96	40
PERSON 17	5	3	5	5	18	4.50	1.00	0.64	56
PERSON 18	5	3	5	5	18	4.50	1.00	0.64	56
PERSON 19	3	2	3	4	12	3.00	0.82	-1.27	37
PERSON 20	5	3	5	5	18	4.50	1.00	0.64	56
PERSON 21	4	2	4	4	14	3.50	1.00	-0.64	44
PERSON 22	4	3	4	4	15	3.75	0.50	-0.32	47
PERSON 23	5	4	5	5	19	4.75	0.50	0.96	60
PERSON 24	3	2	3	3	11	2.75	0.50	-1.59	34
PERSON 25	4	3	3	4	14	3.50	0.58	-0.64	44
PERSON 26	3	2	3	4	12	3.00	0.82	-1.27	37
PERSON 27	5	5	5	5	20	5.00	0.00	1.27	63
PERSON 28	3	2	3	3	11	2.75	0.50	-1.59	34
PERSON 29	5	3	5	5	18	4.50	1.00	0.64	56
PERSON 30	3	2	3	3	11	2.75	0.50	-1.59	34

ITEM MEANS	4.30	3.07	4.23	4.40
ITEM ST.DEVS.	0.84	0.91	0.90	0.72
ITEM VARS.	0.70	0.82	0.81	0.52
SUM ITEM VARS		2.85		
TEST MEAN		16.00		
TEST STD. DEV.		3.14		
TEST VAR.		9.86		
K (# ITEMS)		30.00		
K-1		29.00		

CRONBACH'S

ALPHA 0.7352

Standard Error of Measurement = (Std.Dev. Of Test)(Sq. Root of 1-Cronbach's alpha)

Standard Error of Measurement = 1.62

95% C.I. for 1st person (upper limit) = 22.17

95% C. I. for 1st person (lower limit) = 15.83

95% C.I. for 10th person (upper limit) = 21.17

95% C. I. for 10th person (lower limit) = 14.83

95% C.I. for 20th person (upper limit) = 21.17

95% C. I. for 20th person (lower limit) = 14.83

95% C.I. For a person scoring at the test mean (upper limit) = 19.17

95% C.I. For a person scoring at the test mean (lower limit) = 12.83

Appendix D2: TAB perception questionnaires item analysis: Technical Barrier Perceptions (7 items, 30 respondents).

Examinees	Tech 1	Tech 2	Tech 3	Tech 4	Tech 5	Tech 6	Tech 7	Sum score	Mean Individ	Stdev Individ	z-score	t-score
Person 1	2	2	2	4	5	1	1	17	2.43	1.51	0.22	52
Person 2	3	2	1	5	5	1	1	18	2.57	1.81	0.47	55
Person 3	2	3	3	5	4	2	2	21	3.00	1.15	1.21	62
Person 4	3	1	1	3	1	1	1	11	1.57	0.98	-1.26	37
Person 5	2	2	2	4	4	1	1	16	2.29	1.25	-0.02	50
Person 6	2	2	2	4	5	1	1	17	2.43	1.51	0.22	52
Person 7	3	2	1	5	5	1	1	18	2.57	1.81	0.47	55
Person 8	2	3	3	5	4	2	2	21	3.00	1.15	1.21	62
Person 9	2	2	2	4	5	1	1	17	2.43	1.51	0.22	52
Person 10	3	2	1	5	5	1	1	18	2.57	1.81	0.47	55
Person 11	2	3	3	5	4	2	2	21	3.00	1.15	1.21	62
Person 12	3	1	1	3	1	1	1	11	1.57	0.98	-1.26	37
Person 13	2	2	2	4	4	1	1	16	2.29	1.25	-0.02	50
Person 14	2	2	2	4	5	1	1	17	2.43	1.51	0.22	52
Person 15	3	2	3	5	5	1	1	20	2.86	1.68	0.96	60
Person 16	2	3	3	5	4	2	2	21	3.00	1.15	1.21	62
Person 17	2	2	2	4	5	1	1	17	2.43	1.51	0.22	52
Person 18	3	2	2	5	5	1	1	19	2.71	1.70	0.72	57
Person 19	2	2	2	4	5	1	1	17	2.43	1.51	0.22	52
Person 20	2	3	3	5	4	2	2	21	3.00	1.15	1.21	62
Person 21	2	2	2	4	5	1	1	17	2.43	1.51	0.22	52
Person 22	3	2	1	5	5	1	1	18	2.57	1.81	0.47	55
Person 23	2	2	2	4	5	1	1	17	2.43	1.51	0.22	52
Person 24	2	1	1	2	1	1	1	9	1.29	0.49	-1.75	32
Person 25	1	1	1	1	1	1	1	7	1.00	0.00	-2.25	28
Person 26	2	1	1	2	1	1	1	9	1.29	0.49	-1.75	32
Person 27	1	1	1	3	2	1	1	10	1.43	0.79	-1.51	35
Person 28	2	1	1	2	2	1	1	10	1.43	0.53	-1.51	35
Person 29	2	2	2	4	4	1	1	16	2.29	1.25	-0.02	50
Person 30	2	2	2	4	4	1	1	16	2.29	1.25	-0.02	50

Item Means	2.20	1.93	1.83	3.97	3.83	1.17	1.17
Item St.Dev	0.55	0.64	0.75	1.10	1.51	0.38	0.38
Item Vars	0.30	0.41	0.56	1.21	2.28	0.14	0.14

Sum Item VARS	5.0448
TEST MEAN	16.1000
TEST STD. DEV.	4.0459
TEST VAR.	16.3690
K (# ITEMS)	30.0000
K-1	29.0000

CRONBACH'S ALPHA 0.7157

Standard Error of Measurement = (Std.Dev. Of Test)(Sq. Root of 1-Cronbach's alpha)

Standard Error of Measurement = 2.16

95% C.I. for 1st person (upper limit) =	21.23
95% C. I. for 1st person (lower limit) =	12.77
95% C.I. for 10th person (upper limit) =	22.23
95% C. I. for 10th person (lower limit) =	13.77
95% C.I. for 20th person (upper limit) =	25.23
95% C. I. for 20th person (lower limit) =	16.77
95% C.I. For a person scoring at the test mean (upper limit) =	20.33
95% C.I. For a person scoring at the test mean (lower limit) =	11.87

Appendix D3: TAB perception questionnaires item analysis: Time Barrier Perceptions

(3 items, 30 respondents).

EXAMINEES	Time 1	Time 2	Time 3	Sum Score	Mean Indiv	Stdev Indiv	z-score	t-score
PERSON 1	4	3	3	10	3.33	0.58	1.77	68
PERSON 2	3	2	2	7	2.33	0.58	0.28	53
PERSON 3	3	2	1	6	2.00	1.00	-0.22	48
PERSON 4	5	4	4	13	4.33	0.58	3.26	83
PERSON 5	3	1	2	6	2.00	1.00	-0.22	48
PERSON 6	2	3	1	6	2.00	1.00	-0.22	48
PERSON 7	2	2	2	6	2.00	0.00	-0.22	48
PERSON 8	3	2	1	6	2.00	1.00	-0.22	48
PERSON 9	2	1	1	4	1.33	0.58	-1.21	38
PERSON 10	3	2	2	7	2.33	0.58	0.28	53
PERSON 11	3	1	1	5	1.67	1.15	-0.71	43
PERSON 12	3	2	2	7	2.33	0.58	0.28	53
PERSON 13	3	3	1	7	2.33	1.15	0.28	53
PERSON 14	3	2	2	7	2.33	0.58	0.28	53
PERSON 15	3	2	2	7	2.33	0.58	0.28	53
PERSON 16	2	1	1	4	1.33	0.58	-1.21	38
PERSON 17	3	2	2	7	2.33	0.58	0.28	53
PERSON 18	3	1	1	5	1.67	1.15	-0.71	43
PERSON 19	2	2	2	6	2.00	0.00	-0.22	48
PERSON 20	2	1	1	4	1.33	0.58	-1.21	38
PERSON 21	2	1	1	4	1.33	0.58	-1.21	38
PERSON 22	3	2	2	7	2.33	0.58	0.28	53
PERSON 23	4	3	3	10	3.33	0.58	1.77	68
PERSON 24	3	2	2	7	2.33	0.58	0.28	53
PERSON 25	2	1	1	4	1.33	0.58	-1.21	38
PERSON 26	2	2	1	5	1.67	0.58	-0.71	43
PERSON 27	3	2	2	7	2.33	0.58	0.28	53
PERSON 28	2	1	1	4	1.33	0.58	-1.21	38
PERSON 29	3	2	2	7	2.33	0.58	0.28	53
PERSON 30	3	3	2	8	2.67	0.58	0.78	58

Item Means	2.80	1.93	1.70
Item St.Devs.	0.71	0.78	0.75
Tem Vars.	0.51	0.62	0.56

SUM ITEM VARS	1.13
TEST MEAN	6.43
TEST STD. DEV.	2.01
TEST VAR.	4.05
K (# ITEMS)	30.00
K-1	29.00

Cronbach's Alpha 0.75

Standard Error of Measurement= (Std.Dev.Of Test)(Sq.Root of 1-Cronbach's alpha)
 Standard Error of Measurement= 1.01

95% C.I. for 1st person (upper limit) = 11.99

95% C. I. for 1st person (lower limit) = 8.01

95% C.I. for 10th person (upper limit) = 8.99

95% C. I. for 10th person (lower limit) = 5.01

95% C.I. for 20th person (upper limit) = 5.99

95% C. I. for 20th person (lower limit) = 2.01

95% C.I. For a person scoring at the test mean (upper limit) = 8.42

95% C.I. For a person scoring at the test mean (lower limit) = 4.45

Appendix D4: TAB perception questionnaires item analysis: Psychological Barrier Perceptions (3 items, 30 respondents).

EXAMINEES	Psy1	Psy2	Psy3	SUM SCORE	MEAN INDIV	STDEV INDIV	z-score	t-score
PERSON 1	3	3	3	9	3.00	0.00	-0.08	49
PERSON 2	4	5	5	14	4.67	0.58	1.48	65
PERSON 3	1	4	4	9	3.00	1.73	-0.08	49
PERSON 4	1	3	3	7	2.33	1.15	-0.71	43
PERSON 5	1	3	2	6	2.00	1.00	-1.02	40
PERSON 6	3	3	3	9	3.00	0.00	-0.08	49
PERSON 7	4	5	5	14	4.67	0.58	1.48	65
PERSON 8	1	4	4	9	3.00	1.73	-0.08	49
PERSON 9	1	3	3	7	2.33	1.15	-0.71	43
PERSON 10	4	5	5	14	4.67	0.58	1.48	65
PERSON 11	1	4	4	9	3.00	1.73	-0.08	49
PERSON 12	1	3	3	7	2.33	1.15	-0.71	43
PERSON 13	1	3	2	6	2.00	1.00	-1.02	40
PERSON 14	3	3	3	9	3.00	0.00	-0.08	49
PERSON 15	4	5	5	14	4.67	0.58	1.48	65
PERSON 16	1	4	4	9	3.00	1.73	-0.08	49
PERSON 17	1	3	3	7	2.33	1.15	-0.71	43
PERSON 18	4	5	5	14	4.67	0.58	1.48	65
PERSON 19	1	4	4	9	3.00	1.73	-0.08	49
PERSON 20	4	5	5	14	4.67	0.58	1.48	65
PERSON 21	1	3	3	7	2.33	1.15	-0.71	43
PERSON 22	4	5	5	14	4.67	0.58	1.48	65
PERSON 23	1	4	4	9	3.00	1.73	-0.08	49
PERSON 24	4	5	5	14	4.67	0.58	1.48	65
PERSON 25	1	3	2	6	2.00	1.00	-1.02	40
PERSON 26	1	1	1	3	1.00	0.00	-1.96	30
PERSON 27	1	3	3	7	2.33	1.15	-0.71	43
PERSON 28	1	3	3	7	2.33	1.15	-0.71	43
PERSON 29	1	3	2	6	2.00	1.00	-1.02	40
PERSON 30	3	3	3	9	3.00	0.00	-0.08	49

ITEM MEANS	2.07	3.67	3.53
ITEM ST.DEVS.	1.36	0.99	1.14
ITEM VARS.	1.86	0.99	1.29

SUM ITEM VARS	2.85
TEST MEAN	9.27
TEST STD. DEV.	3.20
TEST VAR.	10.27
K (# ITEMS)	30.00
K-1	29.00

Cronbach's Alpha 0.75

Standard Error of Measurement = (Std.Dev. Of Test)(Sq. Root of 1-Cronbach's alpha)

Standard Error of Measurement = 1.61

95% C.I. for 1st person (upper limit) = 12.15

95% C. I. for 1st person (lower limit) = 5.85

95% C.I. for 10th person (upper limit) = 17.15

95% C. I. for 10th person (lower limit) = 10.85

95% C.I. for 20th person (upper limit) = 17.15

95% C. I. for 20th person (lower limit) = 10.85

95% C.I. For a person scoring at the test mean (upper limit) = 12.42

95% C.I. For a person scoring at the test mean (lower limit) = 6.11

Appendix D5: TAB perception questionnaires item analysis: Sociological Barrier Perceptions (3 items, 30 respondents).

EXAMINEES	soc1	soc2	soc3	SUM SCORE	MEAN INDIV	STDEV INDIV	z-score	t-score
PERSON 1	1	3	2	6	2.00	1.00	-2.50	25
PERSON 2	3	5	3	11	3.67	1.15	0.73	57
PERSON 3	2	4	2	8	2.67	1.15	-1.21	38
PERSON 4	3	4	2	9	3.00	1.00	-0.56	44
PERSON 5	3	5	3	11	3.67	1.15	0.73	57
PERSON 6	2	5	2	9	3.00	1.73	-0.56	44
PERSON 7	3	5	3	11	3.67	1.15	0.73	57
PERSON 8	3	5	2	10	3.33	1.53	0.09	51
PERSON 9	3	4	2	9	3.00	1.00	-0.56	44
PERSON 10	3	5	2	10	3.33	1.53	0.09	51
PERSON 11	2	5	2	9	3.00	1.73	-0.56	44
PERSON 12	3	5	2	10	3.33	1.53	0.09	51
PERSON 13	3	4	2	9	3.00	1.00	-0.56	44
PERSON 14	3	4	5	12	4.00	1.00	1.38	64
PERSON 15	3	5	3	11	3.67	1.15	0.73	57
PERSON 16	3	4	5	12	4.00	1.00	1.38	64
PERSON 17	3	4	2	9	3.00	1.00	-0.56	44
PERSON 18	3	5	3	11	3.67	1.15	0.73	57
PERSON 19	3	4	5	12	4.00	1.00	1.38	64
PERSON 20	3	5	3	11	3.67	1.15	0.73	57
PERSON 21	3	5	3	11	3.67	1.15	0.73	57
PERSON 22	3	5	3	11	3.67	1.15	0.73	57
PERSON 23	3	5	3	11	3.67	1.15	0.73	57
PERSON 24	2	5	3	10	3.33	1.53	0.09	51
PERSON 25	3	5	3	11	3.67	1.15	0.73	57
PERSON 26	2	4	2	8	2.67	1.15	-1.21	38
PERSON 27	3	5	3	11	3.67	1.15	0.73	57
PERSON 28	2	4	2	8	2.67	1.15	-1.21	38
PERSON 29	3	4	1	8	2.67	1.53	-1.21	38
PERSON 30	2	4	1	7	2.33	1.53	-1.85	31

ITEM MEANS	2.70	4.53	2.63
ITEM ST.DEVS.	0.53	0.57	1.00
ITEM VARS.	0.29	0.33	1.00

SUM ITEM VARS	0.61
TEST MEAN	9.87
TEST STD. DEV.	1.55
TEST VAR.	2.40
K (# ITEMS)	30.00
K-1	29.00

Cronbach's Alpha 0.77

Standard Error of Measurement = (Std.Dev. Of Test)(Sq. Root of 1-Cronbach's alpha)

Standard Error of Measurement = 0.74

95% C.I. for 1st person (upper limit) = 7.46

95% C. I. for 1st person (lower limit) = 4.54

95% C.I. for 10th person (upper limit) = 11.46

95% C. I. for 10th person (lower limit) = 8.54

95% C.I. for 20th person (upper limit) = 12.46

95% C. I. for 20th person (lower limit) = 9.54

95% C.I. For a person scoring at the test mean (upper limit) = 11.32

95% C.I. For a person scoring at the test mean (lower limit) = 8.41

Appendix D6: TAB perception questionnaires item analysis: Legislative Barrier Perceptions (3 items, 30 respondents).

Examinees	Legal1	Legal2	Legal3	Sum Score	Mean Indiv	Stdev Indiv	z-score	t-score
Person 1	2	2	3	7	2.33	0.58	0.77	58
Person 2	2	3	3	8	2.67	0.58	1.27	63
Person 3	3	3	3	9	3.00	0.00	1.76	68
Person 4	2	2	2	6	2.00	0.00	0.28	53
Person 5	2	1	1	4	1.33	0.58	-0.71	43
Person 6	4	4	4	12	4.00	0.00	3.24	82
Person 7	1	2	1	4	1.33	0.58	-0.71	43
Person 8	2	2	2	6	2.00	0.00	0.28	53
Person 9	1	1	1	3	1.00	0.00	-1.20	38
Person 10	1	2	1	4	1.33	0.58	-0.71	43
Person 11	2	1	1	4	1.33	0.58	-0.71	43
Person 12	3	3	3	9	3.00	0.00	1.76	68
Person 13	2	2	2	6	2.00	0.00	0.28	53
Person 14	2	2	2	6	2.00	0.00	0.28	53
Person 15	2	1	1	4	1.33	0.58	-0.71	43
Person 16	2	2	3	7	2.33	0.58	0.77	58
Person 17	1	2	1	4	1.33	0.58	-0.71	43
Person 18	2	1	1	4	1.33	0.58	-0.71	43
Person 19	1	2	2	5	1.67	0.58	-0.21	48
Person 20	2	1	1	4	1.33	0.58	-0.71	43
Person 21	1	1	1	3	1.00	0.00	-1.20	38
Person 22	2	1	1	4	1.33	0.58	-0.71	43
Person 23	2	1	1	4	1.33	0.58	-0.71	43
Person 24	3	2	1	6	2.00	1.00	0.28	53
Person 25	2	1	2	5	1.67	0.58	-0.21	48
Person 26	1	2	1	4	1.33	0.58	-0.71	43
Person 27	2	2	1	5	1.67	0.58	-0.21	48
Person 28	2	2	2	6	2.00	0.00	0.28	53
Person 29	2	2	2	6	2.00	0.00	0.28	53
Person 30	2	1	1	4	1.33	0.58	-0.71	43

Item Means	1.93	1.80	1.70
Item St.Devs.	0.69	0.76	0.88
Item Vars	0.48	0.58	0.77

Sum Item Vars	1.06
Test Mean	5.43
Test Std.Dev.	2.03
Test Var.	4.12
K (# ITEMS)	30.00
K-1	29.00

Cronbach's Alpha 0.77

Standard Error of Measurement = (Std.Dev. of Test)(Sq.root of 1-Cronbach's alpha)
 Standard Error of Measurement = 0.98

95% C.I. for 1st person (upper limit) = 8.91

95% C. I. for 1st person (lower limit) = 5.09

95% C.I. for 10th person (upper limit) = 5.91

95% C. I. for 10th person (lower limit) = 2.09

95% C.I. for 20th person (upper limit) = 5.91

95% C. I. for 20th person (lower limit) = 2.09

95% C.I. For a person scoring at the test mean (upper limit) = 7.35

95% C.I. For a person scoring at the test mean (lower limit) = 3.52

Appendix D7: TAB perception questionnaires item analysis: Organizational Barrier Perceptions (3 items, 30 respondents).

EXAMINEES	Org1	Org2	Org3	Sum Score	Mean Indiv	Stdev Indiv	z-score	t-score
PERSON 1	2	2	3	7	2.33	0.58	0.77	58
PERSON 2	2	3	3	8	2.67	0.58	1.27	63
PERSON 3	3	3	3	9	3.00	0.00	1.76	68
PERSON 4	2	2	2	6	2.00	0.00	0.28	53
PERSON 5	2	1	1	4	1.33	0.58	-0.71	43
PERSON 6	4	4	4	12	4.00	0.00	3.24	82
PERSON 7	1	2	1	4	1.33	0.58	-0.71	43
PERSON 8	2	2	2	6	2.00	0.00	0.28	53
PERSON 9	1	1	1	3	1.00	0.00	-1.20	38
PERSON 10	1	2	1	4	1.33	0.58	-0.71	43
PERSON 11	2	1	1	4	1.33	0.58	-0.71	43
PERSON 12	3	3	3	9	3.00	0.00	1.76	68
PERSON 13	2	2	2	6	2.00	0.00	0.28	53
PERSON 14	2	2	2	6	2.00	0.00	0.28	53
PERSON 15	2	1	1	4	1.33	0.58	-0.71	43
PERSON 16	2	2	3	7	2.33	0.58	0.77	58
PERSON 17	1	2	1	4	1.33	0.58	-0.71	43
PERSON 18	2	1	1	4	1.33	0.58	-0.71	43
PERSON 19	1	2	2	5	1.67	0.58	-0.21	48
PERSON 20	2	1	1	4	1.33	0.58	-0.71	43
PERSON 21	1	1	1	3	1.00	0.00	-1.20	38
PERSON 22	2	1	1	4	1.33	0.58	-0.71	43
PERSON 23	2	1	1	4	1.33	0.58	-0.71	43
PERSON 24	3	2	1	6	2.00	1.00	0.28	53
PERSON 25	2	1	2	5	1.67	0.58	-0.21	48
PERSON 26	1	2	1	4	1.33	0.58	-0.71	43
PERSON 27	2	2	1	5	1.67	0.58	-0.21	48
PERSON 28	2	2	2	6	2.00	0.00	0.28	53
PERSON 29	2	2	2	6	2.00	0.00	0.28	53
PERSON 30	2	1	1	4	1.33	0.58	-0.71	43

ITEM MEANS	1.93	1.80	1.70
ITEM ST.DEVS.	0.69	0.76	0.88
ITEM VARS.	0.48	0.58	0.77

SUM ITEM VARS	1.06
TEST MEAN	5.43
TEST STD. DEV.	2.03
TEST VAR.	4.12
K (# ITEMS)	30.00
K-1	29.00

Cronbach's Alpha 0.77

Standard Error of Measurement = (Std.Dev. Of Test)(Sq. Root of 1-Cronbach's alpha)
 Standard Error of Measurement = 0.98

95% C.I. for 1st person (upper limit) = 8.91

95% C. I. for 1st person (lower limit) = 5.09

95% C.I. for 10th person (upper limit) = 5.91

95% C. I. for 10th person (lower limit) = 2.09

95% C.I. for 20th person (upper limit) = 5.91

95% C. I. for 20th person (lower limit) = 2.09

95% C.I. For a person scoring at the test mean (upper limit) = 7.35

95% C.I. For a person scoring at the test mean (lower limit) = 3.52

Appendix D8: TAB perception questionnaires item analysis: Change Resistance

Perceptions (3 items, 30 respondents).

EXAMINEES	Chg1	Chg2	Chg3	Sum Score	Mean Indiv	St.dev Indiv	z-score	t-score
PERSON 1	1	1	1	3	1.00	0.00	-0.77	42
PERSON 2	2	2	2	6	2.00	0.00	1.39	64
PERSON 3	2	2	2	6	2.00	0.00	1.39	64
PERSON 4	1	1	1	3	1.00	0.00	-0.77	42
PERSON 5	1	1	1	3	1.00	0.00	-0.77	42
PERSON 6	2	2	2	6	2.00	0.00	1.39	64
PERSON 7	2	2	2	6	2.00	0.00	1.39	64
PERSON 8	1	1	1	3	1.00	0.00	-0.77	42
PERSON 9	2	1	1	4	1.33	0.58	-0.05	50
PERSON 10	1	1	1	3	1.00	0.00	-0.77	42
PERSON 11	1	1	1	3	1.00	0.00	-0.77	42
PERSON 12	1	1	1	3	1.00	0.00	-0.77	42
PERSON 13	2	2	2	6	2.00	0.00	1.39	64
PERSON 14	1	1	1	3	1.00	0.00	-0.77	42
PERSON 15	2	2	2	6	2.00	0.00	1.39	64
PERSON 16	1	1	1	3	1.00	0.00	-0.77	42
PERSON 17	1	1	1	3	1.00	0.00	-0.77	42
PERSON 18	2	2	1	5	1.67	0.58	0.67	57
PERSON 19	1	1	1	3	1.00	0.00	-0.77	42
PERSON 20	1	1	1	3	1.00	0.00	-0.77	42
PERSON 21	1	1	1	3	1.00	0.00	-0.77	42
PERSON 22	2	1	2	5	1.67	0.58	0.67	57
PERSON 23	1	1	1	3	1.00	0.00	-0.77	42
PERSON 24	1	1	1	3	1.00	0.00	-0.77	42
PERSON 25	2	2	2	6	2.00	0.00	1.39	64
PERSON 26	1	1	1	3	1.00	0.00	-0.77	42
PERSON 27	1	1	1	3	1.00	0.00	-0.77	42
PERSON 28	1	1	1	3	1.00	0.00	-0.77	42
PERSON 29	2	2	2	6	2.00	0.00	1.39	64
PERSON 30	2	2	2	6	2.00	0.00	1.39	64

Item Means	1.40	1.33	1.33
Item St.Devs.	0.50	0.48	0.48
Item Vars.	0.25	0.23	0.23

SUM ITEM VARS	0.48
TEST MEAN	4.07
TEST STD. DEV.	1.39
TEST VAR.	1.93
K (# ITEMS)	30.00
K-1	29.00

Cronbach's Alpha 0.78

Standard Error of Measurement= (Std.Dev.Of Test)(Sq.root of 1-Cronbach's alpha)
 Standard Error of Measurement= 0.65

95% C.I. for 1st person (upper limit) = 4.28

95% C. I. for 1st person (lower limit) = 1.72

95% C.I. for 10th person (upper limit) = 4.28

95% C. I. for 10th person (lower limit) = 1.72

95% C.I. for 20th person (upper limit) = 4.28

95% C. I. for 20th person (lower limit) = 1.72

95% C.I. For a person scoring at the test mean(upper limit) = 5.35

95% C.I. For a person scoring at the test mean(lower limit) = 2.78

Appendix D9: TAB perception questionnaires item analysis: Overall questionnaires
(29 items, 30 respondents)

Technology Acceptance Barrier Construct	Cronbach's Alpha	Number of Items
Financial Barrier	0.74	4
Technical Barrier	0.72	7
Time Barrier	0.75	3
Psychological Barrier	0.75	3
Sociological Barrier	0.77	3
Legislative Barrier	0.77	3
Organizational Barrier	0.77	3
Change Resistance	0.78	3
Overall Cronbach's Alpha	0.8245	29

APPENDIX E
RESULTS OF THE STRUCTURAL EQUATION MODELING
FOR UTAUT-BASED GPS ACCEPTANCE MODEL
BY THAI PUBLIC TRANSPORTATION INDUSTRY

DATE: 08/01/2013

TIME: 16:01

L I S R E L 9.10 (STUDENT)

BY

Karl G. Jöreskog & Dag Sörbom

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Defencing\Thesis documents\Data Analysis\000research result model\Research Final
Result Model.lpj:

! UTAUT model : SEM for the UTAUT-based GPS acceptance. (With ExpFC as mediator and BP interactive with FC)

DA NI=8 NO=377 MA=CM

LA

BI USE PE EE SI FC ExpFC BPFC

CM

0.1319

0.1537 0.2050

0.0939 0.1186 0.1225

0.0887 0.1137 0.1138 0.1240

0.2256 0.2494 0.1499 0.1388 0.4163

0.1516 0.2012 0.1171 0.1130 0.2462 0.2044

0.1220 0.1571 0.1041 0.0985 0.2002 0.1565 0.1558

-0.0668 -0.0891 -0.0544 -0.0548 -0.1028 -0.0856 -0.0699 0.0953

MO NX=6 NY=2 GA=FI BE=FI TD=SY TE=SY TH=FU,FI

FR GA(1,1) GA(1,2) GA(1,3)

FR BE(2,1)

FR GA(2,4)

FR TH(3,2) TD(4,3)

FR GA(2,5) TH(5,1)

FR GA(2,6) TD(6,3)

PD

OU MI RS EF FS

! UTAUT model : SEM for the UTAUT-based GPS acceptance. (With ExpFC as mediator

Number of Input Variables	8
Number of Y - Variables	2
Number of X - Variables	6
Number of ETA – Variables	2
Number of KSI – Variables	6
Number of Observations	377

! UTAUT model : SEM for the UTAUT-based GPS acceptance. (With ExpFC as mediator)

Covariance Matrix

	BI	USE	PE	EE	SI	FC	ExpFC	BPFC
BI	0.132							
USE	0.154	0.205						
PE	0.094	0.119	0.122					
EE	0.089	0.114	0.114	0.124				
SI	0.226	0.249	0.150	0.139	0.416			
FC	0.152	0.201	0.117	0.113	0.246	0.204		
ExpFC	0.122	0.157	0.104	0.099	0.200	0.157	0.156	
BPFC	-0.067	-0.089	-0.054	-0.055	-0.103	-0.086	-0.070	0.095

Total Variance = 1.455 Generalized Variance = 0.837283D-12

Largest Eigenvalue = 1.192 Smallest Eigenvalue = 0.003

Condition Number = 21.634

! UTAUT model : SEM for the UTAUT-based GPS acceptance. (With ExpFC as mediator)

Parameter Specifications

BETA

	BI	USE
BI	0	0
USE	1	0

GAMMA

	PE	EE	SI	FC	ExpFC	BPFC
BI	2	3	4	0	0	0
USE	0	0	0	5	6	7

PHI

	PE	EE	SI	FC	ExpFC	BPFC
PE	8					
EE	9	10				
SI	11	12	13			
FC	14	15	16	17		
ExpFC	18	19	20	21	22	
BPFC	23	24	25	26	27	28

PSI

BI	USE
29	30

! UTAUT model : SEM for the UTAUT-based GPS acceptance. (With ExpFC as mediator)

Number of Iterations = 19

LISREL Estimates (Maximum Likelihood)

BETA

	BI	USE
BI	-	-
	0.227	
USE	(0.029)	-
	7.895	

GAMMA

	PE	EE	SI	FC	ExpFC	BPFC
	0.096	0.095	0.476			
BI	(0.034)	(0.032)	(0.009)	-	-	-
	2.809	2.976	52.464			
				0.723	0.088	-0.062
USE	-	-	-	(0.033)	(0.023)	(0.016)
				22.129	3.867	-3.845

Covariance Matrix of Y and X

	BI	USE	PE	EE	SI	FC	ExpFC	BPFC
BI	0.132							
USE	0.154	0.205						
PE	0.094	0.119	0.122					
EE	0.089	0.114	0.114	0.124				
SI	0.226	0.249	0.150	0.139	0.416			
FC	0.152	0.201	0.117	0.113	0.246	0.204		
ExpFC	0.122	0.157	0.104	0.099	0.200	0.157	0.156	
BPFC	-0.067	-0.089	-0.054	-0.055	-0.103	-0.086	-0.070	0.095

PHI

	PE	EE	SI	FC	ExpFC	BPFC
	0.123					
PE	(0.009)					
	13.638					
	0.114	0.124				
EE	(0.009)	(0.009)				
	13.084	13.638				
	0.150	0.139	0.416			
SI	(0.014)	(0.014)	(0.031)			
	10.678	10.059	13.639			
	0.117	0.113	0.273	0.204		
FC	0.010	0.010	(0.020)	(0.015)		
	11.472	11.162	13.733	13.640		
	0.104	0.098	0.200	0.157	0.156	
ExpFC	(0.009)	(0.009)	(0.017)	(0.012)	(0.011)	
	11.612	11.152	11.918	12.722	13.641	
	-0.054	-0.055	-0.119	-0.086	-0.070	0.095
BPFC	(0.006)	(0.006)	(0.012)	(0.008)	(0.007)	(0.007)
	-8.673	-8.681	-10.020	-10.086	-9.602	13.639

PSI

BI	USE
0.007	0.005
(0.001)	(0.000)
13.795	12.922

Squared Multiple Correlations for Structural Equations

BI	USE
0.946	0.974

NOTE: R² for Structural Equations are Hayduk's (2006) Blocked-Error R²

Reduced Form

	PE	EE	SI	FC	ExpFC	BPFC
	0.096	0.095	0.476			
BI	(0.034)	(0.032)	(0.009)	-	-	-
	2.805	2.971	52.394			
	0.022	0.022	0.108	0.723	0.088	-0.062
USE	(0.008)	(0.008)	(0.014)	(0.033)	(0.023)	(0.016)
	2.642	2.800	7.688	22.099	3.862	-3.839

Squared Multiple Correlations for Reduced Form

BI	USE
0.946	0.972

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Log-likelihood Values

	Estimated Model	Saturated Model
Number of free parameters(t)	34	36
-2ln(L)	-7467.526	-7467.848
AIC (Akaike, 1974)*	-7399.526	-7395.848
BIC (Schwarz, 1978)*	-7265.829	-7254.287

*LISREL uses $AIC = 2t - 2\ln(L)$ and $BIC = t\ln(N) - 2\ln(L)$

Goodness of Fit Statistics

Degrees of Freedom for (C1)-(C2)	2
Maximum Likelihood Ratio Chi-Square (C1)	0.322 (P = 0.8513)
Browne's (1984) ADF Chi-Square (C2_NT)	0.322 (P = 0.8511)
Estimated Non-centrality Parameter (NCP)	0.0
90 Percent Confidence Interval for NCP	(0.0 ; 2.362)
Minimum Fit Function Value	0.000854
Population Discrepancy Function Value (F0)	0.0
90 Percent Confidence Interval for F0	(0.0 ; 0.00627)
Root Mean Square Error of Approximation (RMSEA)	0.0
90 Percent Confidence Interval for RMSEA	(0.0 ; 0.0560)
P-Value for Test of Close Fit (RMSEA < 0.05)	0.938
Expected Cross-Validation Index (ECVI)	0.186
90 Percent Confidence Interval for ECVI	(0.186 ; 0.192)
ECVI for Saturated Model	0.191
ECVI for Independence Model	16.111
Chi-Square for Independence Model (28 df)	6057.707
Normed Fit Index (NFI)	1.00
Non-Normed Fit Index (NNFI)	1.004
Parsimony Normed Fit Index (PNFI)	0.0714
Comparative Fit Index (CFI)	1.000
Incremental Fit Index (IFI)	1.000
Relative Fit Index (RFI)	0.999
Critical N (CN)	10744.241
Root Mean Square Residual (RMR)	0.000
Standardized RMR	0.000321
Goodness of Fit Index (GFI)	1.00
Adjusted Goodness of Fit Index (AGFI)	0.996
Parsimony Goodness of Fit Index (PGFI)	0.0555

Standardized Residuals

	BI	USE	PE	EE	SI	FC	ExpFC	BPFC
BI	-0.018							
USE	-0.070	-0.085						
PE	-0.036	0.138	0.000					
EE	0.043	-0.150	0.000	0.000				
SI	0.013	-0.017	-0.098	0.000	0.015			
FC	-0.050	-0.086	0.000	0.000	0.000	-0.086		
ExpFC	-0.070	-0.142	-0.078	0.000	0.021	-0.121	-0.102	
BPFC	0.046	0.081	0.000	0.000	0.000	0.083	0.117	-0.056

Summary Statistics for Standardized Residuals

Smallest Standardized Residual = -0.150

Median Standardized Residual = 0.000

Largest Standardized Residual = 0.138

Stemleaf Plot

- 1|5

- 1|4200

- 0|99987765

- 0|422000000000

0|1224

0|5889

1|124

! UTAUT model : SEM for the UTAUT-based GPS acceptance. (With ExpFC as mediator)

Modification Indices and Expected Change

Modification Indices for BETA

	BI	USE
BI	-	0.026
USE	-	-

Expected Change for BETA

	BI	USE
BI	-	-0.017
USE	-	-

Modification Indices for GAMMA

	PE	EE	SI	FC	ExpFC	BPFC
BI	-	-	-	0.006	0.036	0.003
USE	0.028	0.031	0.022	-	-	-

Expected Change for GAMMA

	PE	EE	SI	FC	ExpFC	BPFC
BI	-	-	-	-0.009	-0.019	0.009
USE	0.003	-0.003	0.008	-	-	-

Modification Indices for PSI

	BI	USE
BI	-	-
USE	0.101	-

Expected Change for PSI

	BI	USE
BI	-	
USE	-0.001	-

Modification Indices for THETA-EPS

	BI	USE
BI	0.024	
USE	0.097	-

Expected Change for THETA-EPS

	BI	USE
BI	0.001	
USE	-0.001	-

Modification Indices for THETA-DELTA-EPS

	BI	USE
PE	0.281	0.299
EE	0.272	0.289
SI	0.006	-
FC	0.058	0.165
ExpFC	-	0.065
BPFC	0.000	0.141

Expected Change for THETA-DELTA-EPS

	BI	USE
PE	-0.001	0.000
EE	0.001	0.000
SI	0.000	-
FC	0.001	0.001
ExpFC	-	-0.001
BPFC	0.000	-0.003

Modification Indices for THETA-DELTA

	PE	EE	SI	FC	ExpFC	BPFC
PE	0.001					
EE	0.001	0.000				
SI	0.020	0.004	0.026			
FC	0.299	0.289	-	0.224		
ExpFC	0.287	0.286	0.063	0.051	0.051	
BPFC	0.280	0.271	-	0.158	0.007	0.040

Expected Change for THETA-DELTA

	PE	EE	SI	FC	ExpFC	BPFC
PE	-0.001					
EE	0.000	0.000				
SI	-0.002	-0.001	-0.004			
FC	0.000	0.000	-	-0.002		
ExpFC	-0.003	0.003	0.003	0.001	0.005	
BPFC	0.004	-0.004	-	0.004	-0.002	-0.014

Maximum Modification Index is 0.30 for Element (1, 2) of THETA DELTA-EPSILON

! UTAUT model : SEM for the UTAUT-based GPS acceptance. (With ExpFC as mediator)

Factor Scores Regressions

Y

	BI	USE	PE	EE	SI	FC	ExpFC	BPFC
BI	1.020	0.054	0.063	-0.008	0.009	0.072	-0.242	-0.008
USE	-2.523	1.424	0.020	0.113	1.078	0.062	-0.027	-0.098

X

	BI	USE	PE	EE	SI	FC	ExpFC	BPFC
PE	0.000	0.000	1.000	0.000	0.000	0.000	0.000	-
EE	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000
SI	-2.291	0.652	0.095	-0.121	1.558	0.784	-0.443	-0.196
FC	-2.804	0.472	0.022	0.126	1.197	1.069	-0.030	-0.108
ExpFC	-2.331	0.583	0.076	0.053	0.794	0.081	1.020	-0.071
BPFC	1.674	-0.282	-0.013	-0.075	-0.715	-0.041	0.018	1.065

! UTAUT model : SEM for the UTAUT-based GPS acceptance. (With ExpFC as mediator)

Total and Indirect Effects

Total Effects of X on Y

	PE	EE	SI	FC	ExpFC	BPFC
	0.096	0.095	0.476			
BI	(0.034)	(0.032)	(0.009)	-	-	-
	2.832	2.999	52.887			
	0.022	0.022	0.108	0.723	0.088	-0.062
USE	(0.008)	(0.008)	(0.014)	(0.032)	(0.022)	(0.016)
	2.666	2.826	7.760	22.307	3.898	-3.876

Indirect Effects of X on Y

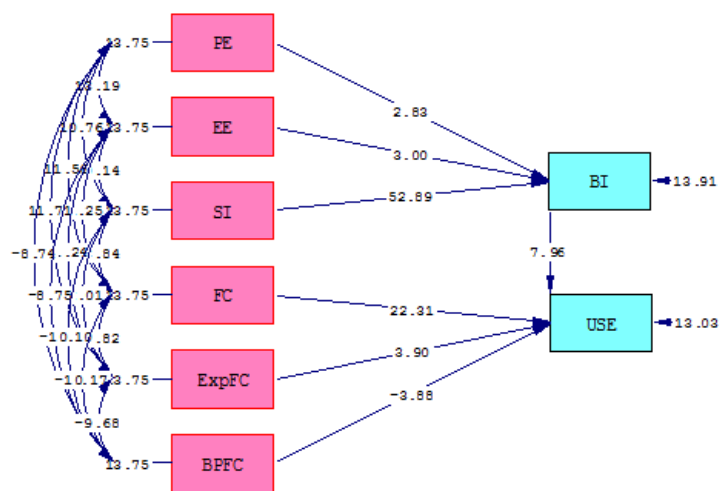
	PE	EE	SI	FC	ExpFC	BPFC
BI	-	-	-	-	-	-
	0.022	0.022	0.108			
USE	(0.008)	(0.008)	(0.014)	-	-	-
	2.666	2.826	7.760			

Total Effects of Y on Y

	PE	EE
BI	-	-
	0.027	
USE	(0.029)	-
	7.959	

Largest Eigenvalue of B*B' (Stability Index) is 0.051

Time used 0.016 seconds



Chi-Square=0.32, df=2, P-value=0.85130, RMSEA=0.000

Figure E.1 The t-value of the structure model.

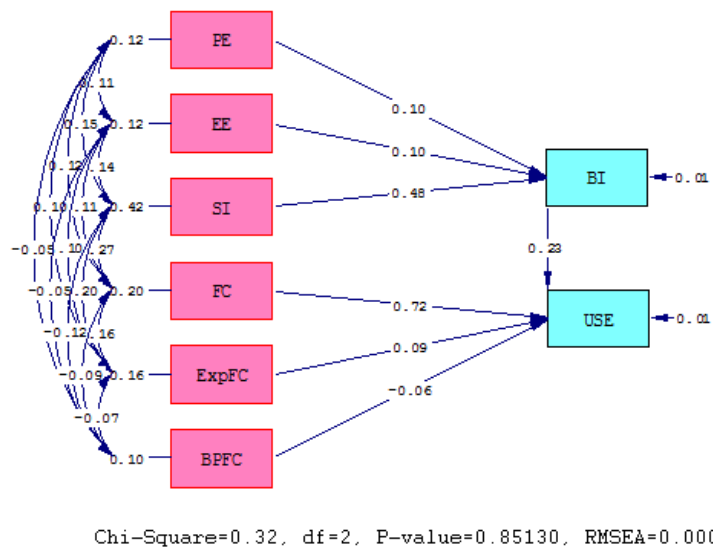


Figure E.2 The estimate value of the structure model.

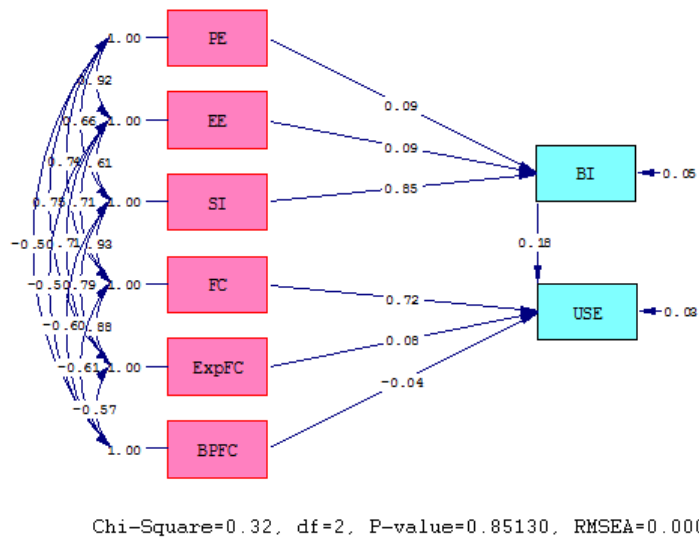


Figure E.2 The standardized solution of the structure model.

BIOGRAPHY

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