FACTORS INFLUENCING DECISION TO USE BTS: A COMPARISON STUDY BETWEEN PUBLIC TRANSPORTATION (PT) USERS AND PRIVATE VEHICLE USERS

PANISARA VANICHKITPISAN

AN INDEPENDENT STUDY REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT
INTERNATIONAL COLLEGE
KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG
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KMITL-2017-IC-M-002-001

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Independent Study Certification

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Independent Study Title	**FACTORS INFLUENCING DECISION TO USE BTS: A COMPARISON STUDY BETWEEN PUBLIC TRANSPORTATION (PT) USERS AND PRIVATE VEHICLE USERS**
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IS Reference Number	KMITL-2017-IC-M-002-001

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Place : International College, 8th floor, 55th Anniversary Chalermprakiat Building

KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG

(Assoc.Prof.Dr.Supat Kittiratsatcha)
Dean of International College
May 20th , 2017

THESIS TITLE	Factors Influence Decision to Use BTS: A Comparison Study between Public Transport (PT) Users and Private Vehicle Users
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STUDENT ID	56610028
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ABSTRACT

The Bangkok Mass Transit system (BTS) was launched in 2000 with the aim of solving an evident, and growing, congestion problem by reducing the number of cars on the streets. Due to BTS characteristics, specifically rapidity and punctuality, it was believed from the outset that the BTS would gain popularity as the major mode of transportation for commuters in Bangkok. In this regard, it is noteworthy that the associated ridership records report the number of rides increased significantly from approximately 55 million in 2000 to 220 million in 2014. Unfortunately, during this time, the number of registered cars in Bangkok also increased. This poses a question as to the actual effectiveness of the BTS, which leads to our investigation on factors influencing the usage of public transportation (PT) versus private transportation. In addressing these questions, the theory of planned behavior (TPB) is employed to categorize factor-effects, such as behavior as attitude, perceived behavior control, and habit. Pertinent questionnaires were designed according to a best-worst scaling system [1] and these were distributed online, along with special questions to differentiate between car users and PT users who responded. This resulted in 97 car users and 132 PT users who responded to

our survey, with this producing a total of 233 respondents. Survey data were analyzed with best-worst scores and a conditional logit model. The result shows that PT users and car users share a number of similar attitudes and perceived behavior controls. They consider *speed of travel* (A1) and *distance between the destination station and rider's origin* (D1) as the most effective factors in using the BTS. Riders are likely to *deny usage of the BTS when travelling with a great deal of baggage* (PBC3). Finally, *parking* (H2) has a major impact on car users. As might stand to reason, there is a low probability to breaking the habit of car users when parking problems continue to grow.

To abate the growing congestion problem in Bangkok, ideally, mass transportation usage shall increase while private transportation usage shall decrease. In this regard, the Bangkok Rail Network project, which is expected to be completed within the next 15 years, is one of many projects proposed by the Bangkok Metropolitan Administration (BMA). This project is expected to cover almost all areas of Bangkok to provide larger accessibility and increase the number of stations. It is believed that this project, upon completion, will persuade people to use Bangkok Rail Network intensively since this project addresses a prime issue of the *distance between the destination station and rider's origin* (D1), which is deemed to be the most effective factor in using BTS. In addition, the policy regarding parking space or parking charges must be tightened. For instance, motor vehicle owners should be forced to provide a permanent parking space for their vehicles before they are permitted to buy any vehicles. This policy would not only affect current car users, but would also have an impact upon PT users who intend to have new vehicles in the future.

ACKNOWLEDGEMENT

This research was made possible by many people but two people, in particular, were with this research from beginning to end. Asst. Prof. Dr.Chivalai Temiyasathit, at King Mongkut's Institute of Technology Ladkrabang and research advisor, assisted me in the entirety of this research. She had many ideas that were implemented in this research and suggested many more. She helped me when I confronted problems and helped me solve them. She suggested the experimental design and statistical analysis tools in this research and also helped me rehearse for my defense and was there to give suggestions during the course of my research. Asst. Prof. Dr.Ratiwan Watanasin, at Suan Dusit University, my research co-advisor, who provided me many ideas about questionnaires design. I am sincerely thankful for their dedication to my research study.

I would like to thank my committee members, Asst.Prof.Dr.Phaophak Sirisuk and Dr.Jaruwit Prabnasak, for supporting this research study, especially in suggesting additional ideas that were implemented in this research.

Finally, a special thanks to my parents for supporting all of my work.

Panisara Vanichkitpisan

TABLE OF CONTENTS

Chapter **Page**

TABLE OF CONTENTS

(Continued)

Chapter **Page**

TABLE OF CONTENTS

(Continued)

Chapter **Page**

LIST OF TABLES

Chapter **Page**

LIST OF TABLES

(Continued)

Chapter **Page**

LIST OF TABLES

(Continued)

Chapter **Page**

LIST OF FIGURES

Chapter **Page**

CHAPTER 1
INTRODUCTION

1.1. Transportation mode in Bangkok

This section provides background information about transportation in Bangkok.

1.1.1. Bangkok Mass Transit system (BTS)

The following schematic shows routes and stations of the current BTS.

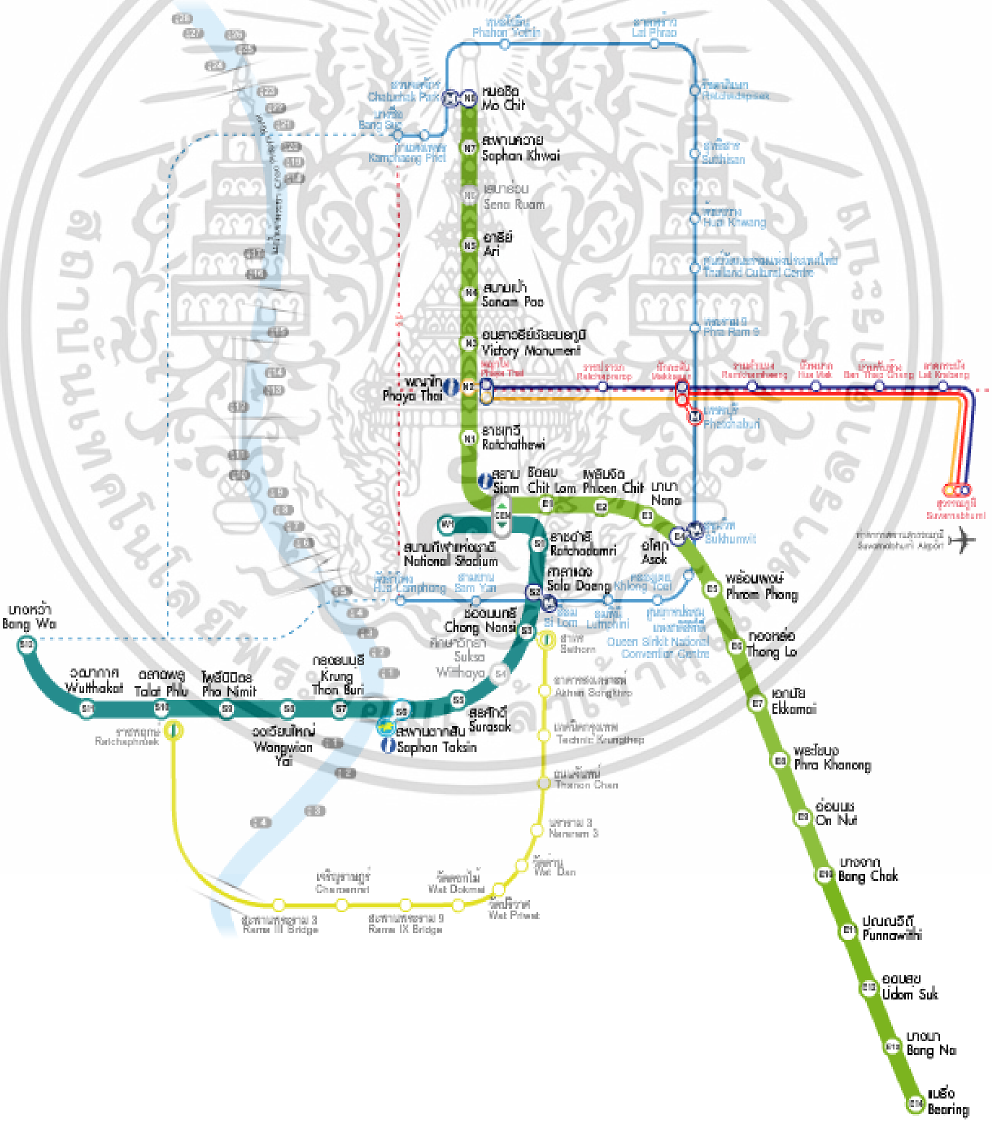


Figure 1.1 BTS Service Route

Source: Bangkok Mass Transit System Public Company Limited. (1999, December 5). (Bangkok Mass Transit System Public Company Limited) Retrieved Febuary 2016, from http://www.bts.co.th/customer/th/main.aspx

In addition to details evident in the graphical representation appearing in Figure 1.1, it is worth noting that the so-called BTS sky train (Bangkok Mass Transit System Public Company Limited, 1999) is the first electric mass transit railway system built and operated by Bangkok Mass Transit System Public company limited. The BTS sky train is typical of high-capacity mass transit trains used worldwide. The first service was provided by this system on 5th December 1999 with the aim to abate a known and growing traffic congestion problem.

The BTS sky train is comprised of 2 lines, being the Sukhumvit line and the Silom line, These are shown in Figure 1.1, and are presented in greater detail by Table 1.1. More specifically, the Silom line passes through Bangkok's financial district with 13 stations (including Siam, which is the interchange station), while the Sukhumvit line, served by 22 stations (and with Siam included), passes through the major shopping area and an upper-class residential area. Originally, and as just indicated, the BTS sky train covered 23 stations for the Sukhumvit Line running over a distance of 17 kilometers. After that, a 5.25 kilometer extension of the Sukhumvit line commenced operations on 12th August 2011, and that line was expanded from On Nut to Bearing. The Silom line was initially running over 6.5 kilometers and officially inaugurated on 5th December 1999. After that, a 2.2 kilometer extension of the Silom line commenced operations on 23rd August 2009, with this expanding services from Saphan Taksin to Wongwian Yai on the Thonburi side of the Chaophraya River. On 14th February 2013, a further 2.17 kilometer extension of the Silom line commenced operations to Pho Nimit and Talat Phlu stations. Finally, on 5th December 2013, a further 3.8 kilometer extension of the Silom line commenced operations to reach Wutthakat and Bang Wa stations. Currently, the BTS sky train lines run a combined length of 36.9 kilometers in connecting 34 stations. The BTS sky train has proved itself to be both efficient and responsive. It is designed to serve approximately 1,000 passengers per trip.

Table 1.1 Opening date of each station

<table>
<tr><th colspan="2">Sukhumvit Line</th><th colspan="2">Silom Line</th></tr>
<tr><th>Station</th><th>Service start</th><th>Station</th><th>Service start</th></tr>
<tr><td>Mo Chit</td><td rowspan="17">5 December 1999</td><td>National Stadium</td><td rowspan="7">5 December 1999</td></tr>
<tr><td>Saphan Khwai</td><td>Siam (Interchange)</td></tr>
<tr><td>Ari</td><td>Ratchadamri</td></tr>
<tr><td>Sanam Pao</td><td>Sala Daeng</td></tr>
<tr><td>Victory Monument</td><td>Chong Nonsi</td></tr>
<tr><td>Phaya Thai</td><td>Surasak</td></tr>
<tr><td>Ratchathewi</td><td>Saphan Taksin</td></tr>
<tr><td>Siam (Interchange)</td><td>Krung Thonburi</td><td rowspan="2">15 May 2009</td></tr>
<tr><td>Chitlom</td><td>Wongwian Yai</td></tr>
<tr><td>Phloen Chit</td><td>Pho Nimit</td><td>12 January 2013</td></tr>
<tr><td>Nana</td><td>Talat Phlu</td><td>14 February 2013</td></tr>
<tr><td>Asok</td><td>Wutthakat</td><td rowspan="2">5 December 2013</td></tr>
<tr><td>Phrom Phong</td><td>Bang Wa</td></tr>
<tr><td>Thong Lor</td><td colspan="2" rowspan="6"></td></tr>
<tr><td>Ekkamai</td></tr>
<tr><td>Phra Khanong</td></tr>
<tr><td>On Nut</td></tr>
<tr><td>Bang Chak</td><td rowspan="2">12 August 2011</td></tr>
<tr><td>Punnawithi</td></tr>
</table>

Udom Suk	
Bang Na	
Bearing	

Source: Bangkok Mass Transit System Public Company Limited. (1999, December 5). (Bangkok Mass Transit System Public Company Limited) Retrieved Febuary 2016, from http://www.bts.co.th/customer/th/main.aspx

The BTS sky train is comprised of 2 lines, being the Sukhumvit line and the Silom line, These are shown in Figure 1.1, and are presented in greater detail by Table 1.1. More specifically, the Silom line passes through Bangkok's financial district with 13 stations (including Siam, which is the interchange station), while the Sukhumvit line, served by 22 stations (and with Siam included), passes through the major shopping area and an upper-class residential area. Originally, and as just indicated, the BTS sky train covered 23 stations for the Sukhumvit Line running over a distance of 17 kilometers. After that, a 5.25 kilometer extension of the Sukhumvit line commenced operations on 12th August 2011, and that line was expanded from On Nut to Bearing. The Silom line was initially running over 6.5 kilometers and officially inaugurated on 5th December 1999. After that, a 2.2 kilometer extension of the Silom line commenced operations on 23rd August 2009, with this expanding services from Saphan Taksin to Wongwian Yai on the Thonburi side of the Chaophraya River. On 14th February 2013, a further 2.17 kilometer extension of the Silom line commenced operations to Pho Nimit and Talat Phlu stations. Finally, on 5th December 2013, a further 3.8 kilometer extension of the Silom line commenced operations to reach Wutthakat and Bang Wa stations. Currently, the BTS sky train lines run a combined length of 36.9 kilometers in connecting 34 stations. The BTS sky train has proved itself to be both efficient and responsive. It is designed to serve approximately 1,000 passengers per trip.

1.1.1.1. BTS System

For the BTS railway operating system, the signaling is designed to be highly secure, even in the event of system interruption. Train status is always adjusted to ensure passenger safety. The BTS operating system is also equipped with other controls, such as the Collision Prevention System and the Speed Control System, and both of these have with full compliance to relevant international standards. All of this is a guarantee that the BTS sky train is very safe for mass transit purposes. It is worth noting that each train uses an electric motor to run along an elevated rail with two lines operating. As well, BTS train carriages are air-conditioned so that passengers can enjoy the feeling of all-around comfort, in addition to safety and fast transportation.

The BTS operates under two models:

- SIEMENS model: This is the original 3-car train-set that are now transformed into 4-car train-sets. The length of a 4-car train is 86.6 meters, with the width of 3.12 meters. The train capacity is approximately 1,490 passengers. They are fully equipped with air-conditioning systems.
- CNR model: This is the latest model, which is 4-car train set with a length of 87.25 meters and width of 3.12 meters. The passenger capacity is similar to the SIEMENS model. All trains are fully equipped with air-conditioning systems and are automatically controlled by a Train Control and Management System (TCMS) that has an LED route map display to show the location of the train.

BTS is an environmentally friendly form of transportation in a congested city. The trains are powered by electrical motors with zero exhaust emission released to the ambient air. In addition, all trains can be automated in order to utilize energy efficiently.

1.1.1.2. Fare and Ticket information

Tickets can be purchased at any Ticket Issuing Machine, which are either a coin-only machine or a coin-banknote machine.

As an indication of the fares, Table 1.2 below shows the cost in Thai baht (THB) of multiple trip tickets for students and adults.

Table 1.2 Promotional price for 30-day trips of Student and Adult Rabbit card

No. of trip	Student Rabbit card (THB)	Adult Rabbit card (THB)
15 trips	345	450
25 trips	525	700
40 trips	760	1,040
50 trips	900	1,250

Source: Bangkok Mass Transit System Public Company Limited. (1999, December 5). (Bangkok Mass Transit System Public Company Limited) Retrieved Febuary 2016, from http://www.bts.co.th/customer/th/main.aspx

In addition, Table 1.3 below shows how low the fares can go in the case of senior citizens.

Table 1.3 Promotional price for Senior Rabbit card

No. of stations	0 - 1	2	3	4	5	6	7	More than 8
Senior Rabbit card (THB)	7	11	13	14	16	17	19	21

Source: Bangkok Mass Transit System Public Company Limited. (1999, December 5). (Bangkok Mass Transit System Public Company Limited) Retrieved Febuary 2016, from http://www.bts.co.th/customer/th/main.aspx

As will stand to reason, the magnitude of BTS fares depend on the distance travelled, which range from 15 THB to 52 THB for non-senior adults. As well, it is worth noting that there are 2 types of tickets, with these being short term and long term use, as are summarized below:

- Short term use:
  - Magnetic ticket includes single journey ticket and one-day pass.
    - *Single journal ticket* is valid for a single journey. The price starts from 10 THB to 52 THB and depends on the distance travelled, and is valid only for the date of purchase.
    - *One-day pass* cost 140 THB. It is valid only for the date of purchase, but allows for unlimited travel.
- Long term use:
  - *Rabbit card* is a rechargeable card. Passengers can pre-deposit into their cards, with the amount of any fare deducted from a card once any trip has occurred. The charged amount is similar to the aforementioned single journey ticket, but the Rabbit card provides greater convenience for passengers who want to avoid ticketing queues, especially any forming during rush hour.
    - There are three types:
      - *Student Rabbit card* (for students not over 23 years old)
      - *Adult Rabbit card*
      - *Senior Rabbit card*

Frequent passengers are eligible to purchase a ticket at promotional prices depending on their usage, such as15, 25, 40, or 50 trips as shown in Table 1.2 above.

1.1.1.3. Promotion for BTS User

The Nuduan Club is organized by BTS Sky Train. This club provides special offers to passengers who hold BTS Rabbit cards, as well as allowing members to enjoy exclusive privileges and also letting them participate in special activities, such as free entrance to, or discounts, to museums or places of entertainment. Members can also enjoy discount on the cost of food in restaurants, discount coupons for movie tickets and free BTS tickets on special occasions such as Mother's Day.

1.1.1.4. Stations and Connectivity

Facilities inside the stations include escalators and elevators, direction signs and route maps, as well as a tourist information center and other business services for passengers. As mentioned, the BTS sky train is comprised of 2 lines, which are Sukhumvit line and Silom line (see Figure 1.1). The Silom line passes through Bangkok's financial district, while the Sukhumvit line passes through a major shopping area and an upper-class residential area.

Table 1.4 BTS interchange stations

Station	Connectivity
Mo Chit	• Interchange with MRT, Chatuchak station • Chatuchak/Mo chit 2 bus terminal
Victory Monument	• Van Terminal
Phayathai	• Interchange with Airport rail link, Phayathai station
Siam	• Interchange with Silom line
Asok	• Interchange with MRT, Sukhumvit station
Ekkamai	• Ekkamai bus terminal
Sala Daeng	• Interchange with MRT, Silom station
Chong Nonsi	• Interchange with BRT, Sathorn station

BTS provide travel flexibility due to the connectivity that it has with many intercity transportation systems, such as the MRT, BRT, bus terminal, van terminal and railway terminal. Table 1.4 lists all BTS interchange stations with their associated connectivity.

1.1.2. Mass Rapid Transit System

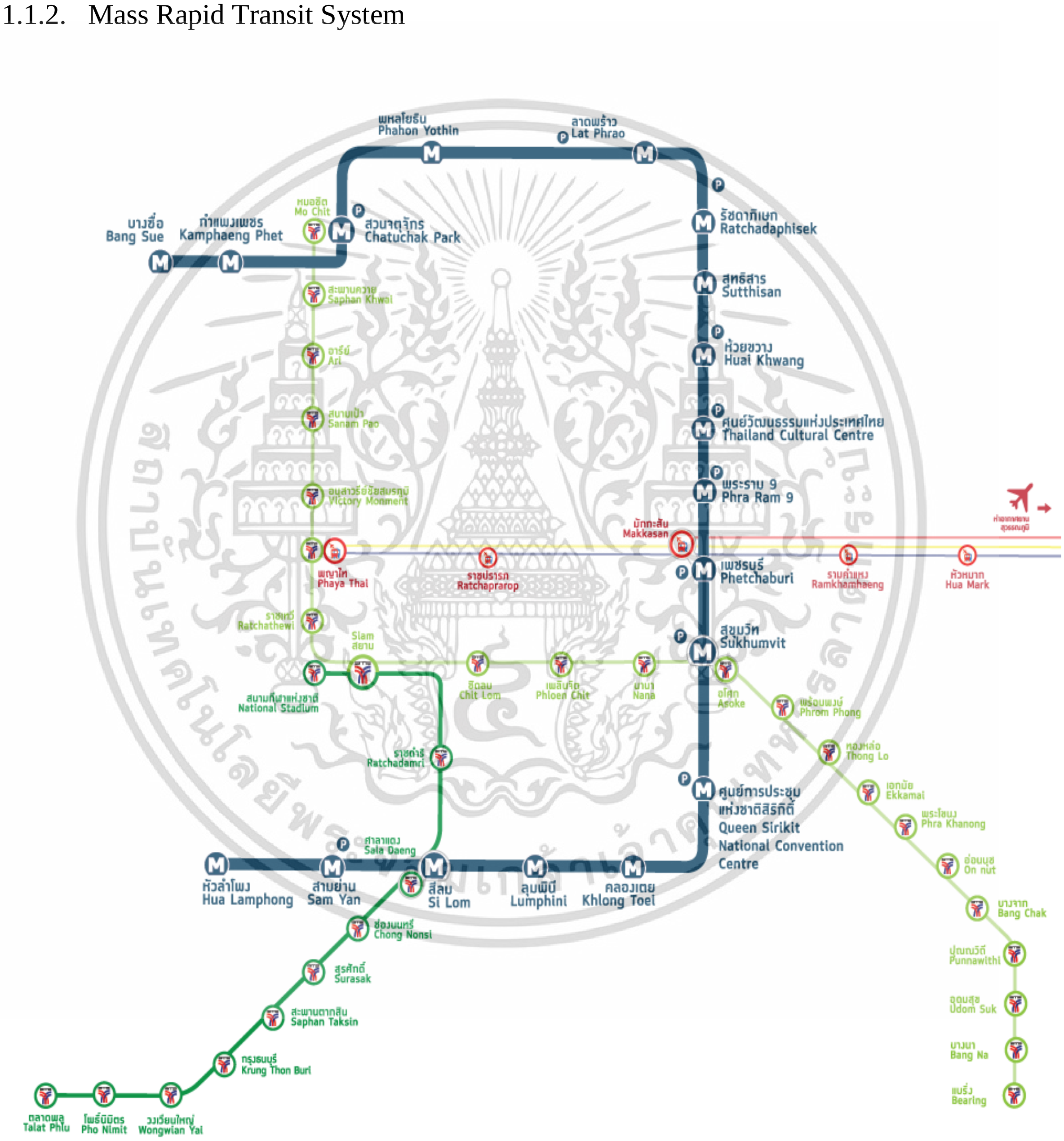


Figure 1.2 M.R.T. Choloem Ratchaongkhon line

Source: PLC., B. E. (2016). *Bangkok Expressway and Metro PLC.* (Bangkok Expressway and Metro PLC.) Retrieved from http://www.bangkokmetro.co.th/map.aspx?Lang=En&Menu=8

The Mass Rapid Transit System (MRT) opened for service on 3rd July 2004 (PLC., 2016). The system is operated by the Bangkok Metro Public Company Limited (BMCL) under a concession granted by the Mass Rapid Transit Authority of Thailand (MRTA). The MRT system provides service along the Choloem Ratchaongkhon line that, informally, is called the Blue line. The service starts from the Bangkok Railway terminal at Hua Lamphong, and ends at Bangsue station (See Figure 1.2 below),and there are 18 stations on that line.

The MRT provides service from 06.00 am. to 12.00 am. daily. Every 5 minutes, a train is released during peak hour, and these run at intervals of10 minutes during regular hours. Ticket price starts from 16 and go to 42 baht, with this amount depending on the travel distance, as well as on with discounts such as for student (who, in comparison, pay anywhere from 14 to 38 baht). Also, special ticket rates are provided for children and the elderly who can travel at a discount of 50%.

Park and ride is one of facilities provided by the Mass Rapid Transit Authority of Thailand (MRTA) for MRT passengers to park their car then travel via the MRT to their destination. Two park and ride buildings are provided at the Thailand Cultural Centre and at Lat Phrao, with nine park and ride areas are provided at Samyan, the Queen Sirikit National Convention Centre, Phetchaburi, Rama 9, the Thailand Cultural Centre, the Thailand Cultural Centre (Ratchada Soi 6), Huai Kwang, Ratchadaphisek, and at Chatuchak Park), which prove parking for more than 4,000 cars in total. The related parking fee is 15 baht for two hours, and 40 baht per hour for non-MRT passengers. A monthly parking service is also provided to MRT passengers with a special rate of 1,500 baht per month.

Connectivity with the MRT is available at three interchange stations of the BTS and one major interchange with State Railway Terminal at MRT Hualumpong (See Figure 1.2). The state railway terminal provides transportation to all parts of Thailand via the State Railway of Thailand, thereby reaching the North (Chiang Mai station), South (Narathiwat station and Padang Besar Station), East (Sa Kaeo station and Ta Phut Industrial Estate station), North East (Ubon Ratchathani station and Nong Khai station), and West (Kanchanaburi station).

1.1.3. Airport Rail Link

The Airport Rail Link (ARL) is owned by the State Railway of Thailand (SRT) and is operated by a SRT subsidiary called the State Railway of Thailand Electrified Train (SRTET). The first service of this transport system was provided on 23rd August 2010. The ARL provides service from Phyathai Station to Suvarnabhumi Airport, covering 8 stations along the way, which are Phayathai, Rajprarop Station, Makkasan Station, Ramkhamhaeng Station, Hua Mark Station. Thab Chang Station, Lad Krabang Station, and Suvarnabhumi Airport over the 28 kilometers of this link. The fare starts from 15 baht and goes up to 45 baht. The one-time token used can be purchased from an automatic token machines or at a service office. The ARL also offers a prepaid pass for frequent passengers. The minimum prepaid value is 50 baht, while the maximum top up is 1,000 baht.

A park and ride building is also provided at the Makkasan station. The maximum capacity of this parking facility is 300 cars.

1.1.4. Bus Rapid Transit

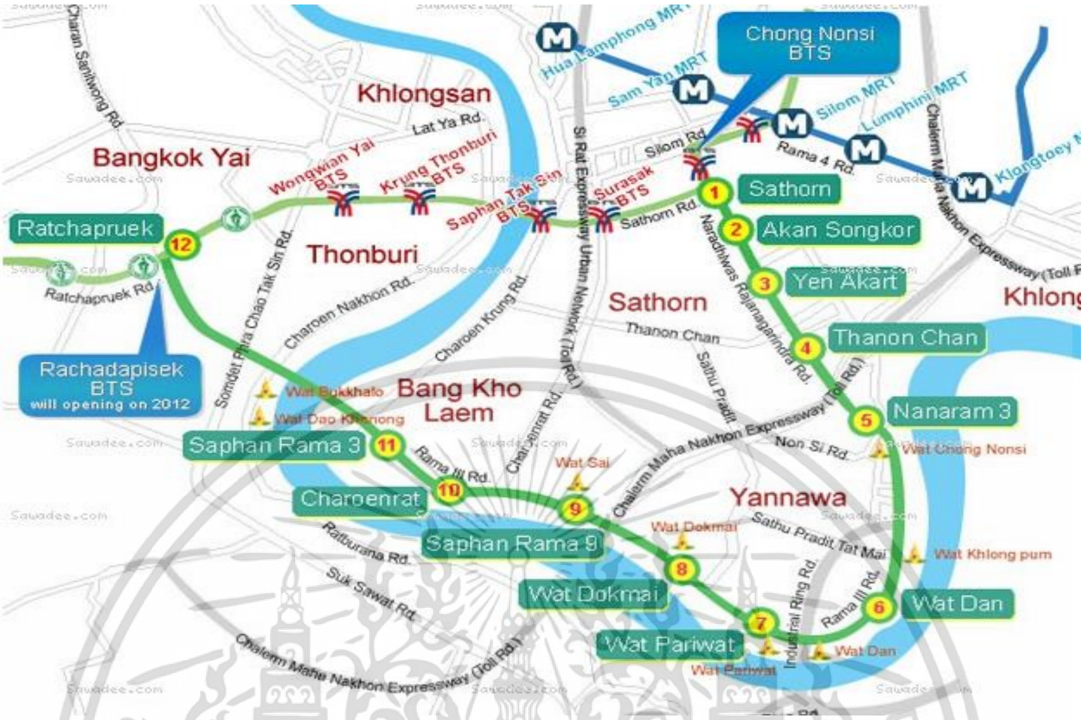


Figure 1.3 Bus Rapid Transit station map

Source: Thanakom, T. K. (2014). *Bus Rapid Transit (BRT)*. (The Krungthep Thanakom) Retrieved 2016, from http://www.thanakom.co.th/thanakom/brt.html

The Bus Rapid Transit system (BRT) started its service on 29 May 2010 with the aim to provide faster, more convenient and better service quality than was on offer from the ordinary bus lines. Such services included sliding glass doors, CCTV inside and outside the bus, and high technology for braking systems. Of particular interest is the fact that the BRT system utilizes a special bus lane for faster travelling, and does so with the flat rate fare system of 5 baht per trip (Thanakom, 2014). The length of this service is 15.69 kilometer in total, and it runs from Sathorn to Ratchapruek, starting at 06.00 a.m. and continuing until to midnight each day.

Note that Figure 1.3 below outlines the BRT route.

1.1.5. Bus

Buses are commonplace in any city. In Bangkok, there ae two specific bus systems, being the intercity line and the cross-city line. Each of these is considered in turn below.

1.1.5.1. Intercity line

Table 1.5 Bus categories, Service rate and Service time

Categories	**Bus Color**	**Fare Rate**	**Service Period**
Regular bus	Cream-Red	6.50 baht	05.00 - 23.00 hrs.
Regular bus	White-Blue	7.50 baht	05.00 - 23.00 hrs.
Regular Express Way (Beige - Red)	Cream-Red	8.50 baht	05.00 - 23.00 hrs.
Regular Overnight (Beige - Red)	Cream-Red	8 baht	23.00 - 05.00 hrs.
Air Condition (White - Blue)	Cream-Blue	10, 12, 14, 16, 18 baht*	05.00 - 23.00 hrs.
Air Condition (Euro 2)	Yellow-Orange	11, 13, 15, 17, 19, 21, 23 baht*	05.00 - 23.00 hrs.

** Depending on the distance traveled*

The Bangkok Mass Transit Authority (BMTA) is operated under the jurisdiction of the Ministry of Transport and Communications by providing bus services for people in Bangkok and vicinities. The BMTA provides 24-hour service for a total of 108 routes, which are served by 3,509 buses (with these regular buses, air-conditioned buses, as well as privately-owned buses operated under the BMTA). The BMTA offering is the cheapest option among other transportation modes in Bangkok and carries approximately 1.05 million people per day.

The BMTA ticket fee depends on the bus type, as shown in Table 1.5 below, where air-conditioned buses have a distance-based rate, while regular buses hold a flat rate. A 50% discount rate is offered to specific groups of passengers, such as blind people, soldiers or police in uniform, elderly people with an age higher than 60 years old, or Buddhist monks and novices.

1.1.5.2. Cross-city line

The Transport Co., Ltd. is a company that provides upcountry transportation services. The location of the related stations are the Bangkok Bus terminal (Chatuchak/Mo chit 2), the Bangkok Bus Terminal (South), and the Bangkok Bus Terminal (Ekkamai). The fare depends on the type of bus and the zone rate, which considers the final destination. Passengers can reserve seats online, and can call or walk-in to buy a ticket. Bus schedules are provided on the website.

1.2. Scope of this study

Bangkok is the capital city of Thailand , which is 1,568.7 square kilometers in size, has approximately 4,700 kilometers of main roads (BMA Data Center, 2013). Bangkok is always listed as a city with a traffic congestion problem. In fact, the world's traffic index measures time spent in traffic due to job commute, along with an estimate of dissatisfaction due to time spent, and an estimate of CO_2 consumption, plus overall inefficiency in traffic systems, and placed Bangkok 12th out of 1,064 locations for the worst traffic in the world. In this regard, the worst traffic situation was given to Los Angeles, USA (ranked 1st), while the minimum traffic index is given to Gioia del Colle, Italy (ranked 1,064th) (INRIX, 2017). In addition, it was determined that the average vehicle speed during rush hour in Bangkok was 18.5 km/hour in the morning and 22.4 km/hour in the evening (Thai Traffic Police Department, 2011). Nevertheless, more cars pour on the streets of Bangkok, as is evident in Figures 1.4, 1.5 and 1.6 that show statistics for vehicles registered in Bangkok over time.

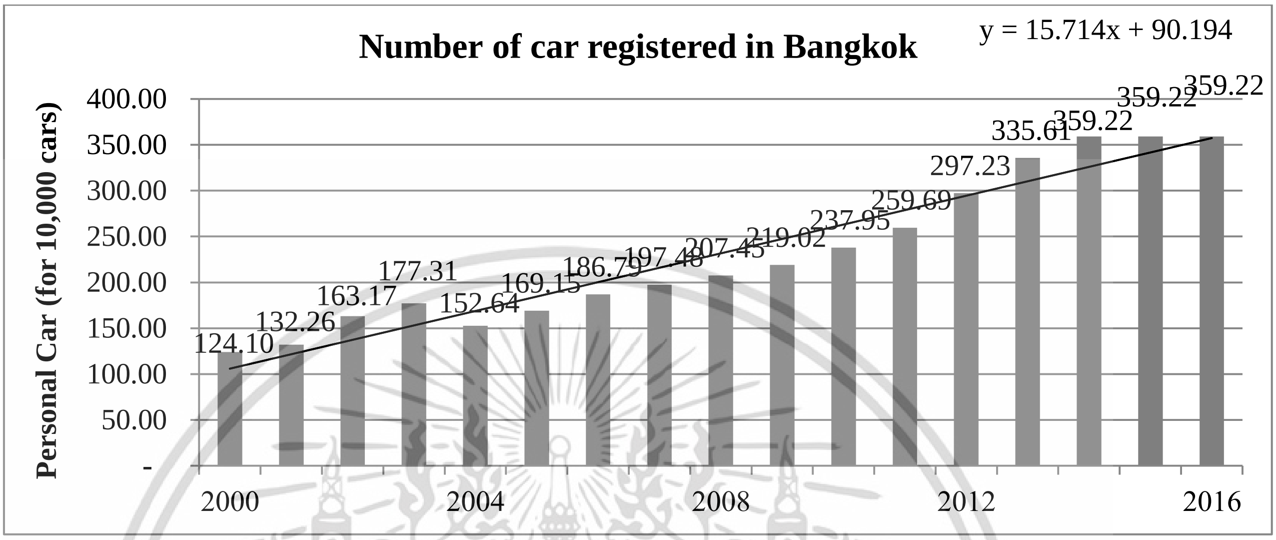


Figure 1.4 Number of Cars Registered in Bangkok

Source: Transport Statistic Sub-Division, Planing Division. (2016). *apps.dlt.go.th*. Retrieved from http://apps.dlt.go.th/statistics_web/newcar.html

Figure 1.4 above shows the number of cars registered in Bangkok from 2011 to 2016 as reported by the Department of Land Transport (Transport Statistic Sub-Division, Planing Division, 2016). The number of cars registered in Bangkok appears to increase consistently from year to year. Additionally, in the year 2012/2013, the Thai government launched the “first-car buyer campaign” whereby the government encouraged people who had never owned a car to buy a new one, and did so by sponsoring a 100,000 THB tax deduction for each car purchased. This was done in order to boost economics of the automotive sector after a long break in production due to the flooding crisis of 2011. Consequently, the number of cars on the road increased rapidly and, hence, the supply of roads was challenged further in trying to meet the increased demand brought about by growth in car ownership.

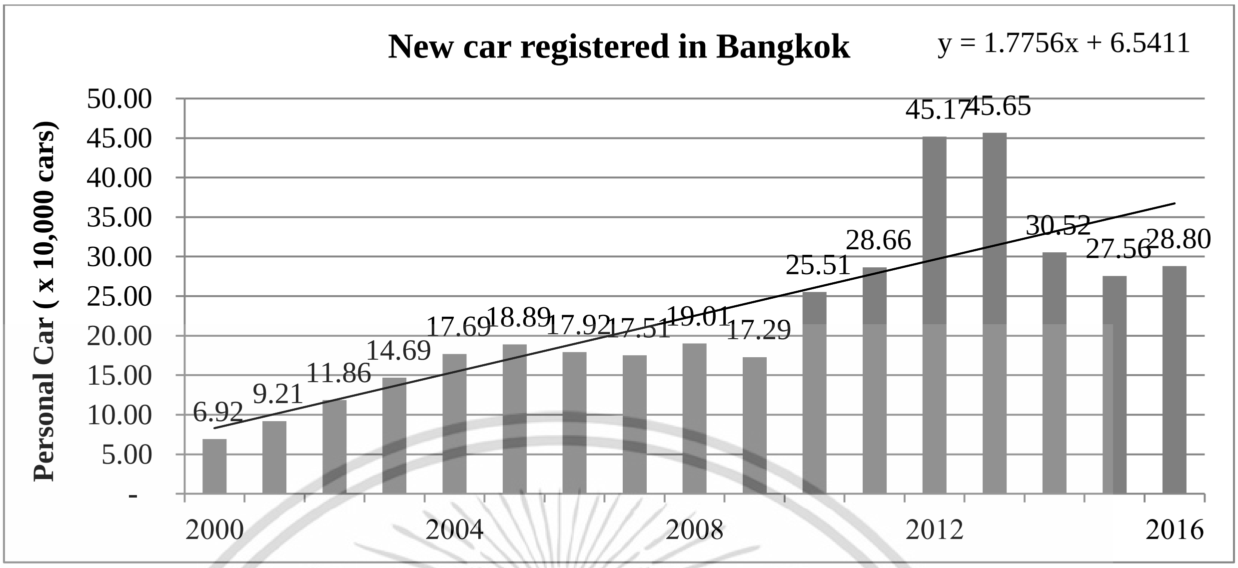


Figure 1.5 New Cars Registered in Bangkok

Source: Transport Statistic Sub-Division, Planing Division. (2016). *apps.dlt.go.th*. Retrieved from http://apps.dlt.go.th/statistics_web/newcar.html

To resolve the existing, and accelerating, traffic congestion problem, the Bangkok Metropolitan Administration (BMA) launched the Bangkok Rail Network project, which is expected to be complete within the next 15 years. The project plans to extend the three existing routes (BTS-Green, MRT-Blue and ARL) and construct 10 new routes around Bangkok with the aim that this rail network can relieve road congestion, reduce car ownership and reduce carbon dioxide (CO_2) emission in the transport sector. Currently, the three rail transit systems, namely the Bangkok Mass Transit system (BTS), the Mass Rapid Transit (MRT) and the Airport Rail Link have had a positive impact on reducing the city's congestion, especially since the BTS passes through most of central business district (CBD), as well as offering connectivity with other transportation modes for intercity or upcountry travel. As indicated in the introductory section, the BTS is the first electrical rail transit system in Thailand. Generally, it is the most popular transit system among the three that are available and this, then, becomes the focus of this study.

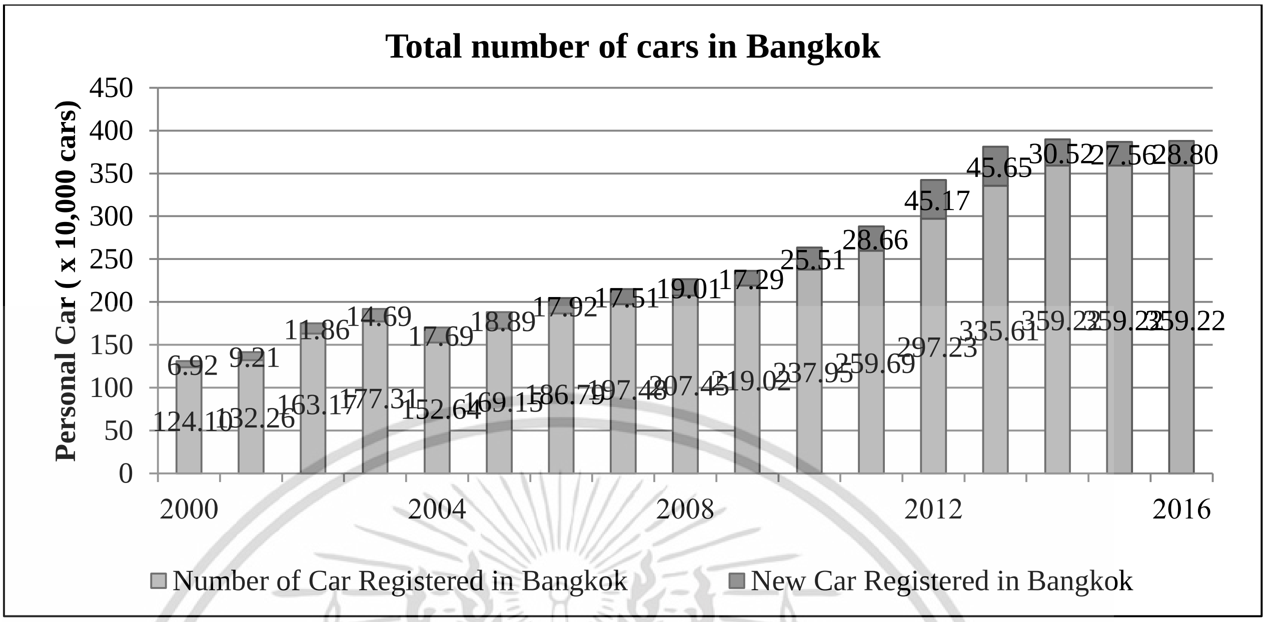


Figure 1.6 Total number of cars in Bangkok

Source: Transport Statistic Sub-Division, Planing Division. (2016). *apps.dlt.go.th*. Retrieved from http://apps.dlt.go.th/statistics_web/newcar.html

As is evident in Figure 1.5 above, the number of new cars registered in Bangkok is continuously increasing overall, but does show a short-term decrease beginning in 2006. On the other hand, as is seen in Figure 1.7 below, the number of BTS users increased in 2006. For years 2007 to 2009, the number of new cars registered declined slightly. In 2008, the number of new cars registered increased from 2007 by considering the capacity utilization rate which increase at 74.9%. This measure is more than that in the year 2007, being at 73.3% (Bank of Thailand, 2009). Reasoning behind the increase in the registration of new cars can be attributed to the availability and use of so-called gasohol E20 fuel, for which there was a 5% cut in the related excise tax, and which stimulated buyers at a time, being the first half of 2008, when the price of oil was increased due to the US financial crisis, and this had an impact upon buyer demand. From that reason, the number of new cars registered had increased just little. In 2009, the number of new cars registered dropped again because of the global financial crisis (Hamburger effect). People reduced spending, especially on electrical and vehicular products in the first half of the year. But, in the second half, after the crisis passed the demand for cars increased, as it did in 2010.

For number of BTS users is presented in Figure 1.6), and it shows an upward trend over time. However, this tendency starts decreasing at a slower rate in 2007, but still increases continuously, especially in 2011 because of the new extensions and stations mentioned earlier in the introduction. We can say that the extension of the BTS lines is a factor that persuaded more people to use the BTS. Although the number of BTS users increase, we also saw that the number of new cars registered also increased over the same period of time. From what is presented in Figure 1.4 above, we can see that the number of cars registered had increased every year. The only reason to make people reduce buying new cars is an adverse economic situation as mentioned before. We can say that even though the service quality of PT is improved, it cannot guarantee that people will use PT and reduce the buying of cars. It can be suggested that the government has to encourage the use of PT by launching an attractive policy that will affect car usage negatively.

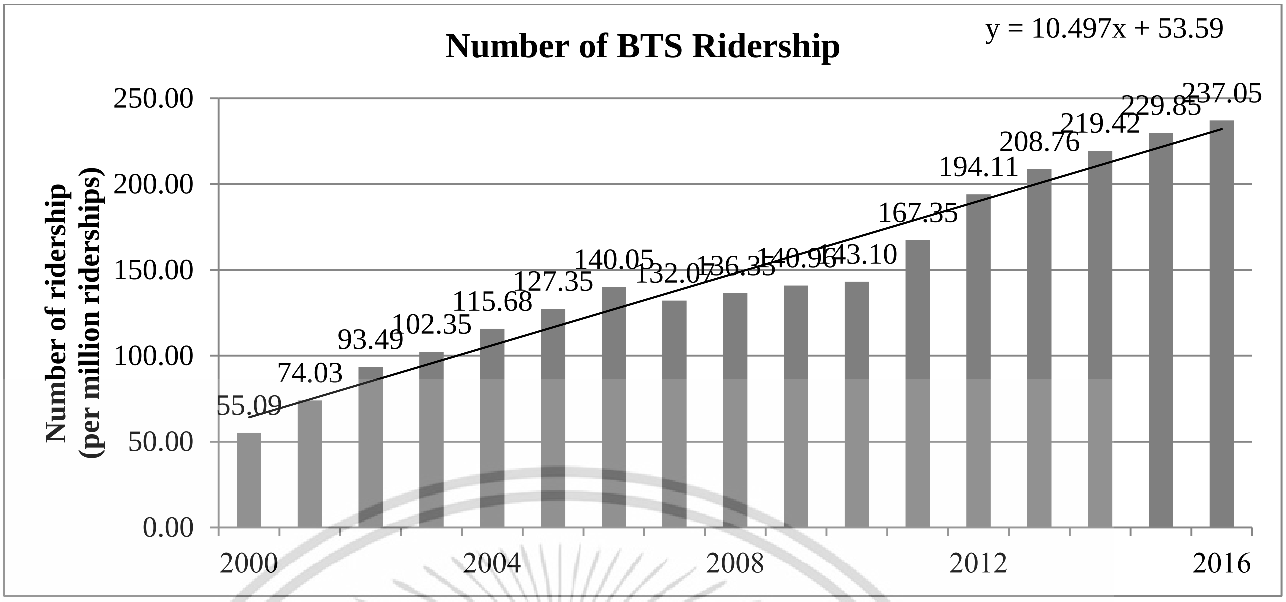


Figure 1.7 Number of BTS Users

Source: *Bangkok Mass Transit System Public Company Limited*. (1999, December 5). (Bangkok Mass Transit System Public Company Limited) Retrieved Febuary 2016, from http://www.bts.co.th/customer/th/main.aspx

At this juncture, it is worthwhile considering the factors influencing transportation options. Weerapong Chompoonut (Chompoonut, 2011) suggests that there are two types of behavior that have an impact on the decision to choose between the use of public transportation (PT) and the use of a personal vehicle (PV). Specifically, these are *attitudes* and *habits*. The attitudes toward PT, especially for anyone in the personal car user group (CU), are such that PT is considered to be an inconvenient mode of transportation as this requires longer travelling time and waiting time. In addition, PT required many transfers to arrive at the desired destination (Chompoonut, 2011). To persuade people to use PT, (Beirao & Cabral, Understanding attitudes towards public transport and private car: A qualitative study, 2007; Chiou, Wen, Tsai, & Wang, 2009; Nurul Habib, Kattan , & Islam, 2011) related researchers and commentators suggest increasing the service quality level of PT, improving the reliability of time schedules, and also increasing the convenience of PT overall. These would be important factors for transit users. Not only do we need to consider attitudes toward PT. We should contemplate attitudes toward personal vehicle usage as these can also impact a person's decision as to how they will travel. Generally, people believe that travelling by car is better than travelling by PT in term of comfortability and higher social status (Van, Choocharukul, & Fujii, 2014). Additionally, habit is considered as an important factor affecting behavior as well. Habit is defined as the automatic action in certain situations that can achieve the known result of a respondent. For example, car users were asked about their actions during periods if traffic congestion. Most of their responses were to do with changing their daily activity, such as avoid travelling in peak hour, or to reduce outdoor activity rather than changing the mode of transportation. In other words, it is their habit and associated preference to choose a car as the major mode of transportation. Dell'Olio, et al. (Dell'Olio, Ibeas, Dominguez, & Gonzalez, 2012) suggests that increasing parking tariffs and fuel taxes can be used as a method to change travel habits and shift preferences from PV to PT in order to decrease car usage. To further investigate the behaviors of both the PT group and the PV group in Thailand, our study employs the Theory of Planned Behavior (TPB) to identify important factors affecting the intention of people to use and not use the BTS. We hope that, by improving quality of those important factors, the BMA will be able to persuade PV users to switch their mode of transportation to PT, which will then resolve the traffic congestion problem in the Bangkok metropolitan area.

CHAPTER 2

LITERATURE REVIEW

A number of studies on BTS user satisfaction in Thailand, as well as to do with factors affecting the use of public transport instead of personal vehicle, have been conducted in order to understand the travel behavior of Bangkok residents. Wanida Thaikua (2001) and Phuttaraporn Netipunya (2005) reveal that most BTS users are office employees and students with the purpose of travelling being to commute to their workplace or academic institute (Thaikua, 2001; Netipunya, 2005). Such travelling will be referred to as a home-based work (HBW) trip. It is understood that the major reasons for people using the BTS service are that 1) the distance from the origin to the initial BTS station and from the final BTS station to the eventual destination are within walking distance; 2) the price is affordable; 3) the BTS is convenient when compared to other forms of public transportation; and 4) the BTS can used to avoid traffic congestion during rush hour and other period of traffic congestion, which implies that the most important factor achieved by the BTS in terms of user satisfaction is rapid and punctual transportation. Other factors investigated that affect the intention of people to use the BTS are convenience, the accessibility and, thus, the number of stations, fare prices, and travelling time. The results of this research were reported with the middle score of a Likert-scale (Thaikua, 2001; Vimoolchart, 2010), which can be conclude that BTS service quality does not impress the ridership. In contrast, personal car users consider convenience, privacy and safety as key factors by which to measure their satisfaction. In addition, they believe that public transportation is unsecure, is inefficient in relation to time utilization, and inconvenient. With any such negative attitude, the intention of people to use public transportation, such as the BTS, would be kept at a minimum.

Further study is considered to be beneficial regarding the intention and attitude of people toward public transportation, as well as any comparison study required to increase the level of public transportation quality.

2.1. Factors affect intention using public and private transport

To study the behavioral intention in relation to people using public and private transportation, sociodemographic, transportation, and psychological variables are considered. Sociodemographic variables include gender, age, car license and ownership, and income. *Gender* is a significant variable in determining both public and private transport usage. For instance, in contrast to females, Loo (2015) reveals that males has more intention to use a car (Loo, Corcoran, Mateo-Babiano, & Zahnow, 2015), and are less likely to use public transportation (Buehler & Pucher, 2012; Peng, Zhi-cai, & Lin-jie, 2014). With regard to *Age*, Van, Choocharukul, and Fujii, (2014) found that young adults have a high intention to use a car (Van, Choocharukul, & Fujii, 2014), although it was noted that any young adults who were without a *driver's license and personal vehicle* still had to travel by public transportation (Worku, 2013; Clark, 2009). The last sociodemographic factor is *income*. Researchers show that people with high income have a high probability of car ownership, and that leads to high car usage when compared to people who have low income (Rong & Tzu, 2014; Loo, Corcoran, Mateo-Babiano, & Zahnow, 2015; Clark, 2009).

Vehicle variables are convenience, travelling time, independence, and safe travelling at night, which can be seen as advantages of owning a personal car (Beirao & Cabral, Understanding attitudes towards public transport and private car: A qualitative study, 2007; Hagman, 2003). In contrast, advantages of public transportation involve more convenience when people ae going to central business district (CBD) and are faced with parking problems there, with this referring to both parking charges and space availability (Beirao & Cabral, Understanding attitudes towards public transport and private car: A qualitative study, 2007). When persuading people to use public transportation, factors that affect their intention include the expense of car usage and the service quality of public transportation. Car usage expenses are comprised of car maintenance and fuel costs. As might be obvious, increasing these costs might affect personal car usage (Rong & Tzu, 2014; Hagman, 2003; Chiou, Wen, Tsai, & Wang, 2009). Improvement of public transportation service quality, such as punctuality, the number of station, and greater coverage of a preferred route will provide a higher probability of public transit usage (Jaiswal & Sharma, 2012; Zhao, Deng, Song, & Zhu, 2013; Dell'Olio, Ibeas, Dominguez, & Gonzalez, 2012). The last consideration here is the psychological variable. It will be discussed later when the theory of planned behavior is presented.

It should be noted that rail transportation offers reliability and convenience and is a good choice among public transportation options, but related fare costs and the limitation of route coverage make buses more appealing. Still, given traffic congestion in metropolitan Bangkok, increased public transportation and service quality is needed. In addition, greater route coverage is a primary factor that begs for improvement. Other factors, such as those related significantly to the use of rail transport, include fares and the location of train stations, specifically in relation to the central business district, educational institutions, and major shopping malls (Zhao, Deng, Song, & Zhu, 2013; Dell'Olio, Ibeas, Dominguez, & Gonzalez, 2012).

2.2. Theories and Model in Psychology

Psychology is the scientific study of mental processes and behavior in humans and is a major area of study. To understand human behavior, many psychologists try to study what factors affect the intention of individuals, and what turns any such intention into action. A number of theories were proposed for study to gain more understanding about psychology. Essentially, different theories of psychology identify how different psychologists approach their research into human behavior. A select few of these are presented below.

2.2.1. The Norm-Activation Model

The Norm-Activation Model (NAM) was proposed by Schwarts in 1977. It contains a complicated model of human decision making in moral situation that describes the relationship between *activators, personal norms* and *behavior*. As is seen in Figure 2.1 below, personal norms take a central position in this theoretical model and these area activated by 6 factors, being 2 personality trait activators and 4 situational factors. A *personal norm* is an expectation from the individual's self. Schwartz assumes that any *personal norm* is activated by *awareness of need* and an *awareness of consequences*, such that a person will perceive negative results if there is no action, and that this might affect the activators' decision to act. *Denial of need*, *effective actions*, *personal ability* and *responsibility* are 4 situational factors. An individual recognizes that their ability could do with help and they will consider obtaining helping. However, if these costs are perceived as too high, they might rationalize the situation in order to neutralize the activated personal norm by way of the *denial of need, effective actions, personal ability* or *responsibility.*

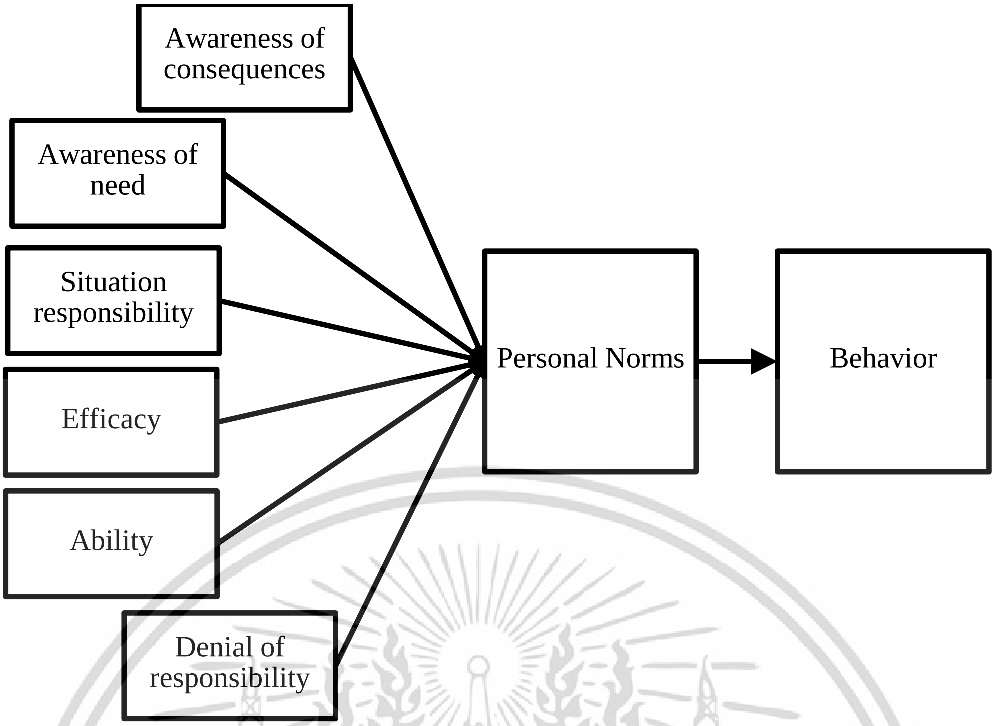


Figure 2.1 The Norm-Activation Model by Schwarts in 1977

The model proposed by Schwarts is widely uses for environmental studies in the transportation area (Harland, Staats, & Wilke, 2007). More specifically, this theory has been used to understand personal norms in relation to the decision of people to use public transportation given the concerns of environmental pollution held by personal car users. The result of such a study concluded that people who concern more about the environment will feel guilty when they use a car and that hey, then, will try to find an environmentally friendly transportation solution (Bamberg, Hunecke, & Blobaum, 2007; Nordlund & Garvill, 2003).

2.2.2. Technology Acceptance Model

The Technology Acceptance Model (TAM) was proposed by Fred Davis in 1986 (Davis, 1986; Chuttur, 2009).This model is commonly used for examining technological acceptance. The model, represented diagrammatically in Figure 2.2 below, shows how user motivation is effected by three factors, with these being *attitude toward using*, *perceived usefulness*, and *perceived ease of use*. The *attitude toward using* is a major determinant in making decision to accept or reject to action and consists of 2 important factor, specifically *perceived usefulness* and *perceived ease of use*. The latter is defined as "the degree which an individual believes that using a particular system would be free of physical and mental effort". *Perceived usefulness* is defined as "the degree which an individual believes that using a particular system would enhance his or her job performance".

The model is used in public the transportation area of research to explore the factors affect car users' intentions to use public transport. Chen and Chao (2011) selected perceived ease to use as a factor in their study after posing the question "how easy is it to use mass rail transit?" and had taken advantage of perceived usefulness in asking a question to do with "is it worth using mass rail transit by considering the travelling time and fare?". The results show that both perceived ease to use and perceived usefulness have a positive effect on the intentions individual, which means that more improvement in the function system design provides more reliability and convenience to users of a transportation system (Chen & Chao, 2011).

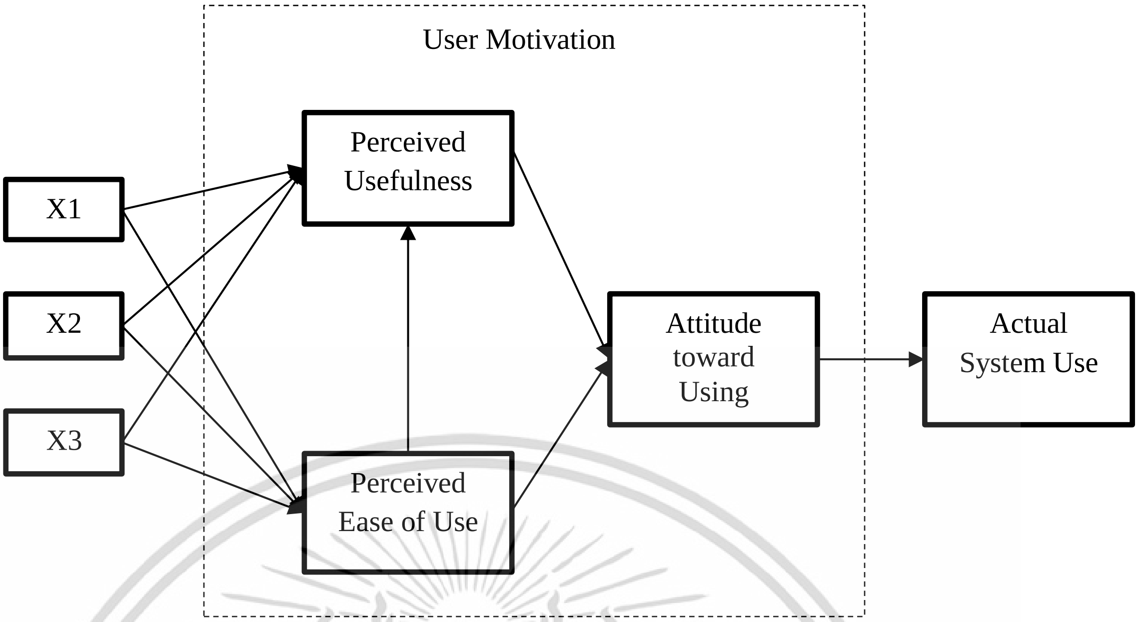


Figure 2.2 Original TAM proposed by Fred Davis

2.2.3. Dittmar

Dittmar is a popular theoretical framework designed in 1992 to assess planned behavior and is used mostly to study the behavioral intentions of car users. It is comprised of three motives, with these being instrumental, symbolic or social, and affective. *An instrumental motive* is defined as the convenience or function of object. *A symbolic or social motive* refers to position in society or social status, as well as to the expression of personal identity and values. *An affective motive* refers to emotions when action takes place.

Steg (2005) used the Dittmar framework to explain to what extent all three motives contributed to car use. The model of this particular study applied determinants of the theory of planned behavior inherent in the Dittmar framework. Symbolic or social motive is based on a subjective norm and, thus, is to do with the impact of social pressure to perform some sort of behavior. Instrumental motive is based on attitude toward behavior, and this infers concern about such factors as convenience, comfort and safety.

The result of the study by Steg shows social pressure or social status is significant to a car user, but not so for the instrumental motive (meaning the attitude about a car, such as in terms of comfort and convenience) (Steg, 2005). In another study from Van, Choocharukul and Fujii (2014), focus is upon the instrumental motive, such as the attitude toward car use; with this referring to comfort, convenience and safety), and this was seen as having a positive effect upon the intention to use a car (Van, Choocharukul, & Fujii, 2014).

2.2.4. Theory of planned behavior

The theory of planned behavior (TPB) is widely used for psychological studies to do with internet banking, the accommodation industry, household energy use, the transportation area and more.

In the internet banking area (Nasri & Charfeddine, 2013), the study uses this TPB to identify and clarify factors that influences internet banking users in Tunisia. The result showed that all three factors, with these being 1) attitude toward the behavior, 2) subjective norm, and 3) perceived behavioral control (PBC) having a positive effect upon customer intention to use internet banking. As suggested earlier, TPB is not only used in the banking area, but in the accommodation industry. For instance, a study in Australia had the objective to understand the psychological factors affecting the crisis planning behavior of accommodation managers (Wang & Ritchie, 2012). The conclusion showed that the attitude toward such behavior, and subjective norms, are identified as key factors that influence crisis planning. Experience was added into this model and was found to have a positive and significant effect. With regard to household energy use, the objective of an associated study was to explore the relationships between household energy use and he intention of householders to reduce their energy use. The results showed that attitude toward the behavior and perceived behavioral control play a role in forming the intention of householders to reduce their energy usage. As well, a higher level of perceived behavioral control (PBC) and a more positive sense of energy conservation had shown stronger intentions to reduce energy use (Abrahamse, 2011).

It is apparent that all of the aforementioned studies support the theory of planned behavior (TPB) and how it affects the intention of individuals, especially in relation to their attitude toward the behavior and perceived behavioral control (PBC). This is reflected in the schematic shown in Figure 2.3 below.

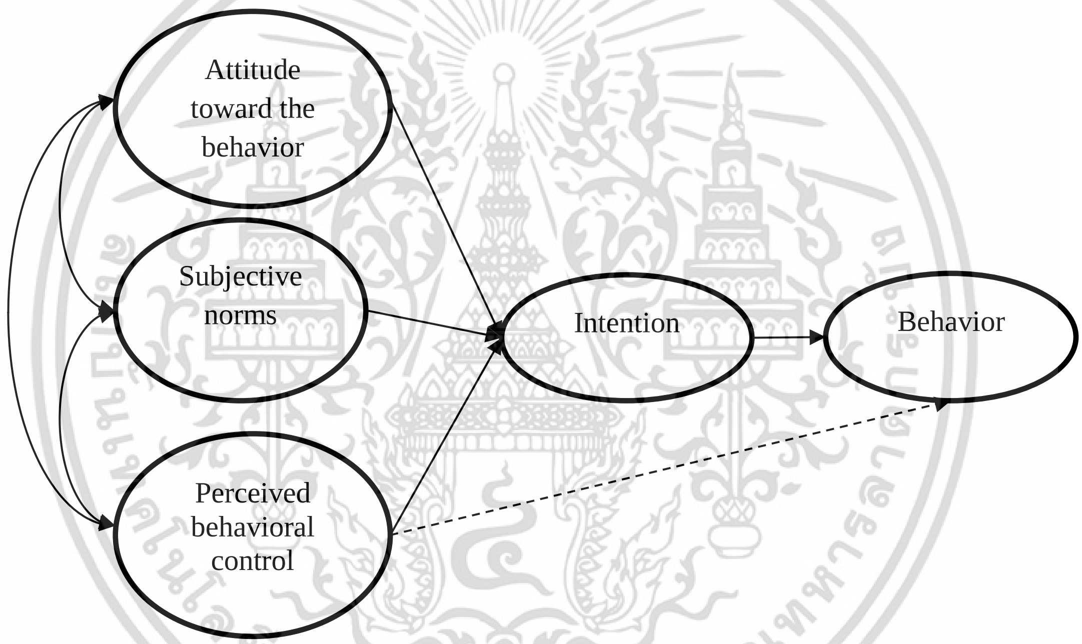


Figure 2.3 Theory of Planned Behavior Model by Icek Ajzen (Ajzen, 1991)

2.2.4.1. Theory of planned behavior in the transportation area

In the transportation area, the theory of planned behavior (TPB) is used to predict and explain travel mode choice behavior, as well as the intention to switch from using a personal car to public transport (PT). Researchers from the United Kingdom (I.J. Donald, S.R Cooper, & S.M. Conchie, 2014), Taiwan (Chen & Chao, 2011) and Thailand (Chompoonut, 2011) had the same objective to identify the difference in psychological factors affecting commuter transport preferences by using the Likert-scale as a tool of study. There were 3 determinants of the theory of planned behavioral (TPB). First, *attitude toward the behavior* associated with public transport is normally assessed using safe – unsafe, convenience – inconvenience, good – bad, or pleasant – unpleasant with regard to the basic question of "what do you think if you have to take public transport to commute next time?". Second, the extent of any *subjective norm* is measured with the use of questions to do with statements, such as "most people who are important to you would support you to take public transport", "most people who are important to you think that you should take public transport", or "public opinion will affect your choice of taking public transport". *Perceived behavioral control (PBC)* is assessed with questions such as, "is it easy for you to take public transport for travelling?" or "do you have high confidence that public transport will work?". Many studies have extended this conceptual framework of the TPB by adding more variables, such as environmental concern, personal norms and habits that can explain more in understanding the choice behavior of commuters. Even as further potential contributors are added, the attitude toward behavior (Simsekoglu, Nordfijaern, & Rundmo, 2015; I.J. Donald, S.R Cooper, & S.M. Conchie, 2014; Bamberg, Hunecke, & Blobaum, 2007), subjective norm (I.J. Donald, S.R Cooper, & S.M. Conchie, 2014), and perceived behavioral control (Bamberg, Hunecke, & Blobaum, 2007; I.J. Donald, S.R Cooper, & S.M. Conchie, 2014) are found to have significant impact upon the intention and behavior of people.

Given all of the theories and models in psychology mentioned thus far**,** the TPB is applied in this study as it is a potentially suitable model for identifying what factors affect people in using the BTS. Travelling mode choices of people are selected by considering their motivation, as well as the impact of external constraints. So it is that the TPB concept can be used to measures the influence of such issues in determining results that might help to gain a better understanding of travelling preferences.

Given that many studies had extend the conceptual framework of TPB by adding more attributes, such as environmental concern and personal norms to explain more in relation to the choice and behavior of commuters, habit is also applied in this study. Essentially, habit is an automatic reaction to certain situations that were acquired through previous repetition of a mental experience. Consequently, any judgment to do with someone making a choice about travelling is made by their habitual behavior more than through information about any associated attributes. Essentially, habit affects the complicated process of decision making associated with what mode of transport to use (Aarts, Verplanken, & Knippenberg, 1997). Therefore, it is a powerful factor that directly or indirectly influences public transportation usage (Chen & Chao, 2011; I.J. Donald, S.R Cooper, & S.M. Conchie, 2014; Simsekoglu, Nordfijaern, & Rundmo, 2015).

2.3. Analytical Model

2.3.1. Best-worst scaling

Best-worst scaling (BWS) avoids problems that occur with other rating scales. It makes respondents select their choice with more precision, reduces social-desirability bias, and diminishes use of the middle or end point. The task of answering questionnaires appears easier to be for respondents, but it is found to be a more time consuming method than is the case for others. However, BWS also lacks discriminating power as it forces respondents to take one of 2 choices (best and worst) even they do not want to or have a preferred alternative in a choice set. Fir instance, some attributes have similar importance or have no best or no worst characteristic among the available choices (Louviere, Lings, Islam, Gudergan, & Flynn, 2013; Huybers, 2014).

Beck and Rose (2016) used best-worst scaling to measure attitude toward public bus transport by way of a survey focused upon both importance and satisfaction. They also compared the best-worst scaling method with the 5 Likert scale by using a correlation coefficient between the satisfaction and importance parameters. The results showed that correlation of the best-worst scaling recovers both a positive and a negative value between the importance and satisfaction results. BWS can clearly discriminate between the most important service and the level of satisfaction. Differing from results of the Likert scale, correlation of importance and satisfaction are all positive, which is hard to analyze in terms of any truly importance factor or satisfaction (Beck & Rose, 2016).

2.3.2. Likert scaling

Likert scale is used primarily in questionnaires to obtain the preferences of participant or the degree of their agreement with a statement or set of statements proposed for their consideration. In such cases, respondents are asked to indicate their level of agreement with a given statement by way of an ordinal scale. A Likert scale provides a range of responses to a given question or statement. In general, there is a 5 point-scale of response by way of words such as strongly approve, approve, undecided, disapprove, and strongly disapprove. Such rating scales are accepted as being a powerful and useful tool, but these still lack accuracy and precision because 1) researchers cannot check if respondents provide real information, 2) respondents cannot add any comments about the survey issue, and 3) there is tendency of respondents select the mid-point of a 5-point or 7-point scale (known as the central tendency). Preston and Colman (2000) studied what the optimal number of response categories in a rating scale might be and their result show that it is most reliable and preferable to use a 7, 9, and 10 point-scale (Preston & Colman, 2000). Scale can be too difficult to use or too simple to allow respondents to express themselves. As well, in case of a lot of questions arise, or many point scale is provided, then respondents might become frustrated and demotivated, and this can mean that the quality of their responses could decrease.

CHAPTER 3

METHODOLOGY

Theory of Planned Behavior

The concept of the theory of planned behavior (TPB) was proposed by Icek Ajzen in 1985 (Ajzen, 1991). Many researchers use it as a framework for gaining more understanding in relation to the personal intention of their particular area of interest. As might very well stand to reason, it is useful to predict and explain human behavior, especially in terms of intention and actual behavior. This helps us to understand the human mind and any behavioral determinants. The theory assumes that *attitude toward the behavior*, *subjective norms*, and *perceived behavioral control (PBC)* affect the intention of a person in any area under investigation.

The first determinant is *attitude toward the behavior*. It is the favorable or non-favorable feeling of an individual toward an object or action performed in a specific situation. For instance, it easy to understand if a person believes that the result of performing behaviorally will turn out to be positive, they will have a favorable attitude toward performing that particular sort of behavior. Next, *subjective norm* describes the perception of social pressure to perform or not perform any type of behavior under consideration. The last determinant is *perceived behavioral control (PBC)*. From what was presented in Figure 2.3, PBC can influence intention or behavior. A linkage of *PBC* and *intention* can be described by way of stating that even people can have a positive attitude, but that a lack of information or resources leads them to uncertainty of success in making them reject a course of action. For linking of *PBC* and *behavio*r, in some situations only self-efficacy, perceived ease of performance, or past experience influences people to behave in a certain way. This concept is the generalized belief that one's outcomes are under the control of one's own behavior, and that this will lead to an action.

Attributes in scope of the study model

The purpose of our study is to find factors affect the intention of individuals in using the BTS by focusing on the theory of planned behavior (TPB); specifically, their attitude toward behavior and perceived behavioral control, their behavioral intention toward using the BTS, and their car usage habit.

It is noteworthy that social norm is not included in this study. As Fishbein and Ajzen (1975) acknowledged, this subjective norm was the least understood aspect. Previous studies also found that the subjective norm had no effect upon a person's intention or action (Abrahamse, 2011; Murtagh, Rowe, Elliott, MaMinn, & Nelson, 2012).

With all of this as pertinent background, the scope of this study is presented in Figure 3.1, which his shown below.

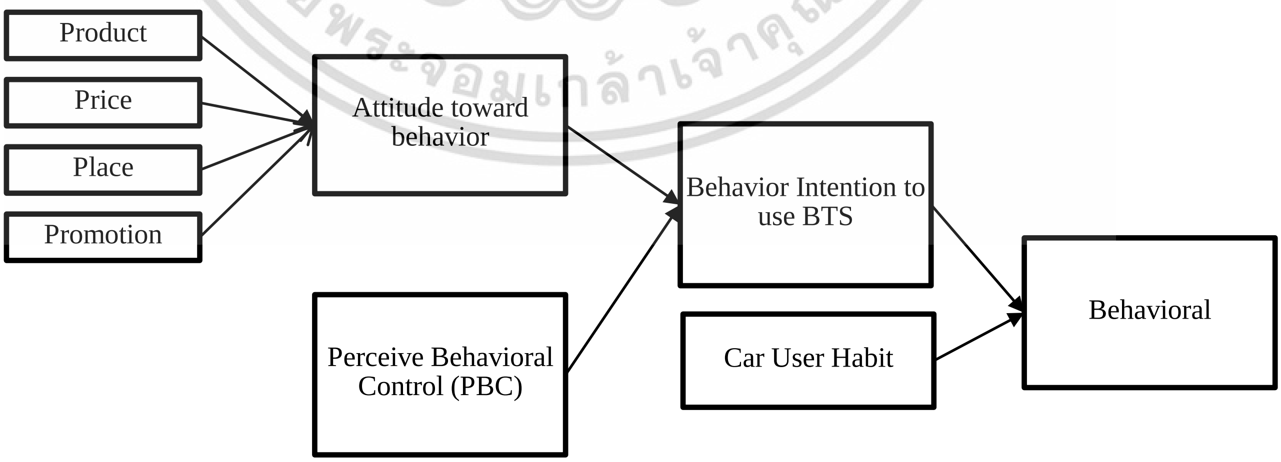


Figure 3.1 Scope of this study model

Attitude toward behavior

For this study into the attitude of people toward usage of the BTS sky train, a marketing mix (referred to as the 4Ps) is applied to identify what factors affect with attitude of BTS users.

The *Marketing Mix* framework (also known as the 4Ps) was introduced by Jerome E. McCarthy in 1964. Implementing this approach allows any company to identify the strengths and weakness insides an organization. This framework is used widely and has become one of the most popular concepts in marketing.

The Marketing Mix (4Ps) components (Kotler & Armstrong, 2010) are presented in Table 3.1, as is shown below.

Table 3.1 Marketing Mix

Marketing Mix (4Ps)			
Product	**Place**	**Promotion**	**Price**
Physical good features	Channel type	Promotion blend	Flexibility
Quality level	Exposure	Salespeople	Price level
Accessories	Intermediaries	• Number	Terms
Packaging	Outlet locations	• Selection	Differentiation
Warranties	Transportation	• Training	Discount
Product lines	Storage	• Incentives	Allowances
Branding	Managing Channels	Advertising	
		• Targets	
		• Media types	
		• Types of ads	
		• Copy thrust	
		Sales promotion	
		Publicity	

Furthermore, it is worth noting additional information about these four key features:

- *Product* means the goods-and services combination that a company offers a target market (and includes: variety of product, quality of product, design, features, etc.)
- *Price* is the amount of money customers must pay to obtain the product (includes: list price, discount, etc.)
- *Place* includes company activities that make the product available to target consumers (includes: location, channels, logistics, etc.)
- *Promotion* means activities that communicate the merits of the product that persuade target customers to buy it (includes: advertising, sales promotion, etc.)

Service quality is a key factor that can persuade a car user to use public transport (PT). In this study we use the *marketing mix* concept for determining the attitude of people toward the BTS. As just indicated, the *marketing mix* includes *product, place, promotion and price*. To identify which factors have any impact upon public transport (PT) usage, the marketing mix concept is applied in relation to the attitude that people have toward travel, and use of the BTS in particular. This is presented in Table 3.2 immediately below.

Table 3.2 BTS in Marketing Mix

Marketing Mix (4Ps)			
Product	**Place**	**Promotion**	**Price**
Travelling time	Accessibility	Advertising	Fare
Time reliable	• Station	Sales promotion	Discount
Extended in operating time	• Connectivity	• Privileges for Nuduan club	Allowances
	Park and Ride		• Ease to

Safety	card	buy ticket
	• Rabbit card	

As can be seen in Table 3.2 above, the first element is *product.* In the context of the BTS, it includes operating time, travelling time, and on-board conditions that consist of comfort, cleanliness, and safety. It is noteworthy that complains about public transportation are always about discomfort, poor accessibility, and also unreliability of travelling times (Jaiswal & Sharma, 2012). these, then, become important factors to which any transportation firm must pay attention (d'Ovidio, Leogrande, Mancarella, Schinzano, & Viola, 2014; Antoniou & Tyrinopoulos, 2013). By so doing, they can improve their service quality to make more people use public transport. In this study, speed of the traveling, reliability of the BTS time schedule, the extent of the BTS operation time, as well as safety inside the BTS stations and on board (Peng, Zhi-cai, & Lin-jie, 2014; d'Ovidio, Leogrande, Mancarella, Schinzano, & Viola, 2014; Noor, Nasrudin, & Foo, 2014; Geetika, 2010; Wei & Fernandez, 2013) are applied as appropriate attribute for review in this study.

Second, *Price* is useful as it influences people to use public transport (Sharaby & Shiftan, 2012). One study mentions the impact of the fare system in Haifa, Israel. That fare system was transformed from a flat fare to becoming zone-based. The result of this study showed that the number of passengers per trip increased as a consequence of the rate policy change. As might be understood, reducing fare charges attracts people and increases their demand for public transport (Dell'Olio, Ibeas, Dominguez, & Gonzalez, 2012). But, in some studies, when fares were compared with other factors, such as comfortable or convenience, it was found that fares were the least effective factor to have ant impact upon the intention people in using PT (d'Ovidio, Leogrande, Mancarella, Schinzano, & Viola, 2014). Not only is it the fare rate that can affect people, but also the very method to get any ticket, such as the number of coins necessary to place in any ticket machine (Noor, Nasrudin, & Foo, 2014). Consequently, ticket issuing machines receive both coins and banknotes are also included in this study (Noor, Nasrudin, & Foo, 2014; Peng, Zhi-cai, & Lin-jie, 2014).

The third element is *promotion*. This includes advertising and sales such as privileges received from Nuduan club membership, and also benefits available to Rabbit cardholders. Such promotion campaigns provide special offers to particular passengers and allows them to enjoy exclusive privileges, such as to participate in special activities, as well as earn discounts for food purchases in restaurants, or to received attractive coupons for the purchase of movie tickets. A s a related aside, the aforementioned study in Haifa, in Israel, had a promotion of 1 hour unlimited travel, and this has a large impact upon passengers. It was found that as much as 45% of the passengers might change their travel behavior if no free travel was provided (Sharaby & Shiftan, 2012).

The fourth element is *place*, and accessibility is mentioned as a very good example her. So it is that greater service coverage will make people use public transport more so (Antoniou & Tyrinopoulos, 2013; Dell'Olio, Ibeas, Dominguez, & Gonzalez, 2012). It is all to do with the approach and ability of PT facilities, as well as the distance to any station and the station location. As stands to reason, most people prefer to use public transportation if a station is near to their home or work place (Worku, 2013). Availability and access affect public transport usage demand, and that can have a positive and significant impact on rail transport usage (Worku, 2013; Zhao, Deng, Song, & Zhu, 2013). Note that the number of transfer has a negative and significant impact, which means that more transfers would cause car users to use public transport less (PT).

Following on from the pervious commentary and assessment, the primary tool in this part of the study is *best-worst scaling.* This is utilized to identify which factor in each element is the most effective. So it is that each element includes 4 level attributes, which means that the related question in each case has 4 choices. More clearly, respondents are required to select two choices. Specifically, these are: the most and least important in each element, which are shown in Table 3.3 below.

Table 3.3 Attributes and Attribute levels of Attitude towards BTS Sky Train usage

Attribute	Attribute Level	
Product (A)	Speed of the traveling	A1
	Reliable of BTS time schedule	A2
	Extent of BTS operation time (currently, the first train operates at 05.00 hours and the last train ends operations at 24.12 hours)	A3
	Safety inside the station and on board	A4
Price (B)	Fare price	B1
	Special fare rate for frequent users	B2
	Number of coins used to obtain a ticked from a machine	B3
	Number of ticket issuing machines that receive both coins and banknotes	B4
Promotion (C)	Point collection for fare ticket discount	C1
	Free ticket on a special day, such as Mother's Day	C2
	Exclusive privileges and discounts for dining, products, services, museum entry or for access to entertainment place	C3
	Reward competition when topping up a Rabbit card	C4
Place (D)	Distance between a station and the passenger's origin and also for the destination	D1
	Able to shift to other transportation such as the airport link or shuttle service	D2
	Number of central business districts or malls near a BTS station	D3
	Number of park and ride facilities nearby a BTS station	D4

Perceived behavioral control

The second part of a survey used in this study is to do with *perceived behavioral control (PBC)*. Best-worst scaling is applied. The survey asked participants to identify what obstacle is the most effective in making them denied using BTS services. The result from this part of the study can be used to improve quality of BTS service, and also help to solve problems that make people reject to use of the BTS. Follwojng in from the format in Table 3.3, details related to the PBC part of this study are presented in Table 3.4 below.

Table 3.4 Attribute and Attribute levels of Perceive Behavioral Control

Attribute	Attribute Level	
Perceive Behavioral Control	Crowded on board in peak hour	PBC1
	Unable to reach the destination within one trip	PBC2
	A lot of baggage	PBC3
	Travel with children/ elderly people/ pregnant women	PBC4

Intention

This part of the survey is divided into 2 questions to address the car user and the PT user, as is expanded upon below. This part of survey uses a 10- point Likert scale with the score ranging from 9 (the most likely choice to action) to 0 (no possibility).

Car user:

This survey asks car users about the possibility of them using the BTS in the future, and does so with the question *"I have intention to use BTS in the future"*. It is self-evaluative, and respondents are asked to provide an indication of possible BTS use in the future with the score from 9 to 0.

PT user:

The question for BTS users is *"I have an intention to buy a car in the future"*. Respondents are asked to address the possibility of them buying a car in the future, and they did so with a score from 9 to 0. The result of this part showed the possibility that the number of BTS users might decline in the future.

Habit

In the model of this study, the habit of car use can affect the transport behavior of a directly. This study tries to identify which policies are the most powerful tools making car users reduce car usage and using more public transport (PT). Increasing parking charge, congestion charge, or annual road tax is established to break the car user habit (I.J. Donald, S.R Cooper, & S.M. Conchie, 2014). Increasing the price of fuel and maintenance costs will also affect the car user negatively. The results from some studies supports the view that increasing fuel prices has a large effect on the reduction of energy consumption and also on the reduction of emissions, which means that there is reduction in the usage of cars (Chiou, Wen, Tsai, & Wang, 2009). On the other hand, increasing fuel charges does not force a reduction in car usage. For instance, perhaps they can afford to pay the extra fuel charge, or maybe will cut down on other expenses instead of reducing their car usage (Hagman, 2003).

With regard to habit, five situations affect car usage, and these are used herein. These are as follows, and are also presented in Table 3.5 below. 1) Increasing fuel charge, 2) Parking problem (parking space and parking charge), 3) Congestion charge policy, 4) Increased vehicle tax by 10% yearly for cars older than 6 years and also an annual road tax surcharge, and 5) New car change every 5 years by way of policy. The result of an associated review will provide us with the most influential policy to reduce car usage.

Table 3.5 Habit-related policy factors used in best–worst scaling choice sets

Attribute	Attribute Level	
Habit (H)	Increasing fuel charge	H1
	Parking problem (parking space and parking charge)	H2
	Congestion charge policy	H3
	Increased vehicle tax by 10% yearly for cars older than 6 years and also an annual road tax surcharge	H4
	New car change every 5 years by way of policy	H5

3.1. Questionnaire design

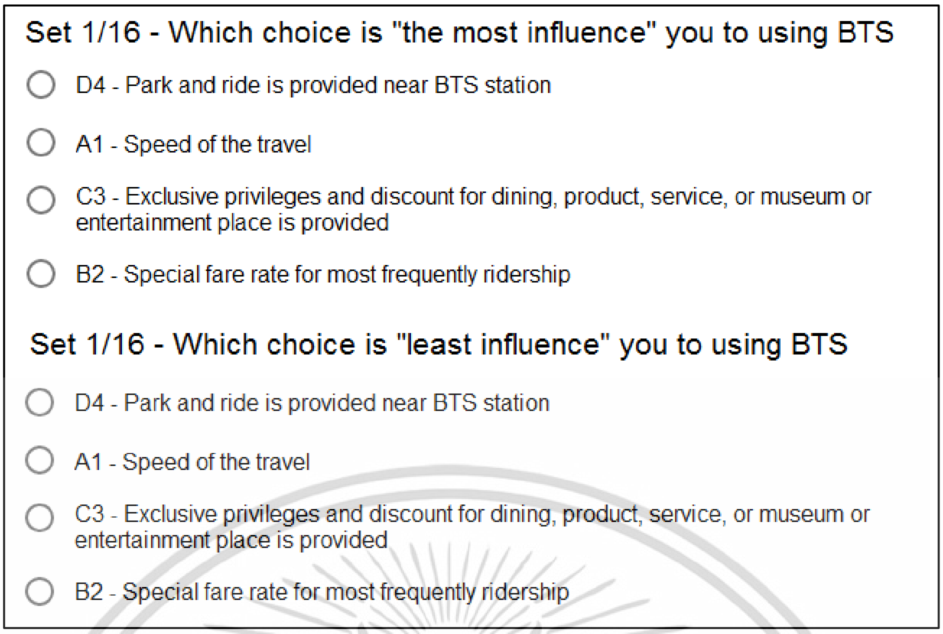
Having designed an appropriate questionnaire, the resultant data were collected between May 2016 and June 2016. A free online survey was provided to respondents via Google instead of using other free online survey methods due to a limitation in the number of questions provided, and also the duration of collecting time (being 30 days for a trial version, for example). The area selected for this study was social media users in Thailand. The study uses both *Best-worst scaling* (Object case and Profile case) and *Likert scaling* to collect data. The questionnaire included 3 sections, which are as follows: The first section relates to socio-economic factors, which include gender, age, education, occupation, income and car ownership. The second section is about daily travelling information. The third section investigated the intention of respondents in relation to using the BTS. This latter section was divided into 4 parts, with these being attitude toward behavior, perceive behavioral control (PBC), and habit using best - worst scaling as a survey method. In addition, a part dealing with intention used a Likert scale.

A best-worst scaling pattern was not available in Google. Therefore, respondents were asked to address 2 sub-questions dealing with the most influence factor for one question and dealing with the least influence factor for another question, as per Figure 3.2

below. The problem with using this pattern is that some respondents selected the same choice for both questions, in which case any such observation was rejected. Therefore, out of the 148 public transport (PT) users who filled out the survey, only 132 completed surveys were used. For car users, only 97 completed surveys were used out of an expected total of 106.

3.1.1. Best-worst scaling

Best-worst scaling (BWS) was developed by Louviere in 1987 (Louviere, Flynn, & Marley, 2015). It is a ranking procedure in which the best and worst attributes are selected out of several alternatives. The respondents are presented with a limited set of large choices and they are required to select two choices: the best and the worst. The method also supports quantitative comparisons between levels within an attribute. The method includes 3 choice-based measurement cases. *Case 1 (Object case),* in which respondents are asked to choose the most attractive and least attractive choice from the set of objects. *Case 2 (Profile case),* which is similar with the object case, but different in terms of the level, whereby respondents evaluate several profiles of objects described by combinations of attributes via an underlying design. That is to say they choose the best and worst attribute levels within each presented profile. Lastly, *case 3 (Multi-profile case),* involves respondents choosing the best and the worst designed profiles (choice alternatives) from various choice sets dictated by an underlying design.


Set 1/16 - Which choice is "the most influence" you to using BTS

- D4 - Park and ride is provided near BTS station
- A1 - Speed of the travel
- C3 - Exclusive privileges and discount for dining, product, service, or museum or entertainment place is provided
- B2 - Special fare rate for most frequently ridership

Set 1/16 - Which choice is "least influence" you to using BTS

- D4 - Park and ride is provided near BTS station
- A1 - Speed of the travel
- C3 - Exclusive privileges and discount for dining, product, service, or museum or entertainment place is provided
- B2 - Special fare rate for most frequently ridership

Figure 3.2 Best-worst scaling used in this study

Table 3.6 BIBD for 16 Attribute Levels of Attitude in relation to the BTS sky train

No. of choice set (question)	Objects in each set			
1	D4	A1	C3	B2
2	B2	A4	C1	D3
3	A2	D3	C4	B1
4	A3	D1	C4	B2
5	C2	D3	B4	A1
6	B1	A1	C1	D1
7	C1	B3	D4	A2
8	C4	A1	D2	B3
9	C3	A4	D2	B1
10	D4	A4	B4	C4
11	D1	B4	C3	A2
12	C3	B3	A3	D3
13	D1	A4	C2	B3
14	B2	C2	D2	A2
15	D4	B1	A3	C2
16	D2	B4	C1	A3

Attitude toward behavior

Best-worst scaling (profile case) is applied in this part of the study to investigate the most and least effective factor affecting respondent in terms of using the BTS. There are 4 attribute, and each of these contains 4 levels. So it is that this part has 16 questions.

Balanced incomplete block design (BIBD) is employed for constructing choice sets or questions. Each choice set (question) must provide four choices, with these being one choice from each of the four attributes . To balance these choice set, each attribute level (A1, A2, …, D4) must appear an equal number of times, i.e., four times in this study. For example, A1 appears four times at choice set 1, choice set 5, choice set 6, and choice set 8; A2 also appears only four times at choice set 3, choice set 7, choice set 11, and choice set 14. According to this BIBD, there are 16 choice sets (questions) from the 16 attribute levels related to the BTS sky train. See Table 3.6 immediately below. Also refer to Table 3.3 above.

Perceive behavioral control

This part of the study is about factor impact whereby respondents deny using the BTS by using best-worst scaling (object case) to find the most and least impacting factors. There are 4 attributes in this part. It has 4 questions, and 3 choices are contained in each question, as is presented in Table 3.7 below.

Table 3.7 BIBD for 4 factors leading people to not using the BTS

No. of choice set (Question)	Objects in each set		
1	PBC1	PBC4	PBC2
2	PBC2	PBC3	PBC4
3	PBC3	PBC1	PBC4
4	PBC1	PBC3	PBC2

Best-worst scaling, case 1 - object case, was applied in this part of the survey. Balanced incomplete block design (BIBD) was employed to construct the choice sets shown in Table 3.7 above. Each respondent was asked "*what situation affects your intention NOT to use the BTS?*", and this was done four times in as many questions. For each of these occasions, the respondent was required to select the most effective and the least effective attribute out of the three objects provided. These questions were designed such that each object was replicated three times without any duplication within question. For example, *crowded on board in peak hour* (PBC1) was listed as an object in question 1, 3, and 4.

Habit

Only car users answered in this part, which uses best-worst scaling (object case). The focus here is on what situation or policy will make car users reduce their car usage. There are 5 attributes in this part, which leads to 5 questions with 4 alternatives provided in each question.

Best–worst scaling (BWS) is used to rank policies that can be used to stop car usage. BWS is provided in this part by using balanced incomplete block design (BIBD) for constructing the choice sets. The question asks a car user "*what policy is effective in reducing or rejecting to use of a personal car for your travelling?*". Each choice set randomly contains 4 possible attributes while 5 choice sets are provided to the respondents, as is presented in Table 3.8 below.

Table 3.8 BIBD for 5 factors leading to car users to stop car use

No. of choice set (Question)	Objects in each set			
1	H5	H1	H3	H2
2	H2	H1	H4	H5
3	H1	H5	H4	H3
4	H2	H5	H4	H3
5	H3	H4	H2	H1

3.1.2. Likert Scaling

The *Likert scale* (Likert, 1932) is a useful device for researchers. It is the most popular technique for measuring the traits of characteristics and personality widely used in social psychology. Measuring by this manner transforms the degree of sensitivity and differences in responses into a quantitative model.

Intention

The question with regard to intention is separated between car users and public transport (PT) users. The question for car users is about the possibility of them using the BTS in the future. The question for PT users is to do with the possibility of them having a car in the future. This part uses Likert scaling with a 10 point-scale to avoid any potential bias of some respondents that comes with all mid-point scale usage. In this instance, that is avoided by way of by a score running from 9 (the most possible option) to 0 (no possibility). Respondents were asked to indicate to their preferred level accordingly, as is presented in Table 3.9 below.

Table 3.9 Likert scaling used in this study

	Possibility of a car user using the BTS in the future	The most - -> no possibility to action									
		9	8	7	6	5	4	3	2	1	0
1	I have an intention to use the BTS in the future										

3.2. Analysis

3.2.1. Best–worst score

Every best–worst score was analyzed by using frequency count of attributes that maximally and minimally affected respondents. The ranking of attribute/attribute levels was derived by the difference of best (B) and worst (W), whereby the result can be called best–worst score (B-W). These B–W scores were used to assign the ranking of each attribute.

3.2.2. Conditional logit model (c-logit)

A paired method of analysis model is employed to determine the possibility that an attribute level can be paired and best–worst pairs can be chosen. For the marginal method of analysis model, the method assesses the possibility that attribute levels can be chosen. From the study of Terry N Flynn, Jordan J Louviere, Tim J Peters and Joanna Coast (2008) (Flynn, Louviere, Peters, & Coast, 2008), the pair method and marginal method were compared to decide which paired method was to be used in this study. It came to pass that the paired method is used in our study. An example of paired method, refer to Figure 3.2 above, involved a question set 1 out of 16 with regard to the attitude of respondents toward the BTS. Note that the total number of possible pairs of question in set 1 is 12 pairs, as shown in Table 3.10 below.

Table 3.10 Best–worst pairs available in relation to attitude toward the BTS question

Pair	Best Attribute Level	Worst Attribute Level
1	Number of park and ride facilities near the BTS station (D4)	Speed of traveling (A1)
2	Number of park and ride facilities near the BTS station (D4)	Exclusive privileges and discounts for dining, products, services, museums or entertainment places (C3)
3	Number of park and ride facilities near the BTS station (D4)	Special fare rate for frequent users (B2)
4	Speed of traveling (A1)	Number of park and ride nearby BTS station (D4)
5	Speed of traveling (A1)	Exclusive privileges and discounts for dining, products, services, museums or entertainment places (C3)
6	Speed of traveling (A1)	Special fare rate for frequent users (B2)
7	Exclusive privileges and discounts for dining, products, services, museums or entertainment places (C3)	Number of park and ride nearby BTS station (D4)
8	Exclusive privileges and discounts for dining, products, services, museums or entertainment places (C3)	Speed of traveling (A1)
9	Exclusive privileges and discounts for dining, products, services, museums or entertainment places (C3)	Special fare rate for frequent users (B2)
10	Special fare rate for frequent users (B2)	Number of park and ride nearby BTS station (D4)
11	Special fare rate for frequent users (B2)	Speed of the traveling (A1)
12	Special fare rate for frequent users (B2)	Exclusive privileges and discounts for dining, products, services, museums or entertainment places (C3)

In this study, paired conditional logit regression was used. From the related results presented in Figure 3.3 and Figure 3.4 shown below, we can see that the paired weight least square (WLS) and paired conditional logit model were used, and that the result is quite similar for both the car user and PT samples.

From what is presented in Figure 3.4, there is no difference in the attribute (A, B, C, and D), but not so in relation to the attribute level, which is shown to be slightly different in C3 and B3.

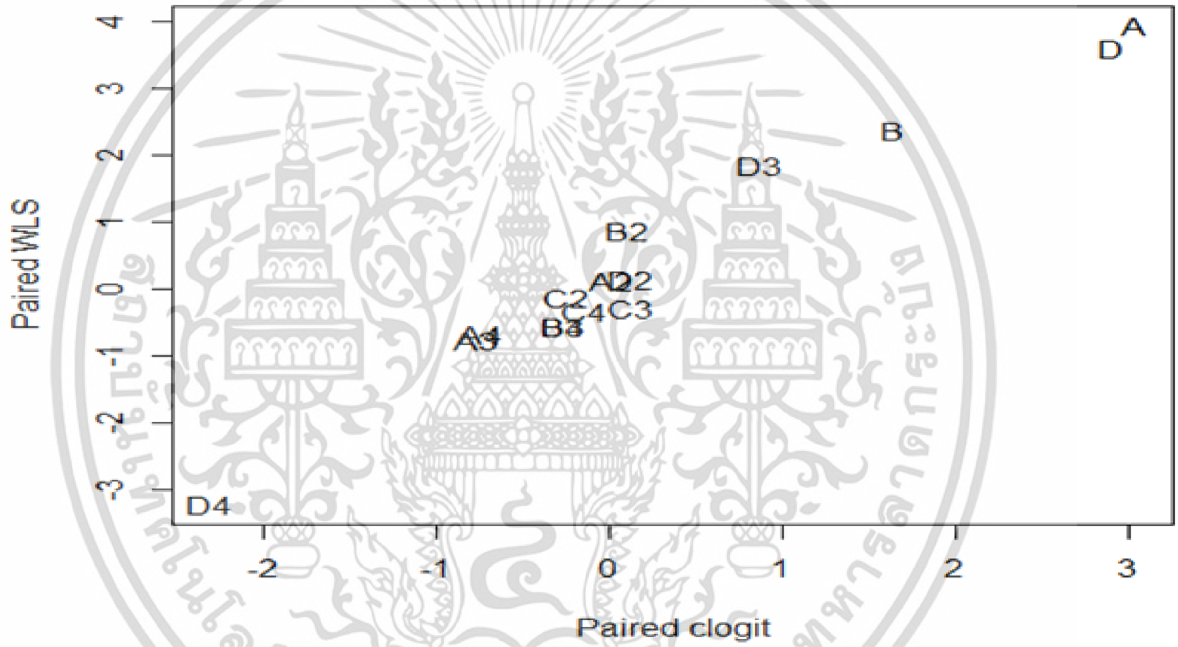


Figure 3.3 Graph of paired c-logit estimates against paired WLS estimates of public transport (PT) users (sample size: 132)

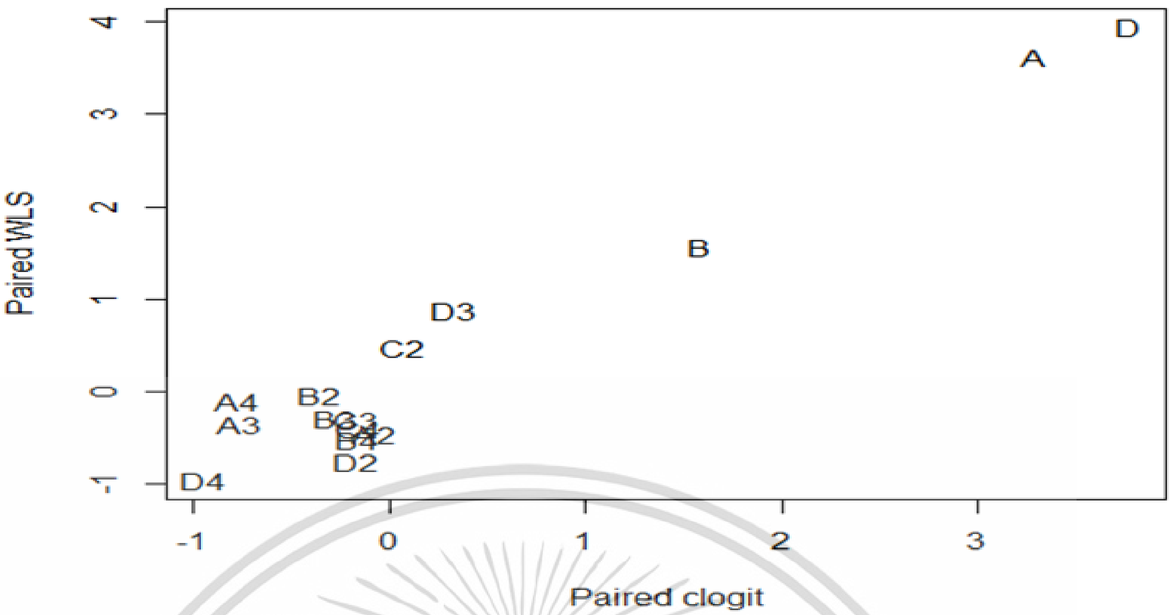


Figure 3.4 Graph of paired c-logit estimates against paired WLS estimates of car users (sample size: 97)

CHAPTER 4

RESULTS

4.1. Socioeconomic factors

Details of the socioeconomic characteristics related to respondents participating in this study are presented in Table 4.1, as is shown below.

Table 4.1 Socioeconomic aspects of respondents

Characteristic	PT Respondents (n = 132)	Car Respondents (n = 97)
Gender		
Male	40 (30.3%)	36 (37.1%)
Female	92 (69.7%)	61 (62.9%)
Age (years)		
below 25	27 (20.5%)	9 (9.3%)
25 to 29	75 (56.8%)	40 (41.2%)
More than 30	30 (22.7%)	48 (49.5%)
Education		
Bachelor’s Degree	86 (65.2 %)	60 (61.9%)
Higher Bachelor’s Degree	46 (34.8%)	37 (38.1%)
Occupation		
Company employee	95 (72.0%)	58 (59.8%)
Others	37 (28.0%)	39 (40.2%)
Income (THB per month)		
0 to 15,000	24 (18.2%)	8 (8.2%)
15,001 to 30,000	58 (43.9%)	28 (28.9%)
30,001 to 50,000	29 (22.0%)	30 (30.9%)
more than 50,001	21 (15.9%)	31 (32.0%)
Travelling charge per month without parking charge (Average)	2,404.05	4,313.81
Parking charge per month (Average)	38.64	211.03

Overall, 254 respondents provided useful data, with this having come via 148 observations from PT respondents and via 106 observations from car user respondents. After the data was checked, 25 observations were removed due to blurred and repeated data. Only 229 effective observations could be used in the analysis, which came via 132 surveys from PT respondents and via 97 surveys from car user respondents.

Of the 132 observations from PT respondents, the sample consisted of 40 males (30.3%) and 92 females (69.7%). For age, 56.8% were 25 to 29 years old, 20.5% were below 25 years old, and 22.7% were age more than 30 years old. For the reported level of education, 65.2% graduated with a Bachelor degree and 34.8% graduated with Master or Doctoral degree. Most of the PT respondents were company workers (72.0%), and another 28.0% had other occupations.

For the 97 observations from car users who responded to the survey of this study, 62.9% were female and 37.1% were male. Of these car respondents, 9.3% were aged below 25 years, 41.2% were 25 to 29 years of age, and 49.5% were aged more than 30 years old. For the related level of education, 61.9% graduated with a Bachelor degree, and 38.1% graduated in Master or a Doctoral degree. As for occupation, 59.8% were company employees and 40.2% had other occupations.

From both groups of respondents, we can see that the range of age for car users is older than for PT user. More specifically, most PT users who respondent were aged below 25 years to 29 years, but car respondents were mostly aged more than 30 years old.

On average, the travelling cost per month of a car user (excluding the cost of parking) is 4,313.81 THB, while the PT user spends less, with this being 2,404.05 THB on average per month. The same comparison can be made for parking costs, with car users spending 211.03 THB per month on average, while PT user spend much less than that with their spending being 38.64 THB per month on average.

In addition to the cost of parking for PT respondents, as is presented in Table 4.1 above, the questionnaire also asked about the daily mode of transportation that respondents use. Table 4.2 immediately below shows the total of people who used each alternative. As can be seen, PT respondents use the BTS most selected, with this followed by bus/van, then taxi/bike, least, a personal car.

Table 4.2 Transportation mode selected

Description		**PT**	**Car**
TM1	Personal car	27	97
TM2	Bus/Van	75	11
TM3	BTS	94	20
TM4	Taxi/Bike	63	16

The data also shows that 27 of the PT respondents have a car and use it for their travelling and transfer to other forms of transportation, with all of this shown in more detail in Table 4.3 below.

Table 4.3 Transportation modes selected by PT users

Description		n = 132
TM2	Bus	10
TM3	BTS	30
TM4	Taxi	5
TM1 + TM2	Personal car + Bus	2
TM1 + TM3	Personal car + BTS	5
TM1 + TM4	Personal car + Taxi	1
TM2 + TM3	Bus + BTS	17
TM2 + TM4	Bus + Taxi	19
TM3 + TM4	BTS + Taxi	10
TM1 + TM2 + TM3	Personal car + Bus + BTS	5

TM1 + TM2 + TM4	Personal car + Bus + Taxi	1
TM1 + TM3 + TM4	Personal car + BTS + Taxi	6
TM2 + TM3 + TM4	Bus + BTS + Taxi	14
TM1 + TM2 + TM3 + TM4	Personal car + Bus + BTS + Taxi	7

As is evident, Table 4.3 above shows daily transportation options for PT respondents. We can see that 87 (65.9%) out of 132 PT observations travel by way of at least 2 modes of transportation to reach their destination. From the data, it's surprising that the was selected by 30 PT users (22.7%) that can go to their destination via only one form of transportation mode, which is higher than expected. In my opinion, the bus/van option for transport should be the most popular among all modes of transportation because better route coverage, the number of bus stops and stations, and also the lower fare charge. From this data, it can be inferred that most of the respondents might live near to a BTS line. In this regard, see the graphical representation in Figure 4.1 below.

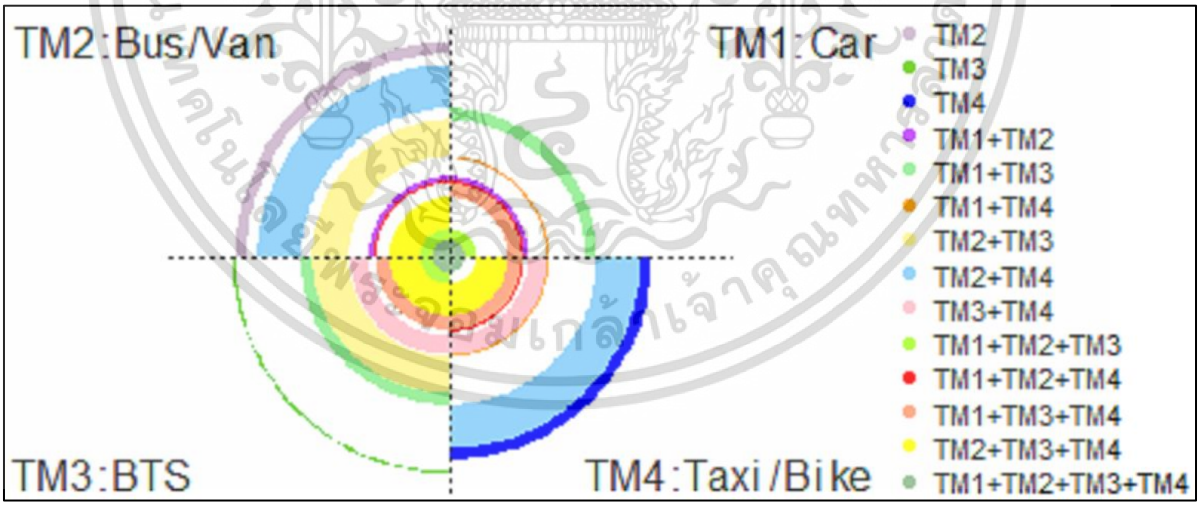


Figure 4.1 Graph of daily modes of transportation for PT users

For car users, data in Table 4.2 shows that all 97 respondents used their own car for daily travelling. Next is popularity for car users is the BTS, with this followed by taxi/bike, and bus/van, which can also be seen clearly in the graphical representation of

Figure 4.2 below. In the TM1 quadrant, the car is the most selected option. Also, in the TM2 quadrant, the (bus/van) option is the least selected mode for car users.

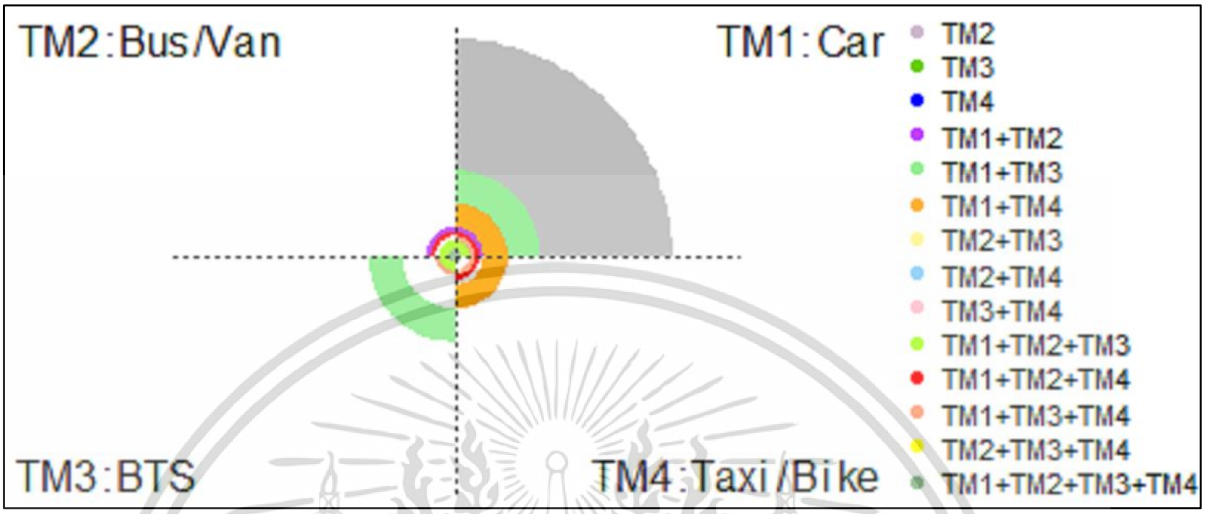


Figure 4.2 Graph of daily modes of transportation for car users

The transportation choices made by car users are worth considering further, which is the point of details presented in Table 4.4 below.

Table 4.4 Number of daily modes of transportation used by car users

Description		n = 97
TM1	Personal car	60
TM1 + TM2	Personal car + Bus	4
TM 1 + TM3	Personal car + BTS	15
TM1 + TM4	Personal car + Taxi	11
TM1 + TM2 + TM3	Personal car + Bus + BTS	2
TM1 + TM2 + TM4	Personal car + Bus + Taxi	2
TM1 + TM2 + TM3 + TM4	Personal car + Bus + BTS + Taxi	3

As can be seen from what Table 4.4 shows, 60 (61.9%) out of 97 car users travel to their destination by way of a personal car, thereby using only one mode of transportation, and 7 (7.3%) respondents travelled with more than 2 modes of transportation to reach their destination.

4.2. Result of attitude toward behavior

To encourage the use of public transportation, service quality has to be improved to a level matching customers' expectations. Reliability and convenience are important factors (Wang, Li, Wu, & Bai, 2013; Redman, Friman, Garling, & Hartig, 2013; d'Ovidio, Leogrande, Mancarella, Schinzano, & Viola, 2014) affecting public transportation usage. However, the effectiveness of any influential factor could very well depends on user demographics, personal situations, or previous experiences with PT services.

With such in mind, this study considers key attitudinal factors regarding the BTS and categorizes them by using a marketing mix strategy that consists of 4 attributes (being product, price, promotion, and place). Each attribute contains 4 levels, as is shown in Table 3.3 earlier.

Taking this further, immediately below, Table 4.5 reports the score of each marketing attribute for car and public transport (PT) users.

Table 4.5 Best and Worst counts of car users and PT users for each attribute

Attribute	**Car User**				**Public Transport (PT) User**			
	Best (B)	Worst (W)	B - W	Ranking of attribute	Best (B)	Worst (W)	B - W	Ranking of attribute
Product (A)	548	48	500	2	950	64	886	1
Price (B)	78	224	-146	3	214	290	-76	3
Promotion (C)	13	1166	-1153	4	18	1638	-1620	4
Place (D)	833	34	799	1	1024	214	810	2

The "Best (B)" column denotes the frequency count of attributes that maximally affect the intention of respondents to use the BTS, while the "Worst (W)" column denotes the frequency count of attributes that minimally affect the intention of respondents to use the BTS. Considering the car user group as an example, among Product (A), Price (B), Promotion (C), and Place (D), Product (A) was selected 548 times as the most important attribute affecting the intention of car user respondents to use the BTS. However, Product was also selected 48 times as the least important attribute. The difference between the "Best (B)" and "Worst (W)" is shown in columns "B – W". These B – W score are used to assign the ranking of attributes. The attribute with the maximum "B – W" score (799) is assigned as the first in this ranking, while the attribute with the minimum "B – W" score (-1153) is assigned as last in the ranking (coming in fourth place). For PT respondents, Product (A) is ranked first with a "B – W" score of 886, followed by Place (D) with "B – W" score of 810, as well as Price (B) with "B – W" score of -76, and Promotion (C) with "B – W" score of -1620, respectively.

Product (A) and Place (D) are considered as important attributes that impact the intention of people to use the BTS despite ranking contradictions between what was found in the analysis for car users when compared with PT users. For instance, car users ranked Place (D) as the most important attribute, while PT users ranked Product (A) as their most important attribute. Given that most PT users travel intensively with the BTS as their primary mode of transportation, they are likely to have higher insight as to the pros and cons of the BTS product, which could be the reason that Product (A) is ranked higher than Place (D). On the other hand, Promotion (C) and Price (B) are considered as unimportant attributes, especially Promotion (C). It could, thus, be interpreted that as promotions launched by the BTS were not interesting to users, or that the Promotion variable is not important at all.

To further investigate these attributes, we decomposed each attribute into 4 levels, specifically A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, D1, D2, D3, and D4. Table 4.6 below Table 4.6 reports the Best and Worst score for the level scale of each attribute for all 16 levels. Similar to the assessments of attribute in Table 4.5 above, a "B – W" score of the level scale was calculated as the difference between "Best (B)" and "Worst (W)". Then we ranked these levels from maximum to minimum.

Table 4.6 Best and Worst counts of car users and PT users for the level scale of each attribute

Attribute Level	**Car User**					**Public Transport (PT) User**				
	Best (B)	Worst (W)	B - W	Global Ranking of attribute level (R_C)	Local Ranking of attribute level (L_C)	Best (B)	Worst (W)	B - W	Global Ranking of attribute level (R_B)	Local Ranking of attribute level (L_B)
A1	285	2	283	1	1	417	1	416	1	1
A2	139	11	128	5	2	250	12	238	4	2
A3	85	27	58	8	4	151	37	114	7	4
A4	71	10	61	7	3	150	17	133	6	3
B1	45	14	31	9	1	107	51	56	8	1
B2	8	80	-72	12	4	43	67	-24	9	2
B3	12	76	-64	11	3	34	92	-58	11	4
B4	15	65	-50	10	2	41	82	-41	10	3
C1	5	297	-292	13	1	12	401	-389	13	1
C2	7	311	-304	14	2	3	441	-438	16	4
C3	1	319	-318	15	3	0	398	-398	14	2
C4	0	319	-319	16	4	3	434	-431	15	3
D1	284	1	283	2	1	397	5	392	2	1
D2	217	15	202	4	3	265	30	235	5	3
D3	248	1	247	3	2	342	3	339	3	2

D4	146	20	126	6	4	39	183	-144	12	4

According to the results presented in Table 4.6, car users and PT users have similar preferences in terms of the first three rankings. For instance, *Speed of the traveling* (A1) is reported as being the most important attribute level that affects the intention of all BTS users, with this followed by *distance between the destination station and rider's origin* (D1), and *number of central business district or mall nearby BTS station* (D3), respectively. Almost similar preferences, with slight contradictions, occurred for the attributes that were rank 4th and rank 5th. Namely, car users considered *transfer with other transportation modes* (D2) as the stronger level of attribute affecting their intention to use the BTS when compared to *reliability of BTS time schedule* (A2). This could due to the fact that traffic conditions in Bangkok are almost unpredictable. Car users in Bangkok always deal with high variability in terms of time schedules when using their cars. Thus, they are capable of handling variability in the BTS time schedule, which they believe to be smaller than variability caused by car. In contrast, PT users ranked *reliability of BTS time schedule* (A2) higher than *transfer with other transportation modes* (D2) with scores of 238 and 235, respectively. However, the difference between these "B – W" scores seems to be trivial, which implies that the related attributes have almost similar impact on the intentions of PT users.

Car users and PT users show similar preference not only in low ranking (that have large positive "B-W" score) attribute levels, but also for the low rank (having large negative "B-W" score) attribute levels. Even with a slightly different order of ranking between that for car users and for PT users, attribute levels (C1, C2… C4) of promotion are placed in the last four rankings (14th -16th). This attribute levels result (as is seen in Table 4.6) confirms the attribute result (as seen in Table 4.5) that promotions launched by the BTS were not interesting to users, or that Promotion is not important at all.

Contents of the last column in Table 4.6 (R_C - R_B) are obtained by subtracting the rank of PT users (R_B) from the rank of car users (R_C). The rank differences mostly lie between ± 3, with one outlier of -6. A rank difference of 0 implies that car users and PT users reach agreement in the ranking of an attribute level, while ± 1, ± 2, and ± 3 in rank differences imply a departure from perfect agreement, with this rising as the number increases. Interestingly, with a rank difference of -6, *Park and ride* (D4) shows a very strong contradiction between the opinions of car users and PT users. It was ranked 6^{th} by car users and 12^{th} by PT users, which could be explained by the fact that there were 27 out of 132 PT users who report that they used a car together with other forms of public transportations when traveling. The remaining 105 PT users, equivalent to approximately 80 percent of the total, did not use a car as a form of transportation. This aligns with our result that *Park and ride* (D4) is not a very important attribute level affecting the intention of PT users to use the BTS. In contrast, *Park and ride* (D4) was ranked 6^{th} by car users, which implies that such facilities are important for them when deciding to use public transport.

4.2.1. Result of attitude toward behavior by using C-Logit

This study used C-logit analysis to gain further understanding of attributes affecting the behavior of car users and PT users, with the results presented in Table 4.7 below.

The conditional logit result with price (B) as a reference attribute is reported in Table 4.7. For car users, the coefficient of Place (D) is 2.2028, followed by 1.7053 for Product (A) when compared to price (B) as our reference attribute. The coefficient of Promotion (C) is -1.5911, and this implies that the Promotion (C) reports negative importance when compared to Price (B). It was found that the coefficient of Place (D) > Product (A) > Price (B) > Promotion (C), which aligns with our Best-Worst count in

Table 4.5. Similarly, the conditional logit coefficient of Product for PT users can be ranked as Product (A) > Place (D) > Price (B) > Promotion (C), which was in the B-W ranking as well.

Table 4.7 Conditional Logit model of Car users and PT Users for each attribute

	Car Users				**Public Transport (PT) Users**			
	coefficient	Z	Pr(>|z|)		coefficient	Z	Pr(>|z|)	
Product (A)	1.7053	19.2340	< 2e-16	***	1.3755	20.834	< 2e-16	***
Price (B)								
Promotion (C)	-1.5911	-24.2020	< 2e-16	***	-1.6445	-27.384	< 2e-16	***
Place (D)	2.2028	24.2720	< 2e-16	***	1.2057	18.755	< 2e-16	***

Significant codes: ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05

Table 4.8 is presented below and reports the results of a conditional logit model at the attribute level. Rather than comparing the main attributes, Table 4.8 focuses on comparing the results within the attribute or the level scale of each attribute. Similar to what was seen in Table 4.7, one level is required as a reference level. In this case, the first level of each attribute: A1, B1, C1, and D1 are selected as the reference levels for both car users and PT users.

Within Product (A), the rank of the attribute levels are similar for both the car users and the PT users. The most effective attribute level is *speed of the traveling* (A1, 1.6178, 1.5149) with a coefficient of 1.6178 for car users and with that being 1.5149 for PT users, followed by *reliability of the BTS time schedule* (A2, -0.0652, -0.0239), *safety inside the station and on board* (A4, -0.7537, -0.7437), and *the extent of BTS operation times* (A3, -0.7988, -0.7473), respectively. Similarity in the ranking of attribute levels for both car users and PT users was also found for Place (D) where the attribute levels ranked from the most effective to least effective were *distance between station and ridership's* *origin / destination* (D1, 0.7677, 1.3207), *number of central business district or mall nearby BTS station* (D3, 0.3384, 0.8844), *able to connect with other transportation mode* (D2, -0.1348, 0.0984), and *number of park and ride nearby BTS station* (D4, -0.9714, -2.3035).

Table 4.8 Conditional Logit model of Car users and PT Users for the level scale of each attribute

	Car User					Public Transport (PT) User				
	coefficient	Z	Pr(>|z|)		Local Ranking of attribute level (L_C)	coefficient	Z	Pr(>|z|)		Local Ranking of attribute level (L_B)
A1	1.6178				1	1.5149				1
A2	-0.0652	-0.7060	0.4803		2	-0.0239	-0.307	0.7591		2
A3	-0.7988	-8.3260	< 2e-16	***	4	-0.7473	-9.699	< 2e-16	***	4
A4	-0.7537	-7.8620	0.0000	***	3	-0.7437	-9.531	< 2e-16	***	3
B1	0.8204				1	0.4475				1
B2	-0.3769	-3.8350	0.0001	***	4	0.1284	1.555	0.1199		2
B3	-0.2634	-2.6890	0.0072	**	3	-0.3009	-3.771	0.0002	***	4
B4	-0.1801	-1.8680	0.0618	.	2	-0.2749	-3.594	0.0003	***	3
C1	0.2312				1	0.2508				1
C2	0.0678	0.6380	0.5232		2	-0.2352	-2.723	0.0065	**	4
C3	-0.1384	-1.2480	0.2120		3	0.1255	1.537	0.1242		2
C4	-0.1606	-1.4340	0.1517		4	-0.1412	-1.646	0.0998	.	3
D1	0.7677				1	1.3207				1
D2	-0.1348	-1.4260	0.1538		3	0.0984	1.316	0.1881		3
D3	0.3384	3.4140	0.0006	***	2	0.8844	11.122	< 2e-16	***	2
D4	-0.9714	-10.4330	< 2e-16	***	4	-2.3035	-28.879	< 2e-16	***	4

Significant codes: '***' 0.001 '**' 0.01 '*' 0.05

As opposed to Product (A) and Place (D), the rank of the attribute levels for car users and PT users are different in terms of Price (B) and Promotion (C). The most effective attribute levels in Price (B), according to car users, are ranked from *ticket price* (B1, 0.8204) with a coefficient of 0.8204, *number of ticket issuing machine receive both coins and banknotes* (B4, -0.1801), *number of coins exchanging machine* (B3, -0.2634), and *special fare rate for frequently ridership* (B2, -0.3769), while PT users rank these attribute levels as follows: *ticket price* (B1, 0.4475), *special fare rate for frequently ridership* (B2, 0.1284), *number of ticket issuing machine receive both coins and banknotes* (B4, -0.2749), and *number of coins exchanging machine* (B3, -0.3009). For Promotion (C), car users considered *point collection for fare ticket discount* (C1, 0.2312) as the most effective attribute levels, followed by *free ticket in a special day* (C2, 0.0678), *exclusive privileges* (C3, -0.1384), and *reward competing when top up a rabbit card* (C4, -0.1606), while PT users considered *point collection for fare ticket discount* (C1, 0.2508) as the most effective attribute levels, with this followed by *exclusive privileges* (C3, 0.1255), *reward competing when top up a rabbit card* (C4, -0.1412), and with *free ticket on a special day* (C2, -0.2352) as the least effective attribute levels. Expectedly, the local rank of attribute levels within each attribute by conditional logit confirms the result from of the best-worst count in Table 4.6 for both car users and PT users.

The result from the conditional logit model saw how each socio-demographic aspect was interacted with each of the 16 level attributes. Only statistically significant effects are reported. Also, the report only mentions product (A) and place (D) because the score from best – worst count (as per Table 4.5) shows a positive value in relation to both attributes. We can say that both the car user and PT user respondents considered these attributes as a factor that can affect their intention to use the BTS. For price (B) and promotion (C), the score from the related best – worst count is a negative value for both groups. So, both attributes do not have importance in persuading any of the respondents in using the BTS.

4.2.1.1.Socioeconomic affect attribute level

<u>Effect of age on attribute levels</u>

For the variant of age, from what can be seen in Table 4.9 below, respondents in age category of 25 – 29 years old (AGE2) for both PT users and car users have significantly different results with regard to the factor of *easy to shift to other transportation mode (D2)* as an attribute level that affects their intention to use the BTS when compared with any other age range. Even the value of the coefficient is negative. But, it shows a positive value of utility (2.1773 for car users and 1.053 for PT users) for both groups of respondents.

Table 4.9 Conditional logit model estimates for the influence of the age covariant on attitude

	Car			PT		
	coefficient	Pr(>|z|)		coefficient	Pr(>|z|)	
A3:AGE1	0.4553	0.2934		-0.0640	0.7222	
A3:AGE2	-0.2029	0.4014		0.3457	0.0080	**
D2:AGE1	0.5545	0.2311		-0.2765	0.1156	
D2:AGE2	-0.5099	0.0459	*	-0.2586	0.0418	*
D4:AGE1	-1.1070	0.0156	*	-0.2574	0.1684	
D4:AGE2	0.5929	0.0188	*	-0.0484	0.7189	

Significant codes: ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05

Regarding the results for car user, *number of park and ride nearby BTS station (D4)* is also the factor that affects the intention of using the BTS in group of AGE2 (25 – 29 years old). Park and ride is one of facilities that allows car users to able to use the BTS or to change their transportation mode easily. So, car users in group of AGE2 can be persuaded to use the BTS if this service can provide them *easy to shift to other transportation mode (D2)* and good facilities in *park and ride nearby BTS station (D4)*.

For PT user respondents, *extent of BTS operation times (A3)* is a factor that affects their intention to use the BTS. The results for AGE2 is a significantly different, whereby the coefficient value is positive. It can be said that this is because most of the respondent in AGE2 are company employees. They might finish work late, or have a party after work, which would make the BTS convenient and safe when compared to other transportation choices. So, PT user in the AGE2 group will consider using the BTS if the related operation time is extended.

<u>Effect of income on attribute levels</u>

From Table 4.10, *able to shift to other transportation mode such as airport or shuttle service (D2)* is the attribute level that both car user and PT user respondents considered as an effective factor in the INC2 group (15,001 – 30,000 THB per month). See Table 4.10 below.

Table 4.10 Conditional logit model estimates for the influence of the income covariant on attitude

	Car users			**PT users**		
	coefficient	Pr(>|z|)		coefficient	Pr(>|z|)	
D2:INC1	0.2887	0.6045		0.1319	0.5144	
D2:INC2	0.6581	0.0056	**	0.7791	0.0000	***
D2:INC3	-0.4680	0.0581	.	-0.2041	0.1891	

Significant codes: ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05

Effect of education on attribute levels

Car users with the education level of Bachelor degree have a significantly different opinion with regard to the extent of BTS operation times (A3) and the number of park and ride facilities nearby a BTS station (D4). When considering this result, it shows that almost 40% of car respondents have a good intention (score 6 - 9) to use the BTS in the future. It can be concluded that the extent of BTS operation times (A3) and the park and ride facilities (D4) are considered to be important because these provides more convenience in terms of allowing the use of multiple modes of transportation. (See the results presented in Table 4.11 below.)

Table 4.11 Conditional logit model estimates for the influence of the education covariant on attitude

	Car users			**PT users**	
	coefficient	Pr(>|z|)		coefficient	Pr(>|z|)
A3:EDU1	0.3630	0.0046	**	0.1484	0.1123
D4:EDU1	0.2733	0.0239	*	0.0788	0.4093

Significant codes: ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05

Effect of occupation on attribute level

For the occupation variant, related analysis is presented in Table 4.12 below). The results for car users, in terms of *safety inside the station and on board (A4), able to shift to other transportation mode such as airport or shuttle service (D2)*, and *park and ride nearby BTS (D4)* are significantly different. For *park and ride nearby BTS (D4),* even the coefficient value is negative. But because the utility value of this factor is positive, respondents in the OCC1 group can be persuaded to use the BTS more than others if park and ride facilities are improved.

Table 4.12 Conditional logit model estimates for the influence of the occupation covariant on attitude

	Car users			PT users		
	coefficient	Pr(>|z|)		coefficient	Pr(>|z|)	
A4:OCC1	0.2956	0.0133	*	0.0178	0.8717	
D2:OCC1	0.2741	0.0208	*	0.1699	0.1084	
D4:OCC1	-0.4110	0.0003	***	0.3077	0.0065	**

Significant codes: '***' 0.001 '**' 0.01 '*' 0.05

As per Table 4.13, the results show negative coefficients, except for that of D4:OCC1. But when we consider its utility value, which is -0.935, it can be concluded that the importance of this attribute level to respondents will not affect with their intention to use the BTS.

Table 4.13 Conditional logit model estimates for the influence of socio-demographic variables on attitude with negative coefficients or utility

	Car users			PT users		
	coefficient	Pr(>|z|)		coefficient	Pr(>|z|)	
D3:INC1	-0.1273	0.8212		0.3029	0.1706	
D3:INC2	-0.0217	0.9276		-0.3826	0.0107	*
D3:INC3	0.1236	0.6235		-0.1267	0.4453	
D4:OCC1	-0.4110	0.0003	***	0.3077	0.0065	**

Significant codes: '***' 0.001 '**' 0.01 '*' 0.05

From all results it can be said that, for car users, *able to shift to other transportation mode such as airport or shuttle service (D2)* and *park and ride nearby BTS station (D4)* are factors that can persuade them to use the BTS. For PT users, *able to shift to other transportation mode such as airport or shuttle service (D2)* is a factor that can persuade them to use the BTS.

It seems likely that connectivity to each transportation mode is an important point to consider for anyone using the BTS. So, improvement of transportation mode transfers should be the first priority for the BTS to consider if they want people to use more public transportation.

4.3.Perceive Behavioral Control

Table 4.14 Best and Worst counts of Perceive behavioral control (PBC) for Car users and PT Users

	Car Users				**Public Transport (PT) Users**			
	Best (B)	Worst (W)	B - W	Ranking of attribute level	Best (B)	Worst (W)	B - W	Ranking of attribute level
PBC1	92	89	3	2	166	117	49	2
PBC2	109	109	0	3	103	190	-87	3
PBC3	118	37	81	1	199	62	137	1
PBC4	60	144	-84	4	76	175	-99	4

According to a passenger perspectives, experiencing any inconvenience affects their passengers' satisfaction results with regard to abstaining from public transportation. To investigate the "*factors affecting the intention of people NOT to use the BTS*", the associated four situations, as were shown in Table 3.4, are examined.

Note that Table 4.14 reports the B-W count and the corresponding rank of attribute levels. Both car users and PT users report similar opinions with regard to the *situation effect intention NOT to use the BTS.* They consider *a lot of baggage* (PBC3, 81, 137) as most effective in deny use of the BTS, with a B-W count of 81 for car users and 137 for PT users. This is followed by *crowded on board in peak hour* (PBC1, 3, 49), *unable to reach the destination within one transfer* (PBC2, 0, -87), and *travel with* *children/elderly people/pregnant women* (PBC4, -84, -99). In other words, the respondents prefer other means of transportation when they need to travel with a great deal of baggage. When comparing PBC1 and PBC2, on average, the respondents are likely to use the BTS though the destination is unreachable within one transfer provided that the BTS system is not over crowded. It appears that *travel with children/elderly people/pregnant women* (PBC4) generates the least amount of trouble among the four objects provided.

Results from the conditional logit model for Perceive Behavioral Control (PBC) in which *crowded on board in peak hour* (PCB1) is selected as a reference factor (see Table 4.15 below) confirmed the associated B-W count that *a lot of baggage* (PBC3, 0.3161, 0.2732) with a utility of 0.3161 for car users and 0.2732 for PT users denotes the most likely situation where respondents do not want to use BTS. *Crowded on board in peak hour* (PBC1, 0, 0), or the reference factor, received utility of 0 and is selected as the 2nd most likely reason why people will not to use BTS, with this followed by *unable to reach the destination within one transfer* (PBC2, 0.0040, -0.3905), and *travel with children/elderly people/ pregnant women* (PBC4, -0.3446, -0.4081). Interestingly, *unable to reach the destination within one transfer* or PBC2 is not statistically significant for car users, which can be interpreted as not being statistically different when comparing PBC1 and PCB2. Also, they show similar opinion for *unable to reach the destination within one transfer* and for *crowded on board in peak hour.* The amount of difference in the B-W count of three (3-0=3) is not broad enough to distinguish between PBC2 and PCB1.

From this part of survey, the factors most affecting the disinclination of people to use the BTS usage are *lot of baggage (PBC3)* and *crowded on board (PBC1). Crowded on board (PBC1)* dissatisfies people and leads them not to travelling by train (Thompson, Hirsch, Mueller, & Rainbird, 2012) because crowding on board can effect with their sense of security and cause a feeling of uncomfortableness due to the closeness of other passengers (Hirsch & Thompson, 2011). To encourage use of the BTS, or any other form of mass transit, room for baggage or delivery services is something that must be considered.

Table 4.15 Conditional Logit model for PBC of Car users and PT users

	Car User			Public Transport (PT) User		
	coef	z	p	coef	z	p
PBC1	-	-	-	-	-	-
PBC2	-0.004	-0.04	0.9642	-0.3905	-4.95	0
PBC3	0.3161	3.47	0.0005	0.2732	3.43	0.0006
PBC4	-0.3446	-3.78	0.0002	-0.4081	-5.14	0

Significant codes: '***' 0.001 '**' 0.01 '*' 0.05

4.4.Habit

Habit is defined as an acquired behavior pattern regularly followed until it has become almost involuntary. Car users with strong habits reported the effect on decision-making of using a car (I.J. Donald, S.R Cooper, & S.M. Conchie, 2014; Simsekoglu, Nordfijaern, & Rundmo, 2015). Table 3.5 proposed a number of policies and campaigns, such as: *increasing fuel charge* (H1), *parking problem (parking space and parking charge)* (H2), *congestion charge policy* (H3), *increasing car tax 10% every year for 6 years old car and annual road tax policy* (H4), and *new car change in every 5 years policy* (H5), which aim to break the habit, change behavior and, thus, reduce car usage. The related analysis, in terms of best-worst counts and the corresponding ranks of habit for car users, is reported in Table 4.16 below.

Table 4.16 Best and Worst counts of Car users in terms of Habit

	Car User			
	Best	Worst	B - W	Ranking of car user
H1	50	154	-104	5
H2	211	37	174	1
H3	51	110	-59	4
H4	78	62	16	2
H5	84	111	-27	3

Perhaps understandably, the difficulty in finding a parking spot and incurring any expensive parking fee can discourage people from using private vehicles (Hagman, 2003; Beirao & Cabral, Understanding attitudes towards public transport and private car: A qualitative study, 2007). Long periods of time consumed in finding a parking spot, as well as the high cost of parking in a large city can encourage people to search for other transportation options in order to save their time and money. The B-W scores shown in Table 4.16 above confirm that the parking problem (H2) denotes the most effective factor for car users to reduce/give up the habit of using private vehicles. This is followed by an increased vehicle tax of 10% yearly for any car older than 6 years and an annual road tax surcharge (H4), a policy for a new car change every 5 years (H5), and increasing the fuel charge (H1). In addition, many studies pointed out that an increase in the fuel charge is the one of the most important effect ways to reduce car usage (Hagman, 2003; Chiou, Wen, Tsai, & Wang, 2009). But this is not the case for Bangkok car users. Particularly, this study reports that an increase in the fuel charge is least effective when compared with the other four factors.

The result of conditional logit models assuming a sequential best–worst choice model with *increased vehicle tax by 10% yearly for car older than 6 years and an annual* *road tax surcharge as with the Singapore policy* (H4) as the reference level is reported in Table 4.17 below.

Table 4.17 Conditional logit model estimates for the influence of any policy stopping the use of cars

	Car User				
	coefficient	exp(coef)	se(coef)	z	p
H1	-0.5607	0.5708	0.0984	-5.7	1.20E-08
H2	0.7284	2.0718	0.0991	7.35	2.00E-13
H3	-0.3525	0.7029	0.0976	-3.61	0.00031
H4	-	-	-	-	-
H5	-0.2026	0.8166	0.0973	-2.08	0.03733

Significant codes: ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05

The positive coefficient indicates that the aforementioned policy is effective relative to the reference item, while negative coefficients indicate that such policies are not very effective in persuading car users to cease their habit of using cars when compare to reference item. *Parking problem* (H2) is reported as the most effective factor. *Congestion charge policy* (H3) and *increase in fuel charge* (H1) were less likely to have negative impact on car users when compared with *10% yearly for cars older than 6 years and an annual road tax surcharge as in Singapore policy* (H4).

To break the habit or to change the behavior of car users, policymakers are encouraged to increase parking charges, and also increase penalties for parking in restricted areas.

Further opportunities can be taken to change behavior that requires a conscious decision. Therefore, campaigns are needed to focus on encouraging public transport use, with other, different campaigns aimed at discouraging personal car use.

4.5.Intention

This part of the study deals with the intention of car users and PT users.

Car users

Respondents were asked if they were interested in using the BTS in the future. This involved a 10-point scale that ran from 0 – 9. The result shows that, from 97 car users who responded, that 28.71% selected 8 and 9 for their intention to use the BTS.

Table 4.18 Number of car user respondents who have an intention to use the BTS in the future - count by scale (n = 97)

Intention to use the BTS in the future										
Point scale	9	8	7	6	5	4	3	2	1	0
Q'ty	13	10	15	18	21	8	5	4	2	1
%	13.40	10.31	15.46	18.56	21.65	8.25	5.16	4.12	1.03	2.06

From what can be seen in the bar chart representation of data in Figure 4.3 below, most of the respondents have a good intention to use the BTS in the future. In total, 20.62% of car users selected 0 – 4, which can say that this group of respondents have low or no intention to use the BTS when compare with the other 79.38% of car user respondents who still consider having some good intention to use the BTS in the future.

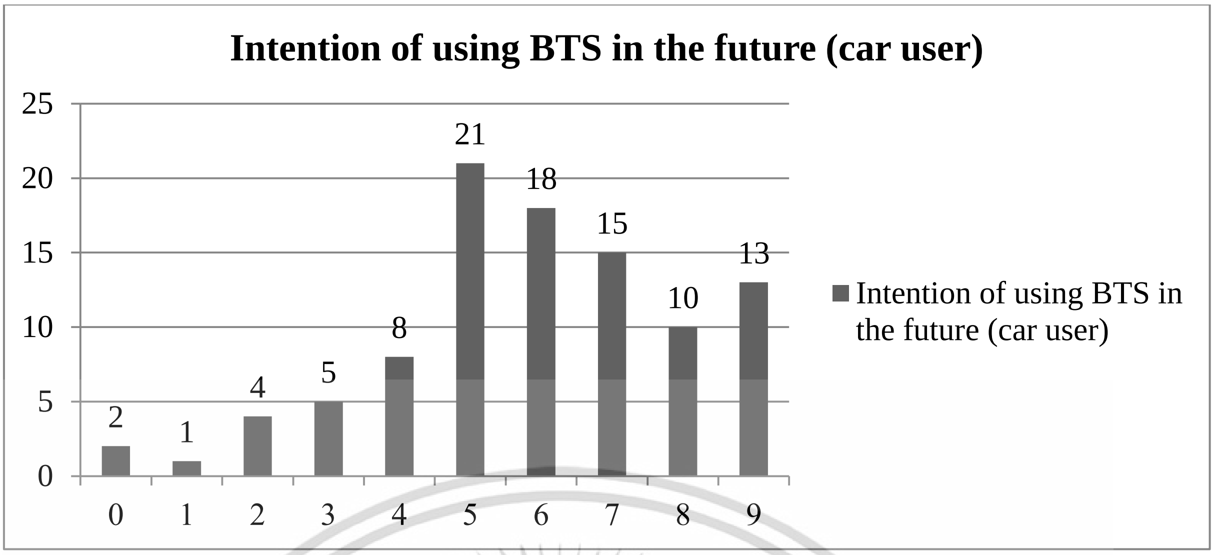


Figure 4.3 Bar graph for the number of car user respondents who have an intention to use the BTS in the future count - by scale (n = 97)

PT users

For PT users, respondents were asked if they had an intention to buy a car in the future. As for the preceding analysis of car users, this question also used a 10 point scale running from 0 – 9. The results, as presented in Table 4.19 and Figure 4.4 below, show that 8.33% of PT user respondents have a high intention to a buy car in the future, and that 2.27% of the respondents do not have any plan to buy a car.

Table 4.19 Number of PT user respondents who have an intention to buy a car in the future - count by scale (n = 132)

Intention to buy car in the future										
Point scale	9	8	7	6	5	4	3	2	1	0
Q'ty	11	12	29	15	24	16	12	10	0	3
%	8.33	9.09	21.97	11.36	18.18	12.12	9.09	7.58	0.00	2.27

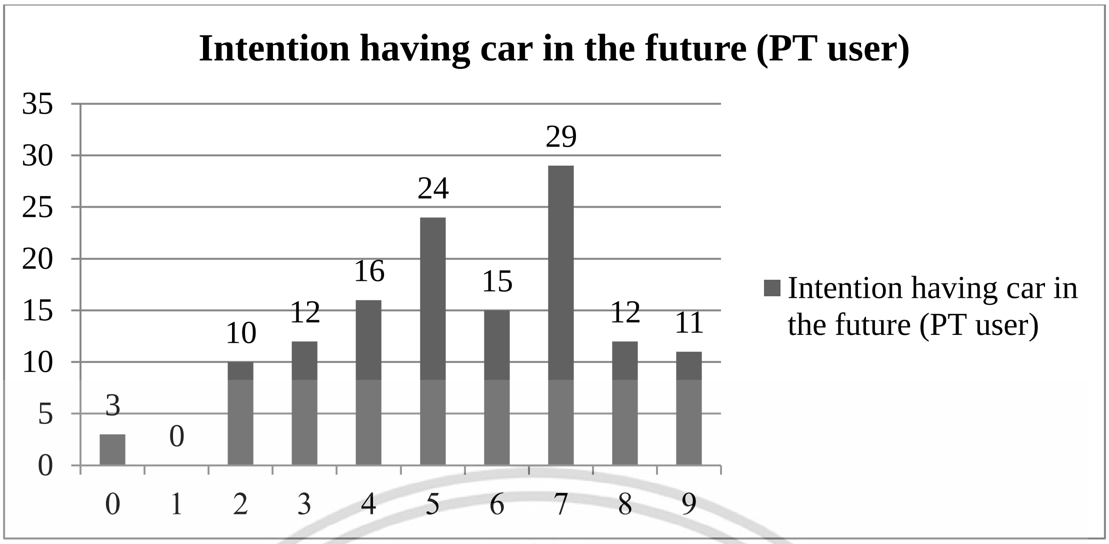


Figure 4.4 Bar graph for the number of PT user respondents who have an intention to buy a car in the future - count by scale (n = 132)

Overall, the data shows that most car users have a good intention to use the BTS in the future. For PT users, the data shows that almost 98% have decided to buy a car in the future. It is interesting that even though the service quality of BTS services has improved, PT users still have a desire to buy a new car. Identifying the reasons why PT users want to buy a new car can be set as a research topic for future study.

CHAPTER 5

CONCLUSION

This study is aimed at finding factors that affect the intention of people in using the BTS sky train, thereby understanding how to persuade them to do so, as well as analyzing factors that can make car users reduce their car usage. The survey provided 2 sets of questionnaires addressing the modes of daily transportation used by two groups of respondents (specifically, PT user sand car users).

In relation to attitude toward behavior, we applied a marketing mix model. According to the best – worst count in Table 4.5, *product (A)* and *place (D)* were the most selected attributes for respondents when deciding whether to use the BTS. For attribute level, the study found that car and PT users have similar preferences in terms of the first three rankings, which are *Speed of the traveling* (A1), followed by *distance between station and ridership's origin / destination* (D1), and *number of central business district or mall nearby BTS station* (D3), respectively (See Table 4.6). In the paired conditional logit results for attributes (as per Table 4.7), the results show the ranking of attributes is the same as per a best – worst count (see Table 4.5). In relation to the effect of covariants on the attribute levels, the results show that both car users and PT users have similar attitudes about the BTS, which they consider is *able to shift to other transportation mode such as airport or shuttle service* (D2) as this factor affects their intention to use the BTS. But car users also consider *park and ride nearby BTS (D4)* as a factor that affects their intention to us the BTS.

For perceive behavioral control (PBC), what situation causes people to deny using he is asked as a question for this factor. This part of the study shows that a lot of baggage is the most influential situation. BTS personnel should find a related solution, such as providing rental rooms for baggage, or provide passengers with a package delivery service.

For car usage habit, we asked car users what policy would make them reduce or reject car usage. Car users considered the most effective policies would relate to parking problems in this regard, such as reducing the number of parking spaces, increasing parking charges, or raising the penalty or fines for parking in restricted areas.

In relation to the intention part of the survey, car users were asked about their intention to use the BTS in future. The results show that only 28.71% of car users who responded have a high intention of using BTS (with these people having selected a score 8 or 9). PT user respondents were asked a different question to do with any intention to have car in the future. Here, only 8.33% of the PT user respondents had a high intention to buy a car.

From all of the results summarized above, we can conclude that the quality of BTS services has to be improved in order to persuade people to use the BTS, especially in terms of the place (D) attribute coupled with a solution to help passengers who have a lot of baggage so they can travel by BTS with more convenience and comfort. It is not only service quality that has to be improved. Specifically, a more strict policy about car usage has to be discussed. More restrictions could affect the habit of car users to reduce using cars and also affect any PT users by causing them to reconsider buying a car.

To resolve the serious congestion problem in Bangkok, improvement in service quality of public transportation has to be considered while the government must also discuss the drafting and implementation of strict policies that can reduce car usage. Not only should the number of cars on road be reduced, but also the number of road accidents. We hope that by improving the quality of those important factors, the BMA will be able to persuade car users to switch their mode of transportation to PT, which will then resolve the congestion problem in the Bangkok metropolitan area.

5.1. Limitation

With regard to potential limitations of this study, the result of the conditional logit, as per Table 4.8, can be analyzed within attribute but it cannot analyze across the attribute. For example, in product (A) we know that speed of travelling (A1) is the most significant among the product attributes, and distance between station and ridership's origin / destination (D1) is the most significant among the place attributes. But we cannot compare A1 or D1 to determine which of these is the most significant.

As well, it is worth noting that the scope of respondents who participated in this study was based on people who use social media. Therefore, the results might be different if we scope the area of respondents to account for significant differences in contexts, such as social-demographic backgrounds, that could affect their actual transportation mode usage (Bamberg, Hunecke, & Blobaum, 2007; Buehler & Pucher, 2012)

5.2. Future work

As is apparent, the result of C-logit analysis cannot identify the most significant attribute levels and their effect in socioeconomic terms. For further study, only the significant factor should be used to analyze the importance of influences, such as the speed of traveling (A1), reliable of the BTS time schedule (A2), distance between station and ridership's origin / destination (D1). So, by so doing, we can more clearly identify which factors affect the intention of PT users and car users to use the BTS. As well, the results of this study can be applied to research focused on other modes of transportation in order to facilitate improvement of public transportation service quality.

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APPENDIX A: Paired model conditional logit estimates adjusting for covariates of Attribute impact

	Car			PT		
	coefficient	Pr(>|z|)		coefficient	Pr(>|z|)	
A	1.6790	< 2e-16	***	1.6792	< 2e-16	***
B	-	-		-	-	
C	-1.9310	< 2e-16	***	-1.7799	< 2e-16	***
D	2.4790	< 2e-16	***	1.5371	< 2e-16	***
A:AGE1	-0.7890	0.0227	*	0.4332	0.0038	**
A:AGE2	0.6038	0.0023	**	-0.1774	0.0962	.
A:EDU1	-0.0947	0.4216		-0.0603	0.4233	
A:F	-0.1550	0.1340		0.1847	0.0082	**
A:INC1	0.0234	0.9554		-0.4683	0.0040	**
A:INC2	-0.4691	0.0122	*	-0.1642	0.1700	
A:INC3	0.0615	0.7656		0.0728	0.5766	
A:OCC1	-0.2389	0.0303	*	-0.1510	0.0915	.
C:AGE1	-0.7171	0.0319	*	0.1232	0.3378	
C:AGE2	0.4612	0.0133	*	0.1316	0.1584	
C:EDU1	-0.0672	0.4155		0.0704	0.2859	
C:F	0.0267	0.7288		-0.0256	0.6855	
C:INC1	0.5176	0.1556		0.0431	0.7729	
C:INC2	-0.5306	0.0014	**	-0.0886	0.3948	
C:INC3	0.1785	0.2715		0.0466	0.6848	
C:OCC1	0.1370	0.0915	.	0.1278	0.0952	.
D:AGE1	-0.3589	0.3157		0.2889	0.0443	*
D:AGE2	0.1228	0.5419		-0.0886	0.3918	
D:EDU1	-0.2664	0.0311	*	-0.1718	0.0206	*
D:F	0.2109	0.0449	*	0.2474	0.0003	***
D:INC1	0.4954	0.2685		-0.4996	0.0017	**
D:INC2	-0.3513	0.0691	.	-0.0342	0.7695	
D:INC3	-0.1734	0.4226		0.1258	0.3245	
D:OCC1	-0.1560	0.1717		-0.2802	0.0016	**

Significant codes: ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05

APPENDIX B: Paired model conditional logit estimates adjusting for covariates of Attribute levels

	Car			PT		
	coefficient	Pr(>|z|)		coefficient	Pr(>|z|)	
A2	-0.1120	0.4592		0.1614	0.1663	
A3	-0.9172	0.0000	***	-1.0216	< 2e-16	***
A4	-0.8783	0.0000	***	-0.7235	0.0000	***
B2	-0.6235	0.0001	***	0.1329	0.2870	
B3	-0.1453	0.3525		-0.4291	0.0003	***
B4	-0.1008	0.5124		-0.2023	0.0727	.
C2	0.0620	0.7137		-0.3060	0.0196	*
C3	-0.2121	0.2541		0.1604	0.1801	
C4	-0.0428	0.8133		-0.1717	0.1769	
D2	0.0854	0.5976		-0.1366	0.2152	
D3	0.5686	0.0007	***	0.9965	< 2e-16	***
D4	-1.3770	< 2e-16	***	-2.4997	< 2e-16	***
A2:AGE1	0.1239	0.7856		-0.0063	0.9722	
A2:AGE2	0.0511	0.8393		-0.1984	0.1317	
A2:EDU1	0.0497	0.6767		-0.1539	0.1023	
A2:F	0.1685	0.1170		-0.1044	0.2399	
A2:INC1	-0.5660	0.2900		0.0390	0.8529	
A2:INC2	-0.2574	0.2604		-0.1350	0.3634	
A2:INC3	0.0616	0.7961		-0.1439	0.3803	
A2:OCC1	-0.2198	0.0511	.	0.1373	0.2143	
A3:AGE1	0.4553	0.2934		-0.0640	0.7222	
A3:AGE2	-0.2029	0.4014		0.3457	0.0080	**
A3:EDU1	0.3630	0.0046	**	0.1484	0.1123	
A3:F	-0.1479	0.1818		0.0360	0.6804	
A3:INC1	-0.2851	0.5791		0.2255	0.2783	
A3:INC2	0.3809	0.0891	.	-0.1653	0.2614	
A3:INC3	0.3403	0.1480		0.2492	0.1219	
A3:OCC1	0.0849	0.4739		0.1072	0.3302	

Significant codes: '***' 0.001 '**' 0.01 '*' 0.05

APPENDIX B: Paired model conditional logit estimates adjusting for covariates of Attribute levels (Continued)

	Car			PT		
	coefficient	Pr(>|z|)		coefficient	Pr(>|z|)	
A4:AGE1	-0.6186	0.1911		0.2124	0.2383	
A4:AGE2	0.1610	0.5399		-0.1142	0.3821	
A4:EDU1	-0.1827	0.1420		-0.0415	0.6578	
A4:F	-0.1665	0.1334		-0.1165	0.1828	
A4:INC1	0.7870	0.1474		-0.2860	0.1697	
A4:INC2	-0.2279	0.3346		0.1709	0.2469	
A4:INC3	-0.3643	0.1335		-0.0610	0.7068	
A4:OCC1	0.2956	0.0133	*	0.0178	0.8717	
B2:AGE1	-1.0540	0.0264	*	-0.1720	0.3656	
B2:AGE2	0.3944	0.1333		0.1449	0.2957	
B2:EDU1	0.0680	0.5842		-0.0289	0.7736	
B2:F	0.0010	0.9930		0.1116	0.2303	
B2:INC1	1.0470	0.0567	.	0.0386	0.8603	
B2:INC2	-0.1967	0.4110		-0.1821	0.2449	
B2:INC3	-0.1509	0.5405		-0.1817	0.2877	
B2:OCC1	0.1109	0.3575		-0.0105	0.9286	
B3:AGE1	0.4144	0.3479		-0.1126	0.5419	
B3:AGE2	-0.2103	0.3964		0.0362	0.7861	
B3:EDU1	0.1257	0.3056		-0.0442	0.6408	
B3:F	-0.1433	0.2082		-0.0667	0.4592	
B3:INC1	0.1802	0.7215		0.4261	0.0442	*
B3:INC2	-0.0922	0.6843		0.1959	0.1877	
B3:INC3	0.0038	0.9871		-0.1970	0.2287	
B3:OCC1	0.0000	0.9997		0.1337	0.2247	

Significant codes: '***' 0.001 '**' 0.01 '*' 0.05

APPENDIX B: Paired model conditional logit estimates adjusting for covariates of Attribute levels (Continued)

	Car			PT		
	coefficient	Pr(>|z|)		coefficient	Pr(>|z|)	
B4:AGE1	0.6010	0.1693		0.1980	0.2691	
B4:AGE2	-0.3099	0.2086		-0.1817	0.1597	
B4:EDU1	0.0460	0.7076		-0.0355	0.6973	
B4:F	0.0187	0.8681		-0.1554	0.0738	.
B4:INC1	-0.4097	0.4124		-0.0263	0.8972	
B4:INC2	0.1695	0.4548		0.1777	0.2169	
B4:INC3	-0.0043	0.9849		0.1648	0.2957	
B4:OCC1	0.0343	0.7739		0.0248	0.8156	
C2:AGE1	0.0789	0.8732		-0.5239	0.0091	**
C2:AGE2	-0.1957	0.4848		-0.1033	0.4695	
C2:EDU1	-0.0443	0.7412		-0.0423	0.6776	
C2:F	0.1306	0.3017		0.0076	0.9393	
C2:INC1	0.3864	0.4779		0.2183	0.3465	
C2:INC2	-0.1292	0.6163		0.3925	0.0168	*
C2:INC3	0.5396	0.0302	*	0.2708	0.1297	
C2:OCC1	0.0302	0.8196		-0.1777	0.1211	
C3:AGE1	0.0439	0.9372		0.1348	0.4787	
C3:AGE2	0.0941	0.7598		0.0397	0.7737	
C3:EDU1	0.1072	0.4307		-0.0793	0.4083	
C3:F	0.0072	0.9552		0.0212	0.8193	
C3:INC1	-0.2398	0.7016		-0.0686	0.7513	
C3:INC2	-0.3025	0.2842		-0.1030	0.4975	
C3:INC3	0.0265	0.9240		-0.0515	0.7598	
C3:OCC1	-0.0013	0.9923		0.0703	0.5300	

Significant codes: ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05

APPENDIX B: Paired model conditional logit estimates adjusting for covariates of Attribute levels (Continued)

	Car			PT		
	coefficient	Pr(>|z|)		coefficient	Pr(>|z|)	
C4:AGE1	-0.0796	0.8733		0.1566	0.4350	
C4:AGE2	0.1853	0.5126		0.1036	0.4858	
C4:EDU1	-0.2375	0.0878	.	-0.0515	0.6131	
C4:F	-0.2347	0.0730	.	-0.0030	0.9753	
C4:INC1	0.0654	0.9075		0.1288	0.5661	
C4:INC2	0.2969	0.2485		-0.1967	0.2228	
C4:INC3	-0.5725	0.0325	*	-0.2774	0.1251	
C4:OCC1	0.0627	0.6456		0.1648	0.1699	
D2:AGE1	0.5545	0.2311		-0.2765	0.1156	
D2:AGE2	-0.5099	0.0459	*	-0.2586	0.0418	*
D2:EDU1	-0.0336	0.7856		0.0603	0.5036	
D2:F	0.0276	0.8031		-0.0113	0.8947	
D2:INC1	0.2887	0.6045		0.1319	0.5144	
D2:INC2	0.6581	0.0056	**	0.7791	0.0000	***
D2:INC3	-0.4680	0.0581	.	-0.2041	0.1891	
D2:OCC1	0.2741	0.0208	*	0.1699	0.1084	
D3:AGE1	0.7015	0.1312		0.1740	0.3427	
D3:AGE2	-0.2840	0.2695		0.1721	0.1942	
D3:EDU1	-0.0686	0.5920		-0.0582	0.5428	
D3:F	0.0254	0.8237		0.0702	0.4358	
D3:INC1	-0.1273	0.8212		0.3029	0.1706	
D3:INC2	-0.0217	0.9276		-0.3826	0.0107	*
D3:INC3	0.1236	0.6235		-0.1267	0.4453	
D3:OCC1	0.0591	0.6279		-0.0578	0.6090	

Significant codes: '***' 0.001 '**' 0.01 '*' 0.05

APPENDIX B: Paired model conditional logit estimates adjusting for covariates of Attribute levels (Continued)

	Car			PT		
	coefficient	Pr(>|z|)		coefficient	Pr(>|z|)	
D4:AGE1	-1.1070	0.0156	*	-0.2574	0.1684	
D4:AGE2	0.5929	0.0188	*	-0.0484	0.7189	
D4:EDU1	0.2733	0.0239	*	0.0788	0.4093	
D4:F	-0.1191	0.2722		-0.1849	0.0406	*
D4:INC1	0.2214	0.6813		0.2848	0.1792	
D4:INC2	-0.3956	0.0825	.	-0.1898	0.2091	
D4:INC3	0.0041	0.9865		-0.0621	0.7087	
D4:OCC1	-0.4110	0.0003	***	0.3077	0.0065	**

Significant codes: ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05

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