

# An Analysis of Commuters' Transport Mode Selection: The Case of Chiang Mai Smart Bus

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## Abstract

The objectives of the study aim to examine factors or causes which influence to commuter decision to select smart bus. The result illustrated that most commuter is local students. In addition, income and accommodation around place of living are the factors which influence to frequency of use of public bus in a week. Time period when people travel most is at 08.00 am till 10.00 am. And there are different of commuters' character each bus route, R1 route is the most travelled by student because there are some malls in the route while B3 route is most travelled by tourist due to the bus is heading to Chiang Mai airport. Most factors which commuters satisfied on public bus are bus physical, cleanliness, the way that driver driving, temperature on board and seat quality.

**Keywords:** Behaviour, public transportation, Chiang Mai, BRT

## 1. Introduction

Look backward for 200 years in 1820s, people has used a horse to travel from place to place, spend several days on the road before got to the destination. Few years later the way to travel was developed, Omnibus occurred and then followed with the horse car before human found the new system to travel, cable line, and new more systems further. Nowadays, transportation has become an importance part of human's daily routine already. A large number of people in several cities spend pretty much time on street as the information Data Company has revealed that average US commuter spend 42 hours in traffic per year. (Business Insider, 2017)

Public transportation transform people way of living by spurring economic development, provide sustainable and high quality of life. There are number of public transportation but most used are rail and bus. (Statista, 2015) In 2017, there was mass transit carrying 53 billion passenger worldwide which increase from 2012 for 9 billion of passengers, most of that growth occurring in Asia, and the Middle East-North Africa region as reveal in Figure 1. (Florida, 2018) And US people made their trip by bus for 50%, rail for 48% and 2% for the others in 2017. (American Public Transportation Association, 2017)

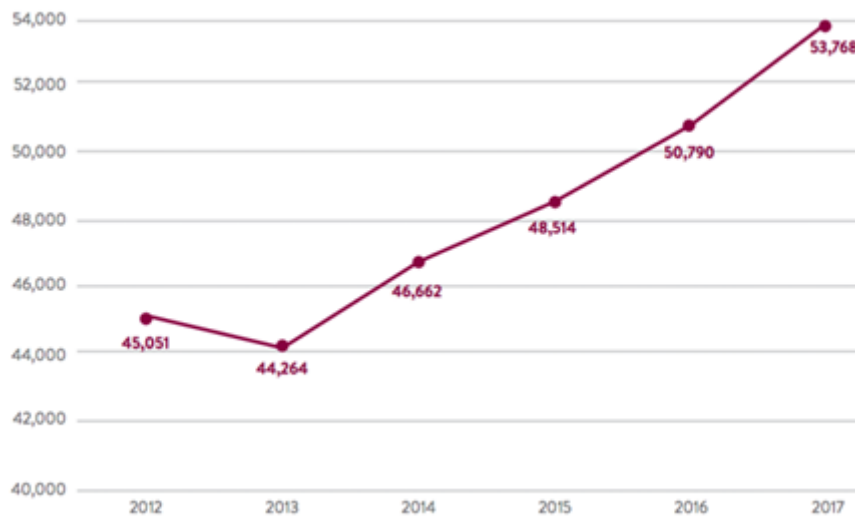


Figure 1 Global Ridership Evolution (in Millions)

Said Florida, also, this was as the result of world's population has rapidly urbanization. The Figure 2 display the number of transit system which growing up since 1970s to 2017 to carries increasing of amount of passengers. The 2017 busiest transit system revealed that Tokyo is the first in rank, follow by Moscow, Shanghai, Beijing and Seoul, it also show that 6 from top ten of this rank are the countries from Asia.

Apparently, people all around the world use more public transportation each year, especially in Asia.

In Thailand, also, amount of passengers who travel by public transportation have increased since 2009 to 2015. Most use is BRT and then, BTS, airport rail link, and MRT. By the way, the information display BRT passenger had been decreasing more each year, even used most in overall viewing, but passenger who travel by BTS, airport rail link, and MRT keep increasing each year as show in Figure 3. (TCIJ, 2018)

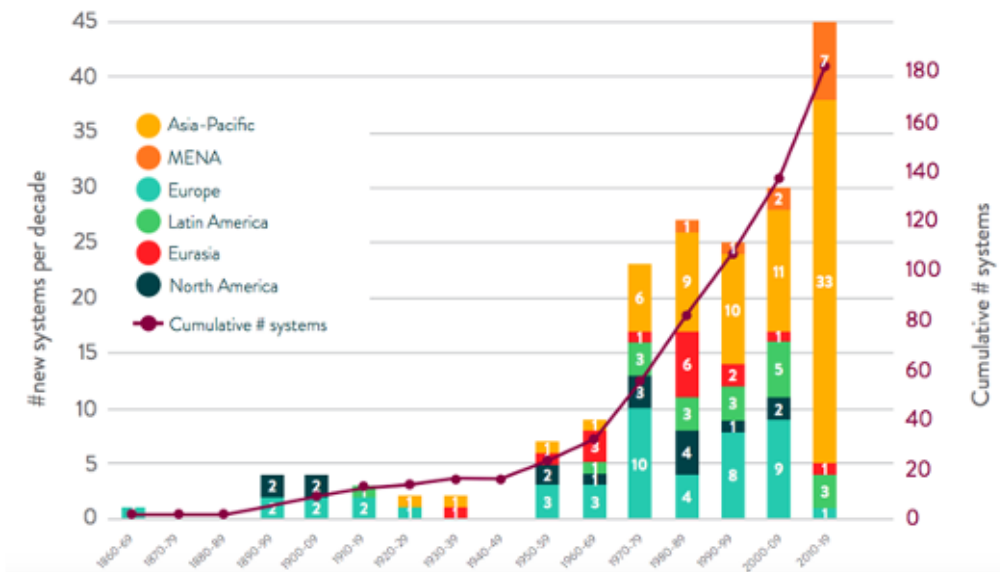


Figure 2 Metro System Opening (Per Decade) 1860 — 2017

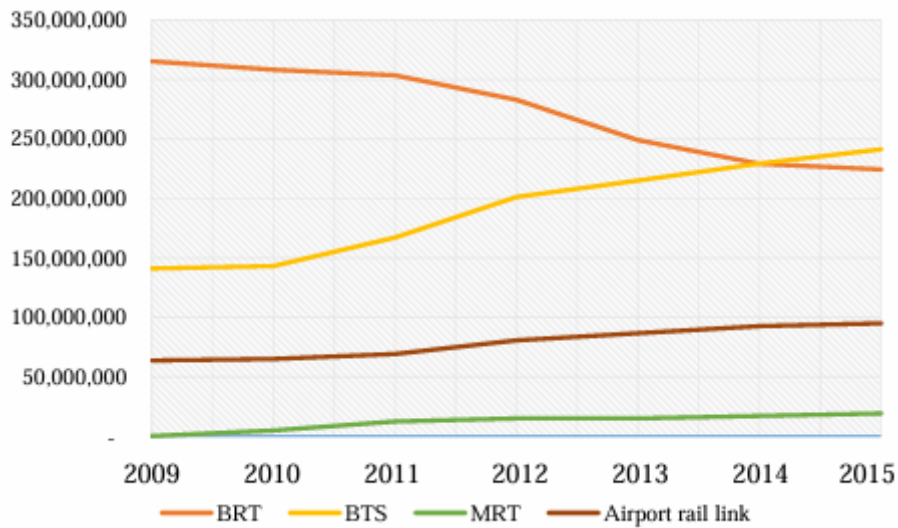


Figure 3 Passenger separate by types of transit in Bangkok since 2009 – 2015

In Chiang Mai, there are many different kind of public transport to choose for people who live there; tri-wheel taxi or Tuk Tuk, Songthaew, red taxi and more; it really helpful for tourism and local people who didn't owned individual vehicle. Moreover, some of Chiang Mai transportation such like Red taxi or Tuk Tuk are also famous among international tourists. By the way, there is no service of public bus or BRT (Bus Rapid Transit) there even though it is the most used in America and many countries and tend to used much more in the future. Early 2018, however, Regional Transit Corporation Co.,ltd; city development companies joint venture with aim to developing downtown public transportation system; announced the plan to invest in downtown site of Chiang Mai public transportation with 50 million baht of budget in the form of Smart Bus. (Prachachat, 2018) Then the following question is while people have got choices of public transportation already, why do they need more one? Which factors will drive them to select public bus instead of the others?

This research aim to examine the effective factors which influence commuters decision to select new transportation as the smart bus. What is the stronger causes or factors which drive people select smart but instead of others familiar domestic public transportation that they ever used and feedback from commuters who have used which could be one of essential keys element to improve Chiang Mai smart bus further. Research objectives

1. To examine factors or causes which influence commuters' decision to select smart bus.
2. Gather and consider feedback from commuters to improve Chiang Mai smart bus further.

## 2. Research Objectives

### 2.1 Study area

Chiang Mai is one of the most popular destinations in Thailand; both of Thai and foreign tourists; to travel, relax and to experience the diversity of nature and culture. There are a large number of tourists who come to visit Chiang Mai recently years and tend to be increasing continuously further. (Ministry of tourism and sport, 2017) Moreover, Chiang Mai is a province where order and talked into the 1st strategy of the national economic and social development board number 12; since 2017 to 2021; that will be developed in term of tourism with high quality of products, services and benefit distribution each areas equality. (The national economic and social development board number 12, Northern developed plan, 2017)

Chiang Mai is the most importance after Bangkok, both of them are dominate to domestic economic in the similar way. However, there is one thing which make Chiang Mai totally different to Bangkok, transportation. Said Prinya (2007), Chiang Mai local public transportation can't support increasing population and it was leading to traffic problems later. Not only the system which unable to support, songthaew or red taxi and traffic local institution are also factors which effect to Chiang Mai transportation. With deeper details, most people who use public transportation are influenced by price, income, safety, distance between living accommodation and work place, and career.

### 2.2 Overview

Transportation is a crucial part of human life, it isn't just the way to connect people to people but it also mean style of life, communication and economic. (Mathew and Rao, 2007) However, transportation modes and system are totally different from the present time. Human began the transportation with

extremely old technology. Transportation, both systems and vehicles, have been developing over time until today. Also, transportation tend to growing up more and more, in 2016 volume of road freight grew by 3.5% a year, the road now take about 75% of freight traffic within the EU and number of cars tripled. (UKEssays, 2017) Moreover, Information from American Public Transportation Association (APTA) (2017) have revealed that 18.8 billion of American citizen have made their trips by public transportation due to safety, facilitation, and more efficient for rider.

The major causes which impact people to use more public transportation are namely vehicles safety, cleanliness, quality of services and price ticket. (Irtema et al., 2018) Other factors, also, impact to commuter behaviour of public transportation like natural factor; weather or temperature (Miao et al., 2019), performance of system, transit social popularity and facilitation. Transportation always has been investing in transportation each economic areas. The information from International Transport Forum (2015) illustrated about inland transportation investment. In Western European countries, rail is the most invested, it has increased steadily from 30% to 40% in 18 years; 1995 till 2013. Also, rail is also invested more than road in Japan and North America. Since 1993 till 2016, there is increasing of public transit vehicle accessibility, in case of bus and BRT have increased for 39.7%; from 60% to 99.7%.

In Thailand, public transportation is under local government organization. By the way, Bangkok and metropolitan area are the spots where public transportation have been developing most while other provinces do not developed as much as transit in capital city. Example case about public transportation in other province; Nakhon Si Thammarat province; has revealed that only public transportation there is Songthaew and the problems are redundancy of Songthaew rout and cluster in a few spots (Piti, 2016) but public transportation

in Bangkok is consist of buses, minibuses. Vans, boats and BTS sky trains. (Anuphak et al., 2011).

In Chiang Mai, there are several choices of domestic public transportation for local people, traveller and tourist like Songthaew, minivans, or motorbike taxi. In case of smart bus. From the latest announcement details updated, there are 38 buses with 7 route in town (ChiangMaicityupdate, 2016) and local transportation in Chiang Mai is one of many factors which influence to group tour of Chinese tourists' satisfaction. (Akarapong, 2018) By the way, Chiang Mai transportation is cluster only in downtown side and low connection to the area of edge of town and red cars or red taxi is the most influences transit in Chiang Mai due to they are have got concessions solely. This cause effect to Chiang Mai people have a few choices of transportation. (Anuphak et al., 2011).

Figure 1 is revealing the latest details about Chiang Mai bus's routes that there are 38 buses, 7 routes with total 225 bus stops (Chiang Mai city update, 2018);

R1 route: Chiang Mai zoo – Warorot market – The mall Central Festival Chiang Mai

R2 route: The mall Promenada – Nong Hoi – Chang Klan – Tapae – Warorot market

R3 route: (Both left/right ways) Chiang Mai airport – Nimman – Old town – Warorot market – Night bazar

B1 route: Chiang Mai Provincial Arcade Bus Terminal – Chiang Mai train station – Chiang Mai zoo

B2 route: Chiang Mai Provincial Arcade Bus Terminal – Tapae - Chiang Mai airport

B3 route: Chiang Mai Provincial Arcade Bus Terminal - The 60th Anniversary of His Majesty the King's Accession to the Throne International Convention Centre – Chiang Mai government centre

Poh-Oe 10.: City bus from suburb to downtown with 74 bus tops.



Figure 4 Chiang Mai bus routes

## 2.3. Related theory

### 2.3.1 Multiple linear regression

Multiple linear regression is a method which use to carried out to estimate the relationships between dependent variable and 2 or more independent variables. The multiple linear regression has equation is as follow:

$$\hat{Y} = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_pX_p + e \quad (1)$$

Where  $\hat{Y}$  is the predicted of expected result,  $b_1$  is the estimated regression coefficient that quantifies the association between the risk factor  $X_1$  and the outcome, adjusted for  $X_2$ .  $b_2$  is the estimated regression coefficient that

quantifies the association between the potential confounder and the outcome. (Department of Statistics and Science Data, Yale University, 2019).

### 2.3.1 Likert Rating Scale

Likert scale of Likert rating scale is use for assume strength or intensity of experience as a linear. This rating scale was developed by Likert in 1932 to measure attitude by asking people to respond question from their experience. Rating scale is separate for 5 levels where 5 in the best or most agree to the topic which asked and 1 and worst or totally disagree. (McLeod, 2008).

Result of Likert scale is mean value, which equation is as follow:

$$\bar{X} = \frac{\sum X}{n} \quad (2)$$

### 2.3.3 Transportation role

Role of transportation in society can be classified according to economic, social, hospital and environmental roles. There are a large number of areas around the world got chances to developed and very easily governed from the good transportation, both of travelling terms and logistic terms. (Mathew, 2009; Mathew and Krishna, 2007). Like case of Washington, D.C., the cities have transformed by transportation and developing technology. A century ago, people in Washington, D.C. were walking between home and work place, schools, churches and shopping. By the way, the way these activities were working changed over time. People can go for work or the others activities in the separate quarters of the city easier.

Transportation isn't only about the way that people use to make their trips or travel from places to places but actually also means logistic or transport of goods and services in businesses sector. For industries, transportation system be like the importance key element in a logistic chains to manage resources, productivity and send/receive goods and services. (Tseng et. al, 2005) By the way

developed of transportation lead to natural environment negative effects due to pollutions; air and noise pollution; that was producing from vehicles, worldwide death and injuries from road accidents, also, negative effects mean higher energy consumption each years. (Mathew, 2009; Mathew and Krishna, 2007).

### 3. Research Methodology

#### 3.1 Sample and data collection

This study have studied in Mueang Chiang Mai District, Chiang Mai province where most economy activities and transportation occur. The information have collected in February 2019 by questionnaires.

Researcher randomly collected data base on Taro Yamane formula

$$n = \frac{N}{1 + Ne^2} \quad (3)$$

Taro Yamane formula use for calculate amount of sample size from the population, most researchers who collected primary information use this formula to calculate how many of sample size all they need.

In this research, focus group is 400 commuters who use Chiang Mai smart bus; no separate there's first time or not; and collect the information by randomly survey method. In term of information collective area, researcher have collected information each bus stops; totally 225 bus stops with all 7 routes; and commuters who they are on the way to travel.

In term of the questionnaires, they were written both in Thai and English language, asked for experience of Chiang Mai domestic public transportation which separate for 3 parts. The first part is demographic questions such as age, gender or career. (Obsurvey, 2014) The second part was seeking for the factors which influence to the commuter's transit selection behaviour. They

are consist of 2 majors sections; factors which influence to commuters' behaviour and for local people and tourists. The last part is about commuters' satisfaction which separate for 7 categories; availability, accessibility, information, time, customers care, comfort and security. (Wang and Liu, 2015)

### 3.2 Data analysis

The information which gathered in the 2 first parts in the questionnaire form will be analyse through SPSS by basically multiple linear regression method with Statistics Package for the Social Science: SPSS program.

Refer to equation (1), the real equation which use to analyse in this research is able to write as:

$$\hat{Y} = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + e \quad (4)$$

Where Y is Commuter's frequency in use of public transportation (times per week),  $X_1$  is gender,  $X_2$  is age,  $X_3$  is career,  $X_4$  is income,  $X_5$  is Driving license,  $X_6$  is bus stops near accommodation,  $X_7$  is bus stops near the destinations,  $X_8$  is Amount of bus stops, and  $X_8$  is Facilitation.

The result of this equation display which are the most effective factors which dominate commuters' behaviour.

In part of commuters' satisfied, there will be analyse by calculate the mean value of all points,  $\bar{X}$ , which gathered from group of sample of population and display the final result refer to Likert Rating Scale, to display rank of categories which commuters most satisfied.

## 4. Research Findings Summary

### 4.1 Result

Due to limitation of the time and budget, there are only 105 questionnaires were collected. All collected information separate for 89 of local

people and 16 of tourists, both Thai and foreigner. With the same causes, there are only 6 from 7 routes researcher collected information.

From the information, 66 questionnaires were response by male, account for 62.8%, and 39 questionnaires were response by female account for 37.1%. 48% of sample of population age between 21-30 years old, 40% is under 20 years old, 7.8% age between 31-40 years old and 3.8% of people who older than 40 years old. In term of career, 72.3% or 76 persons are students, 12.3% of freelance, 5.7% of state employees, 4.9% of private employees, and 4.7% for the other.

With multiple linear regression analysis, the result display in Table 1.

**Table 1 The final result analyzed by multiple linear regression method**

Variable	Coefficient	Coefficients Std. Error
Constant	.563	.780
Gender	.185	.401
Age	.184	.041
Career	.322	.129
Income	.039***	.000
Driving license	.539	.001
Bus stops near accommodation	.000***	.002
Amount of bus stops	.609	.003
Facilitation	.768	.002

The result in table 1. Display that at 99% confident interval, there are only 2 variables have significant to the commuters' frequency of using Chiang Mai public bus; income bus stops near accommodation. However, the most not

significant variables is facilitation, amount of bus stops, driving license, career, gender, and age for the last one.

From above information, researcher found that the most effective factors which dominate commuters' bus use behaviour are income, and bus stops near their accommodation. That's mean, commuters' bus use frequency per week will increase or decrease depending on these 2 factors.

In addition, commuters' characteristics differ by bus route. From the collected questionnaires, most students were travelling by R1 bus due to there are some malls into the route. By the way, most tourists were travelling by B3 bus route due to buses in this route are heading to Chiang Mai airport. In case of time most commuters travel, even though this part isn't too constant bus information which collected display that most commuter tend to travel at 08.00 am. - 10.00 am.

In terms of commuters' satisfaction, all mean score each issues are in Table 2. Commuters' have satisfied on physical of bus and cleanliness on board, followed by driver, on board temperature, and seat quality at the same level, then price and ease of get on/off the bus. By the way, commuters have low satisfaction on the way to announcement why the bus leave or arrive bus stops delay and promoting by institution.

Table 2 The final result analyzed by Likert scale (Full of 5)

Issues	Mean score ( $\bar{X}$ )	Meaning of Likert rank
Physical of bus	4.3	
Price levels	4.1	
Ease of get in/off	4.1	
Appropriate of bus stops	3.4	
On board walking distance	3.87	
Time schedule at bus stops	3.4	
Institution promoting	2.9	
Time schedule on board	3	1.00-1.49 means totally not satisfy
Be on time	3.1	1.50-2.49 means less satisfy
Travel time between bus stops	3.3	2.50-3.49 means satisfy
Announcement of bus delay	2.6	3.50-4.49 means very satisfy
Service provider's manner	4	4.50-5.00 means most satisfy
Way to complain	3.5	
Seat quality	4.21	
On board temperature	4.2	
Cleanliness	4.3	
Drivers	4.2	
Safety at bus stops	3.8	
Safety in board	3.94	

## 4.2 Discussion

Focus on other details of information, even though career and bus routes aren't significant to commuters' behaviour but there are some interesting points to talk to. All sample of population in this research, 89 persons or 84.7% is local people and all of local people, 76 persons or 72.3% is students. It's apparently this public transport most used by local students. It could say that student is the major group of this public transport, then if service provider have policies which encourage this target group, Chiang Mai public bus could be more

used and popular further. One of person who have given the information said it better if service provider have different rate of price between workers and students.

For bus routes part, commuters each routes are totally different. Students most used R1 route due to there are the bus stops at Chiang Mai University and the malls; the mall Maya and the mall Central Festival. While most tourists used B3 route because this route is heading to Chiang Mai airports. Most tourists didn't travel into the town by public bus but others transit, information from several tourism websites have shown that to travel by songthaew or Red taxi is the activities tourists shouldn't miss (Chiang Mai traveller, 2017), it could be a reason why public bus isn't popular among tourists except they would like to go to the airport. Each bus routes of different of commuter characters, it better to design each bus functions to support to commuters, e.g. B3 route should have more space for tourists' luggage or bigger backpack while R1 should of many seats due to a lot of students travel by this route.

In terms of commuters' satisfaction, institution promoting and announcement of bus delay are least satisfied, then the project administrator need to fix this problem by more promoting and announce to commuters when there are some causes make the bus leave or arrive the bus stops delay. One more problem which need to fix is about time schedule. Some bus stops have very small time schedule which too difficult to check each bus routes' travelling time. Moreover, some bus stops have no time schedule and only one thing commuters can do is wait and notice bus route on the bus. To make more clear time schedule may allow commuters use Chiang Mai public bus easier.

## 5. Conclusion

This research is to study about commuters' behaviour who decided to travel by Chiang Mai public bus by focus on gender, age, income, career, traveling time, bus routes and bus stops around accommodation and destination from 105 people of sample of population with 6 routes. The result illustrated that there are 3 factors which dominate commuters' public transport selection; income, traveling time, and bus stops around their accommodation while most commuters is local people.

The commuters tend to use public bus with high frequency each week if there are many bus stops around there accommodation. Also, the period of traveling also dominate to commuters' behaviour too, especially at 08.00 am till 10.00 am. And income is the third factor which dominate commuters' behaviour.

For the further research, should collect more information at least 400 of questionnaires, refer to Taro Yamane's formula, and study by focus on local's behaviour and tourist's behaviour about how different they are.

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