



Factors Affecting Decision-Making to Use Feeder Bus Services and Air-Conditioned Buses in Salaya Subdistrict Towards A Sustainable Transport Policy

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Abstract

This research aims to study the factors affecting the public transport travel behavior of people in the community around Salaya station area. We distributed 375 questionnaires to examine the behavior of people in Salaya subdistrict municipality area and its environs. To promote sustainable transport, it is important to consider policy interventions that encourage the use of public transport and reduce dependence on private cars. Therefore, the study area has been chosen in order to give an insight into feeder bus planning will supports the commuter railway line that is to be developed in the near future. This study focuses on two research questions necessary for the feeder transport planning as factors that affect the choice of a feeder system to travel in the area and the factors that affect the choice of using the air-conditioned feeder bus. The behavior of the samples was analyzed by binary logistic regression in two steps: first, to predict the factors that affect the probability that people will use the feeder bus service that picks up passengers between destinations in SALAYA and between SALAYA and Bangkok. Second, to predict the factors that affect the probability of choosing an air-conditioned bus service. As a result, the demographic factors that appeared to affect the decision of choosing a feeder bus were income and the number of vehicles owned. Furthermore, the factors affecting the decision to use air-conditioned buses are age, education, and income. Understanding these factors can help local transport authorities for designing more effective shift-mode strategies.

Keywords : Public Transportation; User Perception; Feeder Bus; Logistic Regression; Mode Choice

Introduction

Bangkok Metropolitan Region (BMR) is the largest urban area in Thailand and has struggled with problems in travel management. The cities, which are part of BMR, failed to promote high quality bus transport which is one of the major causes of severe traffic congestion as well as increasing air pollution problems. In many agencies that are ranked, the factors that result in traffic jams are composed of the factors mentioned above. Many studies by experts mentioned that a key to solving this problem is to use public transport. Therefore, many agencies are trying to support public transport in the main

transport system and secondary travel to encourage more people to use public transport services. This can be observed from the number of electric train projects increasing in order to meet the needs of people who want to travel from more places [1].

According to the research from the National Research Institute [2], Thailand has been facing air pollution problems, and many agencies are interested in solving or reducing them. This research found that land transport contributes the most to the occurrence of the PM 2.5 problem, accounting for about 31 percent. There are many ways to reduce this problem, such as by supporting the use of electric vehicles, reducing the consumption of

diesel, and shifting from private vehicles to public transport.

This research, therefore aims to study the behavior of people living in the Salaya area to identify factors that affect their decision-making when choosing a bus service for traveling around the Salaya area. The study focuses on identifying the factors related to the decision-making process between selecting air-conditioned buses or ordinary buses. The findings of this study provide an insight into information that supports a sustainable transport policy by examining people's preferences for using public buses.

The study area is the Salaya subdistrict municipality, which is the major town of Phutthamonthon district, Nakhon Pathom province. It is located to the west of Bangkok, the capital of Thailand. It is also considered as the part of BMR area. We used Salaya subdistrict as a study area due to the future plan of commuter rail development which needs feeder transport planning to help connecting to places near the station. Also, Salaya subdistrict is highly populated because of the aggregated government offices, schools and universities, as well as the rapid growth of communities which is reflected in the glowing public transport travel demand.

The factor that will make public transport most efficient is connectivity between nodes and places. Feeder bus service is often planned along with metro expansion to encourage connections between railway stations and their destinations.

Therefore, this study investigates factors that influenced their decisions on mode-shift to use the feeder bus service by investigate the factors affecting people's decisions to use feeder bus service and the decisions to choose the air-conditioned bus for their feeder bus trip. This study provides a research method for consequential decisions on using public transport to help local transport authorities determine the type of feeder bus service which will encourage the mode-shifting in station premises which would help them achieve the sustainable transport policy advocacy.

The objectives of this study focus on the decisions to use public transport in tropical countries. The literature on factors affecting

the decision to use public transport and the factors affecting the use of air-conditioned buses has therefore been reviewed. There are various studies related to these topics that can help develop the research methodology for this study. The literature reviews can be summarized as follows:

Factors affecting the decision to use public transport

According to research, the factors for public bus service users' decision-making include gender, age, education, income, occupation, and educational background [3-5]. Other personal factors that affect the willingness to use public transport include the number of vehicles possessed, and ability to drive different types of cars [3, 6, 7], but some studies have also questioned the ability to drive and possession of vehicles such as the studies of [6, 8-10].

The factors that will affect the trip can be generally classified into two groups: the travel cost and the total travel time including the time spent on the journey and the waiting time that occurs at the time of deciding to travel by public transport. A number of studies have shown that travel time affects travel decisions [3, 7, 11-13, 10]. Many studies specify that the travel time is directly related to the decision to use public transport [3, 7, 10-13].

Service reliability has a huge impact on decisions to use public transport [2-4, 6, 10, 13, 14, 17]. The service frequency has generally been mentioned as a major cause of the reliability [8, 11, 12, 15, 16], followed by safety, which usually includes safety at bus stops or terminals and onboard safety [14, 17].

Another factor of service reliability is service quality, which was mentioned in the research of [9-11, 13, 14] who stated that the customer services provided by public transport operators are related to the willingness to use public transport. The better a user's satisfaction, the more attractive using public transport is in other words, passengers expect a good experience during a trip. This also includes the information provided by the transit operators. The passengers want to know information about various aspects of the service in order to make a decision to use it.

The cleanliness aspect is also considered as a factor of service quality. Cleanliness affects the decision to use public transport because passengers prefer travel in clean bus [10, 12-14]. Cleanliness refers to the hygiene and comfort of the service [11-13, 17, 18] which make passengers feel safe and comfortable during the trip.

The surge in environmental concerns also affects the intention to use public transport. Nowadays, many people pay more attention to transport activities that harm the environment. These may be considered as unsustainable activities such as car dependency or overuse of fuel in transport activities. Various studies have confirmed that those activities caused a negative environmental impact. This evidence affects the increase in use public transport worldwide both with regard to individual decisions and urban policy [6, 11, 14, 13, 17].

Factors affecting air-conditioned bus users

Thailand is located in a tropical zone near the equator. Throughout the country, the average temperature is between 18 - 38 degrees Celsius. The summer lasts about 3 months. The hottest weather is in mid-April. After that, under the influence of the monsoon winds, Thailand enters the rainy season for 6 months and the winter for 3 months respectively [19].

Generally, buses in BMR provide two types of service: regular buses and air-conditioned buses. Several bus lines have both services operating on the same route to let passengers choose the service they prefer. The fares for both services are approximately 50% different. On this sensitivity of mode choice, there are limited studies that focus on the decision to use air-conditioned bus services. This research reported that the comfortable temperatures on the paratransit are significant for the intention to use public transport [13]. Another study conducted in Delhi, India, applied multi-criteria decision-making to observe travel mode shifts to use public transport and considered 4 groups of factors: reliability, comfort, safety and cost. The results of the study suggested that the comfort factor which consists of the air-conditioned vehicles affected 16% of intentions to use public transport. However, the

most influential factor was safety which accounted for 27% followed by the fare at 21% [12].

The limitations of the study about decisions to use air-conditioned public transport services brought us to explore the factors that influenced people to use the air-conditioned feeder bus service. The results of this analysis could explain more about the sensitivity between cost and time for using public transport in Salaya City.

Methodology

This study focuses on factors that affect the decisions about using feeder transport by investigating the factors and the probability that passengers decide to use feeder bus services in the study area. The present bus operation in BMR has both air-conditioned and non-air-conditioned bus services. We also investigated the major causes of selecting air-conditioned feeder bus services for short trips within the study area. These objectives are fruitful for the feeder bus operation especially in tropical countries as the area of this study has an average maximum temperature of 32-34 degrees Celsius throughout the year [20].

Data collection was done by questionnaire surveys distributed to people who live or have experience of traveling to Salaya area. A total of 375 samples were collected. The questionnaire was endorsed with MU-CIRB project code 2021/483.2211. The questionnaire focuses on the decision to use a bus service to transport passengers between places within the study area. The logic of the questionnaire survey is illustrated in Figure 1.

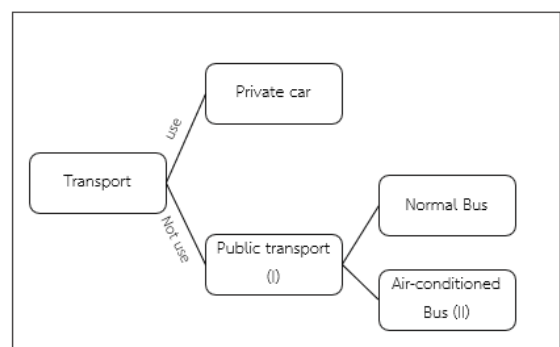


Figure 1 The logical of questionnaire survey

From the distribution of all questionnaires, there were a total of 409 questionnaires, 29 samples were excluded due to no experience of visiting Salaya area and another 5 people refused to answer the questionnaire. Therefore, 375 samples were used in this analysis.

We use statistical analysis to explain the factors affecting the mode choice of the sample. The analytical method is adopted from the study of [20] which used a logic tree binary logistic regression for making a logic of public transport users' decisions. The binary logistic regression model is therefore used in this study for predicting decisions to use feeder bus services and air-conditioned buses in

Salaya subdistrict. The study predicts the consequential decisions related to the use of feeder bus services including two research questions: first, to predict factors affecting the probability that people will use the feeder transport service; and second, to predict the factors that affect the chances of using an ordinary bus (non-air-conditioned) or the air-conditioned bus. The data was analyzed using the binary logistic regression model which is described in **Equation 1**. The descriptive statistics are shown in Table 1.

$$\rho(x) = \frac{1}{(1+e^{-(\alpha+\sum \beta_i x_i)})} \quad \text{Equation 1}$$

Table 1 Descriptive Statistic

Characteristics		Frequency	Percentage
Sex	Male	180	48%
	Female	190	50.70%
	LGBTQ+	5	1.30%
Age	Less than 20 years	89	23.70%
	21-30 years	142	37.90%
	31-40 years	79	21.10%
	41-50 years	43	11.50%
	More than 50 years	22	5.90%
Education	Primary	46	12.30%
	Secondary	76	20.30%
	Non-Formal Education	3	0.80%
	Vocational Certificate	84	22.40%
	High Vocational Certificate	32	8.50%
	Bachelor Degree	86	22.90%
	Master Degree	35	9.30%
	Doctor Degree	13	3.50%
Occupation	Student	75	20%
	Government career	35	9.30%
	Company employee	215	57.30%
	Freelance	26	6.90%
	Business owner	12	3.20%
	Retired	6	1.60%
	Other	6	1.60%
Personal Income	Less than 9,000 baht	221	58.90%
	9,001-15,000 baht	35	9.30%
	15,001-30,000 baht	63	16.80%
	30,001-50,000 baht	34	9.10%
	50,001-100,000 baht	16	4.30%
	More than 100,000 baht	6	1.60%

Characteristics	Frequency	Percentage
Number of vehicles in owner		
0	45	12%
1-2	146	38.90%
3-4	163	43.50%
4-5	18	4.80%
more than 5	3	0.80%
Total	375	100

Results and Discussion

Decision to use feeder bus service

The results of binary logistic regression analysis on the effect of personal factors in the decisions to use the feeder bus service in Salaya found that the inclusion of the explanatory variables reported predictive value of 91.2%. The results shown in Table 2 suggest that income and the number of vehicle owners are strongly related to the willingness to use the feeder bus service. Results of the analysis indicated that the model fit the data as Hosmer-Lemeshow's test was 0.691.

Equation 2 examines the binary logistic regression equation for the decision to use feeder bus service. As a result, only the income factor and the number of vehicles

owned correlated with the tendency of using feeder bus services. The interpretation of the logit was the lower numbers of vehicles owned and lower income led a higher possibility to use feeder bus service. When comparing decisions to use feeder buses with different income ranges, the lower income group has a probability of decision to use feeder buses 0.529 times higher than the higher income group. The comparison among the different numbers of vehicle ownership, the lower numbers of vehicle owned has a probability of decision to use feeder buses 0.568 times higher than vehicle ownership.

$$\text{Logit (Decision)} = 4.173 - 0.565 \text{veh} - 0.637 \text{income}$$

Equation 2

Table 2 Explanatory variables for probability of using feeder bus service

Explanatory variables	B	Wald	df	Sig.	Odd ratio	95% C.I. for Odd ratio Lower	Upper
Income	-.637	7.446	1	.006	.529	.334	.836
Number of vehicle owned (vehicle)	-.565	3.512	1	.061	.568	.315	1.026
Constant	4.173	11.645	1	<.001	64.932		

Using air-conditioning bus service (II)

The results of binary logistic regression analysis on the effect of personal factors on the decision to use the feeder bus service in Salaya found that the inclusion of the explanatory variables reported the predictive value as 77.6%. The results shown in Table 3 suggest that age, education and income are strongly related to the willingness to use air-conditioned bus services. Results of the analysis indicated that the model fit the data as Hosmer-Lemeshow's test was 0.675.

Equation 2 examines the binary logistic regression equation for the decision to use feeder bus services. As a result, only age, education and income correlated with the tendency to use air-conditioned bus services. The interpretation of the logit was that the lower age, lower income and lower education led to higher possibility of using air-conditioned bus services. When comparing the decisions to use air-conditioned bus services using different age ranges, the lower age group has 1.309 times higher probability of deciding

to use air-conditioned bus services than the higher age group. The comparison among different education determined that the lower education level has a 1.228 times higher probability of making a decision to use air-conditioned bus services. The comparison between the different levels of income determined that the lower income group has 1.608 times higher probability of deciding to

use air-conditioned bus services than the higher income group.

The Probability Prediction Equation that People Choose Air-conditioned Bus Services can be shown as follows **Equation 3**.

$$\text{Logit (Air - condition)} = -3.943 + 0.269\text{age} + 0.206\text{edu} + 0.475\text{income}$$

Equation 3

Table 3 Explanatory variables for probability of using air-conditioned feeder transport

Explanatory variables	B	Wald	df	Sig.	Odd ratio	95% C.I. for Odd ratio	
						Lower	Upper
Age	.269	3.069	1	.080	1.309	.969	1.768
Education	.206	5.179	1	.023	1.228	1.029	1.466
Income	.475	9.687	1	.002	1.608	1.192	2.168
Constant	-3.943	33.956	1	<.001	.019		

Conclusions

This study predicted the decisions to use feeder bus services and air-conditioned buses in Salaya subdistrict, Thailand, using a binary logistic regression model. The model gave an insight of the factors that influenced the samples decision making which benefited the transit authority's plan for public transport services in Salaya subdistrict. This plan assists the metro rail expansion project called the Red-line extension in terms of the connectivity which has a huge impact on mode shift.

The prediction is based on the binary logistic regression logit on two consequential decisions for using feeder bus services in the study area including factors affecting the decision to use feeder bus services and the decision to use air-conditioned bus services. The air-conditioned bus service became the subject of this study as the current operation of buses in Bangkok has two types of bus service including air-conditioned bus and non-air-conditioned bus. These two types are operating on the same routes in some areas to provide users a choice of travel.

From the findings of this study, it can be concluded that income and the number of vehicles owned are the variables that significantly correlated with the tendency to use feeder bus services as the inclusion of the explanatory variables reported predictive value

of 91.2%. Odd ratios of the income variable and the numbers of vehicles owned indicated 0.529 and 0.568, respectively. While age, education and income are strongly related to the willingness to use air-conditioned bus service the inclusion of the explanatory variables reported predictive value of 77.6%. Odd ratios of age, education, and income are shown as 1.309, 1.228, and 1.608, respectively. In contrast, sex and occupation are not significant to the tendency to use feeder bus services or air-conditioned bus services. The income variable is correlated in both observed decisions as it illustrated a strong correlation. This indicates that feeder bus service users vary with the level of income. Although income and occupation seem to correlate, we discuss that this study did not establish the relationship between occupation and income due to the lack of justification for the level of occupation. Thus, we cannot determine whether there is a correlation between occupation and income based on the findings of this study. Additionally, the relationship between occupation and income is redundancy.

Also, the lower income group prefers air-conditioned bus service and this group basically has a higher tendency to use public transport than other groups. In our discussion, we consider that having a lower personal income could make it less likely for people to use air-conditioned bus service, as the fare for

these services is typically around 50% higher than that of non-air-conditioned buses. However, it should be noted that the maximum fare for air-conditioned bus services on this particular route is only 30 baht, which falls within the range of what low-income individuals may be willing to pay. Therefore, we recommend that further research be conducted on the willingness to pay for these services in order to effectively encourage the use of public transport.

A limitation of this study was that it only investigates the sampling's decision by using socio-economic factors which excluded the people's attitude for selecting public transport as a daily mode of transport. Even though a large number of people have changed their attitudes to pay more attention to the environmentally friendly activities, the attitude about using public buses in Bangkok has not been identified. We state these aspects because there is an attitude issue of how Thai people receive public transport which is considered as a transport choice for low-income people and also considered as an uncomfortable and old-fashioned mode of transport. A perspective on the service reliability of bus services in Bangkok is that it is perceived as an unreliable mode of transport. We also note that this study is a case study of countries with a tropical climate where the air-conditioner is a crucial factor for any activities in a closed environment. Therefore, the findings of this study may help local transport authorities to understand the socio-economic factors that affect bus service selection, but the implications of a sustainable transport policy may also need to consider the feasibility of future service providers that will be in charge of operating the feeder bus in the Salaya area and the long-term environmental impact of the overall transport activities as well.

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