Defining the Role of the Paratransit as a Feeder Mode in the Mass Transit System in Metro Manila

Daniel MABAZZA[a]

[a]*Associate Professor, Department of Geography, University of the Philippines Diliman*
[a]*E-mail: dlmabazza@up.edu.ph*

Abstract: This study determines the attitudinal and socioeconomic factors that influence the public's choice and preference of paratransit modes. The study also evaluated different factors that lead to preference of specific types of paratransit modes as feeders to mass transport systems using a Structural Equation Model. The main objective of the study is to understand traveler's attitudes on service attributes of paratransit feeding systems based on those perceptions and to identify potential strengths and weaknesses of paratransit feeding systems. Both quantitative and qualitative methods are used as research methods. The unit of analysis is the mass transit connectivity attitude towards paratransit service while the units of observation are attitudinal factors to feeder services offered by tricycles and jeepneys and attitudes towards bus and rail transit based on the variables such as information, safety, and comfort and convenience.

Keywords: Mass Transport System, Paratransit, Feeder Mode, Structural Equation Modeling

1. INTRODUCTION

1.1 Background of the Study

Metro Manila's mass transport system is not one without problems. Although the bus and train systems in the country's capital are continuously being expanded with the construction of new train routes and stations and the breakthrough innovations in bus systems, the problem of poor integration of these modes still remains unresolved. In other words, although the mass transit system in the country already covers a decently large area, the public still find themselves struggling in getting to the different stations because these are not easily accessible. This problem of lack of accessibility hinders people from directly using the mass transit.

This gap has led to the emergence of informal public transport modes or paratransit in developing countries. This type of transport exists in various forms. The functional definition of paratransit states that it is an "urban passenger transportation service usually in highway vehicles operated on public streets and highways in mixed traffic; it is provided by private or public operators and it is available to certain groups of users or to the general public, but adaptable in its routing and scheduling to individual user's desire in varying degrees" (Vuchic, 1981). Given this definition, it is also important to note that the context of paratransit differs in developed and developing countries. In developed countries, paratransit is characterized by demand-responsive systems such as shared-ride taxis and dial-a-ride services like Uber. On the contrary, in developing countries, where the population has a lower standard of living, it serves the purpose of bridging the gap between public mass transit systems and private automobiles.

A major part of the daily commute of Filipinos nationwide are the jeepneys, tricycles, and other Asian Utility Vehicles (AUV), a term used in Southeast Asia referring to basic transportation vehicles. These paratransit modes are cheap and a lot more flexible and accessible to people compared to the mass transit system that has fixed stations scattered in Metro Manila. Since people do not have direct access to the bus and train system, they first have to use various forms of paratransit to get from wherever they are coming from and to the station. In fact, in most cities, these modes are already considered as the primary means of transport by most people when the travel distance is not that far away. The problem society is currently facing is that the national government bears a limited scope of the regulation of these paratransit modes since its role in the overall transportation system is not clearly defined. The difficulty of integrating paratransit with the mass transport system leads to the rise of inefficiencies in the paratransit market, including negative externalities like road congestion and air pollution, among others. True enough, jeepneys and tricycles are often the ones blamed for the heavy traffic on the main roads of Metro Manila, which is why some legislators have already proposed stricter road regulations to ban these paratransit modes to decongest traffic in the city. One thing is for sure, it would not be sustainable to ban these paratransit modes because they serve and important purpose of connecting people to the stations of the mass transit systems. The problem of inefficiency will not be solved by trying to remove the paratransit modes altogether because they serve a bigger purpose to society in providing mobility to the population that mass transit systems cannot provide.

In order to solve issues related to paratransit modes, the researcher find it important to integrate them into Metro Manila's formal network of transportation which will be done by clearly defining the role of paratransit as a feeder mode that improves the connectivity of people to the mass transit system. With a paratransit system that is integrated into the overall network, it would then be easier to craft rules and regulation that will improve its monitoring and maximize the efficiency of the system as a whole. This paper will focus on the case of the urban Philippine setting, where the use of paratransit and mass transit system goes hand in hand. By analyzing passenger perception and attitudes toward various paratransit modes, a formal definition of its role as a feeder mode for passengers will be established, and thus lead to the proper delineation of transport routes which will eventually lead to minimizing the inefficiencies that are created by the overlapping roles of the various modes in Metro Manila's transport system, like urban transport congestion.

1.2 Statement of the Problem

For years, both the Metro Rail Transit (MRT) System and Light Rail Transit (LRT) System have been operating in Metro Manila. These rail systems, along with the Philippine National Railways (PNR) comprise the rail system of Metro Manila. This rail system circumnavigates and passes through the cities of Caloocan, Manila, Marikina, Pasay, Pasig, Quezon, and San Juan as seen in Figure 1. LRT is a light rail system that uses light rail vehicles, but acts more like a rapid transit system. On the other hand, the MRT acts more like a light rail system for it uses light rail vehicles, single line rail system and lower number of passengers compared to LRT. The former is operated by Light Rail Transit Authority (LRTA), which is under the Department of

Transportation and Communications (DOTC), while the latter is operated by the Metro Rail Transit Corporation (MRTC), a private company.

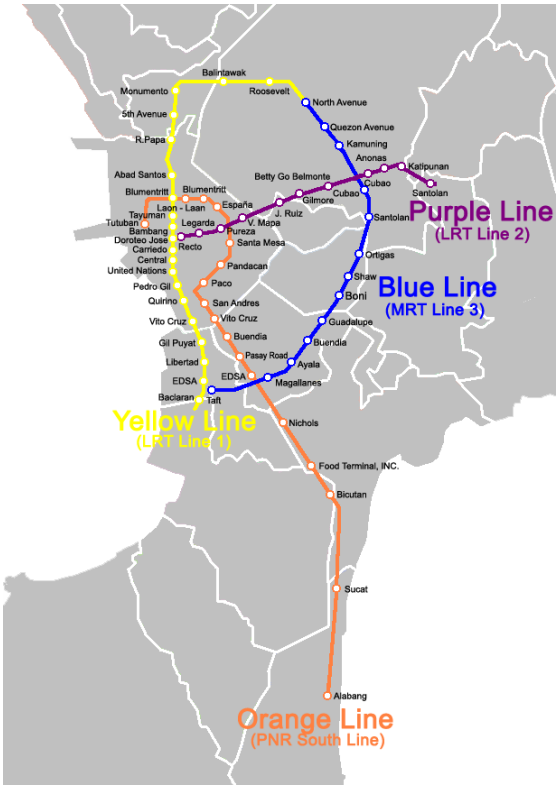

Figure 1.1. Rail lines in Metro Manila as of December 2016

These railway systems are estimated to have carried about 1.35 million passengers on an average weekday in 2012 (JICA-NEDA, 2014). Truly, the mass transit system has greatly improved the mobility of the urban population. However, the problem of accessibility of the stations still remains. Passengers are not able to access stations directly; there is a need to travel a certain distance from their homes to the station. This gap is bridged by the paratransit system which serves as a feeder mode to the mass transit system.

A number of negative externalities are linked to the paratransit services, especially to the jeepneys, which comprise a significant share of the total demand for this type of mode. Jeepneys comprises 51% of the total demand or 77% of public transport demand alone (Chiu & Shioji, 2006). The growing number of jeepneys in the streets of Metro Manila are blamed to have caused most of congestion, accidents, and pollution in the urban area. Aside from these, there are also operational inefficiencies and disruptive competition among the players in the paratransit market. Furthermore, one can observe the disorganised and fragmented nature of the paratransit sector, and this is often viewed as a hindrance to efficient operations of modern transport systems (Ferro, 2015). Yet, paratransit operations also provide great advantages to the public transport system in the Philippines. These advantages include demand-responsiveness, operational flexibility, and wide territorial coverage in the streets of Metro Manila. Passengers can easily access these paratransit services near their homes to get to and from wherever they want to go. Additionally, paratransit services have relatively lower fares.

These negative externalities and advantages are closely linked together which is why it is a challenge to balance these two opposing forces. Though its role as a feeder system is important, one should not dismiss the fact that its operation also creates a lot of costs and welfare loss to the society and the economy. The informal paratransit system is characterized by its fragmented and demand-driven nature. This mode must be integrated with the mass transport system in order to create a seamless and well-integrated transport system in the Philippines for the satisfaction of the passengers and for it to be an effective enabler of national development.

1.3 Objectives

The investigation aims:

1.) To determine the socioeconomic factors that influence people to use or not use specific types of paratransit feeding systems;
2.) To understand traveler's attitudes on service attributes (fare, comfort, accessibility, reliability, and safety) of paratransit feeding systems based on those perceptions; and
3.) To identify potential strengths and weaknesses of paratransit feeding systems

1.4 Scope and Limitations

This study aims to investigate the overall attitude and socioeconomic attributes connectivity towards paratransit modes as feeder modes to mass transit systems. The study focused on paratransit services located within a one kilometer radius from the LRT or MRT stations. The researchers focused on five existing stations and two stations which were still in their proposal stage and therefore had not yet been built (MRT-7's Tandang Sora and Masinag). Data gathering was only limited to residents, workers and students located within a one kilometer radius and were selected through purposive sampling and qualified respondents were chosen by their history and capability of riding different paratransit modes. Respondents were asked to express their user perception, choices, preferences and attitudes towards both paratransit and mass transit services apart from their socioeconomic characteristics. Due to the eligibility nature of purposive sampling, the respondents were guided by the researcher and surveyors as they answered the survey. It should also be noted that due to time constraints, the sample size was just minimum for performing Structural Equation Modeling.

2. LITERATURE REVIEW

2.1 Influences of Commuter Perception on the Feasibility of Paratransit as Feeder Modes

In order to improve the patronage of commuters to mass transit, paratransit services have been introduced to serve as feeders to these mass transit systems. Paratransit services enhance the performance of urban transportation and perform the role providing easy connectivity. In a study by Nwaogbe, Ukaegbu, and Ibe (2012), the quality of the paratransit service and its operation is Aba, Nigeria was examined. Paratransit services have expanded in busy corridors of Nigerian

cities due to the low level of transport services that are being provided by the conventional transport systems. The study found out that before tricycles were introduced, 40% of the respondents used buses for their traveling, 28% used motorcycles, 15% private cars and 17% taxis. After the tricycles were introduced, 85% of the respondents used the tricycle, 8% private cars, 2% taxis and 5% used buses for their traveling. The study also concluded that paratransit services show the capability of being implemented as a feeder system to the formal public transport system of Aba and surrounding areas.

A study by Tangphaisankun, Nakamura, and Okamura (2009) examined the 'influences of paratransit as a feeder of mass transit system in developing countries', taking into account commuter satisfaction. The study investigates the paratransit services' potential as well the commuters' perception on using paratransit services as feeder to mass transit systems. Most paratransit services emerged due to the need to deal with the difficulty in accessing mass transit systems. Paratransit services consist of (1) the flexible for-hire services (motorcycle-taxi and the Tuktuk) and (2) the fixed-routed services (the Songtaew). The study found out that commuters' attitudes are powerful tools that can be used to assess the quality of paratransit services and reveal problems that should be tackled concerning the connectivity of paratransit and mass transit. The study also concluded that the satisfaction of commuters positively influences attitudes toward mass transit connectivity and the use of both paratransit and mass transit in the future.

Another study by Bhat (2009) entitled A Study on Para-transit System in Indore City tried to understand the current state of the para-transits and their impacts to the transport system of Indore City, which is the most populous city in the state of Madhya in India. Several of their findings include the physical characteristics of roads (e.g. in terms of width, vendors along the sides of the road, etc.) and how it prevents public transport modes to go to those areas leaving commuters using either paratransit modes or private vehicles. On the other hand, paratransit modes are not considered as an integral part of the transport system by authorities because it results in the growth of an informal demand and supply. Therefore, paratransit modes are limited on roads while not improving public transport modes result to private car use and even more congestion. Lastly, two other important factors considered were environmental impacts, and safety. Due to these underlying factors, effective implementation of policies will remain constrained.

Characteristics of Indore city is somehow similar to the case of Metro Manila and this study emphasizes how commuter characteristics play an important role in understanding paratransit modes and its impacts to the transport system.

2.2 Data Collection Methods and Analysis

The main objective of this study is to be able to recognize the feasibility of paratransit systems as feeder modes to mass transit systems through people’s satisfaction and perception of these two. There are several ways to collect the commuters’ satisfaction and perception. Survey interviews are done personally or through the telephone. Survey questionnaires are also a probable method of collecting data through a mail survey, group administered questions, or household drop-off survey.

The study of Tangphaisankun *et al.* (2009) used personal interview and pick-up & drop-off questionnaires to survey the commuters’ satisfaction. It was done in the household of the commuter and on-site where it was conducted in the station areas. The questions asked were

the socio-economic information of the commuter, the present trip pattern of the commuter, the mass transit trip of the commuter, and the commuter's attitudes and intentions to use the public transportation.

Another study by Tangphaisankun *et al.* (2010) also conducted both personal interviews and pick-up & drop-off questionnaires but along BTS and MRT Lines in Bangkok, Thailand. The questionnaire was divided into four sections. First, the commuter's present travel patterns. Second, the commuter's travel choice consideration. Third, the commuter's individual attitudes and preferences and last, their general information.

A similar study on the public transport passengers behavioral intentions by Sumaedi *et al.* (2012) in Jakarta, Indonesia collected data through survey questionnaires and employed convenience sampling technique. The research population was not stated in the study but all the participants of the study are paratransit users.

Another version of the study by Tangphaisankun *et al.* (2011) analyzed the factors that influence commuter's personality and preferences in developing countries in terms of choosing modes of transport depending on their travel intention. Same data collection methods were used as in their previous studies. Focusing on the characteristics of the commuters, they were categorized into different groups based on personality and preferred modes of transport and their influences. For the personality and preference, respondents were asked in terms of ecology (whether they are concerned with nature), economy (if their mind is focused on profit and saving money), and car use (the frequency of using private vehicles). These categories were further classified into groups like car and non-car oriented group, eco-friendly persons and saving minded persons, and, other combined characteristics. After categorizing, these groups shall undergo a compare and contrast analysis through their responses like educational background, present and preferred travel modes, travel attitudes based on experiences and travel time. The combined personalities of commuters shall also be analyzed further.

Understanding relationships between socio-economic factors and commuting patterns will help policy makers administer the needs of the people. It will be easier to provide efficient solutions to transport problems particularly congestion if we know about the composition of the community, their personalities, their preferences, and their travel patterns.

2.3 Structural Equation Modelling

Hoyle (as cited in Suhr, 2006) defined the structural equation model (SEM) as a "comprehensive statistical approach to testing hypotheses about relations among observed and latent variables". The goal of SEM is "to understand patterns of correlations among a set of variables and to explain as much of their variances" (Kline, 1998, as cited in Chima & de Carvalho, 2014). However, it is also best to remember that SEM is only a confirmatory technique. Kline (2011) further elaborates that "the results of a SEM analysis cannot generally be taken as evidence for causation". Therefore, "SEM is usually used in determining whether a certain model is valid rather than "finding a suitable model." ("Structural Equation Modeling", 2015)

Interpreting research data and analyzing results can be daunting. Traditional statistical analyses prefer specific default models and assume error-free measurements hence, they are somewhat inflexible. On the contrary, SEM requires a model calibrated using theory and research. According to Suhr (2006), SEM is a multivariate technique incorporating measured variables and latent constructs, and explicitly specifies measurement error. The model is a

diagram showing the relationships between variables. This kind of model may be very general but it is also a very powerful technique. Sudano & Perzynski (2013) describes SEM as a more specific version of several other analysis methods such as causal modeling or path analysis, confirmatory factor analysis, second-order factor analysis, covariance structure models, and correlation structure models.

SEM is similar to traditional methods like correlation, regression, and analysis of variance in many ways: they are both based on linear statistical models, statistical tests associated with both methods are valid only if certain assumptions are met, and neither offers a test of causality. (Suhr, 2006). On the other hand, traditional approaches differ from SEM in several areas. First, SEM is a highly flexible and comprehensive. Thus, measurement is recognized as difficult and prone to error. By explicitly modeling measurement error, SEM seeks to derive unbiased estimates for the relations between latent constructs. To this end, SEM allows multiple measures to be associated with a single latent construct. ("Structural equations modeling", 2015)

A graphic representation, usually a diagram, provides a simple way to present complex relationships in SEM. The diagram is transformed into a set of equations. The set of equations is then solved simultaneously to test model fit and estimate parameters.Traditional statistical methods normally utilize one statistical test to determine the significance of the analysis. Structural equation modeling, however, relies on several statistical tests to determine the adequacy of model fit to the data.

2.4 Perceived Service Quality of Paratransit: A Structural Equation Approach

When looking for a study that uses Structural Equation Modelling (SEM), it is useful to look at the study of Rahman et al (2016). Their study presents the results of an investigation into the overall paratransit service quality and a variety of other variables affecting paratransit service quality. Specifically, several models are developed based on structural equation modeling (SEM) using twenty-four service quality (SQ) variables. To calibrate the models, a dataset of 2008 paratransit users of Dhaka City are utilized and interviewed with a structured questionnaire to know their experience, level of satisfaction and opinion about the existing service as well as their expectations. In identifying the structure that suits paratransit data of developing countries, five different SE models are developed to which the best one is selected using statistical parameters. Results show that from these five models, the best structure is found with two latent variables: (1) Physical Appearance and (2) Service Features. From the analysis, it is seen that 'Physical Appearance' has a little less influence than 'Service Features' on the overall paratransit service quality. It indicates that users of developing countries are more concerned about the service provided by the paratransit. Furthermore, 'Punctuality and Reliability', 'Fitness of Vehicle', and 'Travel Cost' are found to be the most significant observed variables that influence the service quality. Moreover, results from the best SE model show that 'Speed of Paratransit' is not influenced by 'Quality of Driver'. This counterintuitive result is explained by the prevailing congestions in Dhaka city, which force vehicles to crawl in the network. So, speed choice does not solely depend on the drivers. Results also revealed that decreasing 'Travel Time' (both during office days and holidays) increases 'Travel Cost'. This signifies vehicles that need lower trip time charge higher fares. The results are based on individual users' specific observations which reflect their needs and expectations. Indeed,

determining the most and the least important SQ variables certainly helps to concentrate the limited resources of developing countries to improve individual SQ variables.

It is useful to note that SEM is not about determining whether the model fits perfectly but rather whether it fits well enough to be a useful approximation to reality and a reasonable explanation of the trends in the dataset. It should also be remembered that simply because a model fits the data well does not mean that the model is necessarily correct. One cannot really prove that a model is true – to assert this is the fallacy of affirming the consequent. However, the model fitting the data does not necessarily imply that the model is the correct one. There may be another model that fits the data equally well.

3. METHODOLOGY

3.1 Study Area

In this study, the areas selected are intended to cover all existing rail lines, including an extension project, and projected rail lines. The selected stations were chosen because of one different factor: apparent paratransit networks within the station. Another factor is the land use of the surrounding areas. The researcher is familiar with these areas and because of the familiarity, it helped the researcher to choose the stations.

Shown in Figure 2 is the map of existing and projected rail lines. These are LRT 1 (from Roosevelt to Baclaran that traverses along EDSA, Rizal Avenue and Taft Avenue), LRT 2 (from Santolan to Recto that traverses along Aurora Boulevard and Claro M. Recto Avenue) and MRT 3 (from North Avenue to Taft that traverses along EDSA). The proposed line of MRT 7 is also included in the figure.

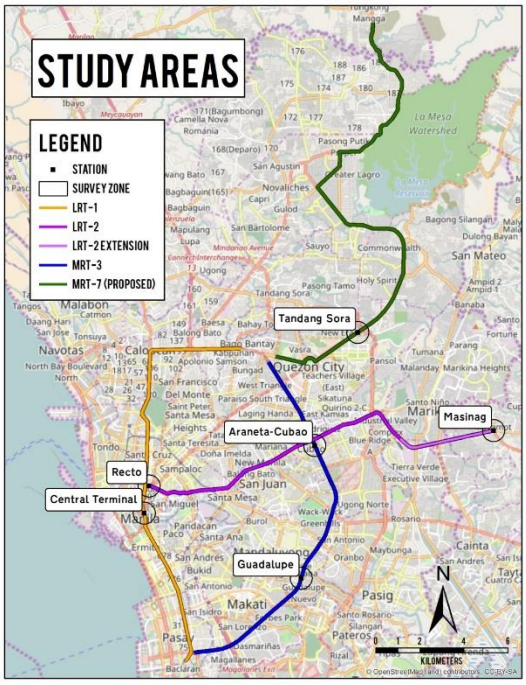

Figure 2. General map of rail transit lines, highlighting selected stations for study.

3.2 Data Collection

The researcher conducted an on-site survey among participants who use paratransit and mass transit in their regular travel pattern. Thirty (30) respondents were selected within a one kilometer radius from each LRT or MRT stations. The selected participants were randomly selected among the passengers using the stations and were interviewed individually using a survey questionnaire.

The survey composed of three parts based on factors affecting the trip pattern of the commuter. The first part of the questionnaire consists of demographic and socio-economic information of the respondents such as gender, age, education level, occupation, income and characteristics of the household. The participants were also asked about their public transport usage. The public transport usage consists of paratransit modes such as tricycle, jeepney and AUV and mass transit modes like rail transits (MRT, LRT1 and LRT2) and bus. Information about the nature of their living area which includes the availability of transport modes to access main streets, conditions of streets, and traffic congestion was also collected.

The second part of the survey covered the trip and travel pattern of the respondents. Regular access and egress trip information was gathered. Access trip refers to trips from either home or work/school to public transit. On the other hand, egress trip refers to trips from public transit to either home or work/school. The access and egress trip show that public transit can be an origin or a destination. Factors such as transport modes, travel time and travel costs were assessed for the trip and travel pattern.

The last part of the survey examined the attitude of the respondents regarding public transport. The respondents were asked about which modes they used and their knowledge with these modes. Their viewpoint and satisfaction regarding public transit, both paratransit and mass transit, was also asked. Refer to the appendix for the survey questionnaire.

3.3 Data Analysis

A Chi-Square test for independence is used in this research to discover if there is a relationship between two categorical variables. The variables car ownership, education, household type and income are used to know if there is a correlation between these factors and the type of transport mode the participants are using. An Independent sample test between the participant's attitude towards paratransit (information, safety, and comfort) and the type of paratransit modes (AUV, jeep, and tricylcle) the participants are using before accessing the public transit is also used to determine if there is a statistically significant difference between the means of the two unrelated groups.

Structural equation modeling (SEM) which was used in Tangphaisankun's study (2010) was also used to analyze the data gathered in this research. SEM mainly deals with a large number of exogenous and endogenous or the observed variables as well as the latent or unobservable variable that are not directly measured but determined by the correlations among the observed variables.

The primary use of SEM in this research is to estimate the relationship between the socioeconomic data gathered from the respondents and the estimation of the relevant factors as reliably as possible. A two-part analysis: (1) the conceptual diagram which distinguishes the exogenous from the endogenous variables as well as the measurement of the latent variable, which will show the relevant factors and the nature of the relationship between the variables, and

(2) the mathematical equation are required for this statistical method. This paper, however, will limit itself to the conceptual diagram as a preliminary approach.

The SEM concept diagram also consists of two model components. First is the measurement model used to examine the relationship between the observed and latent variables and also has two submodels, one for the endogenous variable and another for the exogenous variables. Second is the structural model used to find the causal influences between the exogenous and endogenous variables, and the causal influences between the endogenous variables themselves.

As shown in Figure 3, the structural equation model is given by the 6 measured variables pertaining to attitudes towards paratransit, namely, tricycles, jeepneys and AUVs, in three aspects: safety and security; comfort and convenience; and information services. There are also 2 latent variables, the connectivity between paratransit and rail transit and connectivity between paratransit and bus services. Together, these 8 variables each have sets of observed variables related to them.

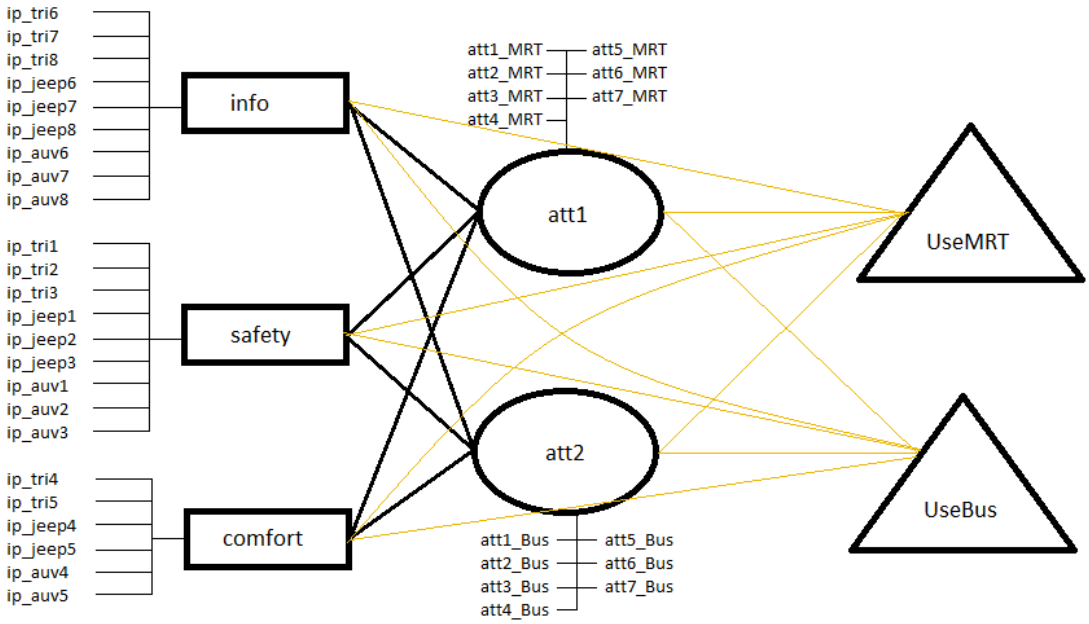

Figure 3. Structural Model diagram

4. RESULTS AND INTERPRETATION

4.1 Respondents' Characteristics

The demographic and socioeconomic characteristics of the respondents vary significantly in terms of gender, age, occupation, education, income, household type, and car and motorcycle ownership. The study has a total of 180 respondents with 30 respondents per station – Central Terminal, Araneta Center-Cubao (MRT 3), Guadalupe, Recto, (Proposed) Masinag, and (Proposed) Tandang Sora Station. The respondents consist of 101 females and 79 males with an average age of 24.6.

Figure 4 shows the age distribution of respondents: 15 - 24 years old with 120 respondents, 25-34 years old with 38 respondents, 35-44 years old with 11 respondents, 45-54 years old with 6 respondents, 55-64 years old with 2 respondents, and 65 - older with 1 respondent. Majority of the respondents were students and private employees, 53.3% and 30.6% respectively. Others are government workers (7.2%), labor/workers (4.4%), self-employed (2.8%), and unemployed (1.7%) (See Figure 5).

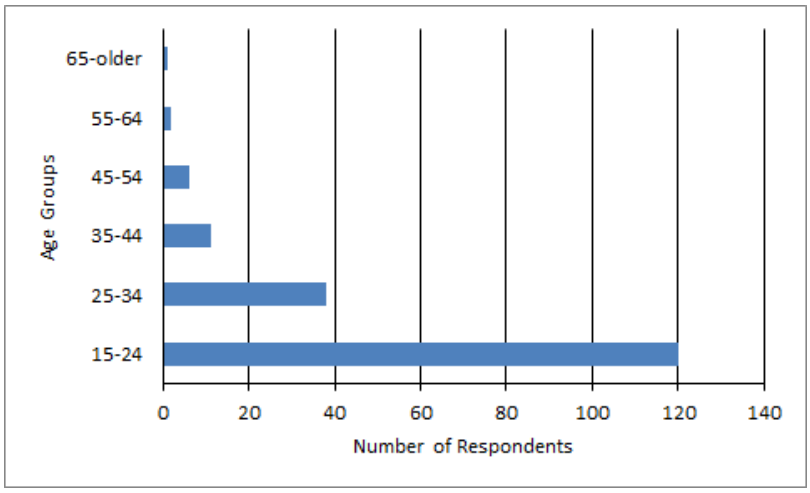

Figure 4. Age Distribution of respondents

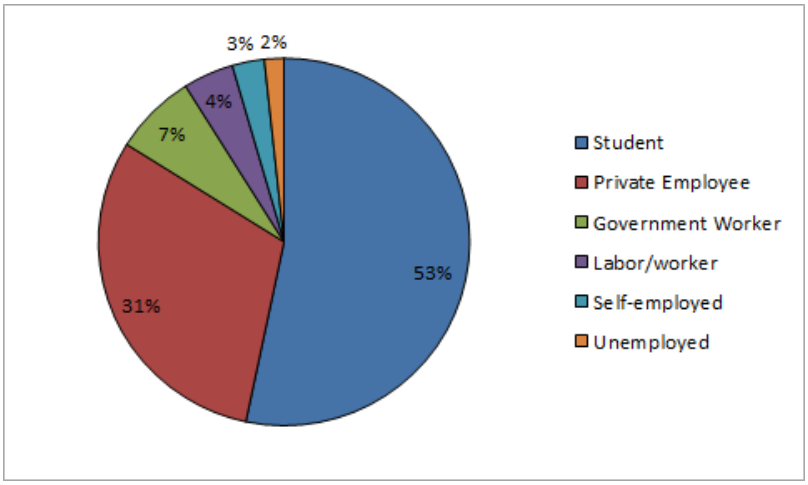

Figure 5. Occupation of respondents

Household types of respondents were also varied: 53.3% have their own houses, 27.8% rent apartment, 7.8% live in condominiums, 5.6% live in shared houses, and 4.4% stays in dormitories (Figure 6). On the other hand, household motorcycle and car ownership is at 16.1% and 31.7% respectively, but only 28.1% use their personal motorcycle and 20.7% use their personal car (Figure 7).

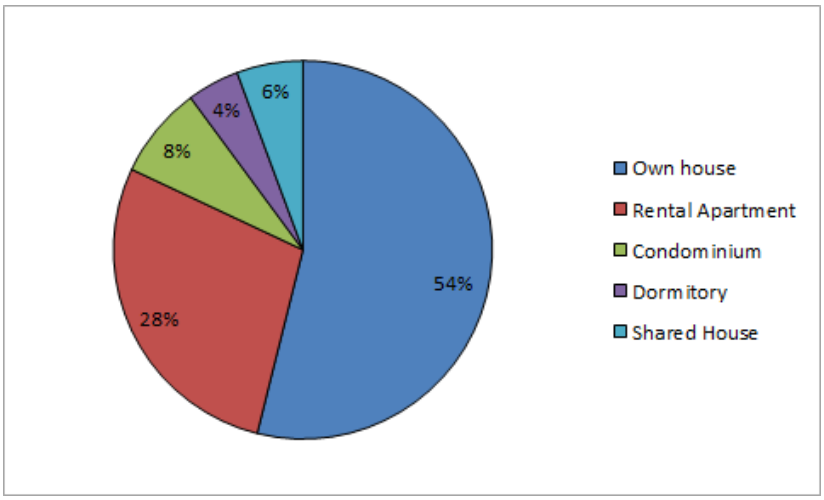

Figure 6. Household types of respondents.

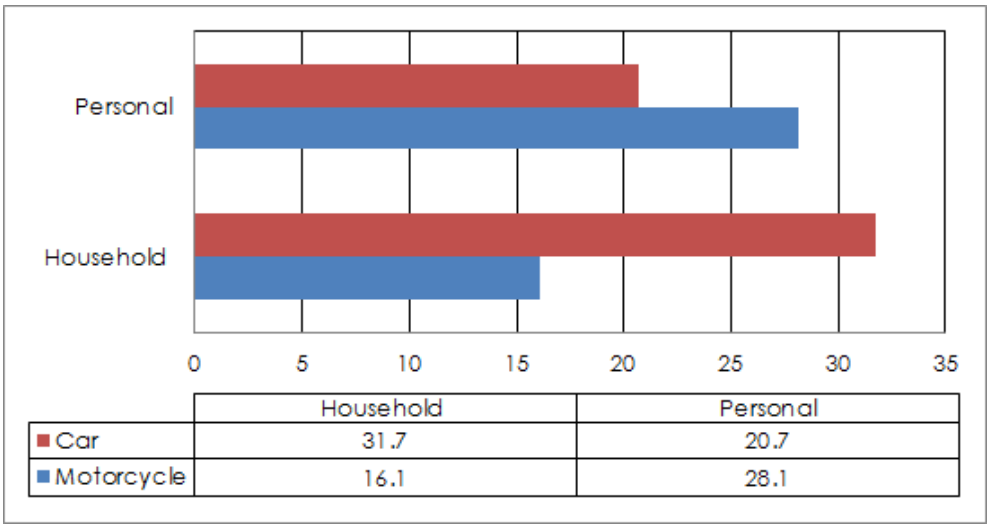

Figure 7. Motorcycle and car ownership of respondents.

4.2 Characteristics of Trip and Travel Patterns involving Paratransit Modes

Based on the research conducted, jeepneys are widely used because they are the most accessible to the area; they are almost ubiquitous because they are available everywhere. It could be seen in Fig. 8 that 56% of the respondents use the jeepney at least 3 times a week.

It is interesting to note that there are a lot of passengers of the MRT/LRT that use the tricycle more than 3 times per weekday (Figure 9). With this information, it goes to show how paratransit is important in their daily commutes. Finally, the use of AUVs are not as frequent because the accessibility to this mode of transit is not widely available. As shown in the Figure 10, most of the respondents answered rarely or not at all because some stations that were surveyed had no AUVs passing by the area, specifically Guadalupe, Recto.

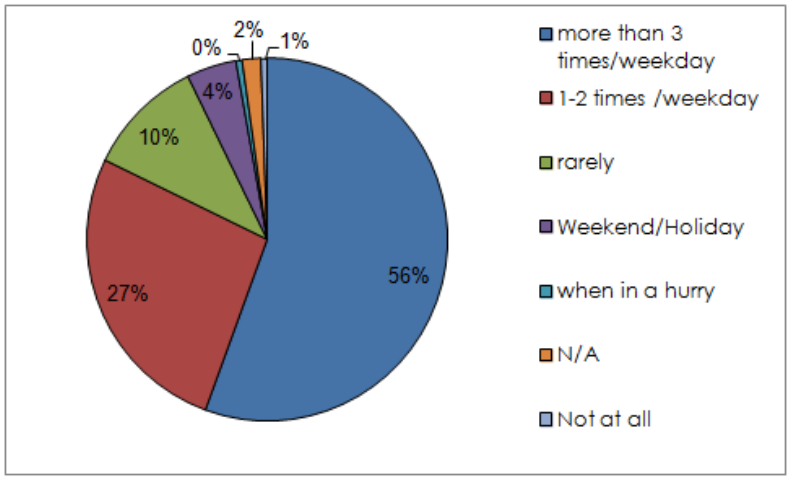

Figure 8. Frequency of jeepney use of respondents.

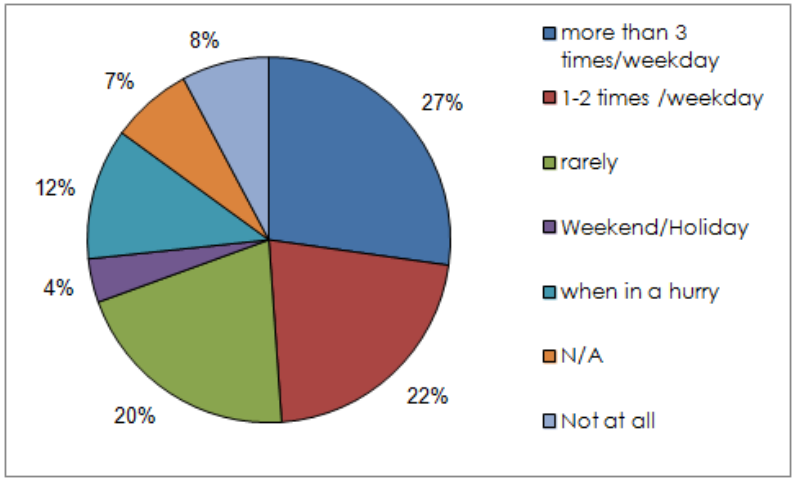

Figure 9. Frequency of tricycle use of respondents.

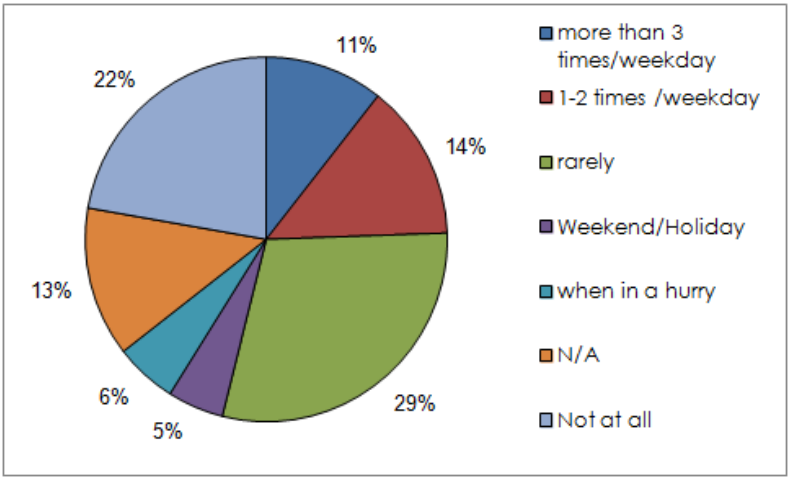

Figure 10. Frequency of AUV use of respondents

Based on Figure 11 below, jeepneys are the most popular form of paratransit used to go to the main streets and MRT/LRT stations. Again, this can be attributed to the availability and ubiquity of this said mode. Tricycles come in close second. Aside from these widely used modes (tricycles and taxis), other commuters also use pedicabs and buses occasionally.

Although there is paratransit to help ease the congestion of roads, the heavy traffic could be seen almost everywhere in the city. Roads are mostly congested because of the density of population in the city. With millions of commuters each day and poor traffic management, homes and subdivisions are also affected by congestion and pollution. Eighty percent (80%) of the respondents reported to have experienced. medium to heavy congestion from their living area going to main streets and train stations.

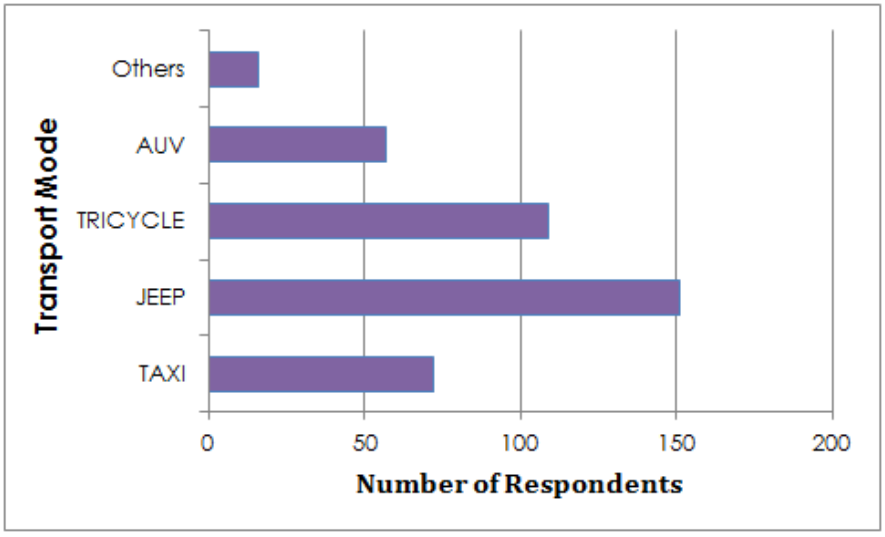

Figure 11. Available transport modes to respondents to access main streets and MRT/LRT stations.

4.3 Commuter Attitude and Satisfaction

4.3.1 Attitudes towards transit and paratransit modes

The respondents were asked to state their attitudes on the mass transit services through seven attributes relating to their access to public transit services (bus, MRT, LRT1 and LRT2) and eight topics relating to their attitude regarding paratransit feeder modes in terms of the areas for improvement. For the improvements in services for paratransit feeder modes with regards to services that pertain to vehicle standards, and safety and security equipment, it can be gleaned from the survey that the respondents were not satisfied with the service improvements for the paratransit feeder modes and that the AUV/FX is the least dissatisfying of the paratransit feeder modes. Similarly, it can be concluded that they are also generally dissatisfied with the current services of the public transit modes and that they are more satisfied with the MRT/LRT than with the Bus in terms of access (see Table 1).

Table 1. Summary of mean ratings of access trips to MRT/LRT and Bus.

Access Trips	Variables' code	MRT/LRT	Bus
Total access time from home/office/school to public transport.	att_rt1 and att_bus1	2.737	2.53
Total waiting time from home/office/school to public transport	att_rt2 and att_bus2	2.667	2.568
Total cost from home/office/school to public transport	att_rt3 and att_bus3	2.775	2.674
Number of transfers or modes used from home/office/school to public transport	att_rt4 and att_bus4	2.728	2.552
Walking time to bus stop/MRT/LRT station from last access mode	att_rt5 and att_bus5	2.837	2.684
Walking time to ride paratransit mode from your home/school/office	att_rt6 and att_bus6	2.943	2.732
Pick-up and drop-off facility for paratransit service	att_rt7 and att_bus7	2.717	2.548

The respondents were also asked to rank the reasons behind their paratransit usage from 1-6 with 1 being the most important and 6 being the least important. The ranking asked for their perception on whether the paratransit mode is cheap, easy to find, safe, fast, close to the destination and necessary. Table 2 shows the mean rankings for each perception and its respective paratransit feeder mode. As a result, it can be inferred that a paratransit feeder mode that is easy to find, fast, and cheap are the 3 important reasons (rank 1-3 respectively) to consider when choosing a paratransit feeder mode to use and that necessity, safety and proximity to destination are the least important reasons(rank 6-4 respectively) to consider when choosing a paratransit feeder mode to use.

Table 2. Mean ranks of reasons behing using each transport mode

Mode	Cheap	Easy to Find	Safety	Fast	Close to Destination	Necessary
Tricycle	3.667	1	5.833	2.333	3.1667	5
Jeepney	1.167	2	5.833	4.333	3.667	4
AUV/FX	5.5	3.5	1.667	1.333	4.167	4.833
All 3 modes	3.444	2.167	4.444	2.667	3.667	4.611

The respondents were also asked to mark whether their perception on the services provided by paratransit feeder mode is either "Adequate" or "Inadequate". The paratransit modes received a mean score of 1.359, 1.430, and 1.361 for tricycle, jeepney, and AUV/FX respectively. Overall, the respondents perceive the services of the paratransit feeder modes to be adequate.

4.3.2 Results of the SEM

The latent variables are the three dimensions affecting commuters' decision on taking paratransit services, namely Information Services (abbreviated "info"), Safety and Security ("safety"), and Comfort and Convenience ("comf"). The observed variables for the three types of paratransit services (tricycle, jeepney, and AUV) are all pooled together. This is to prevent the test from being highly parameterized and to produce stable results given the sample size.

The attitude towards mass transit, particularly for MRT/LRT (att1) and Bus (att2) were also measured. The six attitudinal factors served as exogenous variables while the two variables on attitude towards mass transit are the endogenous variables. The attitudes on paratransit services were used as predictors on their attitude towards mass transit. The attitudes on both paratransit services and mass transit were all used to predict the propensity of the commuters on taking the MRT (UseMRT) or bus (UseBus).

The value for the Comparative Fit Index (CFI) is at 0.583 meaning that the factors have moderate correlation in the entire SEM. The Root Mean Square Error of Approximation (RMSEA) value is considerably low at 0.108.

The *P* values for each variable endogenous to the SEM, as seen in Table 3, are all below 0.05 which indicates that the sub-variables are correlated with each other. It can be concluded that the variables *info*, *safety*, and *comf* have significant correlation on att1 (attitudes regarding the MRT/LRT), att2 (attitudes regarding the Bus), UseMRT (propensity to use the MRT), and UseBus (propensity to use the Bus). Looking at the last column, we can see that safety has a significant effect on att1, att2, and UseBus. The results, therefore, tell us that our respondents are not very concerned with the comfort and with the amount of information they have when riding the mass transit systems. Additionally, the variable att2 under UseMRT also have a significant P value. This means that a person's perception of the bus services affects his/her propensity to use the MRT/LRT.

Table 3. List of endogenous variables in the SEM and corresponding P-values

Endogenous Variable	Estimate	P(>|z|)
info		
ip_tri6	1.000	0.000
ip_tri7	1.855	0.000
ip_tri8	1.271	0.000
ip_jeep6	1.484	0.000
ip_jeep7	1.961	0.000
ip_jeep8	1.152	0.001
ip_auv6	1.155	0.001
ip_auv7	1.523	0.000
ip_auv8	1.167	0.000
safety		
ip_tri1	1.000	0.000
ip_tri2	0.787	0.000
ip_tri3	0.925	0.000
ip_jeep1	0.905	0.000
ip_jeep2	0.590	0.000
ip_jeep3	0.892	0.000
ip_auv1	0.696	0.000
ip_auv2	0.480	0.000
ip_auv3	0.770	0.000
comf		
ip_tri4	1.000	0.000
ip_tri5	1.333	0.000
ip_jeep4	1.191	0.000
ip_jeep5	1.211	0.000
ip_auv4	1.157	0.000
ip_auv5	1.131	0.000
att1		
att_rt1	1.000	0.000
att_rt2	0.993	0.000
att_rt3	1.124	0.000
att_rt4	1.034	0.000
att_rt5	1.298	0.000
att_rt6	1.325	0.000
att_rt7	1.361	0.000
att2		
att_bus1	1.000	0.000
att_bus2	0.903	0.000
att_bus3	0.823	0.000
att_bus4	1.079	0.000
att_bus5	0.994	0.000
att_bus6	0.986	0.000
att_bus7	1.080	0.000

5. CONCLUSION

The aim of the study has been to define the role and function of paratransit as a feeding system to mass transit options. Through a combination of qualitative and quantitative techniques, the study aimed to determine if certain socio-economic factors influence the usage of specific paratransit options. It also explored commuter's perception and attitudes towards service characteristics of those systems. Through the information gathered, the study was able to identify potential strengths and weaknesses of paratransit systems.

The role of paratransit in transport is not only limited to being a feeder to mass transits. People, who do not regularly use LRT, MRT, or bus also make use of paratransit systems as their main mode of transportation to get around Metro Manila. Paratransit also helps ease traffic going to main streets and train stations. The congestion, caused by a dense population and poor traffic management in these areas, is reported to be medium to heavy by 80% of our respondents. Paratransit modes help ease these by reducing the ratio of the space that the vehicles consume to the individual using the paratransit modes are less than that of private vehicles. Overall, people who make use of these paratransit systems generally see them as adequate with regards to their roles as feeder modes. The main qualities that contribute to the use of these modes are that they are easy to find, fast, and cheap. This is reinforced by the fact that the most widely used of paratransit modes are jeepneys as they are the most ubiquitous paratransit in that they are available almost everywhere.

Certain demographic factors also affect the use of paratransit modes. Results show that females generally feel safer than males in using tricycles and jeepneys. Furthermore, age is also a

factor in influencing the use of paratransit modes since a person's perception on paratransit services is based on the amount of information they have. The amount of information a person can gather on these services increases with age, and as a result, there is a tendency to feel safer and more comfortable with different modes of paratransit as they grow older, although the correlation is weak. The role of income however, does not influence the perception towards paratransit systems. This is due to the fact that regardless of income, people would take the routes of with least cost in terms of time and money.

With regards to the which mode of paratransit to use, the socioeconomic factors were observed in this study were education, household type, car ownership, and income. While education and car ownership does not affect the choice of paratransit modes. The use of jeepneys and AUV's are dependent upon the household type and income and income of the individual.

As for the use of mass transit, results show that comfort and with the amount of information they have when riding the mass transit systems do not affect people's propensity to use mass transit. The factors that have shown to have an effect on the use of mass transit were safety and person's perception or attitude towards bus services.

Descriptions and analyses above is an attempt to define the role of paratransits, in a developing country context, and highlighted one of its role as a feeder mode in the realization that developing mass transit system is one solution to urban transportation problem. Understanding the context of paratransit using the descriptions and analyses in this research will support and assist in the formulation of policies and regulations of these modes as well as promoting mass transit system without diminishing and undermining the role of this often labeled "unconventional and inefficient" modes – the paratransit – as well as the social capital that goes with it. Satisfaction of commuters has a positive influence on mass transit connectivity attitudes and the future use of both
paratransit and mass transit. Therefore, improvement policies regarding the paratransit service must be carefully drawn with the purpose of enhancing the performance of mass transit.

REFERENCES

Behrens, R. (2016) Improving paratransit service: Lessons from inter-city matatu cooperatives in Kenya. *Transport Policy*, Volume 53, 79-88. Retrieved from http://www.sciencedirect.com/science/article/pii/S0967070X16306059

Chiu, C. L., & Shioji, H. (2006) *Rivalry of Development and Survival In and Out of the Road: The Case of Transport Industry in Metro Manila Philippines.* Gutman Conference Center.

Ferro, P. S. (2015) *The Challenge of Finding a Role for Paratransit Services in the Global South.* Istanbul: CODATU Conference.

JICA-NEDA. (2014). *Roadmap for Transport Infrastructure Development for Metro Manila and its Surrounding Areas.* Japan International Cooperation Agency (JICA); National Economic Development Authority (NEDA).

Joewono, T. (2005). The Characteristics of Paratransit and Non-Motorized Transport in Bandung, Indonesia. *Journal Of The Eastern Asia Society For Transportation Studies*, *6*, 262-277.

Nwaogbe, O., Ukaegbu, S., Ibe, C. (2012). Quality of the paratransit service (tricycle) and its operation in Aba, Nigeria: An analysis of customers' opinions. *Journal of Transport and*

Supply Chain Management 6, no. 1: 262-276. Retrieved from http://www.jtscm.co.za/index.php/jtscm/article/viewFile/64/60.

Rahman, F. et al (2016). Perceived service quality of paratransit in developing countries: A structural equation approach. *Transportation Research Part A: Policy and Practice,* Volume 93, 23-38. Retrieved from http://www.sciencedirect.com/science/article/pii/S0965856415302639

Sumaedi, S., Bakti, G. M. Y., & Yarmen, M. (2012). The empirical study of public transport passengers‟ behavioral intentions: The roles of service quality, perceived sacrifice, perceived value and satisfaction (Case study: Paratransit passengers in Jakarta, Indonesia). International Journal for Traffic and Transport Engineering, 2(1), 83-97. UDC: 656.121.072(594).

Tangphaisankun, A. (2009). Influences of paratransit as a feeder of mass transit system in developing countries based on commuter satisfaction. *Journal of the Eastern Asia Society for Transportation Studies* 8. Retrieved from https://www.researchgate.net/publication/228351755_Influences_of_Paratransit_as_A_Feeder_of_Mass_Transit_System_in_Developing_Countries_Based_on_Commuter_Satisfaction.

Tangphaisankun, A. (2010) A study in integrating paratransit as a feeder into mass transit systems in developing countries: a study in Bangkok. Doctoral Dissertation, Yokohama National University.

Tangphaisankun, A., Okaumura, T., Nakamura, F., Wang, R., (2010). A Study in Integrating Paratransit as A Feeder System into Urban Transportation and Its Effects on Mode Choice Behavior: A Study in Bangkok, Thailand [Abstract]. (n.d.). Retrieved from http://www.wctrs.leeds.ac.uk/wp/wp-content/uploads/abstracts/lisbon/general/02546.pdf

Tangphaisankun, A., Okamura, T., Wang, R., Osada, C., & Nakamura, F. (2011). Influences of Commuters' Personality and Preferences on Travel Intention in Developing Countries: A case of Bangkok. *Journal of the Eastern Asia Society for Transportation Studies*, 9, 370-381. Retrieved from https://www.jstage.jst.go.jp/article/easts/9/0/9_0_370/_pdf.

Thingom, N., & Bhat, G. (2011, January 3). A Study on Para-transit System in Indore City. Retrieved December 14, 2016, from http://www.wrirosscities.org/sites/default/files/Study-Para-Transit System-Indore-City_0.pdf

Vuchic, V. R. (1981). Urban public transportation: Systems and technology. Englewoods Cliffs, New Jersey: Prentice-Hall.