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PASSENGER MODE SWITCHING BEHAVIOR IN THE ELEVEN STATIONS OF THE PASIG RIVER FERRY

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Abstract: This research studied the variables that contribute to why the current passengers of the Pasig River Ferry patronize the ferry. Six variables are studied in the research namely safety, comfort, travel cost, travel time, connectivity to land-based transit and river characteristics. A survey method was used to gather the data for the research and 360 respondents were surveyed. Qualitative factors were analyzed based on the observations, interviews, while the quantitative factors were analyzed using Binary Logit Regression. The main findings showed that passengers use Public Utility Jeepney (PUJ) as the main reference of comparison to the ferry because it is the alternative mode of transport, making the PUJ the main competitor. In order for passengers to shift to ferry, the services must be competitive to PUJ to influence their mode switching behaviors.

Key words: River Ferry Transportation, Mode Switching Behavior, Alternative Public Transport, Regression Modeling

1. INTRODUCTION

1.1 Background of the Study

One of the recent attempts of the government to ease the traffic congestion in Metro Manila is the revival of the Pasig River Ferry System. It has been in operation since 1990 and has been closed and reopened four times. A number of recurring problems can be identified as a hindrance to the success of the ferry, problems that the government tried to address, but despite these efforts the river ferry system still failed to produce its expected output – which is to provide alternative transportation to commuters and help ease the traffic congestion in the city.

For a long time, the indifference of human actions led to the degradation of the river. Aside from the lack of effective infrastructure development like vessels and stations, the viability of the river to support public transportation was affected by pollution. Siltation affected the mobility of the vessel, while the solid waste that accumulated through time affected the odor and appeal of the river to the public.

1.2 Research Problem

How will the factors of safety, comfort, river characteristics, travel cost, travel time and the connectivity of land-based transit to river ferry system affect the mode switching behavior of commuters using the Pasig River Ferry Service? Does the availability of land-based transportation, after riding the ferry, affect the mode switching behavior of the passengers?

1.3 Research Objectives

The general objective of the study is to establish how the factors of safety, river characteristics, travel cost, travel time, comfort and the connectivity of commute to land-based transit from the river ferry systems, affect the mode switching behavior of the Pasig River Ferry passengers.

1.4 Significance of the Study

According to the Japan International Cooperation Agency (JICA), the present traffic congestion in Metro Manila incurs 2.4 billion pesos daily in economic loss; if no significant intervention is done this will increase to 6 billion pesos per day by 2030. It is therefore a welcome relief to provide alternative means of transportation to the people of Metro Manila. One of these alternative means of transportation is the Pasig River Ferry. The utilization of the Pasig River as an alternative route of transportation may help ease the problem of traffic congestion in Metro Manila. The river is an ideal alternative because (1) the lack of traffic congestion which implies that commuters will be able effectively to go from point A to point B; and (2) the Pasig River Ferry is an ideal commute because it cuts through four major cities of Metro Manila (Manila, Mandaluyong, Makati and Pasig) – all of which are business centers because of the convenient route provided by the river, passengers can easily reach their destination.

1.5 Scope and Limitation

The study will be limited to the eleven stations of the current Pasig River Ferry, which is located in four major business districts of National Capital Region (NCR). Six out of the eleven stations are situated in Manila City, these are Intramuros (Plaza Mexico) Station, Escolta Station, Quezon (Lawton) Station, PUP Station, Sta. Ana Station and Lambingan Station. Two are located in Makati City, these are Guadalupe Station and Valenzuela Station. Another two stations are from Pasig City which are San Joaquin Station and Pinagbuhatan Station, and the last one is located in Mandaluyong City which is Hulo Station. The data of the research is also limited to that of the survey from the passengers of the ferry.
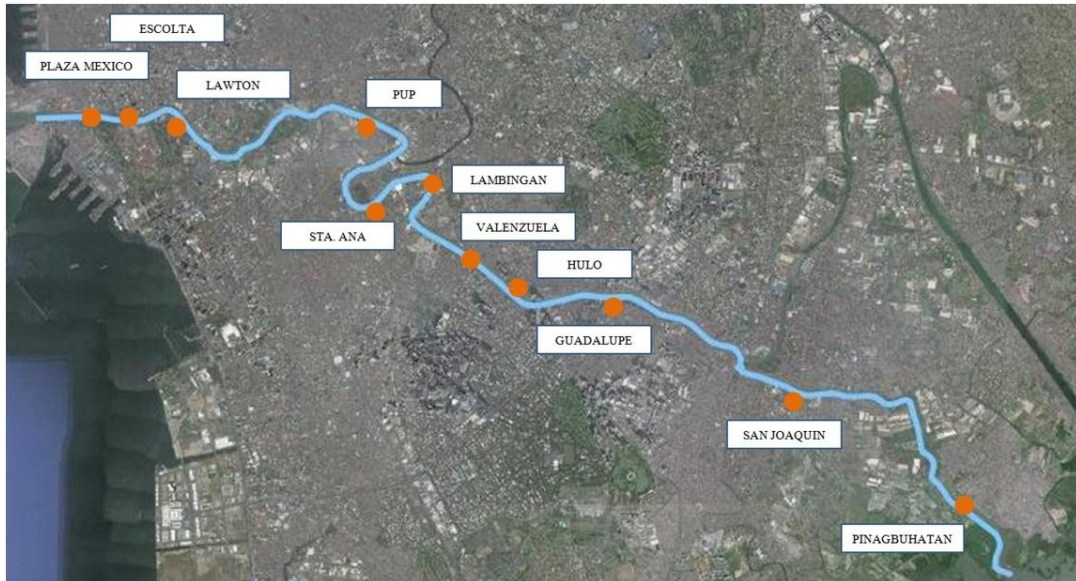
Figure 1. Location of Pasig River Ferry Service (PRFS) Stations along the Pasig River

2. REVIEW OF RELATED LITERATURE

2.1 Travel Time and Travel Cost

The study "Demand for the River Ferry Service: the Case of the Pasig" by Jasmine Abad identified reasons for shifting to the ferry which are the following (1) easier travel time and (2) reasonable cost (Abad, 1998). Travel time and travel cost are factors that will significantly affect the passenger's decision to switch modes.

Another study which focused solely on the behavior of PUP students, entitled the "Analysis of Mode Switching Behavior of PUP Main Campus Students to Pasig River Ferry Service" identified ferry waiting time as a factor that contributes to travel time while the willingness of students to pay for the travel cost depends on their daily allowance. Most of the students in PUP belong to the middle class and have an allowance that ranges from 80 to 120 pesos, thus their preference for cheaper travel cost. The study's results showed that the flat rate of the Pasig River Ferry of 20 pesos was not favorable to the students thus their conclusion that the Pasig River Ferry should lower their price to suit the students' budget. (Vilma Clemente, Guevarra & Mazo, 2009).

2.2 Comfort

Comfort is often related to services; from the same study "Analysis of Mode Switching Behavior of PUP Main Campus Students to Pasig River Ferry Service," one of the findings is that students are willing to pay more just to have a comfortable ride before heading to school (Vilma Clemente, Guevarra & Mazo, 2009). Transportation modes increase competitive edge when it is comfortable, and the study showed that people prefer to take the ferry when they feel comfortable and quality of service is consistent.

2.3 Safety

Passenger ridership is also dependent on the level of safety and security. Out of the seven variables in "Determinants of Demands of Pasig River Ferry," an undergraduate thesis from the School of Civil, Environmental and Geological Engineering of Mapua Institute of Technology, safety and security were identified as the main factors students consider before riding the ferry (Dapito, Egar & Tan, 2014). The safety of the vessel is determined by the students based on its maintenance and condition.

2.4 River Characteristics

In the thesis dissertation "The Social Acceptability of Introducing a Mass Transit System on the Pasig River" by Armando N. Alli, it studied the social acceptability of the then proposed Pasig River Ferry through a survey. It was used to ascertain a passenger's "needs, desires, wants, expectations, apprehensions, fears, objections, etc." with regard to the transit system of the river ferry (Alli, 1994). Results showed that passengers or potential riders want services and accommodations like that of the LRT or something better than the ordinary bus. The study also showed that people tend to refrain from using the Pasig River Ferry for three main reasons—the foul smell, unpleasant sights and high fares.

2.5 Connectivity

A station is more patronized by passengers if it is easily accessible (Vilma Clemente, Guevarra & Mazo, 2009). A student may not ride the ferry if it is not close of proximity to their home. They would rather take land-based transit to get to and from their destination. A potential passenger chooses the more convenient and shorter way of travel because time is of the essence. This is why the distance of the station is a significant factor to a person's mode switching behavior.

3. CONCEPTUAL FRAMEWORK

The conceptual framework (Figure 2) shows the identified factors of mode switching behavior considered by passengers when choosing what mode of transportation to use. These factors were identified based on the Review of Related Literature and will serve as the variables to be studied on the research. The factors affecting passenger Mode Switching behavior used both mode and user characteristics as the function of mode choice. Mode characteristics refer to the actual mode used - in this case, the ferry boat and ferry station. The determinants focused however on mode characteristics.
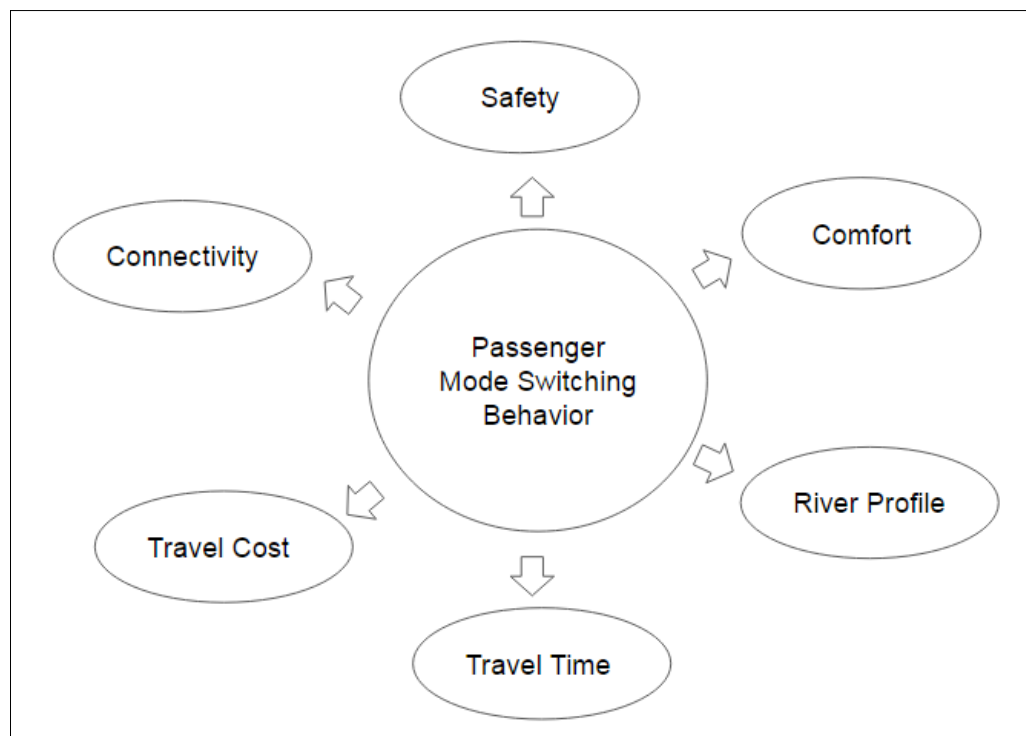

Figure 2. Conceptual Framework

The research aims to identify how these factors interact with each other to form the decision of a passenger to choose the Pasig River Ferry as part of their transportation trip chain. A survey will

be used to gather the necessary data from the passengers. The survey will be done on all the eleven stations of the river ferry which is discussed further in the Methodology.

4. METHODOLOGY

4.1 Description of Respondents

The respondents of the research are the passengers of the eleven stations of the Pasig River Ferry Service. These are regular passengers, those that ride the ferry on a regular basis, and those that use the ferry sporadically. They will be the subject of the survey and interview to gather the data needed to analyze their mode switching behavior. They are chosen as the respondents of the research whose experience will be the basis of the data required by the research.

4.2 Sampling

The researchers used Slovin's formula to derive the sample size that will be taken from the population and Stratified Random Sampling to distribute the sample size accordingly throughout the stations. Microsoft Excel functions were used to execute the formula.

$$n = \frac{N}{1 + (N \ x \ e^2)} \qquad\qquad n = \frac{Strat}{N} \ x \ 100$$

Where:
n = number of samples
N = Total Population
e = margin of error

Where:
n = number of samples
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Strat = Number of Strata

4.3 Data Gathering

The researchers acquired the passenger manifest of the ferry to determine the population size that will be used for the survey. This was secured before the survey commenced. The researchers identified the station peak hours prior to the survey. This was used to schedule the survey for each station. Station managers and personnel were also interviewed to gather additional data regarding passenger behavior.

While on the study area, the researchers observed passenger behavior and station characteristics. During the survey, respondents were given ample time to answer the survey which takes ten (10) minutes on the average.

4.4 Instrument

The researchers used a survey question as the instrument for data gathering. The survey form is divided in categories representative of the variables being studied on the research. To ensure the effectiveness of the survey questionnaire a test survey was done to evaluate how the passengers will interpret the questions. After the test survey was done, necessary revisions were made in line with the results of the tests run.

The objective of a Binary Logistic Regression Model makes it possible to create a range practical model feasible in choice situations. It is easy to illustrate basic conceptual problems in the concept of a binary choice. In choosing a particular choice between modes, there is a dependent and independent variable. Since the actual value cannot be ascertained, the current mode is set to 0 and the alternative mode is 1. This sets the probability between 0 and 1.

Logistic regression, also called a logit model, determines the maximum likelihood estimation. It provides a preferred way to fit-likelihood logit models as well as analyze logistic models and

model dichotomous outcome variables. Similar to logit, logistic omits variables due to a one-way causation. Errors are assumed to contain standard logistic distribution. Regression forecasts the relationship between the target (dependent variable) and predictor (independent variable) to find the causal effect of such.

The relationship between travel cost and travel time with passenger mode switching behavior in this case can be applicable through regression analysis. Stata software was used to analyze the probability of a passenger to switch modes based on travel cost and travel time. The log odds of the outcome are formed as a linear combination of the variables predicted.

Binary Choice Logit Model formula:

$$P = \frac{1}{1 + e^{-(a+bX)}}$$

Where P = probability that the event Y occurs, p(Y=1)
As (a + bX) increases, P approaches 1;
and as (a + bX) decreases, P approaches 0

The target variable for the study is whether or not a person is willing to switch to the ferry based on their appeal to the existing ticket price or travel time. The dependent variable or target that is binary has two values, being "yes" and "no." The question "Do you think the price of the ferry is just" was the categorical variable used wherein in the code binary, 0 was set to "no" and 1 was set to "yes." While for the travel demand regression graph, the question "If you were to compare the ferry to another mode of transportation (i.e. jeep, bus, train), do you arrive faster?" was used as the dependent variable.

In the equation, P is the probability of a success, e is the base of the natural logarithm while a and b are the parameters. The value of P adjusts when X is zero and b adjusts, as X changes a single unit. As the value of X and P is nonlinear, b doesn't have a straightforward interpretation in the model as with ordinary linear regression. Different choices of a or b gives the curve a steeper or flatter, or backwards S-shape.

Values were inputted in the Stata software while graphs were made using Microsoft Excel. Logistic regression does not require a linear relationship among the dependent and independent variable. It also applies to non-linear log transformation therefore can handle various types of relationships to the prediction of the odds ratio.

4.5 Data Analysis

Figure 3 shows how the variables of the study will be analyzed. The data collected in the survey will be analyzed based on the factors of mode switching behavior the researchers identified. The analysis of the six factors will be divided in to two. The first group refers to those that are directly related and comparable to land-based transit; these are travel time, travel cost and connectivity to land-based transit. The second group of factors aims to understand the effects of the qualitative data to the mode switching behavior of the passengers of the Pasig River Ferry. All the data will be based on the response that will be gathered through the survey.

Because of trip cancelation and delays, passengers are dissuaded to ride the ferry. This is interpreted by potential passengers as the inability of the ferry to provide the service they require.
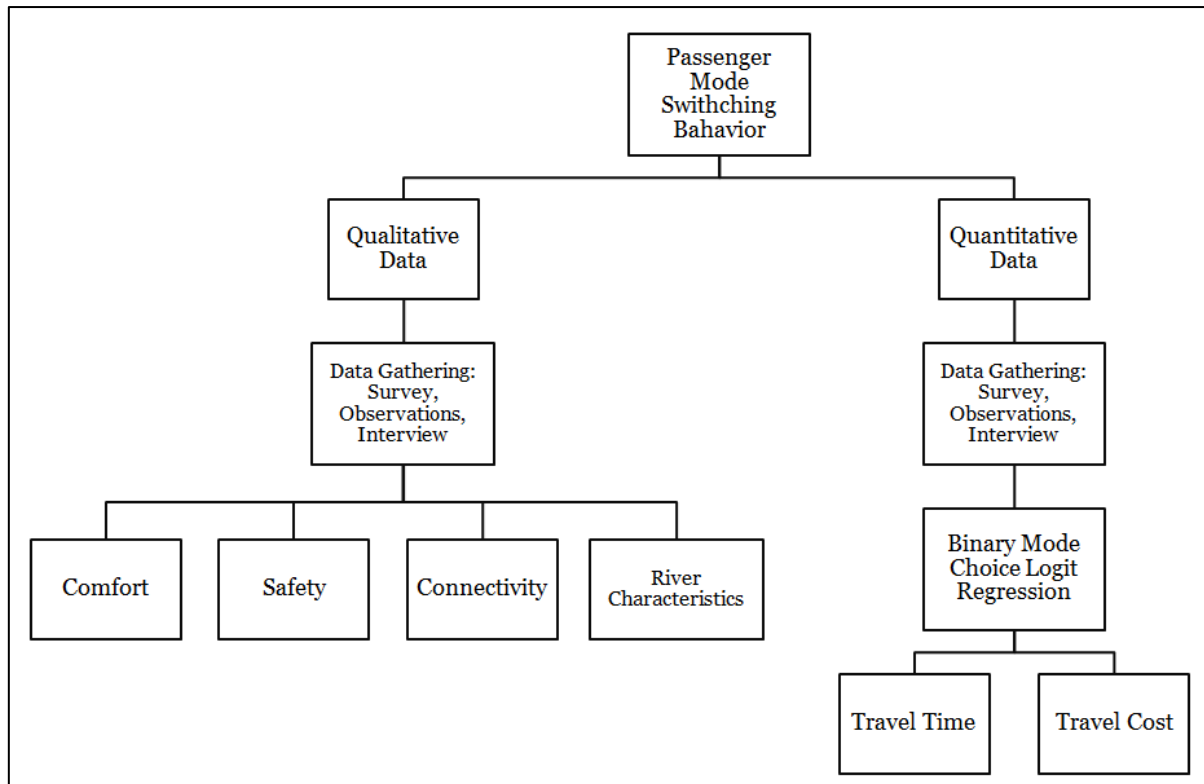
Figure 3. Analytical Framework

From the data analysis the researchers can incur that the major variables that affect the mode switching behavior of the Pasig River Ferry are comfort, safety, travel time and travel cost as these are the variables directly comparable to the PUJ. These factors contribute to the competitiveness of the ferry against other modes of transportation.

5. PRESENTATION AND ANALYSIS OF DATA

Table 1 shows the summary of the most dominant characteristics of each station of the Pasig River Ferry. It shows that stations located near commercial areas, market places and institutions, like Escolta, Guadalupe, Intramuros and Sta. Ana yield the most passengers, while those stations situated in residential areas yield the least. Most of the passengers are employed, hence the main trip purpose of passengers are work and errands, whereas the most frequent station destination are stations near commercial and institutional areas.

Table 1. Ferry Station Profile

Rank	Ferry Station	Passenger Distribution	Status	Frequency	Trip Purpose	Station Destination
1	Guadalupe	35%	More are employed	More people ride the ferry monthly	Majority use the ferry for work	More people head to Escolta
2	Escolta	20%	More are employed	More people ride the ferry monthly	Majority use the ferry for errands	More people head to Guadalupe
3	Pinagbuhatan	10%	More are employed	Majority ride the ferry from Mondays to Fridays	Majority use the ferry for work	More people head to Guadalupe
4	PUP	9%	More are students	More people ride the ferry monthly	Majority use the ferry for leisure	More people head to Intramuros
5	Plaza Mexico	7%	More are employed	More people ride the ferry from Mondays to Fridays	Majority use the ferry for work	More people head to Guadalupe
6	Sta. Ana	6%	More are employed	More people ride monthly	Majority use the ferry for errands	More head to Escolta
7	Valenzuela	4%	More are employed and housewives	More people ride weekly	Majority use the ferry for leisure	More head to Escolta
8	San Joaquin	4%	More are students	More people ride monthly	Majority use the ferry for errands	More head to Escolta
9	Lawton	2%	More are employed	More people ride the ferry from Mondays to Fridays	Majority use the ferry for work	More people head to Guadalupe
10	Lambingan	2%	More are employed	More people right weekly and monthly	Majority use the ferry for work	More head to Intramuros
11	Hulo	1%	More are employed	More people ride weekly and from Mondays to Fridays	Majority use the ferry for work	More head to Intramuros and Escolta

The frequency of the ferry trips on the station is affected by passenger yield. The lower the passenger yield of the station, the less frequent ferry trips are in that station. This is why ferry trips with low passenger yield have irregular trip schedules, which translates to the unreliability of the ferry when passengers travel needs are not met.

Ferry "reliability" is another factor which can be contributed to the lack of success of the ferry. Lack of passenger yield lessens the frequency of the ferry trips making the service more inconvenient for passengers because of the inconsistent trip schedule and predictability of the service. Though this was not mentioned as a factor of mode switching behavior in the paper, it can be explored in the near future.

5.1 Ferry Comfort

Based on the survey, 93% of the respondents said they feel comfortable riding the ferry. When asked why, majority of the respondents said they feel comfortable riding the ferry because it is not crowded (30%) and because of the comfortable seats (27%). This response may be attributed to the "no overloading" policy of the ferry management. The management of the ferry ensures that each trip does not exceed the maximum passenger capacity of the vessel as per the rules of the Philippine Coast Guard.

Those who responded that they feel comfortable riding the ferry said it was because the vessels look sturdy (44%) and are well-maintained (19%), implying that the passengers take into

consideration the physical attributes of the vessels as a basis to gauge the reliance of the craft as a mode of transport.

5.2 Station Comfort

The response of the passengers also showed that the station itself is also taken into consideration when they avail of the services of the Pasig River Ferry. 12% of the respondents said that the maintenance of the ferry station contributes to their comfort. All the stations of the Pasig River Ferry are maintained properly because each has a janitor to ensure that the facilities of the station like the waiting area and toilets.

5.3 River Characteristics

River characteristics are important to consider when riding the ferry because this is where passengers spend most of their time while on the ferry. This pertains to the physical attributes of the ferry, and majority of the respondents answered that these characteristics do not affect them. 55% of the respondents said the smell of the river does not affect them, and 56% said the current state of the river does not bother them as well. According to the respondents and to the personnel of the ferry, the severity of these aspects depend on the season; the river would usually stench when the weather is hot and water hyacinths are abundant during rainy seasons. The stench is not really bothersome and eventually people get used to it. Another reason why people are forgiving of this variable is the reputation of the Pasig River. It is expected that the river will not be pristine, thus the passengers just accept it as it is.

5.4 Travel Cost

The data for the factor of cost is shown on Figure 3 and was analyzed using the Logistic Regression Model using the Stata Software. 360 observations were used and fitted into the maximum-likelihood logit model with 0.014 pseudo rho squared value. The graph shows that fare cost and the probability to shift has an inverse relationship. This means that as the ferry fare price increase the probability of passengers to shift to the ferry decrease, indicating that the fare price of the ferry is highly elastic especially between the ranges of 50 to 150.
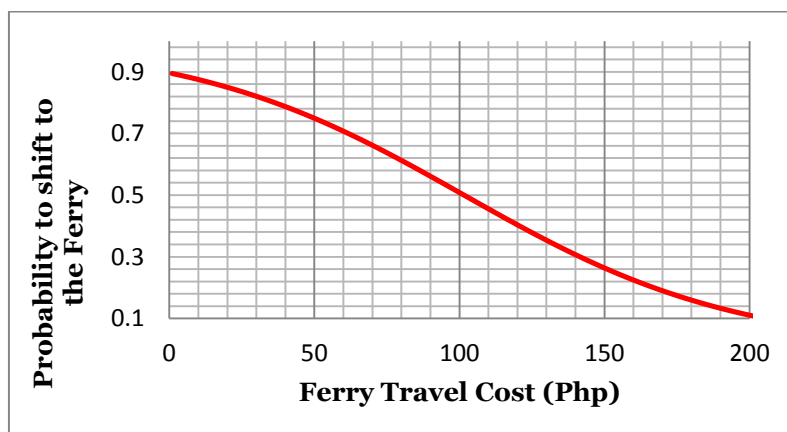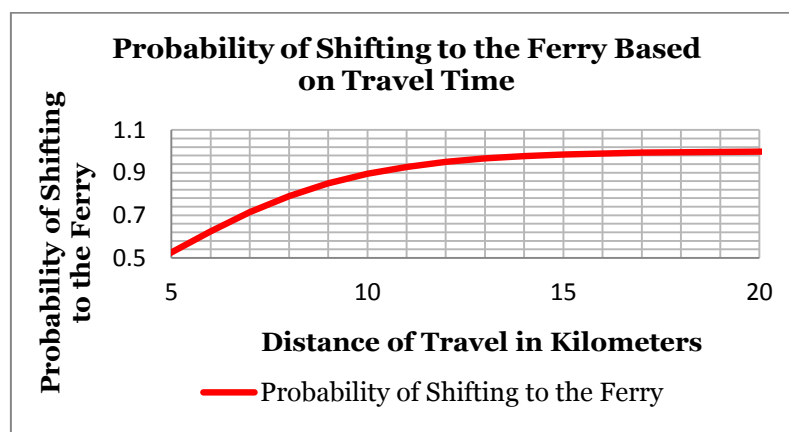

Figure 3. Graph of the Probability of the Passengers to Shift to the Ferry Based on the Variable Travel Cost

5.5 Safety

To account for the factor of safety, respondents were asked if they feel safe while riding the ferry, and why they feel safe. The summary of the answer to these question showed that 96% of all the respondents feel safe while on the vessel. When asked why they feel safe, 46% answered that they feel safe riding the ferry because of the assistance the ferry personnel provides, and 44% answered that they feel safe because they think the ferries are sturdy.

5.6 Travel Time

The variable of travel time is measured using the Binary Logit Regression Model from the Stata software and is shown on figure 4. The distance the ferry travels was the basis of this variable. The Pasig River Ferry System covers a total distance of 20.89 kilometers, while the average speed vessels used is 30 kilometers. The probability curve shows that the distance traveled by the passengers is directly proportional to the passenger's probability to shift to the ferry. The longer the distance the passengers travel, the more likely they will shift to the ferry. The reason for this is because the ferry is most viable for long distance travel like city to city travel, where cost and travel time is more reasonable compared to the PUJ. The longer the distance of travel on land, the more they will encounter land travel challengers like traffic congestion, unlike in the Pasig River Ferry where the more distance they travel, they reduce travel time with no existing traffic congestion.

Figure 4. Graph of the Probability of the Passengers to Shift to the Ferry Based on the Variable Travel Time

5.7 Connectivity to Land-based Transit Systems

One of the factors of passenger mode switching that the researchers identified is connectivity to land-based transit systems. To reflect this factor on the survey, respondents were asked whether or not there is available land-based transit near the ferry stations. 80% of the total 360 sample answered that there are readily available land-based transit near the ferry, while 20% answered it is not readily available to them. According to them, the next mode of transport is not available to them because they have to walk long to get to the place where they can ride the next mode. They also have to wait long, either because they have to queue long lines in terminals or because of infrequent trips the next mode has, or a combination of this. These answers hardly constitute the lack of the next available transit; these are instead representations of the inconvenience people experience when transitioning from the ferry to the next mode of transport, further emphasizing that comfort and convenience are major factors of the respondents' mode switching behavi

6. SUMMARY AND CONCLUSION

6.1 Summary

The researchers used the survey method in gathering data on the 11 stations of the Pasig River Ferry, where 360 respondents were surveyed. The data gathered and analysis conducted led to several findings.

Public Utility Jeepneys (PUJ) are the main competitor of the ferry; it is also the main alternative mode of transport passenger use. It is for this reason that PUJs were used by the passengers as a comparison reference when answering the survey. The "No-Overloading" policy of the ferry greatly affected the comfort and safety of passengers while in the vessel. Passengers feel comfortable while riding the ferry because it is not crowded, thus giving them more room to relax and move during trip, compared to the PUJ which is often filled beyond the seating capacity.

The feeling of safety while riding the ferry is primarily interpreted by the passengers in two ways. The first is the vessel's probability to sink and the ability of the ferry management to save the passengers when this happen. This is why the sturdiness of the boats is considered by the passengers as a contributing factor to safety. The second interpretation is the safety from pickpockets and crimes. The passengers feel that they are less likely to become victims of crimes when they are using the ferry. The river odor and river appearance are still a bother to a considerable number of passengers, but not enough of an obstacle to dissuade passengers from riding the ferry.

Travel cost of the ferry is more expensive than that of its primary competitor, the PUJ. When fare matrix is compared, it shows that passengers travel less distance using the ferry but pay a high price for it, while PUJ travel longer distances for cheaper fare price. Travel time using the ferry is more effective in greater distance like city to city travel than intercity travel. Finally, land-based transit is accessible from the station but not always readily available for various reasons like long queue and infrequent trips.

6.2 Conclusion

Passenger distribution is greatly affected by location of the station. The location of the station defines the potential passengers and the needs of these passengers. For example, when the station is located in a residential area, the top two purposes of riding the ferry are going to work and leisure. If the station is located in business district or leisure areas like Escolta and Intramuros, the main purpose of the passengers riding the ferry would be errands and leisure. High passenger yield is evident when the location of the station is close to commercial and institutional areas where there is a diverse passenger trip purpose to cater to, and trips extend from one city to another.

Low passenger distribution is common when stations are located near a residential area like Lambingan, Valenzuela, Hulo and San Joaquin. When a station is near a residential area people prefer using the PUJs over the ferry because it is more economical and people are more accustomed to it. PUJ is preferable when the travel is within the city as it is cheaper and faster, while ferry is a viable option when the distance of the travel is from one city to another.

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