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# Comparative Analysis of Transportation Network Companies (TNCs) and Conventional Taxi Services in Metro Manila

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**Abstract** — This paper presents a comparative analysis of key performance indicators of Transportation Network Companies (TNCs) vs Conventional Taxi. The key performance indicators include travel speed, reliability, passenger expense, and quality of service, and these are used to determine if TNCs have a beneficial impact to our transport system. Previous studies and problems encountered in other countries were used as the basis of comparison of TNC and conventional taxis. The ridesharing history and concept were compared to Philippine setting. Travel diaries from regular riders of Uber, GrabCar and Conventional Taxi's ran for 30 days in order to gather data and compare its Key Performance Indicators. Hence, additional surveys such as: (1) availability of vehicle check and (2) performance indicator survey were also conducted in order to validate and support the travel diaries submitted by the regular riders.

According to other studies in USA, car-sharing was revealed to have more benefits, particularly in the reduction of vehicle ownership that helped alleviate traffic congestion, improve mobility and address parking needs. The operations of Uber and GrabCar in the Philippines were examined led to findings indicating that these do not conform to the original ridesharing concept. Instead, these have become more like a premium taxi service that had a predetermined booking as an advantageous procedure. Ridesharing is still existing and this is through android and IOS applications however this is not LTFRB registered. Carpooling on the other hand is still being practiced in some business areas.

Vehicle rental and private automobiles overlap with the service of TNCs as it performs similar point to point service. TNCs also overlap with taxi services as these both use non-commercial vehicles for public transport. TNCs however provide more convenience and flexibility than taxi.

Based from the results of the travel diary submitted, Uber is faster than GrabCar and Conventional Taxi. In terms of reliability or the number of available vehicles at a specified pick up point, GrabCar dominates Uber and Conventional Taxi. Uber

is said to be cheaper than conventional taxis. However, GrabCar was costlier among the three (3) transport modes. Lastly, Uber and GrabCar has better quality of service compared to conventional taxis.

The reasons on how TNCs like Uber and GrabCar can contribute to sustainable transport are as follows: 1) If it supplements to urban public transit rather than a substitute for it; 2) When ride-sharing principle is applied; 3) When competition with taxi service benefits the consumers; 4) By promoting safety; and 5) Through the use of Intelligent Transport System (ITS) and Information Communication Technologies (ICT).

TNCs like Uber & GrabCar which are now part of our public transportation should find ways to minimize the number of trip request rejections especially for GrabCar. Furthermore, the study found that in order to ensure sustainability and advantages over conventional taxis, TNC's like Uber and GrabCar should maintain a strict screening of skilled drivers to ensure the passengers' safety and convenience. TNC's should also duly comply with the policies implemented by DOTC and LTFRB.

**Keywords**—TNC; Uber; GrabCar; Conventional Taxi; Car-sharing; Ridesahring

## I. INTRODUCTION

### A. Background of the Study

Uber is a popular mode of car sharing in the United States that is currently becoming popular in Metro Manila. GrabCar, on the other hand, provides the same services as Uber and was an added feature in GrabTaxi App. It originated in Malaysia and has start up success in the Philippines. This service is classified by the Department of Transportation and Communications (DOTC) as Transport Network Company (TNC), while their partners are called Transportation Network Vehicle Service (TNVS).

The previous studies and problems from other countries where car-sharing success originated can be used as a basis for upgrading our transport system. Hence, solutions and improvements can be incorporated to TNCs in our country to help further enhance its services.

In order to compare the services and performances of TNCs vs Conventional Taxi, Key Performance Indicators will be used as a measurement. As such, Travel Speed, Reliability, Passenger Fare, and Quality of Service will be used to validate the beneficial impact of TNCs to our transport system. The positive results which translate to a more convenient and safer ride in turn can contribute to a sustainable transportation system.

### B. Research Problem

Performance indicators of largest TNCs (Uber, & GrabCar) against Conventional Taxi should be checked to compare the quality of service of each mode. Profiling of rides can also help us determine if TNC's perform as taxi service.

### C. Significance of the Study

- Profiling the users of Uber, GrabCar and Conventional Taxi will give us the necessary data we need for analysis;
- This study aims to measure the performance of existing operation of regular taxi versus the new transport online app service like Uber and GrabCar;

### D. Objectives

This study has the following objectives:

- To profile the users of Uber, GrabCar, and Conventional Taxis
- To measure performance of existing taxi services versus the newly introduce Transportation Network Vehicle Service (TNVS): Uber and GrabCar;

### E. Scope and Limitation:

The scope of the study includes the following:

- The study is limited to TNC like Uber & GrabCar, and Conventional Taxis in Metro Manila
- Study area is limited to Metro Manila
- The study focuses on the comparison of these three types of transit, namely: Uber, GrabCar, and Conventional Taxi
- The performance indicators are limited to Reliability, Travel Speed, Passenger Expense and Quality of Service

## II. STUDY FRAMEWORK

Taxi is a public utility vehicle for hire with a driver, used by single passenger or a group of people, and often not shared using a car. It transports passengers to the location of their choice point to point.

Transportation Network Company (TNC) is a company that uses online-enabled application using personal and non-

commercial vehicles for car-sharing/ridesharing/resourcing purposes. (Uber, GrabCar, Lyft Etc.)

The study will focus on the Four (4) Performance Indicators in order to compare and analyze the service provided by Uber, GrabCar and Conventional Taxi.

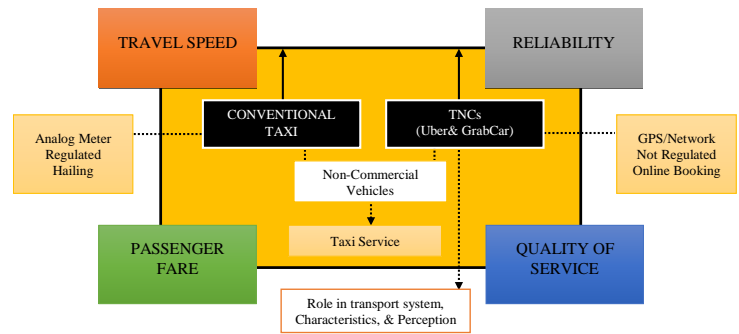


Fig. 1. Study Framework and Key Performance Indicators of Transportation Network Companies (TNC) vs Conventional Taxi.

### Key Performance Indicators (KPIs)

1. Travel Speed refers to the average speed of the vehicle from origin to destination. This is also known as travel time.
2. Reliability refers to the number of available vehicles and its average waiting time.
3. Passenger Expense refers to the cost of the fare
4. Quality of service refers to the degree of comfort, convenience, aesthetics, the attitude of the driver, cleanliness, and ease of using the system)

## III. REVIEW OF RELATED LITERATURE

The concept of the Transportation Network Company (TNC) like Uber and GrabCar originated in Car-Sharing idea, also known as Ride-Sharing, Ride-Resourcing and mobile app based taxi. TNC's are evolving as it directly competes to the taxi industry.

### A. Uber Experience in the U.S.A.

In the USA (Frizell 2015), most of the Uber Drivers are male, only 13.8% are female. They are also younger than the U.S. worker and Taxi driver with an age between 30 to 39 years old compared with 22.5% in the regular work force and 19.9% among regular taxi drivers and chauffeurs. About 37% of Uber drivers have a college degree, versus 25.2% in the general work pool.

About one-third of the Uber drivers started with Uber to earn money while looking for a steady, full-time job. Over 62% of the Uber drivers are working fulltime or part-time on another job. Majority (51%) of Uber drivers work 15 hours a week or fewer. Only 19% are driving full-time (35 hours per week or more) compared to regular taxi drivers with 81%.

Uber in the U.S.A. performs like a ride-sharing in a form of additional income.

B. Surge Pricing

Deep (2015), whenever the demand increase, per mile prices are automatically increased resulting to surge pricing. The new fare will depend on the number of drivers and the number of request made by people who want to ride Uber. Price surge technology was patent by Uber in the U.S.

Pullen (2014), Uber’s pricing can be subject to “surge” pricing in addition to operating on supply and demand which increase the rates in return. Uber uses surge to pricing to encourage more drivers to get out and drive during busy times. Some critics called it price gouging during natural calamities and bad weather. However, Uber amended its policy saying it will no longer charge surge rates during natural emergencies.

Toor (2016), On April 21, 2016 the government of Delhi India suspend the surge pricing of Uber and local ride-hailing company Ola. Chief Minister of Delhi Arvind Kejriwal described the practice of surge pricing as “highway robbery” and strict action would be taken against drivers who raise their fares.

Figure 2 shows a Sample Surge Pricing in Metro Manila. Surge usually happens during rush hours, a bad weather or during special occasions.

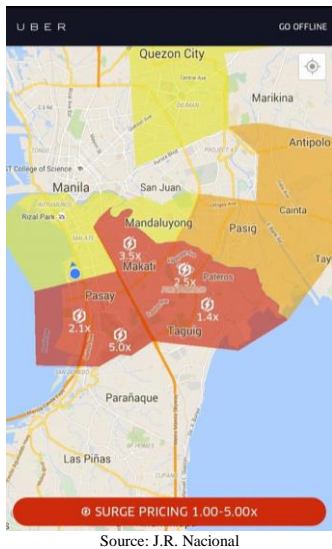


Fig. 2. Sample Surge Pricing in Metro Manila

C. Sustainable Urban Transport

Evans (2011) defines sustainable transport as green transport and it does not use or rely on decreasing natural resources. It relies on renewable or regenerated energy rather than fossil fuels and it has low effect on the environment. Examples of sustainable transport includes walking, cycling and sailing.

Sustainable Transport is “Transport that meets the current transport and mobility needs without compromising the ability of future generations to meet these needs.” Black (1996)

Avoid, Shift, Improve Strategies in Sustainable Urban Transport, UNDESA (2012)

Avoid: This first strategy seeks to avoid unnecessary travel and reduce trip distances.

Shift: This strategy seeks to shift passengers towards more sustainable transport modes. Encourage to use start using more public and non-motorized transport.

Improve: The third strategy focuses on policies that aim to improve transport practices and technologies

D. Sharing Economy

As shown in Table I, Wallsten (2015) compared Uber, Lyft and other taxi-like service to Airbnb. Airbnb makes the empty homes or empty rooms possible for rent, on the other hand, cars sit parked and depreciate maybe utilized in Uber. Unemployed and underemployed people represents wasted productive assets.

TABLE I. THE “SHARING ECONOMY” AND RIDE-SHARING SERVICES WALLSTEN (2015)

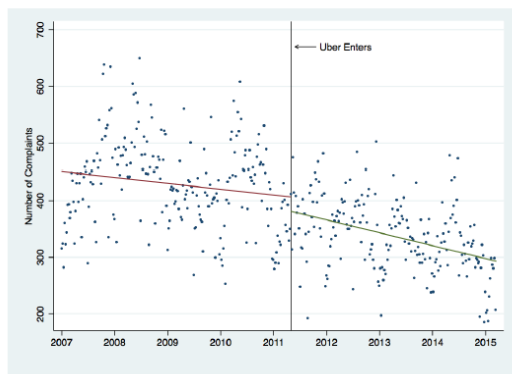
Assets	Traditional	Sharing Economy
Cars	Taxi Industry	Uber, Lyft & Others
Homes	Hotel Service	Airbnb
		*cheaper

In his study, Wallsten, 2015 used the New York City Taxi and Limousine Commission (NYCTLC) data on every taxi ride in the city from 2010 to 2014 (more than 1 billion observations). Also NYC’s Open Data Project provides data on taxi complaints. Chicago contains detailed complaint data. He used Google trend to generate an index in Ubers ride sharing’s growing popularity in NYC and Chicago. (Please see Figure 3)



Fig. 3. Daily Taxi Trips (Thousands) in New York

In Figure 4, data reveal that as the number of complaints per taxi trip in NYC has declined along with the growth of Uber (Wallsten, 2015). Customers who used to complain, switched companies instead of complaining and taxi drivers responded to competition from Uber by increasing quality of service.



Source: Wallsten 2015

Fig. 4. Number of Taxi Complaints Submitted to NYCTLC

### E. Dynamic Pricing

Uber shows that both supply curve and demand curve are highly elastic (Bill Gurley, 2014). When price surge, an immediate reduction in open-to-order ratios. As expected, higher prices will reduce demand. Uber's decrease in price will result materially to increased demand.

Dynamic pricing policies are well applied also in hotels, airlines and rentals. Same as other Internet marketplace companies, when scarcity of supply is experienced, dynamic pricing is the solution (Bill Gurley, 2014). Some of the examples that use dynamic prices are Ebay's original auction model, Airbnb and Homeaway, and Google's core Adwords offering.

### F. Coase Theorem

The Coase Theorem is an example of transformation of taxi industry (Justin Jenks, 2015). The Coase Theorem, as postulated by Nobel Laureate Ronald Coase (1991).

Coase Theorem states that "if trade in an externality is possible and there are no transaction costs, bargaining will lead to an efficient outcome regardless of the initial allocation of property rights". George Stigler restated it: "with zero transaction costs, private and social costs will be equal".

Through this theorem, online and digital firms will have a cost advantage in our marketplace over traditional firms (Justin Jenks, 2015). The transaction cost is approaching zero. Three characteristics of this theorem: reducing transaction costs; increasing social utility; and changing the nature of participating firms

The mobile app for taxi or ride sharing is a big worry for the taxi industry because it manages virtual fleets (Justin Jenks, Raktas, 2015). The taxi industry is monopolistic, highly regulated and ossified. Current practice often licensed taxis are hailed from the street and fares paid in cash. Fleets are supplemented by radio-taxis and chauffeured services to allow increased capacity, but required booking with confusing payment methods.

The taxi industry is characterized by poor behaviors (Justin Jenks, 2015). They provide poor infrastructure, inefficient booking, pre/post journey delays, poor capacity-supply/demand

management, poor service & fulfillment, questionable vehicle quality, (in) experienced drivers, poor Customer Experience, high/monopolistic fares, payment confusion, in difficult working conditions."

Similar passenger KBFs (Key Buying factors) are clear: the ability to secure a taxi, waiting times for pickup, journey quality, fares and payment add important quality and time improvement aspects (Justin Jenks, 2015)

### G. Ridesharing

In 2011, Amey, A. Et al, defines "real-time" ridesharing "A single, or recurring rideshare trip with no fixed schedule, organized on a one-time basis, with matching of participants occurring as little as a few minutes before departure or as far in advance as the evening before a trip is scheduled to take place".

Amey, A, 2011 said that "Real-time" services rely on (1) Smart Phones (2) Constant Network Connectivity (3) GPS Functionality (4) Ride Matching Algorithm (5) Data Repository (6) Stored User Profiles (7) Social Network Integration (8) Participant Evaluation (9) Automated Financial Transactions (10) Incentives and Loyalty Rewards Linked to Participation.

Although Uber and GrabCar originated in the concept of ridesharing and car-sharing, in Metro Manila it became an evolve taxi with premium service. Ridesharing still exist here through android/IOS apps, but they are not registered in LTRFB. Carpooling on the other hand is still practiced in some offices.

### H. Car-Sharing

Car-Sharing provides access to a fleet of vehicles by reservation either online, by phone, walk to nearest parking space, open the doors via electronic keycard and drive off. It can be a substitute for car ownership at home and provides access to vehicles for business use and personal errands at the workplace. Being a car-sharing operator has a different purpose, it can be for profit companies, non-profits with environmental and social change mission. It is also called the "missing link" being an alternative to private cars. Users can ride transit, cycle and walk for most of their trips, but have access to a car when needed. Car-sharing also complements taxis, which is better for one-way trip, for those who cannot drive, and car rental which is cheaper for long journeys. (Adam Ball, Gail Murray, Jessica Schure, & Christine Fox, Transportation Research Board, TCRP Report 108, Car-Sharing: Where and How It Succeeds, 2005)

Car-sharing provides options for mid-distance trips where destinations may not be accessible by public transportations as shown in Fig. 5. Relationship to other modes (TCRP Report 108, 2005).

#### 1) Impacts of Car-sharing (TCRP Report 108, 2005)

- Vehicle Ownership – reduced vehicle ownership can lead to increased parking availability



- Vehicle Travel – reduced vehicle travel, strong financial incentive to drive less, non-car owners can use service to make vehicle trips, improves mobility
- Other Impacts
  - Lower emission, – car-sharing reduces emissions by cutting vehicle travel and the use of newer, fuel-efficient vehicles.
  - Increased transit ridership – by reduction of vehicle travel, car-sharing shifts some trips to transit.
  - Cost Savings – saving money on transportation is the reasons why many households and business joins car-sharing.
  - Greater Mobility – car-sharing allows people without a car to get to new places.

## 2) Layered Benefits (TCRP Report 108, 2005)

### a) Environment/Community

- Lower Emissions
- Cost Savings for development
- Less congestion
- Better urban design
- More compact development
- Less energy resources for vehicle manufacturing

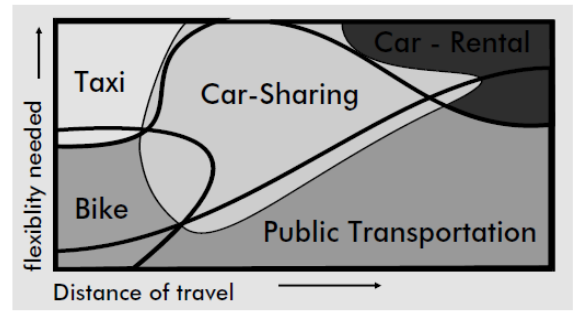
### b) Transportation Systems

- Lower parking demand
- More fuel-efficient vehicles
- Less vehicle travel
- More transit ridership

### c) Individual/Business

- Cost savings
- Greater mobility
- Convenience

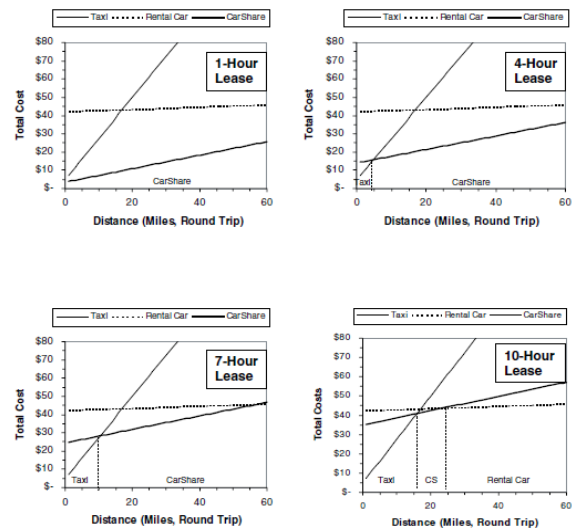
In Fig. 5, we can see that the role of car-sharing is for intermediate trips. Taxis and bike are economical for short distance trips while car-rental and public transportation is for long trips.



Source: Schwartz, Joachim. Presentation at Car-Free Cities Working Group Seminar, London, 1999.

Fig. 5. Relationship to other modes (TCRP Report 108, 2005)

As shown in Fig. 6, Car-sharing is cheaper for intermediate length trips, Rentals are cheaper for longer trips (priced by day and unlimited mileage), and Taxi's tends to be cheaper for short distance. (Adam Ball, Gail Murray, Jessica Schure, & Christine Fox, Transportation Research Board, TCRP Report 108, Car-Sharing: Where and How It Succeeds, 2005)



Source: Cervero & Tsai (2003).

Fig. 6. Cost Comparison for Rental, Taxis, and Car-Sharing (TCRP Report 108, 2005)

## IV. METHODOLOGY OF THE RESEARCH

### A. Survey Methodology

In this study, the researcher aims to obtain data from the regular users of Uber, GrabCar and Conventional Taxi. Performance indicators obtained from the travel diaries and a validation survey will be used for comparison.

Travel diaries from regular riders of Uber, GrabCar and Conventional Taxi's ran for 30 days in order to gather data and compare its Key Performance Indicators.

Additional surveys for validation such as: (1) Availability of vehicle check and (2) Performance indicator survey were also conducted in order to validate and support the travel diaries submitted by the regular riders.

Reliability includes data from booking time (mins), waiting time (mins), number of vehicles available, and number of trip rejection.

Travel Speed includes data from travel distance (km), travel time (min) and travel speed (kph).

Passenger fare includes data from passenger fare and peso/km.

Quality of service includes ratings for Comfort, Cleanliness, Passenger Fare, Convenience, Driver's Conduct, and Speed.

#### B. Travel Diary Survey

Eighteen (18) respondents who confirmed to participate in the travel diary survey was given a form which they need to fill-up with pertinent details of their trips for 30days. Through this method, we can profile the user/riders and have a comparative analysis of the Performance Indicators.

Participants of the survey also had a chance to win one of the five (5) gift cards worth PhP 1,000.00.

#### C. Availability of Vehicle Check Survey

The researcher conducted an availability survey to measure the number of available vehicles of Uber, Grab, and Taxi at a specified time and location. The count run at an interval of 15 minutes and a common radius of measurement for 13 hours. Number of available Uber and GrabCar units can be seen in the application while the number of conventional taxis in the area was counted manually or using a counter device. Chosen cities were Makati, Pasay, and Taguig as they have the most number of riders. Surge rate for Uber throughout the day was also included. This survey validated the Travel Diaries submitted by the respondents.

#### D. Performance Indicator Survey

The purpose of this survey was to validate the KPIs submitted in the travel diaries. The survey run for 13 hours with the help of three (3) surveyors who rode an Uber, GrabCar and Taxi vehicle simultaneously for ten (10) routes. Survey forms was filled up and smart phones were used for booking Uber and GrabCar.

Classification of Trips:

S –Short Trip (less than 5 kms. intracity)

M – Medium Trip (>5 < 10kms. intercity)

L – Long Trip (>10 kms intercity)

#### E. The Study Area

The study area is limited to cities in Metro Manila as the Uber & GrabCar are only allowed in Metro Manila.

In the Availability of Vehicle Check Survey, Makati, Pasay and Taguig Cities were chosen as survey location.

In the Performance Indicator Survey conducted, five (5) cities in Metro Manila were chosen such as: Makati City, Quezon City, Manila City, Marikina City, Taguig City.

### V. PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

#### A. TNC's Role to Other Modes in Metro Manila

Figure 7 shows the role of TNCs to other modes of transportation in Metro Manila. Walking, bicycle and pedicabs being non-motorized transport is preferred for short distance trips. Motorcycles provide transport for short to long trips and is considered the most affordable mode of transportation while Tricycle is used for short distance trips only.

Vehicle rental is preferred for short to long trips with long durations. However, vehicle rental together with private automobiles overlap with the service of TNCs as it performs similar point to point service.

Also, TNCs overlap with taxi service as these both use non-commercial vehicles for public transport. TNCs advantage is that it provides more convenience and accessibility than taxi. However, some TNC operators are providing car rental service illegally.

High capacity transport like MRT and LRT overlap with the service provided by City Buses. Both MRT and LRT provide mid-distance to long distance trips but needs other mode to access it while PNR is preferred for long trips. On the other hand, the Jeepneys and UV Express are used primarily for short to medium trips.

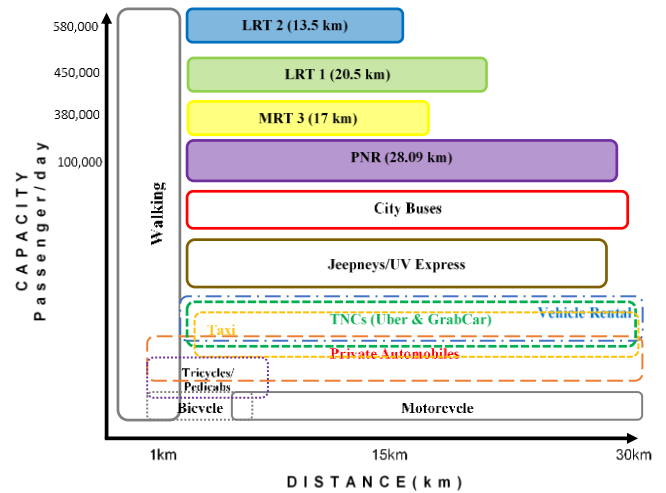


Fig. 7. TNC's Role Versus Other Modes of Transport In Metro Manila

#### B. Travel Diary Survey

The travel diary survey results obtained from 13 out of 18 respondent riders in a period of 30 days greatly helped the researcher for this study. There are four performance indicator which the researcher had used to compare and contrast whether there appears to be a significant difference among the three and determine among the three (Conventional Taxi, Uber, and GrabCar) which are significantly different with each other.

The four (4) performance indicators are the following: travel speed (kph), passenger (pesos/km), reliability (no. of available vehicles around the area) and the quality of service (rating scale of 1 to 5).

Since three independent samples are involved, the One-Way ANOVA (Analysis of Variance) test was used to compare Uber, GrabCar & Conventional Taxi.

The Tukey HSD Test was used to determine which of the pairs of treatments are significantly different from each other.

Table II shows the summary of the result of the travel diary survey.

TABLE II. TRAVEL DIARY SUMMARY OF RESULT

TRAVEL SPEED (kilometers per hour)		
Uber	GrabCar	Conventional Taxi
21.3189	12.3267	12.9462
RELIABILITY (availability)		
Uber	GrabCar	Conventional Taxi
2.7572	7.6	2.6792
PASSENGER EXPENSE (pesos per kilometer)		
Uber	GrabCar	Conventional Taxi
20.7157	32.0678	28.4879
QUALITY OF SERVICE (5 as the highest)		
Uber	GrabCar	Conventional Taxi
4.8179	4.7111	3.9434

1) In terms of travel speed (kph), Uber was the fastest with 21.32 kilometers per hour (kph) average travel speed compared to GrabCar that registered 12.33 kilometers per hour (kph) and conventional taxis with 12.95 kilometers per hour (kph). The travel speed values for GrabCar and Conventional Taxis are close and statistically insignificant. It should be noted that Travel Speed can be subjective to the driver, but in the case of this survey, multiple responses were gathered from different drivers;

2) In terms of reliability or the number of available vehicles at the requested pick up point, GrabCar has the highest value of 7.6, while Uber has 2.76 and Conventional Taxis with 2.68. The values of availability for Uber and Conventional taxi are close and statistically insignificant.

3) In terms of passenger fare (pesos/km), Uber was found to be the cheapest mode among the three (3) transport modes with a value of PhP 20.72 per kilometer. Conventional taxi rate at PhP 28.49 per kilometer and GrabCar with PhP 32.07 per kilometer. GrabCar was the costliest among Uber and Conventional Taxi. Tip and unreturned change was included the taxi fare and GrabCar because of the cash payment mode, which makes the passenger fare costlier. GrabCar and Conventional Taxi values for passenger fare are statistically insignificant.

4) Lastly for quality of service, Uber has the highest rating for quality of service with 4.82, followed by GrabCar with 4.71. Conventional taxi has the lowest rating among the three (3) modes with a value of 3.94. Uber and GrabCar values are close and statistically insignificant. Furthermore, problems with the taxi service resulted to a lower rating given by the passengers.

Table III, summarizes the quality of service based on the travel diaries submitted by the respondents. Conventional taxis recorded the highest percentage of complaints based on the

travel diaries submitted, with 21 complaints out of 58 rides or 36.31%. Uber got 22 complaints out of 199 rides or 11.06%. GrabCar, on the other hand, got 10 complaints out of 106 rides or 9.43%. The result shows that there are problems in the quality of service in conventional taxis.

TABLE III. TRAVEL DIARY SURVEY RESULTS – QUALITY OF SERVICE

MODE	No. of Complaints/ Problems	Total No. of Rides	Percentage of Complaints
UBER	22	199	11.06%
GRABCAR	10	106	9.43%
CONVENTIONAL TAXI	21	58	36.21%
<b>TOTAL</b>	53	363	

### C. Availability Check Survey

Availability check survey was conducted to verify the result obtained from the travel diary survey. Table IV shows the average number of vacant taxis and occupied taxis. The survey locations were Glorietta 5-Makati City, Mall of Asia-Pasay City, and BGC, Taguig City. The results of this survey is subjective to the time and day.

TABLE IV. AVAILABILITY CHECK SURVEY (VEHICLE COUNT) – FOR CONVENTIONAL TAXI

LOCATION	VACANT TAXI	OCCUPIED TAXI
G5, MAKATI	19.63	16.12
MOA, PASAY	69.94	23.17
BGC, TAGUIG	28.31	36.00
<b>AVERAGE</b>	<b>39.29</b>	<b>25.10</b>

As seen in Table V, the average number of UberX and UberBlack units for the three (3) surveyed cities together with the average surge rate for UberX and UberBlack.

TABLE V. AVAILABILITY CHECK SURVEY (VEHICLE COUNT) – FOR UBER

LOCATION	UberX	UberX - Surge Rate	UberBlack	UberBlack - Surge
G5, MAKATI	3.67	1.39x	2.65	1.29x
MOA, PASAY	3.54	1.00x	1.40	1.18x
BGC, TAGUIG	3.38	1.24x	3.55	1.24x
<b>AVERAGE</b>	<b>3.53</b>	<b>1.21x</b>	<b>2.53</b>	<b>1.23x</b>

Table VI, shows the average number of GrabTaxi, GrabCar (sedan), GrabCar (6 seater) and GrabCar+ available for the three (3) surveyed cities. Grab app shows all available vehicles in the app so the count was done in a common radius as Uber.



TABLE VI. AVAILABILITY CHECK SURVEY (VEHICLE COUNT) – FOR GRAB

LOCATION	GrabTaxi	GrabCar (sedan)	GrabCar (6 seater)	GrabCar+
G5, MAKATI	11.16	8.00	1.88	0.84
MOA, PASAY	16.09	15.83	1.63	0.43
BGC, TAGUIG	9.55	12.85	1.68	0.87
AVERAGE	12.26	12.23	1.73	0.71

A comparison of the availability check survey for all the modes (conventional taxi, Uber, and GrabCar) were shown in Table VII. UberBlack, GrabCar (6 seater) and GrabCar+ have limited availability. Even though conventional taxis got highest available vehicles from the survey conducted, taxis did not utilize demand and supply of passengers during this spot check survey.

TABLE VII. AVAILABILITY CHECK SURVEY (VEHICLE COUNT) – FOR ALL MODES

LOC.	V.T.	U.X.	U.B.	G.T.	G.C.S.	G.C.6	G.C.+
G5, MAKATI	19.63	3.67	2.65	11.16	8.00	1.88	0.84
MOA, PASAY	69.94	3.54	1.40	16.09	15.83	1.63	0.43
BGC, TAGUIG	28.31	3.38	3.55	9.55	12.85	1.68	0.87
AVERAGE	39.29	3.53	2.53	12.26	12.23	1.73	0.71

V.T. - Vacant Taxi, U.X. - UberX, U.B. - UberBlack, G.T. - GrabTaxi, G.C.S. - GrabCarSedan, G.C.6. - GrabCar6Seater, and G.C.+ - GrabCar+

In Fig. 8, the number of available vehicles (Conventional Taxi, Uber, and Grab) in the survey conducted in Glorietta 5, Makati City, conventional taxis registered the highest number throughout that day. The graph also showed that Uber and GrabCar was available throughout that day, while there was only limited supply of UberBlack, GrabCar (6 seater) and GrabCar+.

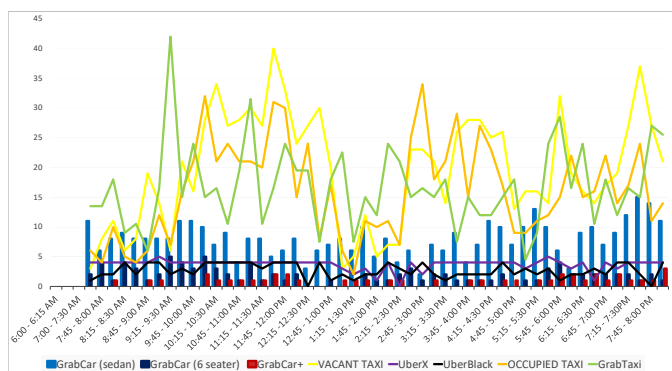


Fig. 8. Availability Check Survey (Vehicle Count) – Glorietta 5, Makati City, March 4, 2016

In Fig. 9, the availability check survey conducted in Mall of Asia, Pasay City showed that there was an oversupply of conventional taxis. Uber and GrabCar are constantly available

in this area throughout the day except for UberBlack, GrabCar+ and GrabCar (six seater) which had a limited number. The surveyor failed to capture data from 7:30am to 11:45am for Uber and Grab. This survey was conducted on a Saturday, where a higher volume of riders and taxis were expected.

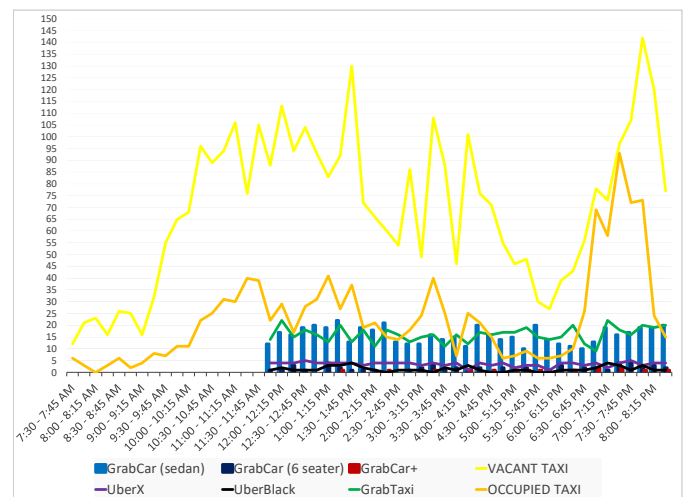


Fig. 9. Availability Check Survey (Vehicle Count) – MOA, Pasay City, March 5, 2016

In Fig. 10, availability check survey was also conducted in BGC, Taguig City. Same as with the two previous cities discussed earlier, Taguig City exhibited both a high supply, as well as high demand for conventional taxis. The graph showed that occupied taxis were greater than vacant taxis especially during the afternoon peak hour thereby making it difficult to hail a taxi. Uber and GrabCar were constantly available here. GrabCar, however had more vehicles here compared to the cities of Makati and Pasay.

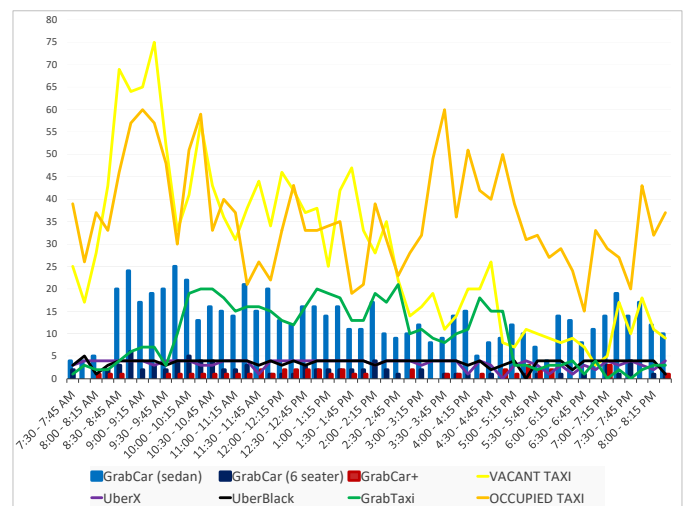


Fig. 10. Availability Check Survey (Vehicle Count) – 32<sup>nd</sup> St. BGC, Taguig City, March 8, 2016

Surge pricing is Uber's way to decrease the demand of ride by increasing the fare. It is also a way to encourage more

drivers during rush hours to balance the demand and supply. Uber Manila still continue the practice of surge pricing in Metro Manila.

During the availability check survey, the surge rate was seen the app and it was recorded throughout the day for UberX and UberBlack. However, the surge rate for GrabCar was not available in their app. The surge rate is subjective to different condition like time and location.

Fig. 11 shows Uber Surge Rate in Glorietta 5, Makati City. The fare surge was experienced throughout the day except for 10:00 am to 12:45 pm.

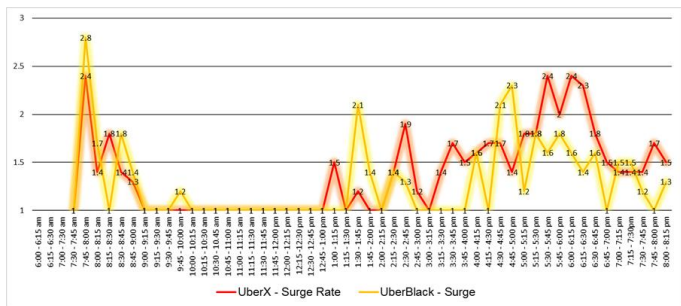


Fig. 11. Uber Surge Rate at Glorietta 5, Makati City, March 4, 2016

Fig. 12 shows that Uber Surge Rate at MOA, Pasay City. The highest surge rate for UberBlack is 2.8x. It was experienced from 7:45 am to 8:00 am on that day.

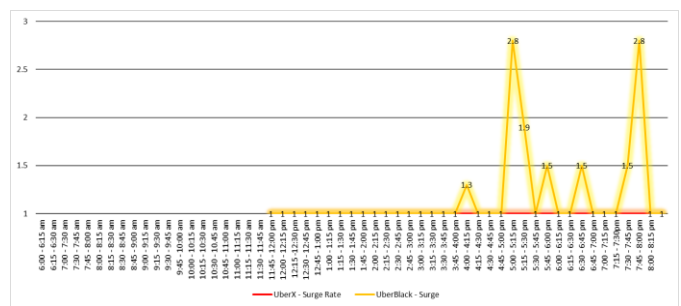


Fig. 12. Uber Surge Rate at MOA, Pasay City, March 5, 2016

Fig. 13 shows the Uber Surge Rate for BGC, Taguig City. During the survey, the highest surge rate is 2.9x from 7:30 pm to 7:45 pm.

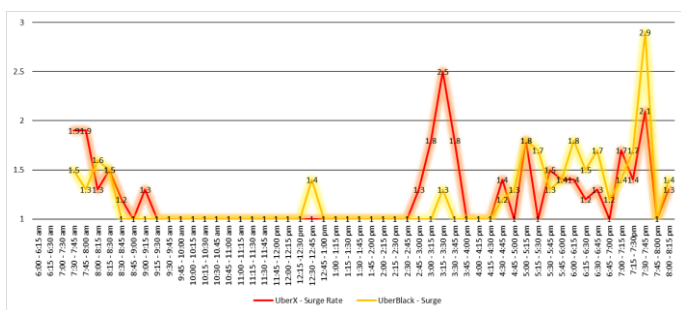


Fig. 13. Uber Surge Rate at 32<sup>nd</sup> St. BGC, Taguig City, March 8, 2016

#### D. Performance Indicator Survey

In Table VIII, 10 routes within Metro Manila were chosen where Uber and GrabCar were allowed. Five (5) cities were selected and routes were categorized as either short, medium or long trips. Three (3) surveyors took the routes simultaneously in order to compare the performance indicators of Uber, GrabCar and conventional taxis. Results from this survey were used for verification of travel diaries.

TABLE VIII. PERFORMANCE INDICATOR SURVEY ROUTES

ROUTE NO.	ROUTE	TRIP CATEGORY (S, M, OR L)
1	Parksquare, Makati – Rockwell, Makati (3.2 kms.)	S
2	Starbucks, Rockwell, Makati – UP Town Center, Q.C. (16 kms.)	L
3	UP Town Center, Q.C. – SM Marikina (6.1 kms.)	M
4	SM Marikina – Shopping Center, UP Diliman (6.1 kms)	M
5	Shopping Center, UP Diliman – UP Technohub (2.8 kms)	S
6	UP Technohub – SM San Lazaro (10.5 kms)	M
7	SM San Lazaro – UST Hospital (1.4 kms)	S
8	UST Hospital – SM Aura, Taguig (15 kms)	M
9	SM Aura, Taguig - Greenbelt 1, Makati (6.4 kms)	M
10	Greenbelt 1, Makati – Parksquare, Makati (1.0 kms)	S

As shown in Table IX, GrabCar got the highest total combined booking time of 93.83 minutes for the 10 trips. Problem in trip rejection was the cause of extended booking time in GrabCar. Drivers of GrabCar have the option to accept or reject the trip whenever it is unfavorable to them based from the requested destination noted by the passenger in the app. Furthermore, GrabCar app is also time consuming sometimes compared to Uber as it requires more details.

Uber on the other hand, only got 9.33 minutes of total booking time. Total waiting time was measured after booking a ride and the time of pick-up for the trips. Uber got the highest total waiting time of 76 minutes, 68 minutes for GrabCar and 61 minutes for conventional taxis. Although the number of Uber operators are greater than GrabCar, the waiting time however was longer because of their option to accept passengers during existing trip.

GrabCar got the highest number of trip rejection with 21 throughout the day, only one (1) for Uber and 11 for conventional taxis.

Conventional taxis got the shortest total travel time of 292 minutes for the 10 trips probably because taxi drivers are more knowledgeable in direction and fastest routes possible. Conventional taxis also got the lowest total passenger fare of 1,405.50 pesos for the ten trips compared to Uber with 1,540.00 and GrabCar with 2,071.00.

TABLE IX. PERFORMANCE INDICATOR SURVEY  
(SUMMARY OF RESULTS – TOTAL FOR TEN TRIPS)

MODE	B. T. (MIN)	W. T. (MIN)	NO. OF T. R.	T.T. (MIN)	T.D. (KM)	P. F.
UBER	9.33	76.00	1.00	328.00	69.57	1,540.00
GRABCAR	93.83	68.60	21.00	303.76	67.20	2,071.00
ORD. TAXI	N.A.	61.00	11.00	292.00	67.90	1,405.50
TOTAL						5,016.50

B.T.-Booking Time, W.T.-Waiting Time, No. of T.R.- No. of Trip Rejection, T.T.-Travel Time, T.D.-Travel Distance, and P.F.-Passenger Fare

Table X presents the captured data during the 1-day performance indicator survey involving 10 same routes consisting of short, medium and long trips using Uber.

While Table XI presents the captured data using GrabCar with the same routes as Uber and Conventional Taxi. Longer booking time, a number of trip rejections, and higher passenger fare were observed in some of the trips.

Lastly, Table XII presents the captured data using a conventional taxi. A number of trip rejections were observed in some of the routes undertaken.

TABLE X. PERFORMANCE INDICATOR SURVEY – FOR UBER

NO.	ROUTE	TRIP CAT. (S, M, OR L)	BOOKING TIME (MIN)	WAITING TIME (MIN)	NO. OF VEHICLE AVAIL	NO. OF TRIP REJECT ION	TRAVEL SPEED (KPH)	TRAVEL TIME (MIN)	TRAVEL DIS. (KM)	FARE	PESO/ KM
1	Parksquare, Makati – Rockwell, Makati (3.2 kms.)	S	0.17	4.00	2.00	0.00	12.68	16.00	3.38	89.00	26.33
2	Starbucks, Rockwell, Makati – UP Town Center, Q.C. (16 kms.)	L	0.17	2.00	1.00	0.00	8.24	91.00	12.50	295.00	23.60
3	UP Town Center, Q.C. – SM Marikina (6.1 kms.)	M	0.50	5.00	1.00	0.00	8.37	45.00	6.28	168.00	26.75
4	SM Marikina – Shopping Center, UP Diliman (6.1 kms)	M	1.00	13.00	4.00	0.00	14.88	20.00	4.96	109.00	21.98
5	Shopping Center, UP Diliman – UP Technohub (2.8 kms)	S	0.17	7.00	2.00	0.00	34.69	11.00	6.36	98.00	15.41
6	UP Technohub – SM San Lazaro (10.5 kms)	M	0.17	8.00	3.00	<b>1.00</b>	11.68	54.00	10.51	207.00	19.70
7	SM San Lazaro – UST Hospital (1.4 kms)	S	1.00	10.00	3.00	0.00	13.39	16.00	3.57	92.00	25.77
8	UST Hospital – SM Aura, Taguig (15 kms)	M	3.00	9.00	4.00	0.00	18.66	48.00	14.93	266.00	17.82
9	SM Aura, Taguig – Greenbelt 1, Makati (6.4 kms)	M	3.00	7.00	4.00	0.00	15.87	20.00	5.29	154.00	29.11
10	Greenbelt 1, Makati – Parksquare, Makati (1.0 kms)	S	0.17	11.00	4.00	0.00	15.34	7.00	1.79	62.00	34.64

TABLE XI. PERFORMANCE INDICATOR SURVEY – FOR GRABCAR

NO.	ROUTE	TRIP CAT. (S, M, OR L)	BOOKING TIME (MIN)	WAITING TIME (MIN)	NO. OF VEHICLE AVAIL	NO. OF TRIP REJECT ION	TRAVEL SPEED (KPH)	TRAVEL TIME (MIN)	TRAVEL DISTAN CE (KM)	FARE	PESO/ KM
1	Parksquare, Makati – Rockwell, Makati (3.2 kms.)	S	0.17	8.63	2.00	0.00	16.00	12.00	3.20	100.00	31.25
2	Starbucks, Rockwell, Makati – UP Town Center, Q.C. – SM Marikina (6.1 kms.)	L	0.08	4.25	5.00	0.00	12.63	76.00	16.00	<b>350.00</b>	21.88
3	UP Town Center, Q.C. – SM Marikina (6.1 kms.)	M	0.05	14.50	1.00	0.00	9.15	40.00	6.10	134.00	21.97
4	SM Marikina – Shopping Center, UP Diliman (6.1 kms)	M	<b>35.08</b>	2.82	7.00	0.00	7.78	37.00	4.80	165.00	34.38
5	Shopping Center, UP Diliman – UP Technohub (2.8 kms)	S	0.08	3.42	1.00	0.00	25.53	6.58	2.80	100.00	35.71
6	UP Technohub – SM San Lazaro (10.5 kms)	M	<b>22.20</b>	8.08	9.00	<b>8.00</b>	12.60	50.00	10.50	<b>226.00</b>	21.52
7	SM San Lazaro – UST Hospital (1.4 kms)	S	<b>18.65</b>	4.17	7.00	<b>4.00</b>	11.70	7.18	1.40	178.00	127.1
8	UST Hospital – SM Aura, Taguig (15 kms)	M	13.30	11.38	11.00	<b>9.00</b>	19.15	47.00	15.00	<b>628.00</b>	41.87
9	SM Aura, Taguig – Greenbelt 1, Makati (6.4 kms)	M	4.03	5.13	12.00	0.00	18.29	21.00	6.40	115.00	17.97
10	Greenbelt 1, Makati – Parksquare, Makati (1.0 kms)	S	0.18	6.22	8.00	0.00	8.57	7.00	1.00	75.00	75.00

TABLE XII. PERFORMANCE INDICATOR SURVEY – FOR  
CONVENTIONAL TAXI

NO.	ROUTE	TRIP CAT. (S, M, OR L)	BOOKING TIME (MIN)	WAITING TIME (MIN)	NO. OF VEHICLE AVAIL	NO. OF TRIP REJECT ION	TRAVEL SPEED (KPH)	TRAVEL TIME (MIN)	TRAVEL DISTAN CE (KM)	FARE	PESO/ KM
1	Parksquare, Makati – Rockwell, Makati (3.2 kms.)	S	N.A.	0.00	4.00	<b>1.00</b>	14.18	11.00	2.60	70.00	26.92
2	Starbucks, Rockwell, Makati – UP Town Center, Q.C. (16 kms.)	L	N.A.	4.00	1.00	0.00	41.74	23.00	16.00	250.00	15.63
3	UP Town Center, Q.C. – SM Marikina (6.1 kms.)	M	N.A.	2.00	1.00	<b>1.00</b>	6.78	54.00	6.10	150.00	24.59
4	SM Marikina – Shopping Center, UP Diliman (6.1 kms)	M	N.A.	0.00	2.00	<b>1.00</b>	11.52	25.00	4.80	110.00	22.92
5	Shopping Center, UP Diliman – UP Technohub (2.8 kms)	S	N.A.	0.00	2.00	<b>1.00</b>	18.00	10.00	3.00	80.00	26.67
6	UP Technohub – SM San Lazaro (10.5 kms)	M	N.A.	0.00	5.00	<b>1.00</b>	12.41	58.00	12.00	225.00	18.75
7	SM San Lazaro – UST Hospital (1.4 kms)	S	N.A.	23.00	2.00	<b>4.00</b>	4.67	18.00	1.40	70.00	50.00
8	Taguig (15 kms)	M	N.A.	15.00	2.00	<b>2.00</b>	16.10	60.00	16.10	260.00	16.15
9	SM Aura, Taguig – Greenbelt 1, Makati (6.4 kms)	M	N.A.	15.00	1.00	0.00	11.76	25.00	4.90	120.00	24.49
10	Parksquare, Makati (1.0 kms)	S	N.A.	2.00	6.00	0.00	7.50	8.00	1.00	70.50	70.50

### E. Sustainable Transport

Based from the results of the study, the researcher found out the reasons on how TNCs like Uber and GrabCar can contribute to sustainable transport.

The reasons on how TNCs like Uber and GrabCar can contribute to sustainable transport are as follows:

1) If it supplements to urban public transit rather than a substitute for it;

Based from the result of the travel diary, riders choose TNCs as alternative mode of transport due to the unavailability of public transport such as LRT and MRT during midnight. Hence, TNCs like Uber and GrabCar can be a substitute to public transit during midnight and on other special holidays and occasions when the ridership is already low. Extended operation of public transit with limited number of passengers is not economically efficient.

2) When ride-sharing principle is applied;

During the survey conducted, it was found out that TNCs like Uber and GrabCar are both not practicing the ride-sharing principle in Metro Manila but performs as a taxi with premium service.

When ride-sharing principle is applied to Uber and GrabCar, it can contribute to sustainable transport. This is through increasing the occupancy rate of the TNC unit which in turn reduces car use that will help improve traffic congestion.

Moreover, Uber will be launching the UberPool which promotes ridesharing.

3) When competition with taxi service benefits the consumers;

The healthy competition between TNCs and traditional taxi will help improve the services of taxi. TNCs will not replace the traditional taxi but the competition will benefit the consumers. It will force the taxi companies to start investing in modern services and upgrading of its fleets which will make it more environmental friendly.

4) By promoting safety;

In a sustainable urban transport, policies in improving safety of passengers is important. TNCs like Uber and GrabCar promotes safety of their passenger through features of their

applications like driver's identification and rating, vehicle details and route tracking.

5) Through the use of Intelligent Transport System (ITS) and Information Communication Technologies (ICT);

It was determined in the study that TNCs like Uber and GrabCar utilized the innovation of Intelligent Transport System (ITS) and Intelligent Communication Technologies (ICT) through online application which helps manage transport demand. Since the location is pre-determined for TNCs, it avoids unnecessary travel and reduce trip distance unlike in taxi where the pick-up point is undetermined.

Hence, the use of Intelligent Transport System (ITS) and Intelligent Communication Technologies (ICT) through the TNC application improves the management of transport demand and supply of passengers.

## VI. CONCLUSIONS

The following conclusions are made based on the findings of this study:

- Uber and other related transportation applications is under the sharing economy, which makes it cheaper versus taxi which is traditional.
- As we revisit the original concept and principle of TNC which is car-sharing we found out that it is the "missing link" being alternative to private cars and it also complements taxis. Some of the impacts of Car-sharing are 1) Reduced vehicle ownership, 2) Reduced vehicle travel, and 3) Other impacts like: Lower emission, Increased transit ridership, Cost Savings, and Greater Mobility. Although, the TNC's here in Metro Manila deviates from the true concept of car-sharing, because most cars were bought brand new instead of existing vehicle for the purpose of becoming a TNC partner, we can still experience the same positive impacts of car-sharing if private car users will shift to using TNC instead.
- Uber and GrabCar does not perform the ridesharing principle. It performs similar to a conventional taxi with premium service that has a predetermined booking. Ridesharing is still existing and this is through android and IOS applications however this is not LTFRB registered. Carpooling on the other hand is still being practiced in some business areas.
- Vehicle rental and private automobiles overlap with the service of TNCs as it performs similar point to point service. The use of private automobiles is the most preferred transport mode due to the poor service that our public transport provides. Motorcycles provide transport for short to long trips and is considered the most affordable mode of transportation.
- TNCs also overlap with taxi services as these both use non-commercial vehicles for public transport. TNCs however provide more convenience and flexibility than taxi.

- The travel diary survey results obtained from 13 respondents in a period of 30 days greatly helped the researcher for this study. The results are as follows:

Travel Speed: Uber was the fastest with 21.32 kilometers per hour (kph) average travel speed compared to GrabCar that registered at 12.33 kilometers per hour (kph) and conventional taxis with 12.95 kilometers per hour (kph). The travel speed values for GrabCar and Conventional Taxis are close and statistically insignificant. It should be noted that Travel Speed can be subjective to the driver, but in the case of this survey, multiple responses were gathered from different drivers;

Reliability: It is the number of available vehicles at the requested pick up point. GrabCar has the highest value of 7.6, while Uber has 2.76 and Conventional Taxis with 2.68. The values of availability for Uber and Conventional taxi are close and statistically insignificant.

Passenger Expense: Uber was found to be the cheapest among the three (3) transport modes with a value of PhP 20.72 per kilometer. Conventional taxi rate is at PhP 28.49 per kilometer and GrabCar with PhP 32.07 per kilometer. Tip and unreturned change were included in the taxi and GrabCar fares because of the cash payment mode, which makes the passenger fare costlier. Furthermore, GrabCar and Conventional Taxi values for passenger expense are statistically insignificant.

Quality of Service: Uber has the highest rating for quality of service with 4.82, followed by GrabCar with 4.71. Conventional taxi has the lowest rating among the three (3) modes with a value of 3.94. Uber and GrabCar values are close and statistically insignificant. Furthermore, problems with the taxi service resulted to a lower rating given by the passengers.

Based from the results of the travel diary submitted, Uber is faster than GrabCar and Conventional Taxi. In terms of reliability or the number of available vehicles at a specified pick up point, GrabCar dominates Uber and Conventional Taxi. Uber is said to be cheaper than conventional taxis. However, GrabCar was costlier among the three (3) transport modes. Lastly, Uber and GrabCar has better quality of service compared to conventional taxis.

- The reasons on how TNCs like Uber and GrabCar can contribute to sustainable transport are as follows:
  - 1) If it supplements to urban public transit rather than a substitute for it;
  - 2) When ride-sharing principle is applied;
  - 3) When competition with taxi service benefits the consumers;
  - 4) By promoting safety;

- 5) Through the use of Intelligent Transport System (ITS) and Information Communication Technologies (ICT);

## VII. RECOMMENDATIONS

The following recommendations are made towards improving transport services provided by TNCs as well as in aid of regulations and policy making for these modes:

1. TNCs like Uber & GrabCar which are now part of our public transportation should find ways to minimize the number of trip request rejections especially for GrabCar. TNCs should give sanctions to picky drivers.
2. Number of vehicles per TNC operator should be limited to give opportunities for other private car owners to rideshare through TNC;
3. Further studies on the maximum age of vehicle to be used for TNC should be considered. Continuous purchasing of new vehicles for TNC can contribute to traffic congestion;
4. In order to ensure sustainability and advantages over conventional taxis, TNC's like Uber and GrabCar should maintain a strict screening of skilled drivers to ensure the passengers' safety and convenience. TNC's should also duly comply with the policies implemented by DOTC and LTFRB.

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