

Impact of the COVID-19 Pandemic on the Operations of Transportation Network Vehicle Services (TNVS) in Metro Manila.

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Abstract: The Philippines' transportation sector has been greatly affected by the COVID-19 Pandemic wherein new regulations that have been implemented to prevent the further transmission of the virus. Such regulations implemented are limited seating capacity, requiring the passengers to wear face masks and face shields, and also practice of social distancing inside the vehicle. The focus of the study is the impact of the COVID-19 pandemic to the operations of Transportation Network Vehicle Services (TNVS) by determining the changes in the perception of users and drivers towards TNVS. Five factors that would influence the attractiveness of users and the satisfaction of drivers were considered to which, the definition/scope of the variables vary according to the population being considered. These factors were then incorporated into a survey that was deployed on online. The gathered data from the survey was analyzed with statistical tests to determine change in the responses in between periods.

Keywords: COVID-19 Pandemic, Transportation Network Vehicle Services (TNVS)

1 INTRODUCTION

Transportation Network Vehicle Service (TNVS) is usually affiliated with taxis since they act as a competition for taxis in the transportation industry due to their similarities. Taxis were deemed as an alternative for public transportation and TNVS also served the same purpose. There are a lot of problems raised by taxi users and these concerns are the attitude of taxi drivers towards passengers, over-pricing, and rejection by the driver etc. This is one reason TNVS is popular in the transportation industry as they can also resolve the concerns with taxis. In addition, TNVS are bound to give better security and better quality of service since they are being monitored by their respective TNC (Depusoy, et.al. 2018).

Looking at what sets TNVS apart from other modes of public transportation are its safety features. Considering the unfortunate events that have occurred from taxi trips and other modes of public transportation, Filipino passengers have been more attracted to TNVS due to the efficient tracker offered during trips (Bahjin et. al, 2015, p. 31). Another study has stated that

the advantages of ride-hailing services are the ease of booking a ride, users will be able to see the availability of TNVS drivers around them, and the ability to accept and cancel trips (Nguyen-Phuoc et.al, 2020).

Since the start of COVID-19 pandemic in early-2020, its impact on the travel behavior of the people and the transportation sector of the country as a whole resulted in changes to better fit the new normal. Consequently, since the beginning of the enhanced community quarantine (ECQ), the operations of public mass transit, public utility vehicles (PUVs), and transportation network vehicle systems (TNVS) have been halted to aid in mitigating the spread of the virus. Subsequently, to resume the operations of rail-based transits, health screening of passengers, social distancing of at least 1 meter, and implementation of block systems were required in every station and platform (Mercado, N., 2020). Although these conditions may have contributed to controlling the spread of the virus, it also caused an imbalance in the travel demand and availability of public transportation. Additionally, these changes in the operations of rail-based transit also caused longer travel times which also contributed to inconvenience for commuters.

In the resumption of land-based transit systems, Grab implemented safety precautions such as requiring the drivers and passengers to use personal protective equipment (PPE), limiting vehicle capacity, placement of barriers, and regular sanitation (Grab, n.d.). In the case of Angkas, in order to comply with the newly implemented policies to minimize interactions, barriers were placed in between the rider and the passenger, passengers must bring their own helmets that are compliant with necessary road safety features, and only cashless transactions were allowed (Lastra, 2020).

With the increase of work-from-home and online-learning activities, the overall demand for transportation decreased (De Vos, 2020) and most significantly affected high-income areas (Wilbur et. al, 2020). In terms of the ridership of TNVS, considering the case of the Philippines where a significant percentage of the population have a lower to middle-income economy, public transportation is still essential.

Due to the pandemic, TNVS proved to be a viable option to help alleviate the demand for transportation while also observing social distancing policies. Furthermore, considering the length of the pandemic as of when this journal was conducted, there were a limited number of studies regarding TNVS in the Philippines and how it has been impacted by COVID-19 pandemic. As the duration of the pandemic and the reversion of TNVS operating conditions to normal is unknown, it is important to determine the changes in the factors users and drivers consider between the two-time frames.

The aim of this study is to determine the impact of the pandemic on the operations of TNVS around Metro Manila given the limited number of studies at the time. This can be achieved by determining the following: the factors affecting user attraction and driver satisfaction towards TNVS, their perception during the two time periods, and the changes in perception. Subsequently, determining the change in the perception of the said population will be able to explain how the TNVS operations are being affected by the pandemic.

The next section talks about the factors that influence the perception of users and drivers towards TNVS and section 3 talks about the framework of the study. For section 4, it contains the methodology, and in section 5, the researchers will be presenting the results of the survey and so as the analysis of the results. Lastly, the last section will conclude the whole study.

2 LITERATURE REVIEW

To accomplish the goal of this study, the researchers have studied the factors that are affecting the patronage to TNVS of users and drivers during the two time periods: pre- and mid-pandemic. These factors will be the basis of the changes in perception of users and drivers towards TNVS. Furthermore, these factors will differ depending on the population since users and drivers perceive TNVS differently.

2.1 Influencing Factors for Users' Attraction towards TNVS

Ride-hailing and TNVS are often seen as alternatives for taxis in terms of travel modes. The ease of payment, the ease to book, the lower prices, and the shorter waiting time are usually stated by individuals as the reason they avail ride-hailing or TNVS compared to taxis (Bhat and Lavieri, 2019). Additionally, another benefit of TNVS is that it provides shorter travel time for users, relieves them from finding parking spots and deciding what route to take. In addition, the satisfaction of passengers and drivers are heavily influenced by the following: punctuality, reliability, safety, and comfortability. Another study has stated that the top four (4) reasons commuters avail the TNVS services are convenience, safety, improved reliability, and shorter waiting time (Napalang & Regidor, 2017). Furthermore, the adoption of ride-hailing services and TNVS will heavily depend on several factors namely the individual perception of convenience and reliability, one's location choice, and lastly is the availability of travel alternatives (Alemi et.al, 2018). Passenger's willingness to adopt these services will be influenced by one's perception and the characteristics of the user alone.

2.2 Influencing Factors for Drivers' Satisfaction when operating under TNVS

Examining the growth of ridesharing or ride-hailing services, it was seen that it was correlated with economic benefits, specifically with monetary gains that are afforded to the drivers (Limpin & Sison, 2018). In the Philippines, most Filipino drivers engage in ridesharing services due to the financial benefits they can receive from the services alone (Limpin, 2018). According to Bahjin et. al (2015), those who signed up for TNCs revealed that before partnering with the company, most were once TNVS passengers and that it was what had prompted those to explore and dig deeper into the TNC. Consequently, it was a positive experience from the TNVS and ride-hailing services which gave the drivers a positive outlook for the industry.

Ride-hailing constitutes one of the best examples of a sharing economy, transport network companies do not really hire workers, each driver is given the opportunity to decide when they would like to drive and where to use his or her own vehicle (Fielbaum & Tirachini, 2020). The flexibility of deciding when to work has a positive impact on the attitude of the drivers towards their job for they can manage their working time and that they are able to earn twice compared to working in non-flexible hours (Chen et. al, 2019). On the other hand, these are the attributes that contributed to the decisions of drivers to operate under this industry: financial benefits, flexibility in work hours, they can use their own vehicles, the ease of payment, and to serve as help to public transit commuters.

3 FRAMEWORK OF THE STUDY

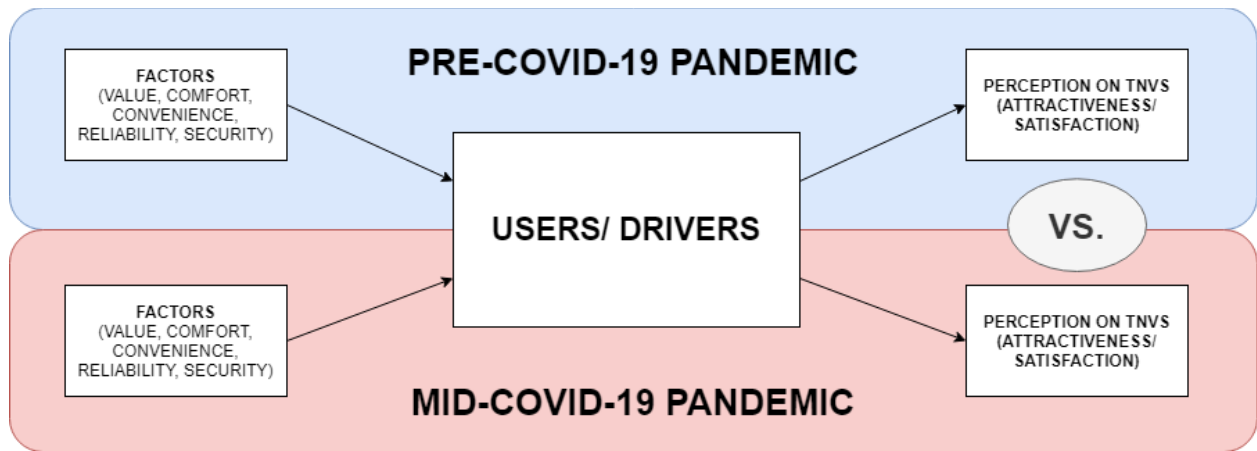


Figure 1 Conceptual Framework

Figure 3.1 shows the contributing factors to a user or driver's attractiveness and satisfaction with TNVS. Considering the framework, five main factors were identified namely value, comfort, convenience, reliability, and security. However, these factors are perceived by users and drivers. This study accounts the effect of the COVID-19 pandemic on the decisions of users and drivers to avail or operate under TNVS.

The contributing factors that were stated above were categorized into five variables: value, comfort, convenience, reliability, and security. In the user's perspective, value will include concerns about the overall incurred cost such as the passenger fare, how reasonable the fare is and the vouchers provided by the TNVS; comfort will cover the factors that will be affecting the satisfaction of users such as the vehicle quality, vehicle ambiance, and driver performance; convenience, on the other hand, is associated with the ease of using the mobile application and the variety of locations that can be set as pick-up and drop-off points; reliability is defined as the effectivity of the mobile application which covers booking time, waiting time, and the ease of getting a ride; lastly, security will include the security measures that are being observed by the TNVS to ensure the protection of the user.

The contributing factors for drivers were also categorized into five variables: value, comfort, convenience, reliability, and security. However, these variables will be defined differently since users and drivers have different perspectives. In the driver's perspective, value will include concerns about the benefits provided such as the driver income and incentives offered by the TNC; comfort will cover the factors that will be affecting the contentment of drivers such as the vehicle quality, availability of the driver's needs, and the attitude of the passenger towards the vehicle and driver; convenience will include the flexibility in work hours and the location of pick-up and drop-off points; reliability covers the effectivity of the application in providing passengers and faster routes; lastly, security will include the security measures being observed that will ensure the protection of the drivers.

4 METHODOLOGY

4.1 Survey Test

The target population of the conducted survey were users and drivers of TNVS. To determine the required number of respondents, the researchers used a ninety-nine percent (99%) confidence level to obtain a larger sample size. Subsequently, a reliability of ten percent (10%) will be used and a fifty percent (50%) response distribution to get the greatest number of sample sizes. The researchers have calculated a minimum number of 166 respondents.

An online survey was conducted from the last week of February, until the second week of May using Google Forms and was disseminated through various social media platforms. The survey contains questions that helped in determining the degree of weight of each factor. Moreover, the survey was divided into three parts: travel information, opinion survey, and lastly, personal information. For the travel information, questions about the detailed trip characteristics of the passenger and the driver were included in this part such as frequency of trip, trip purpose, usual time of departure, usual origin, usual destination, usual travel waiting time, and usual travel time. For the opinion survey, a 4-point Likert-scale was used with “Strongly Agree” as the 1st point and “Strongly Disagree” as the 4th point. For the last part, which is personal information, respondents were asked about their social demographics like age, civil status, income, educational attainment, gender, and number of vehicles.

4.2 Test for Normality

A test for normality was conducted to determine if there were significant differences between the perception of users and drivers towards TNVS during the pre-COVID-19 and mid-COVID-19 periods. As such, to determine the distribution of the data, the Kolmogorov Smirnov test and Shapiro-Wilk test were conducted to determine if the data follows a normal distribution. To follow, SPSS software was utilized to perform both tests wherein result with significance greater than 0.05 (>0.05) depict a normal distribution. Subsequently, Independent sample t-test is to be conducted for normally distributed data, otherwise, Mann Whitney U test is to be conducted.

4.2.1 Independent samples t-test

Independent Samples t-test was to be used as a parametric test to determine if there are any significant differences between the responses with regards independent variables that were considered and these are the 5 factors: value, comfort, convenience, reliability, and security. Subsequently, Independent Samples t-test aims to determine if there is a difference in the means between independent groups, with respect to the satisfaction of the TNVS drivers and the attractiveness of TNVS to the users. As such, the variance ratio, F, is defined as:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \quad (1)$$

with:

$$S_p = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}} \quad (2)$$

where,

\bar{x}_1 : Mean of the first sample

\bar{x}_2 : Mean of the second sample

n_1 : Number of observations for the first samples

n_2 : Number of observations for the first samples

s_1 : Standard Deviation of the first sample

s_2 : Standard Deviation of second sample

s_p : Pooled Standard Deviation

4.2.2 Mann Whitney U Test

The Mann-Whitney U test is to be used to compare differences between two independent samples considering that the distribution of the data is not normal. Additionally, this is the nonparametric equivalent for independent sample t-test. Statistical software (specifically SPSS) was to be used in doing the said test.

$$U = \text{Sum of Ranks} - N * \left(\frac{N+1}{2}\right) \quad (3)$$

where,

N : the number of observations

U : the test statistic.

5 RESULTS AND DISCUSSION

5.1 Descriptive Statistics

From the survey results, a total of 2 independent groups for each population were considered and each group were labelled as *Pre* and *Mid* for each user and driver population respectively. There are a total of 584 pre-COVID-19 users and 337 mid-COVID-19 users while there are 215 pre-COVID-19 drivers and 205 mid-COVID-19. For the users' population, the majority of the respondents were male which is composed of seventy-nine percent (79%) of the total population while the female respondents were made up of the remaining twenty-one percent (21%) of the users' population. In addition, the predominant age group for this population was between 18-24 years old and this takes seventy-nine percent (79%) of the total population. And for the occupational status, most respondents were students, and this comprises fifty-eight percent (58%) of the users' population. For the drivers, the ratio between female and male respondents was twenty-six percent (26%) to seventy-four percent (74%). In terms of the age group of the population group, the majority are aged between 25-39 years old which comprises forty-seven percent (47%) of the total population. In addition, most of the drivers only operate part time (sixty-two percent (62%)) of the total population, while the remaining thirty-eight percent (38%) are operating full time.

As stated earlier, the distribution of the data must be determined before doing further statistical tests since there is an appropriate test for each type of distribution (normal and non-normal). The Kolmogorov-Smirnov test was the test of normality used in order to determine the distribution of the data.

5.2 Test for normality

Table 1 Test for Normality Results for Users

GROUP		Tests of Normality					
		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
VALUE	PRE	.155	584	.000	.955	584	.000
	MID	.163	337	.000	.956	337	.000
COMFORT	PRE	.189	584	.000	.817	584	.000
	MID	.207	337	.000	.827	337	.000
CONVENIENCE	PRE	.166	584	.000	.951	584	.000
	MID	.168	337	.000	.950	337	.000
RELIABILITY	PRE	.168	584	.000	.966	584	.000
	MID	.181	337	.000	.959	337	.000
SECURITY	PRE	.140	584	.000	.966	584	.000
	MID	.160	337	.000	.956	337	.000

Table 2 Test for Normality Results for Drivers

GROUP		Tests of Normality					
		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
VALUE	PRE	.223	215	.000	.919	215	.000
	MID	.204	205	.000	.944	205	.000
COMFORT	PRE	.222	215	.000	.899	215	.000
	MID	.199	205	.000	.932	205	.000
CONVENIENCE	PRE	.240	215	.000	.898	215	.000
	MID	.254	205	.000	.887	205	.000
RELIABILITY	PRE	.264	215	.000	.898	215	.000
	MID	.264	205	.000	.911	205	.000
SECURITY	PRE	.221	215	.000	.923	215	.000
	MID	.225	205	.000	.908	205	.000

Tables 5.1 and 5.2 display all of the significance values of each variable, and it can be seen that all are below the p value 0.05 (0.000 to be exact) which implies that all of the distribution of each data considering the two groups are not normal. With this, non-parametric tests are to be applied in determining the differences between two independent groups (Pre and Mid) for each variable considering the population. The non-parametric test to be done is the Mann-Whitney U test.

5.3 Determining the difference of means between independent groups

Table 3 Mean rank results for Users

	GROUP	N	Mean Rank	Sum of Ranks
VALUE	PRE	584	459.13	268133.00
	MID	337	464.24	156448.00
	Total	921		
COMFORT	PRE	584	469.29	274063.00
	MID	337	446.64	150518.00
	Total	921		
CONVENIENCE	PRE	584	456.73	266727.50
	MID	337	468.41	157853.50
	Total	921		
RELIABILITY	PRE	584	459.64	268427.50
	MID	337	463.36	156153.50
	Total	921		
SECURITY	PRE	584	464.92	271512.50
	MID	337	454.21	153068.50
	Total	921		

Considering the mean rank of each variable of the users population for both time periods, it can be seen that they are not far off from each other, especially the ones from comfort. The mean rank value for the variable comfort is 469.29 for the pre-pandemic period and 446.64 for the mid-pandemic period (see table 5.3). The difference in the mean rank score implies that there is a change in the trend of the responses in between periods, but not to an extent where it is considered significant. On the other hand, reliability had the least/ minimal difference between the mean ranks with regards to both the independent groups.

Table 4 Significance level between periods for Users

	VALUE	COMFORT	CONVENIENCE	RELIABILITY	SECURITY
Mann-Whitney U	97313.0	93565.0	95907.5	97607.5	96115.5
Wilcoxon W	268133.0	150518.0	266727.5	268427.5	153068.5
Z	-.285	-1.309	-.657	-.210	-.597
Asymp. Sig. (2-tailed)	.776	.191	.511	.834	.551

As seen in table 5.4, the significance value yielded by all of the variables are greater than the p-value of 0.05, implying that the null hypothesis, stating that the distribution of the data between the independent groups are the same, are accepted. With the 2 sets of responses varying in the period that was answered, there is no significant change between the said responses for all the variables. Comfort yielded the greatest difference in the mean rank and resulted in a least significant value of 0.191 but it is still greater than 0.05.

Considering the finding that there has been no significant difference between the responses between groups, it can be interpreted that the perception of users towards their attraction to TNVS did not change. For the aspect of value for users; the price range, the promo-codes available and its validity, and the overall expenses incurred ever since before the pandemic may not have changed or has minimal change even during the pandemic. With the current set-up of TNVS brought by the pandemic (Social Distancing, Cashless transaction, additional requirements), this did not affect the perception of users with respect to their comfortability with the said service. This may be interpreted that users may not have minded

the new changes, in terms of the set-up and restrictions, considering that there has been no significant difference in the responses. But looking at the fact that comfort has the least significance value and has the highest greatest difference in mean rank scores, this may imply that there has been a minimal change, but it is not really significant to the point that it will affect their attraction to TNVS. This may be the case due to a possibility that users are more inclined towards being able to reach their destination thru TNVS with ease, to which they do not give much attention to the vehicle's interior condition and their comfortability. On the other hand, this may also be caused by the current set-up being able to provide the same level of comfort for passengers similar as to the previous period.

Table 5 Mean rank results for Users

	GROUP	N	Mean Rank	Sum of Ranks
VALUE	PRE	215	208.24	44772.00
	POST	205	212.87	43638.00
	Total	420		
COMFORT	PRE	215	211.06	45378.50
	POST	205	209.91	43031.50
	Total	420		
CONVENIENCE	PRE	215	210.99	45363.00
	POST	205	209.99	43047.00
	Total	420		
RELIABILITY	PRE	215	210.50	45258.50
	POST	205	210.50	43151.50
	Total	420		
SECURITY	PRE	215	210.20	45193.00
	POST	205	210.81	43217.00
	Total	420		

The mean ranks between the pre and post groups for each variable are relatively near to one another. Reliability yielded the same value for the mean ranks which implies that there is completely no difference between the distribution of the data for the independent groups of that variable while value, had the greatest difference between the mean ranks for each independent group with 208.24 for the pre pandemic group and 212.87 for the mid pandemic group (see table 5.5).

Table 6 Significance level between periods for Drivers

	VALUE	COMFORT	CONVENIENCE	RELIABILITY	SECURITY
Mann-Whitney U	21552.000	21916.500	21932.000	22036.500	21973.000
Wilcoxon W	44772.000	43031.500	43047.000	43151.500	45193.000
Z	-.404	-.100	-.088	-.001	-.054
Asymp. Sig. (2-tailed)	.687	.920	.930	.999	.957

As such, table 5.6 illustrates the results from the non-parametric test Mann-Whitney U and their corresponding significance values; in which none had a value of less than 0.05. The null hypothesis pertaining that there is no significant difference between the distribution of the responses between independent groups is accepted. Looking at the significance values, the value yielded a score of 0.687, making it the one having the nearest one to 0.05, yet still greater than the said value.

For the drivers' group, no significant change is seen in the responses between pre and mid pandemic groups. In terms of value, the rate being observed by TNVS, their incentives and income agreement, and pricing may not have been affected by the pandemic, implying that there has been no changes or only minimal changes, but it did not become as significant that would affect the drivers satisfaction. In terms of their comfort during operations, this was not impacted by the pandemic despite the additional requirements and the restrictions needed to be observed. This may be brought by the adjustments done with respect to the situation which ensured the comfort of the driver, making their level of comfort similar to the one before the pandemic. Such adjustments made were the installation of the acrylic barriers for 4-wheeled TNVS, requiring the users to have the proper PPE, and also requiring the passengers to bring their own helmet (for motorcycle-based TNVS). This may have caused no significant difference between the two periods in terms of comfort. Subsequently, it may also be considered that their comfort may not have been affected by the situation, may be due to the fact that they are more inclined to the operation proper and the performance of the application. Drivers may focus more on finding passengers and on completing trips rather than their own comfort.

6 CONCLUSION AND RECOMMENDATION

The researchers aimed to determine the impact of COVID-19 on the operations of TNVS in Metro Manila. As such, to determine the impact on the operations, the researchers have consolidated factors affecting the perceptions of users and drivers into five (5): value, comfort, convenience, reliability, and security. However, the stated factors were defined differently for the users and drivers. Consequently, those factors were used in the design of the survey questionnaires which were subdivided into three groups: travel/operation characteristics, opinion survey, and sociodemographic. The survey questionnaires were distributed in different social media platforms from the last week of February to the second week of May.

The data from the survey were used in two statistical tests namely, the independent sample t-test and the Mann-Whitney U test. By doing this, the researchers were able to determine the ranking of the variables and were able to determine the differences between the two time periods. Moreover, the results have shown that there were no significant differences in the perception of users and drivers towards TNVS when the pandemic started. This indicates that the TNVS operations around Metro Manila were not affected by the pandemic.

For the improvement of the data to be handled if this study is to be pursued, the researchers recommend increasing the number of statements per variable or factor. This may further help in the analysis of the normality of the data and also in the difference of the means between the independent groups. In addition, other statistical testing may also be explored in order to further determine the impact of the COVID-19 pandemic towards the operations of TNVS in Metro Manila. Furthermore, additional variables may also be considered in the future for further analysis of the impact to the said service.

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