Characterizing Perceptions on Factors Associated with Cycling Behavior in the "New Normal"

Roland Gabriel R. Barcelona, Vinn Austin Hermoso, Samuel Francis D. Mendoza, and Patrick Sean J. Tejada
De La Salle University Integrated School, Manila

Dr. Krister Ian Daniel Z. Roquel, *Research Adviser*
De La Salle University Integrated School, Manila

Abstract: The COVID-19 pandemic hindered transport systems globally. Its transmission is quick due to the dense living condition in metropolises, and mass transit systems soon became a hotspot for contracting the virus. As a result, individualized forms of transport became favorable. The study investigated other forms of individualized transport that hinders the spread of the virus and deters increasing the patronage for private cars. It also seeks to aid in the development of sustainable transport policies in Metro Manila. Accomplishing this required the perceptions of Metro Manila travelers on bicycling, their socio-demographic characteristics, and trip behavior. The data was gathered through an online survey, which were then analyzed and modeled using the descriptive statistics functions of MS Excel to determine which parameters motivate or demotivate travelers from using a bicycle. Results of the survey led to the conclusion that the cyclist's security is a significant motivator and demotivator, and unlike its motivator counterpart, cost does not necessarily demotivate travelers from bicycling, but it is also advised to proceed with caution when interpreting the results for the cost motivator since these may also indicate a demotivation for private car use instead of primarily a motivation to use a bicycle for travel. These results were also disaggregated by trip length. It was found that long trip motivators generally held higher significance but this trend is not followed for both short and long trip demotivators which makes it seem that travelers are more easily demotivated to cycle.

Key Words: bicycle; active transport; barriers; opportunities; Metro Manila

1. INTRODUCTION

The COVID-19 pandemic brought upon a challenging hurdle for transportation around the world. Quarantine has been implemented, limiting public transportation operations because of the contact between people (Yoo et al., 2020). Higher capacities of mass transit do not correlate with an increase in volume inside the spaces, since high density of commuters in a space decreases the effectiveness of social distancing (Evans & Wener, 2007). However, using private vehicles is also not ideal. To compare, influenza, which has a similar transmission, is estimated to have a higher risk in a car as opposed to air travel with one infected person in the plane (L.D. Knibbs, L. Morawska, S.C. Bel, 2012).

Citizens who regularly travel have begun to use active transport as an alternative for the lack of public transportation due to its one-person capacity and compliance with existing quarantine protocols (Cruz & Ives, 2020). Active transport provides essential mobility, physical fitness, and enjoyment (Litman, 2016). Lastly, the decrease of private vehicle use and increased physical activity may result in a reduced risk of diabetes, depression, and dementia in the general population (Woodcock et al., 2010).

The main objective of this research is to investigate the perceptions of Metro-Manila travelers toward bicycling as an alternative. Specifically, this study analyzed a few successful programs and to determine how to implement these in the local setting best. Determining these will aid the development of bicycling policies for the country.

The following section discusses the methodology. Section 3 covers the data analysis, while Section 4 concludes the study.

2. METHODOLOGY

2.1 Conceptual Framework

Contributing factors to implementation of bicycle policies were gathered from literature. The hypotheses are then formulated from the identified factors, which are evaluated through data gathering. An online survey with questions on both the motivators and demotivators for bicycling measured the perceptions of the respondents toward these factors. Socio-demographic characteristics of the respondents were also gathered. Measures of central tendency were used to compare relative significance among the factors. Finally, disaggregated data were analyzed in a similarly.

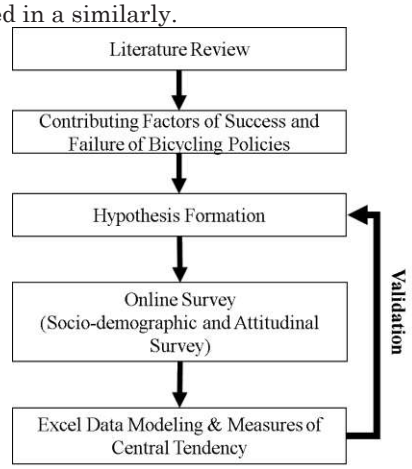

Figure 1. Conceptual framework

2.3 Materials and Procedure

On Appendix A, 233 samples were gathered using an online survey conducted using Google Forms from October 2020 to January 2021. Perceptions were quantified as the respondents' level of agreement with statements of the different factors on Table 1.

Table 1. Motivators and barriers for cycling

VARIABLE	BICYCLING MOTIVATORS	BICYCLING BARRIERS	ASSIGNED VALUES
Comfort and Convenience	There are establishments along the bicycle lanes	The frequency of extreme weather	Very likely (1) – Very unlikely (4)

Qualitative variables such as sex and educational attainment were assigned either 1 (Yes) or 0 (No) values. On the other hand, values of categorical class were used for scalar variables like travel frequency, while age utilized the actual values. Lastly, a Likert Scale from 1 to 4 (very likely and very unlikely, respectively) measured their perceptions. These numbers were assigned values 2, -1, 1, and 2, respectively.

3. RESULTS AND DISCUSSION

Demographic, Trip Conditions and Situations, and Bicycling Trip Preferences of Metro Manila Travelers

The percentage of sexes in Table 2 show similar results from the 2020 Labor Force Survey of the Philippine Statistics Authority. Next, respondent's age ranges from 22 to 54 years, the majority being young adults, employed, single, earn on average Php 29,206.01/month (est. 1 USD = Php 48.44) which reflects the high unemployment proportion, and all have finished compulsory education.

Table 2. Socio-demographic traits and travel behavior (general and by bicycle)

VARIABLES	PARAMETERS	COUNT(%)	MEAN (S.D.)
Sex	Male Female	105(45.06%) 128(54.94%)	-
Age (years)	Exact value	-	29.3 (10.43)
Marital Status	Single Married Annulled Widow	164(70.39%) 66(28.33%) 1(0.43%) 2(0.86%)	-
Educational Attainment	No formal education Elementary diploma High School diploma College degree Masteral or higher	0(0%) 0(0%) 89(32.8%) 113(48.5%) 31(13.3%)	-
Employment Status	Employed Unemployed	122(52.36%) 111(47.64%)	-
Monthly Income (Php)	Less than 10,000 10,000 –25,000 25,000 –45,000 45,000 –70,000 70, 000 –100,000 More than 100,000	92(39.5%) 43(18.5%) 48(20.6%) 21(9.0%) 13(5.6%) 16(6.9%)	29,206.01 (29,215.65)
Trip Purpose	Work Supermarket Market Others	89(40%) 72(32%) 29(13%) 35(15%)	-
Travel Frequency (days/month)	< 1 4 – 8 12 – 16 20 – 24 Everyday	40(17%) 85(37%) 23(10%) 52(22%) 33(14%)	-
Transport Mode	Walk Bicycle Mass Transit Rideshare Carpool Private Car	18(8%) 36(16%) 34(15%) 10(4%) 10(4%) 122(53%)	-
Travel Duration (minutes)	< 15 15 – 30 30 – 60 60 – 120 > 120	49(21%) 84(36%) 55(24%) 34(14%) 11(5%)	39.11 (31.76)
Bicycle Ownership	Yes No	134(58%) 99(42%)	-
Travel Frequency by Bicycle (days/month)	Never < 1 4 – 8 12 – 16 20 – 24 Everyday	124(53.22%) 32(13.73%) 37(15.88%) 19(8.15%) 9(3.86%) 12(5.15%)	4.56 (8.14)
Travel Duration on Bicycle (minutes)	< 5 5 – 15 15 – 30 30 – 60 > 60	4(3.67%) 16(14.68%) 33(30.28%) 29(26.61%) 27(24.77%)	35.20 (19.03)

Most travel for work and supermarket, implying these are prioritized trips as seen on table 2. On the same table, majority report traveling for at most 4 to 8 days a month, and the disparity between private car users and the other modes (n=108) depicts people's fear of the virus when using mass transit. Lastly, bicycle users are slightly greater than mass transit users, implying an increase in bicycling activity.

Figure 2 presents that Metro Manila travelers usually depart from their homes at 8:00 AM and return at 5:00 PM, and most trips, both on and off the bicycle, last for 15 to 30 minutes as seen on Table 2. However, the higher responses for longer durations present the city's underdeveloped bicycling infrastructure. Furthermore, the high amount of long duration trips is likely a result of peak hours, especially since mass transit currently operate at limited capacities leading to increased private car usage (Abad, 2020).

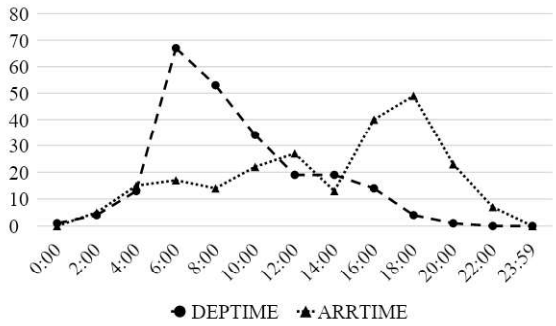

Figure 2. Usual departure and arrival time

Approximately 21% and 49% of bicycle owners have never or sparingly use their bicycles for travel, respectively as presented on Table 3, but the development of the bicycling infrastructure may increase these proportions (Cameña & Castro, 2016; Rissel et al., 2015).To add, Table 4 presents that respondents prefer: flexible pavement, leveled roads, and free-flowing traffic, but most built roads in Metro Manila are constructed with rigid pavement, have steady traffic, and are level. Thus, the problems lie with the current pavement type and traffic situation.

Table 3. Number of bicycle owners by travel frequency

PARAMETER (DAYS/MONTH)	COUNT(%)
Never	28(20.90%)
< 1	29(21.64%)
4 – 8	37(27.61%)
12 – 16	19(14.18%)
20 – 24	9(6.72%)
Everyday	12(8.96%)

Table 4. Bicycling preference of the respondents

VARIABLE	PARAMETER	CURRENT COUNT (%)	PREFERRED COUNT (%)
PAVEMENT TYPE	Rigid	57 (52.30)	58 (24.89)
	Flexible	42 (38.53)	163 (69.96)
	Unpaved	10 (9.170)	12 (5.150)
TERRAIN	Level	77 (70.64)	199 (85.41)
	Rolling	10 (9.170)	10 (4.290)
	Mountainous	22 (20.18)	24 (10.30)
TRAFFIC SITUATION	Free-flowing	32 (29.36)	188 (81.39)
	Steady	47 (43.12)	30 (12.99)
	Congested	30 (27.52)	13 (5.630)

3,2 An Overview on the Average Traveler's Perceptions on Bicycling

On Table 5, COST motivator parameters for an increase in fuel costs or parking fees likely motivates travelers to use a bicycle while the availability of cheaper bikes weakly do so. However, because 53% regularly use private cars, this may also be viewed as a demotivation for private car use rather than solely a motivator for bicycling. Equipping lanes with streetlamps and having a large cycling community shows promise for increasing ridership. However, SCRT presents the presence of traffic enforcement as a weak motivator. This is likely due to fear of encountering corrupt enforcers who accept incentives to drop a motorist's violations, a practice observed called 'kotong'. Finally, Figure 3 further proves the significance of security when traveling by bicycle as it is the most significant motivator.

Table 5. Summary of cycling motivators

VARIABLES (CODE)	PARAMETERS	MEAN(S.D.)
Cost (COST)	Vehicle fuel costs are increasing	1.03 (1.30)
	Vehicle parking fees are increasing	0.76 (1.39)
	Locally manufactured bicycles are promoted	0.34 (1.52)
Security (SCRT)	Installation of streetlamps along the bicycling lanes	1.26 (1.13)
	Seeing other bicyclists use the bicycling lanes	1.15 (1.16)
	Traffic enforcement is present	0.56 (1.44)
Safety (SFTY)	Bicycle repair stations or air stations are present along	0.41 (1.53)

	the bicycling lanes	
	Use of helmets and compliance w/ safety policies is strictly enforced	0.47 (1.58)
	Bicycle safety accessories are easily accessible for purchase	1.18 (1.13)
Information (INFO)	Bicycling lanes are clearly marked and separated from motor vehicle lanes	0.42 (1.67)
	Development and improvement of bicycling facilities are being covered by news reports	0.60 (1.47)
	Awareness campaigns on bicycling laws are promoted to motor vehicle drivers	0.29 (1.57)
Comfort&Convenience (COCV)	Bicyclists are not affected by vehicular traffic congestion	0.24 (1.60)
	Adequate lane widths for bicycling lanes are provided	0.00 (1.68)
	Presence of establishments along the bicycling lanes	1.12 (1.20)
Reliability (RLBT)	LGUs conduct routine road clearing operations	0.40 (1.57)
	Bicyclists have full control over their departure time	1.14 (1.24)
	Availability of first aid stations along the bicycling lanes	-0.40 (1.70)

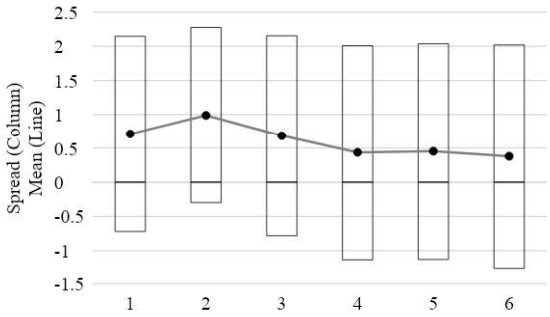

Figure 3. Plot of spread and mean of each motivator variable

SFTY on Table 5 shows that by making bicycle safety equipment more accessible, bicycling may improve patronage while the remaining show less significant results. Thus, it is advisable to plan a relationship that will benefit both stores and the bicycle infrastructure. To add, INFO presents the sensitivity of travelers toward news regarding bicycling. Thus, updating the public on the state of a city's bicycle infrastructure may increase ridership depending on how news is viewed.

Constructing bicycling lanes along establishments may increase bicycle ridership, however COCV on Table 5 shows that if these lanes occupy existing roads and further worsen traffic, dedicated lanes alone weakly motivate bicycle ridership. Thus, policies should achieve coexistence between bicycles and vehicles in Metro Manila. Interestingly, first aid on lanes weakly motivates Filipinos to cycle because they are likely already accustomed to frequent accidents. Furthermore, RLBT on the same table presents the preference of travelers to have full control over their departure time implying that they plan the shortest travel route and time possible.

On Table 6, COST shows most find owning bicycling locks unnecessary, expecting that establishments have these. Emphasis on the value of reducing crime rates along routes is visible from the SCRT results. Next, clearing the lanes of hazards and adding bicycle safety measures at intersections is necessary for them to consider bicycling. However, for the SFTY variable, insufficient bicycle lane networks may detract travelers from bicycling. Furthermore, bicycle safety knowledge, information on the bicycle infrastructure's state and the environment it is built on, and knowledge of bicycle routes that cyclists can take may avoid detracting travelers from cycling.

Table 6. Summary of cycling demotivators

VARIABLES	PARAMETERS	MEAN(S.D.)
COST	No bicycle available for use	-0.01(1.76)
	Bicycle locks are needed	0.95(1.46)
	Helmets and safety accessories are required by law	0.36(1.57)
SCRT	Prevalence of bike theft	1.15(1.27)
	General threat of crime	0.73(1.35)
	Lack of secure parking spaces for bicycles	1.18(1.29)
SFTY	Insufficient bicycle lane networks in my area	1.09(1.31)
	Obstructions are found on the bicycle lanes	0.96(1.29)
	"Bike boxes' are not provided at intersections	1.14(1.28)
INFO	Maps of bicycle routes in the city are unavailable	0.65(1.57)
	Areas with bicycle lanes are reported to have low air quality index	0.67(1.40)
	Lack of bicycle safety classes	0.98(1.27)
COCV	Extreme weather occurs frequently	0.94(1.30)
	Bicycling for long periods results in body aches	0.21(1.53)
	Bicycle lane networks are disconnected across neighboring towns and cities	1.18(1.28)
RLBT	Bicycle lanes are not consistently maintained	1.15(1.20)
	LGUs do not strictly enforce bicycling laws	1.06(1.30)
	Bicycle chains require frequent maintenance	0.41(1.49)

Table 6 shows the COCV variable presents the preference of travelers for weatherproof and continuous bicycle lanes. Thus, policies should mitigate both the issue of disjoined bicycle lanes and effects of extreme weather. Lastly, the respondents show more concern toward maintaining the infrastructure and policing system rather than the bicycle itself as seen on RLBT.

Figure 4 further proves that addressing SCRT, SFTY, RLBT of using bicycle lanes may improve the chances of increasing patronage. Thus, policies may primarily address the cyclists' security, bicycle lanes' safety, and bicycles' qualities sold at stores.

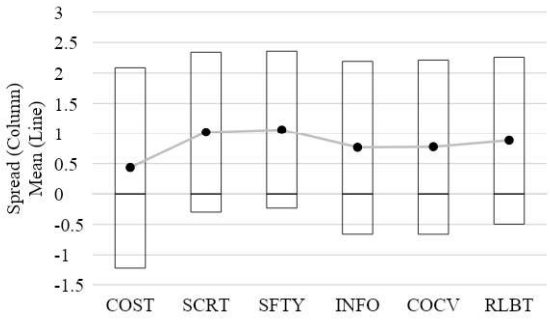

Figure 4. Plot of spread and mean of each demotivator variable

3.3 The Average Traveler's Attitudes on Bicycling by Trip Length

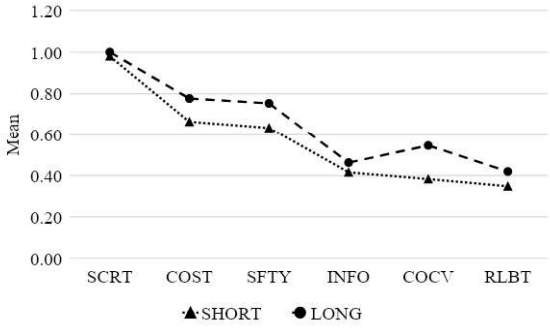

Figure 5. Trip motivators disaggregated by length

Generally, longer trips result in higher significance of a variable. Thus, the higher significance for long trip motivators on Figure 5 implies that most respondents cycle for longer periods which presents them to be more sensitive of these variables' effects. Lastly, the relatively low significance of INFO, COCV, and RLBT for both trip durations requires deeper investigation because results from earlier present that these variables are essential for increasing bicycle ridership.

Unlike on Figure 5, SFTY holds the most significance for both trip durations. Thus, increasing

bicycling patronage may require resolving the issues of rider safety when using the bicycle lanes. Furthermore, minute differences between the SFTY and INFO demotivators may indicate that travelers similarly value these variables for both durations. However, RLBT during longer trips becomes more significant, indicating a change in the trend observed earlier. The increase in RLBTs significance may indicate that travelers are more easily demotivated to cycle regardless of trip length.

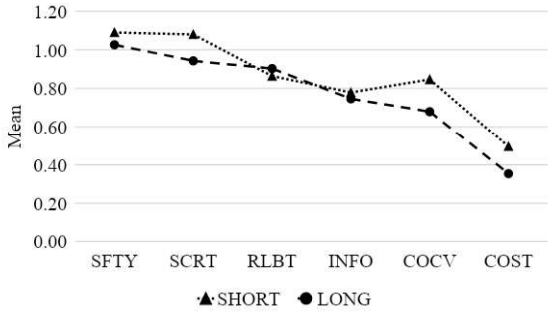

Figure 6. Trip demotivators disaggregated by length

4. CONCLUSIONS

This section will cap the study with recommendations for bicycle policy development, and the conduction of research for this topic.

The following are the recommendations for bicycle policy development based on the findings of this study: make bicycle safety equipment and accessories accessible to the public, present the benefits of bicycling while addressing the barriers and providing the preferences of the travelers for the bicycle lanes, identify the type of bicycle safety equipment that travelers want to personally own or expect to be shared then look into subsidizing the shared equipment, seek to achieve the coexistence of bicycling with the other transport modes, lastly is to not rely on data from studies conducted on foreign countries as Metro Manila travelers have shown behavior that deviate from the results of those studies.

Subsequent studies should take the succeeding recommendations into account. First is to replicate the methodology of this study in a normal, non-pandemic setting of Metro Manila to gain a point of comparison of the travelers' changes in perception during and after the pandemic. Second, enlarge and specify the study area in order to gain a comprehensive understanding of the perceptions of Metro Manila travelers from several locations of Metro Manila. Third, evaluate the parameters to be used by either replacing these with more appropriate parameters or by reframing the currrent parameters for these to better fit the main idea of each variable. Finally, establish communication with other researchers, LGUs, and government agencies who or which are involved in the research and development of the bicycle infrastructure of the city.

5. ACKNOWLEDGMENTS

We wish to show our most profound appreciation to the Senior High School Practical Research directors of the De La Salle University. We also extend our gratitude to the online group administrators and moderators who assisted in disseminating the research survey questionnaire. Lastly, we would also like to thank the family and friends of the group members who provided important insights that contributed to completing the manuscript.

6. REFERENCES

Abad, M. (2020, June 8). FAST FACTS: State of Metro Manila's public transport system. Rappler. https://www.rappler.com/newsbreak/iq/things-to-know-about-metro-manila-public-transport-system?fbclid=IwAR00HvYLojl38DptDAhLZjGUoIx-JRggnLTwNiVgQhx_D35NVc1Nzu3V8I.

Cameña, J. P., & Castro, J. T. (2016). Identifying the Determinants of Walkability and Use of Non-Motorized Transport in a Medium-Sized City : The Case of Iloilo City , Philippines. 23rd Annual Conference of the Transportation Science Society of the Philippines, August. http://ncts.upd.edu.ph/tssp/wp-content/uploads/2016/08/Camena-Castro.pdf

Cruz, K. D. L., & Ives, M. (2020, December 13). When the Trains Stopped, Cyclists Dodged Manila's Choking Traffic. The New York Times. https://www.nytimes.com/2020/12/13/world/asia/philippines-manila-bicycles-coronavirus.html?fbclid=IwAR2f3AxzUikCdhsre1OIdIY7aUDHq251MHYsOgz8Y27kIfup9dE-P8x9NV8.

Evans, G. W., & Wener, R. E. (2007). Crowding and personal space invasion on the train: Please don't make me sit in the middle. Journal of Environmental Psychology. https://doi.org/10.1016/j.jenvp.2006.10.002

L.D. Knibbs, L. Morawska, S.C. Bel. (2012). International Laboratory for Air Quality and Health , Queensland University of Technology , Thoracic Medicine , The Prince Charles Hospital , Brisbane , Australia Corresponding author : L . D . Knibbs , International Laboratory for Air Quality and Health.

Rissel, C., Greaves, S., Wen, L. M., Crane, M., & Standen, C. (2015). Use of and short-term impacts of new cycling infrastructure in inner-Sydney, Australia: A quasi-experimental design. International Journal of Behavioral Nutrition

and Physical Activity, 12(1), 1. https://doi.org/10.1186/s12966-015-0294-1

Woodcock, J., Edwards, P., Tonne, C., Armstrong, B. G., Ashiru, O., Banister, D., Franco, O. H., Haines, A., Hickman, R., Lindsay, G., Tiwari, G., Woodward, A., & Roberts, I. (2010). Public health benefi ts of strategies to reduce greenhouse-gas emissions : Urban land transport Delhi CO2 emissions transport Submitted to Ministry of Urban Development Government of India New Delhi Indian Institute of Technology Delhi. April.

Yoo, J. Y., Dutra, S. V. O., Fanfan, D., Sniffen, S., Wang, H., Siddiqui, J., Song, H. S., Bang, S. H., Kim, D. E., Kim, S., & Groer, M. (2020). Comparative analysis of COVID-19 guidelines from six countries: a qualitative study on the US, China, South Korea, the UK, Brazil, and Haiti. BMC Public Health, 20(1), 1–16. https://doi.org/10.1186/s12889-020-09924-7