Sustainable Transportation: Factors Affecting Bikers and Non-Bikers in Baguio City

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Abstract: This study attempts to determine the factors that affect both bikers and non-bikers' tendency to bike in Baguio city by looking at their demographics, environmental considerations, and subjective considerations. Using the binomial logistic regression results of a survey administered to 213 bikers and non-bikers in Baguio City, the study found that likelihood of biking is significantly affected by an individual's age and sex, the environment's land use, bike infrastructure, and topography, and the public's attitude, image, and time valuation towards biking. The ANOVA results of the survey also find significant differences in these considerations between bikers and non-bikers, such as importance of bike infrastructure, safety perception on biking, and practicality of biking. Biker and non-biker preferences on the city's biking facilities and policies were also determined through focus group discussions conducted on 17 survey respondents. Recommendations to the city's biking infrastructure, policies, and sustainable transportation are also discussed.

Keywords: sustainable transportation, biking, likelihood of biking

1. INTRODUCTION

Around 4.2 billion people, more than half of the world's population, live in cities today. With this trend projected to continue by 2050, the world urban population is expected to constitute7 out of 10 people on earth (World Bank, 2020). The Philippines' urban areas such as Baguio City are no exception to this trend, as more immigrants continue to reside in the urban hill station. The 57.49 km^2 hill station was designed in 1905 by Architect Daniel H. Burnham to accommodate up to 25,000 people (Estoque & Murayama, 2013; CPDO, 2018). However, its population has grown exponentially over the past century, from 489 in 1903 to 345,366 in 2015, a number far beyond its designed carrying capacity.

As the Summer Capital of the Philippines, Baguio City's residential population does not even include the large number of tourists and transients that temporarily visit and reside in it each year. As the Educational Hub of the North, numerous high schools and tertiary education institutions have also increased the city's population of non-resident students (Saro, 2015). With the city's rapid urbanization and population growth, a NEDA-commissioned study entitled "*Estimating the Urban Carrying Capacity of Baguio City*," states that Baguio City is projected to exceed its capacity once its population reaches 700,000 (Philippine Economics Society, 2019; Cabreza, 2019). Furthermore, residents from nearby municipalities of Benguet contribute to the city's congestion.

Urbanization has the potential to contribute to substantial economic growth since over 80% of the global GDP is generated in cities (World Bank, 2020). However, Baguio City still faces many environmental issues such as water rationing, poor solid waste management, land zoning issues, inadequate or substandard road infrastructure, and urban decay due to rapid expansion. Among these issues, traffic and transportation management has been one of the city's major challenges due to its ever-increasing population.

Sustainable transportation plays an important role in sustainable development and is said to even be the key to sustainable cities (Wadhwa, 2000). Active modes of transportation such as biking, walking, and car sharing are therefore essential in making a city sustainable. Gossling (2013) also argues that one favorable approach that may lead to changes in urban transport is integrating bike travel in a city's comprehensive planning framework.

Biking as a sustainable means of transportation not only benefits society as a whole, but also to its individuals as well. As an aerobic physical activity, biking has many health benefits which include, but are not limited to: increased cardiovascular fitness; increased muscle strength and flexibility; improved joint mobility; decreased stress levels; improved posture and coordination; strengthened bones; decreased body fat levels; prevention or management of disease and; reduced anxiety and depression (Better Health AU Gov, n.d.). Furthermore, taking sustainable modes of transportation also contributes to reduced traffic congestion, reduced air pollution, reduced greenhouse emissions, reduced use of non-renewable energy sources, increased social interaction, as well as support for local businesses and a vibrant economy (City of Vaughan, n.d.).

As a biking destination due to its conducive climate and hilly slopes, the potential of integrating bike travel in Baguio City already exists. At the heart of the city itself, one of the most iconic recreational activities for both tourists and locals of all ages is biking along Burnham Park's Lake Drive. Leisure riders can also enjoy biking in the city's forested areas such as Camp John Hay, Wright Park, Panagbenga Park, and Loakan Road due to the flat road surface and pine tree canopies. More experienced bikers can also choose to tackle the city's steeper slopes, making roads such as Kennon Road and Ambuklao Road popular bike routes. The city's challenging terrain has also made it a usual race route for the country's most popular bike race, Ronda Pilipinas (Lobien, 2020). Popular off-road trails are also found in the city as well. Located in Camp John Hay, trail bikers can traverse a network of downhill trails such as Camp John Hay trail, Yellow Trail, Gidaya Trail, and Yellow Trail National Park. Aside from recreational biking, these destinations have also become popular destinations for other active modes of travel such as hiking, jogging, and leisure walking.

The main objective of this study is to therefore determine the factors (demographic, subjective, and environmental) that affect both bikers and non-bikers' tendency to bike in Baguio city. Specifically, the study aims to determine the demographics, environmental, and subjective considerations that significantly affect bikers and non-bikers' tendency to bike in Baguio City, and identify the preferences on the city's biking facilities and policies.

2. LITERATURE REVIEW

The use of bikes is one of the technological approaches in sustainable transportation. According to Gossling (2013), including bicycles as part of a comprehensive planning effort can help make urban transportation more sustainable. In addition to the benefits of bicycle use on health and well-being, cyclists also reduce their carbon footprint, which can help society as a whole. Furthermore, this paradigm assumes a reduction in urban space destruction due to the dominance of private and individual car transportation (Ogryzek, Kmiec, & Klimach, 2020).

Many international studies, especially in western regions such as North America and Europe, provide abundant data on the common factors that influence the use of bikes and bike lanes. According to Dill and Voros (2007), these can be narrowed down into three classifications, namely environmental, subjective, and demographic factors. First, environmental factors include *infrastructure* (Nelson & Allen, 1997; Dill & Carr, 2003; Newhall, 2013; Akar, Flynn, & Namgung, 2012), *topography* (Lu, Scott, & Dalumpines, 2018; Cole-Hunter et al., 2015; Eren & Uz, 2020), *climate* (Dill & Carr, 2003; Tyndall, 2020), and *land use* (Pucher et al., 1999; Cameña & Castro, 2019; Replogle, 1993; Cole-Hunter et al., 2015). Next, subjective factors include human-dependent factors such as *public attitude* (Pucher et al., 1999; Vakili, Jarahi, Bazzaz, & Shojaee, 2016), *public image* (Pucher et al., 1999; Daley & Rissel, 2011; Budi et al., 2021), *safety perception* (Pucher et al., 1999; Sallis, et al., 2013; Troped et al., 2011; Stewart et al., 2012; Budi et al., 2021), *transportation costs* (Skufca, 2008; Dunn, 2009; Newhall, 2013), and *time valuation* (Akar, Flynn, & Namgung, 2012). Lastly, demographic factors include a person's *age, sex, and physical condition* (Sallis, et al., 2013; Garrard, 2003), and *race and income* (Pucher et al., 1999; Dill & Carr 2003; Yu, 2014; Lusk, Shaffer, Wu, & Li, 2017).

Only one research in Iloilo was found to extensively study these factors in the Philippines, which shows that there is a lack of similar studies in this country (Cameña & Castro, 2019). Nevertheless, both international and local references had similar findings in terms of identifying and classifying the factors affecting biking demand. Additionally, some of these international references also studied both biker and non-biker preferences on biking facilities and policies. However, it also must be noted that these factors and their significance differ from place to place. Because of this, additional context was gathered specifically from Baguio City's bikers and non-bikers to provide a more in-depth analysis on why these factors affect their tendency to ride a bike.

3. CONCEPTUAL FRAMEWORK

Based on the literature reviewed, the conceptual framework of this study identifies the significant factors affecting bikers and non-bikers in Baguio City, as presented in Figure 1. These factors are categorized based on Dill and Voros' (2007) three-factor classification which consists of demographics, environmental considerations, and subjective considerations. Additionally, preferences in terms of the city's biking facilities and policies will also be studied.

Since the factors and preferences will differ among bikers and non-bikers, both of these groups had separate survey and focus group discussion questions. First, demographics consist of their age, sex, physical condition (comorbidities), and occupation and income, as well as frequency of biking. Second, environmental considerations consist of factors that externally influence their desire to bike, namely infrastructure (e.g. bike lanes and parking), topography (e.g. slope gradient, road smoothness), climate (e.g. weather and temperature), land use (e.g. accessibility to destinations, aesthetics and greenery).

Third, subjective considerations consist of internal factors that affect biking demand, namely public attitude (e.g. trip purpose, accessibility), public image (e.g. perception on biking and bikers), safety perception (e.g. travel safety, crime), transportation costs (e.g. bike ownership, gas prices, and public transportation fares), and time valuation (e.g. travel time). Lastly, the preferences and recommendations regarding biking facilities and policies will also be assessed for both bikers and non-bikers.

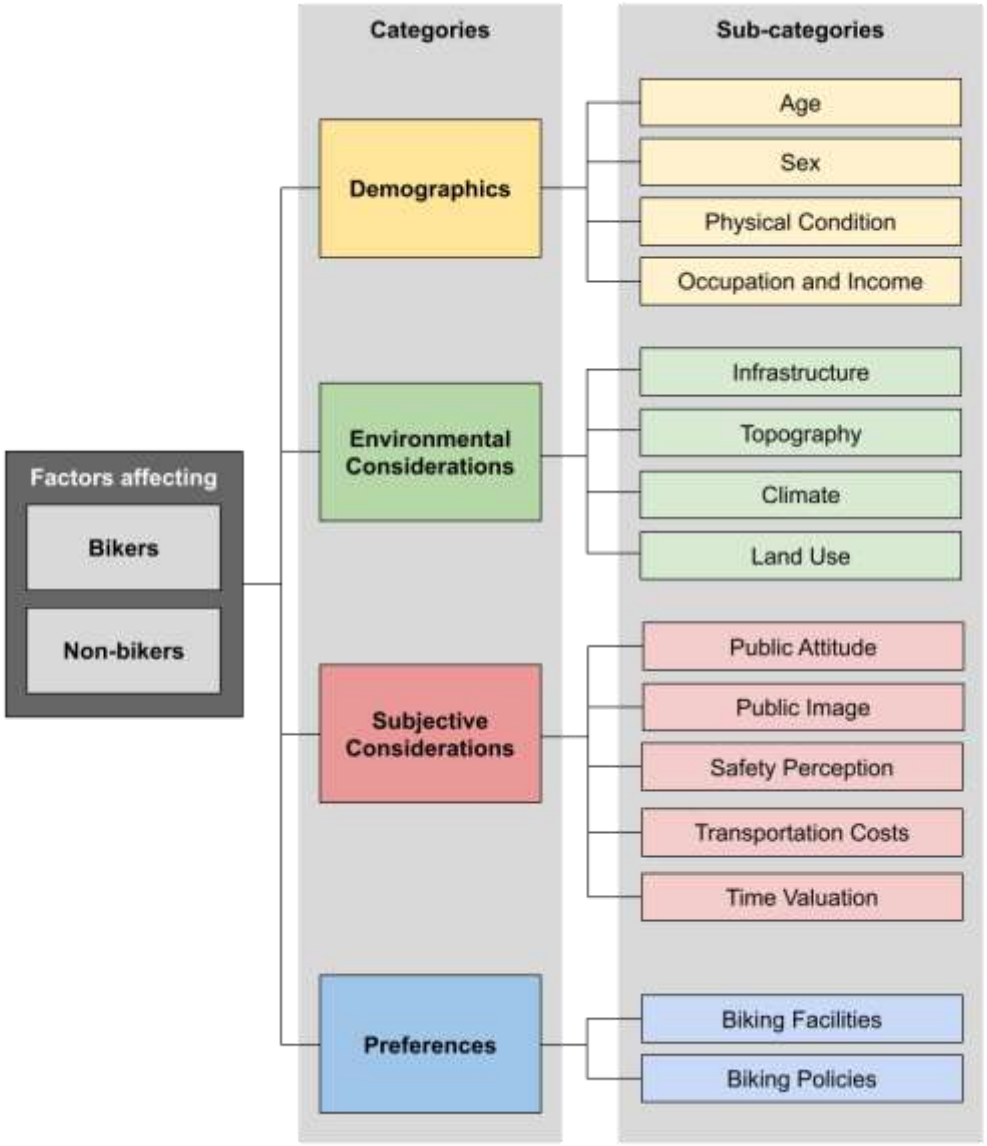

Figure 1. Conceptual Framework

4. METHODOLOGY

An explanatory sequential mixed method was utilized to and gain both general and contextual information on the factors affecting bikers and non-bikers in Baguio City. This methodological choice initially involved the collection and analysis of quantitative data, which was then explained in further detail through a follow-up of qualitative data. This allowed both sets of results to be triangulated and interpreted together to provide a richer and more comprehensive answer to the research questions.

4.1 Survey Questionnaire

Based on Dill and Voros' (2007) three classifications of factors affecting bicycling demand, the research data collection process started with having the respondents answer a survey questionnaire that collected data on the demographics, environmental, and subjective considerations of bikers and non-bikers in Baguio City. Firstly, demographics consist of

questions that primarily ask the respondents' age, sex, physical condition, occupation, and monthly income. The respondents were also classified as bikers and non-bikers based on their frequency of biking and self-concept as a biker, where they answered different tracks afterwards. Biker respondents were also asked who they bike with and why they bike.

Next, both biker and non-biker tracks asked which environmental and subjective considerations significantly affected their desire to bike. Based on the literature review, environmental considerations firstly consist of questions related to infrastructure (availability of bike lanes, bike trail or paths, and bike parking), topography (slope gradient or steepness and road smoothness), climate (weather and temperature), and land use (accessibility to destinations, presence of natural views and greeneries). This is followed by subjective considerations which consist of questions related to public attitude (attitudes towards biking and biking in Baguio City), public image (views on biking and bikers), safety perception (proneness to accidents, crime, and COVID-19), transportation costs (costs of bike travel and vehicular transportation), and time valuation (value of time, travel time, and traffic avoidance).

4.2 Focus Group Discussion

Following the sequential mixed method nature of the study, both biker and non-biker respondents were asked if they were willing to participate in a focus group discussion, which was transcribed, coded, and analyzed through a thematic analysis. The biker and non-biker participants were asked to answer the following guide questions during the focus group discussion:

For bikers: (1) What do you think would encourage more people to bike in Baguio City? What do you think would convince you or other bikers to bike for commuting purposes instead of taking vehicular transportation?; (2) What are your thoughts on the current bike infrastructures (e.g. bike lanes and parking) of Baguio City?; (3) What would your ideal biking environment/setting look like? What biking facilities do the government need to install? (4) What specific policies should the government impose to protect the welfare of both bikers and non-bikers such as motorists and pedestrians?

For Non-Bikers: (1) As a non-biker, what do you think would convince you and other non-bikers to bike in Baguio City?; (2) What are your thoughts on the current bike infrastructures (e.g. bike lanes and parking) of Baguio City?; (3) Should motorists, bikers, and pedestrians co-exist on the roads, what would your ideal biking set-up look like? What biking facilities do the government need to install?; (4) What specific policies should the government impose to protect the welfare of both bikers and non-bikers such as motorists and pedestrians?

The first discussion question was to triangulate the quantitative data and gain additional insights by asking the reasons and context behind the factors they found mostsignificant. The second, third, and fourth questions were used to determine their preferenceson Baguio City's bike facilities and policies, such as what factors would encourage orconvince more people to bike, what their ideal biking environment or setting would look like,what essential biking facilities do you they think are needed for the government to install, andwhat specific policies should the government impose to protect the welfare of both bikers and non-bikers.

4.3 Sample Selection and Size

To gather respondents for the study's survey and focus group discussion, a purposive and snowball sampling method was used, wherein bikers and non-bikers from Baguio City and its

neighboring municipalities (La Trinidad, Itogon, Sablan, Tuba, and Tublay) were purposely selected by the researchers, as well as those not necessarily belonging to these places but were interested in biking in the city. Potential respondents were asked beforehand if they are bikers or non-bikers based on the frequency they bike and whether they consider themselves as bikers or non-bike

Based on the number of members of Baguio Mountain Bikers, the city's largest group of bikers on Facebook, the number of bikers in Baguio City is approximately 11,300 as of January 2022. Thus, at 95% confidence level and 10% margin of error, the appropriate sample size that was calculated for the survey questionnaire was determined to be 96 respondents. To give allowance to incomplete answers, the minimum number of respondents was rounded up to 100 respondents. The researchers have also settled for a relatively smaller sample size due to the limitations brought about by time constraints and the COVID-19 pandemic. In total, 111 bikers and 102 non-bikers completed the survey. From these respondents, 7 bikers and 10 non-bikers participated in the focus group discussion.

5. RESULTS AND DISCUSSION

5.1 Demographics and Respondents' Profile

This section discusses the demographics and profiles of the respondents that were qualified to take part of the data collection process. From the survey conducted, 180 respondents knew how to ride a bike while 33 did not know how to bike. Those that did not know how to ride a bike were immediately redirected to the non-biker's track of the survey. Out of the 180 individuals that knew how to bike, 111 considered themselves as bikers and were prompted to answer the biker's track of the survey and were prompted to answer the biker's track of the survey. On the other hand, 69 respondents did not consider themselves as bikers and were prompted to answer the non-biker's track of the survey. Along with the respondents that did not know how to ride a bike, this brought a total of 102 non-biker respondents. It is also important to note that the 111 bikers and 102 non-bikers do not represent the percentage of bikers and non-bikers in the city, but only the computed sample size for the study. The mean ages of the biker and non-biker survey respondents were 30.15 while 23.21, while their standard deviations were 13.49 and 7.22 respectively.

The participants for the focus group discussions were also taken from the same pool of survey respondents. A total of 17 respondents volunteered and agreed to participate which consisted of 7 bikers and 10 non-bikers. Figure 1 summarizes the distribution of respondents according to age, sex assigned at birth, employment (occupation) and income. It also presents data on frequency of biking, biking companions, and biking purpose.

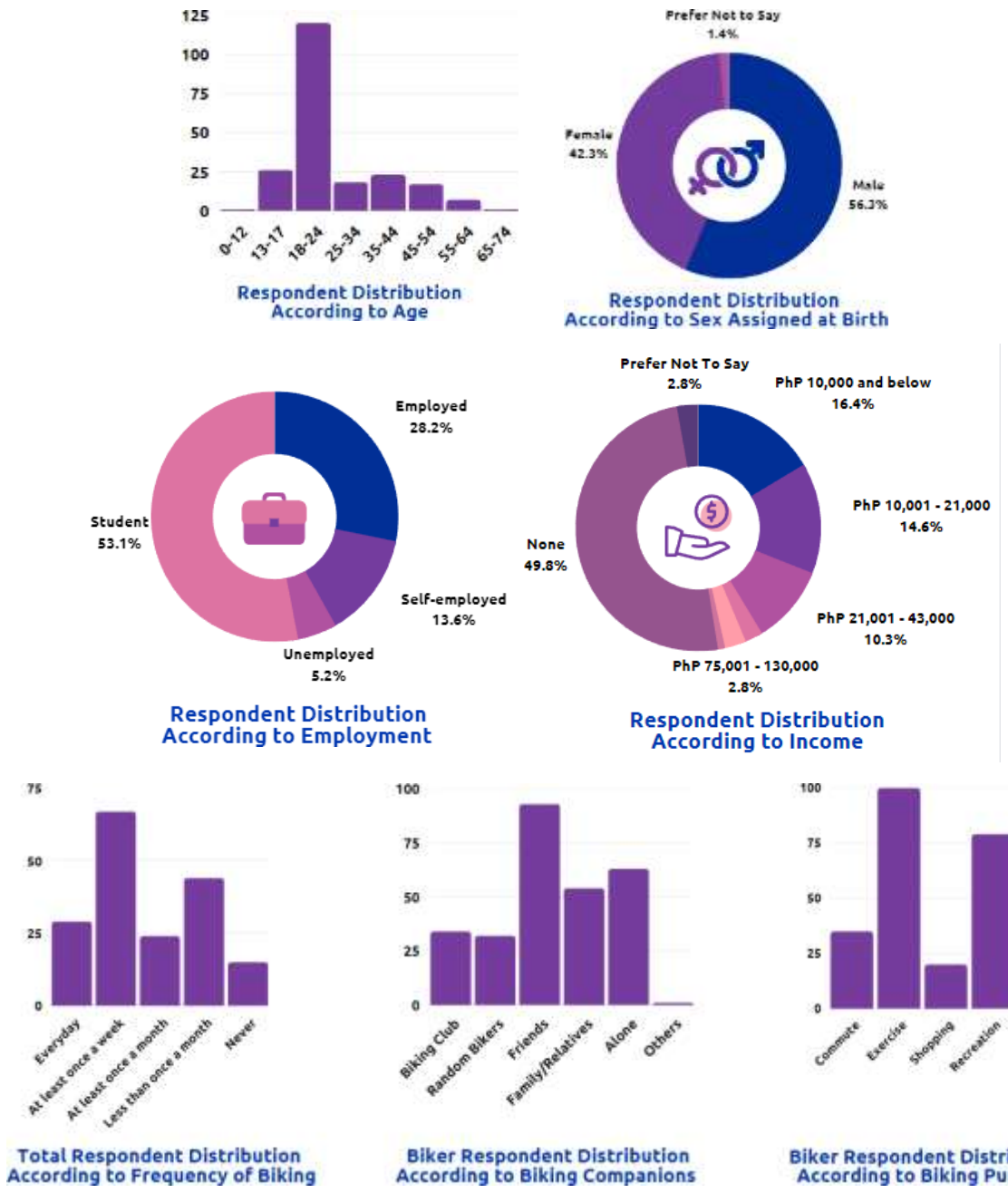

Figure 2. Demographics and Respondents Profile

5.2 Regression models

A binomial logistic regression was utilized to provide a deeper understanding on which factors impact the likelihood of a respondent to become a biker or non-biker. Three outcome variables were tested, namely the likelihood of being a biker according to demographic variables, likelihood of being a biker according to environmental considerations, and likelihood of being a biker according to subjective considerations.

The results below present the binomial logistics regression for the 3 different outcome variables comprised of 14 explanatory variables, namely demographics (age, sex assigned at birth, physical condition, monthly income, and occupation), environmental considerations

(infrastructure, topography, climate, and land use), and subjective considerations (public attitude, public image, safety perception, transport cost, and time valuation). These were done separately to determine which specific subcategories were deemed significant, and also prevent multicollinearity wherein too many variables would be taken into consideration. Out of the 14 explanatory variables that were tested for the 3 different outcome variables, 9 variables proved to be significant in predicting the likelihood of being a biker.

Table 1. Binomial logistic regression for likelihood to become a biker according to demographics

Variables in the equation	*Sig.*	*Exp(B) (odds ratio)*	*95% CI for Exp(B)*	
			Lower	*Upper*
Age	0.047*	1.043	1.001	1.0086
Sex	0.000**	.122	.064	.232
Physical Condition	.722	.837	.315	2.227
Monthly Income	.879	.980	.760	1.265
Occupation	.378	.846	.583	1.227
Constant	.024*	13.293		
Model Summary				
-2 log likelihood	224.568			
Cox & Snell R Square	.281			
Nagelkerke R Square	.375			

*significant at alpha 0.05 **significant at alpha 0.01 ***significant at 0.001

First, Table 1 presents the binomial logistic regression for the likelihood to become a biker according to demographics. Age and sex assigned at birth appeared to be significant factors since they all had a p-value less than 0.05 ($p < 0.05$). Age had an odds ratio of 1.083, which means that for every unit increase in age (in years), the respondent is more likely to be a biker by 8.3%. On the other hand, sex assigned at birth had an odds ratio of 0.275, which means that females are 72.5% less likely to be bikers.

Age has a positive relationship to likelihood of being a rider, while sex has a negative relationship. This matches with the demographic data where 90 males are bikers and 20 are females. Physical condition (physical disabilities, comorbidities, etc.), Occupation and Monthly Income were found to not be significant with a p-value greater than 0.05. This shares the findings of Garrard (2003) where the shares of female cyclists was less than half compared to that of male cyclists. Dill & Voros (2007) also found age, sex, and physical condition to be significant demographic factors, but according to the results, physical condition was not found to be significant.

Table 2. Binomial logistic regression for likelihood to be a biker according to environmental considerations

Variables in the equation	*Sig.*	*Exp(B) (odds ratio)*	*95% CI for Exp(B)*	
			Lower	*Upper*
Infrastructure	.001**	2.090	1.330	3.282
Topography	.005**	.542	.352	.835
Climate	.320	.853	.624	1.166
Land Use	.002**	2.349	1.368	4.034
Constant	.002**	.021		
Model Summary				
-2 log likelihood	269.068			
Cox & Snell R Square	.114			
Nagelkerke R Square	.152			

*significant at alpha 0.05 **significant at alpha 0.01 ***significant at 0.001

Next, Table 2 presents the regression output for the likelihood to be a biker according to environmental considerations. These include bicycle infrastructure such as bike lanes and bike parking spaces, the land's natural topography which refer to slope gradients and smoothness of the roads, climate which refers to weather, levels of rainfall, and temperature, and land use, which includes accessibility of different destinations by bike, and aesthetic views and greeneries.

Based on the results, three of the four explanatory variables proved to be significant, namely infrastructure, topography, and land use, in which all had $p < 0.05$. Among the three significant considerations, land use had the highest odds ratio at 2.349, which means that respondents are 2.3 times more likely to bike if destinations were accessible by bike and when natural views and greeneries are present. This confirms the findings of Cameña and Castro (2019) and Cole-Hunter et al. (2015) in which the accessibility and connectivity to destinations and the presence of views and greeneries significantly increased bike travel.

Infrastructure had an odds ratio of 2.090, which means respondents are 2.1 times more likely to bike if on-street bike lanes, separate bike trails and paths, and bike parking were available. This supports the findings of Nelson and Allen (1997), Dill and Carr (2003), Akar, Flynn, and Namgung (2012), and Newhall (2013) in which bike infrastructure and bike usage are positively related. Lastly, topographic considerations had an odds ratio of 0.542, which means that the respondents were 0.5 times less likely or 45.8% less likely to bike if the road had a favorable steepness and smooth surface. This means that although the respondents are still likely to bike on a favorable steepness and smoothness of road surface, it is less likely to predict the likelihood of biking, compared to infrastructure and land use factors which are also significant. Table 8 shows that although the 2 questions gained a relatively high degree of importance according to the respondents' Likert scales, the factors were found to be not significant. This may be due to other factors affecting bicycle ridership, such as the safety and convenience concerns found in slopes such as difficult climbs and dangerous ascents (Eren and Uz 2020).

Table 3. Binomial Logistics Regression output for likelihood to be a biker according to subjective factors

Variables in the equation	*Sig.*	*Exp(B) (odds ratio)*	*95% CI for Exp(B)*	
			Lower	*Upper*
Public Attitude	.004*	2.052	1.254	3.356
Public Image	.003*	2.201	1.299	3.729
Safety Perception	.642	1.160	.620	2.171
Transportation Costs	.109	1.460	.919	2.320
Time Valuation	.008*	.545	.347	.856
Constant	.007*	.007		
Model Summary				
-2 log likelihood	270.553			
Cox & Snell R Square	.108			
Nagelkerke R Square	.144			

*significant at alpha 0.05 **significant at alpha 0.01 ***significant at 0.001

Table 3 presents the logistic regression output for likelihood to be a biker according to subjective considerations. These subjective considerations consisted of internal factors that affect biking demand, namely public attitude (e.g. trip purpose, accessibility), public image (e.g. perception on biking and bikers), safety perception (e.g. travel safety, crime), transportation costs (e.g. bike ownership, gas prices, and public transportation fares), and time valuation (e.g. travel time).

Based on the results, three of the five explanatory variables were significant, namely public attitude, public image, and time valuation at $p < 0.05$. Public Image had the highest odds ratio at 2.201, which implies that the respondents were 2.2 times more likely to bike if the general attitude towards biking in general was more positive. Similarly, public attitude had an odds ratio of 2.052, which means that the respondents were 2.1 times more likely to bike if the public's image towards bikers was more positive.

Lastly, time valuation had an odds ratio of 0.545, which means that the respondents were 0.5 times or 45.5% less likely to bike if they valued their time more. This confirms the case study on University of Ohio, which also found that the value for time was negatively correlated with bike travel and positively correlated with automobile travel (Akar, Flynn, and Namgung, 2012).

5.3 ANOVA

Table 4 presents the ANOVA results of each question under environmental considerations which were scored through a Likert scale labeled from 1 or "Not Important" to 5 or "Extremely Important." Comparing the responses between the biker and non-biker respondents, the ANOVA results show significant results on questions 1, 3, and 8. For the first and third questions, which talk about on-street bike lanes and parking spaces respectively, the bikers showed a significantly higher mean score compared to non-bikers. This result is also supported by the answers in the open ended questions of the survey and the focus group discussions, wherein bikers heavily emphasize on the lack of bike lanes and bike parking in the city. Question 8 also shows a significant difference in the mean scores between bikers and non-bikers, wherein the presence of natural views and greeneries was determined to be an important factor especially for bikers, which is also supported by the open-ended answers and focus group discussions in which bikers in particular enjoyed traveling and exploring to new places.

Table 4. ANOVA Summary for Environmental Considerations

Environmental Considerations			*n*	*Average*	*F*	*p-value*
Infrastructure	1. Availability of bike lanesalong the street	Biker	111	4.66	7.85	0.0055*
		Non-biker	102	4.31		
	2. Availability of separate bike trails/paths	Biker	111	4.59	3.33	0.0694
		Non-biker	102	4.37		
	3. Availability of bike parking	Biker	111	4.70	12.58	0.0005*
		Non-biker	102	4.26		
Topography	4. Favorable slope steepness/elevation	Biker	111	3.93	1.45	0.2307
		Non-biker	102	4.11		
	5. Smoothness of road surface	Biker	111	4.14	0.00	0.9575
		Non-biker	102	4.13		
Climate	6. Favorable weather and temperature	Biker	111	4.05	0.09	0.7689
		Non-biker	102	4.10		
Land Use	7. Accessibility to destinations by bike	Biker	111	4.56	0.70	0.4052
		Non-biker	102	4.47		
	8. Presence of naturalviews and greeneries	Biker	111	4.56	12.07	0.0006*
		Non-biker	102	4.13		

*significant at alpha 0.05 **significant at alpha 0.001 ***significant at 0.0001

Table 5. ANOVA Summary for Subjective Considerations

Subjective Considerations			*n*	*Average*	*F*	*p-value*
Public Attitude	1. Biking is a fun recreational activity.	Biker	111	4.85	17.96	0.0000***
		Non-biker	102	4.48		
	2. Biking is not a practical means of traveling in Baguio City.	Biker	111	2.09	12.33	0.0005**
		Non-biker	102	2.66		
	3. Biking is more for men than women.	Biker	111	1.77	2.81	0.0951
		Non-biker	102	1.51		
Public Image	4. Bikers are seen as an inconvenience on the road by the general public.	Biker	111	2.61	1.54	0.2164
		Non-biker	102	2.39		
	5. People bike because they cannot afford vehicular transportation.	Biker	111	2.55	7.31	0.0074*
		Non-biker	102	2.11		
	6. I bike because it helps preserve the environment.	Biker	111	4.57	4.01	0.0465*
		Non-biker	102	4.75		
	7. Biking is only for the healthy.	Biker	111	2.05	1.67	0.1981
		Non-biker	102	1.84		
Safety Perception	8. Biking is a dangerous mode of transportation due to higher risk ofaccidents.	Biker	111	2.51	0.72	0.3979
		Non-biker	102	2.64		
	9. Baguio City is a safe place to bike.	Biker	111	3.68	7.69	0.0061*
		Non-biker	102	3.32		
	10. I feel more prone to becoming a victim of crime when I bike.	Biker	111	2.27	12.69	0.0005**
		Non-biker	102	2.75		
	11. Biking is a safer mode of transportation during the COVID-19 pandemic.	Biker	111	4.23	8.22	0.0046*
		Non-biker	102	3.82		
Transportation Costs	12. It is cheaper to travel by bike compared to other modes of transportation.	Biker	111	4.33	0.52	0.4711
		Non-biker	102	4.25		
	13. Purchasing and maintaining a bike is expensive	Biker	111	3.55	2.49	0.1164
		Non-biker	102	3.78		
	14. I am more likely to bike if gasprices and public transportation fares go up.	Biker	111	4.24	13.26	0.0003**
		Non-biker	102	3.69		
Time Valuation	15. My time spent on biking can be used on other activities.	Biker	111	3.22	0.10	0.7520
		Non-biker	102	3.17		
	16. It takes longer to travel to my usual destinations by bike.	Biker	111	3.50	4.86	0.0286*
		Non-biker	102	3.82		
	17. I bike to avoid traffic.	Biker	111	3.91	6.83	0.0096*
		Non-biker	102	4.29		

*significant at alpha 0.05 **significant at alpha 0.001 ***significant at 0.0001

Table 5 presents the ANOVA results for the questions under subjective considerations. For questions under public attitude, the bikers had a significantly higher average score of 4.85 over the non-bikers' 4.48. This means that bikers significantly agree more that biking is a fun

recreational activity compared to non-bikers. This was supported by the responses in the open-ended question of the survey, in which many biker respondents biked because it was a fun activity or hobby. The biker participants' focus group discussion also mentioned that biking was mostly done for fun and recreational purposes. Question 2 was also found to have a significant difference, with a mean score of 2.09 for bikers and 2.66 for non-bikers on the Likert scale. This means that the biker respondents significantly disagree more that biking is not a practical means of traveling in the city compared to non-bikers. This also affirms the answers in the open-ended question and focus group discussion, wherein some non-biker respondents found biking as inconvenient, and time and energy consuming.

For public image, a significant difference was found for question 5 with average scores of 2.55 and 2.11 for bikers and non-bikers respectively. This means that bikers significantly agree more that people bike because they cannot afford vehicular transportation compared to non-bikers. There was also a significant difference found between bikers and non-bikers for question 6, which had mean scores of 4.75 and 4.57 respectively. This means that bikers significantly agree more that biking helps preserve the environment compared to non-bikers. Both the biker and non-biker respondents' agreement to this statement supports the findings of Daley and Rissel (2011), in which biking is positively viewed as eco-friendly, as well as the focus group discussion in which it was agreed upon that biking was environmentally friendly.

For safety perception, three questions were found to be significant, namely questions 9, 10, and 11. In relation to the regression results, safety perception in general for both bikers and non-bikers was found to not be a significant predictor because these did not stop the bikers in particular from using this mode of transportation However the ANOVA results reveal that a significant difference between the groups can be seen.

First, a significant difference was found between the biker and non-biker respondents for question 9, or "Baguio is a safe place to bike," with mean scores of 3.68 and 3.32 on the Likert scale respectively. This means that bikers significantly agree more that biking in the city is safe. This also means that non-bikers find biking around the city less safe. This agrees with the findings of Pucher et al. (1999), wherein the fear of accidents was also one of the main reasons why people do not bike. This also reflects on the answers of the open-ended questions, wherein several non-bikers mentioned that they were scared to bike because of road accidents and reckless drivers.

Next, question 10, or "I feel more prone to becoming a victim of crime when I bike," was also found to be significantly different between bikers and non bikers, at 2.27 and 2.75 respectively. This means that non-bikers felt like they were more likely to become a victim of crime when biking compared to bikers. This also confirms the findings of Troped et al. (2011) and Stewart et al. (2012), in which crime rate decreased the levels of active travel such as biking, especially for women and children. This also reflects on the responses in the open ended questions, wherein some female respondents in particular stated that they refused to bike because of the sexism, catcalling, and sexual harassment experienced by female bikers.

Lastly, question 11, or "Biking is a safer mode of transportation during the COVID-19 pandemic," was also found to have a significant difference between the two groups at 4.23 and 3.82 respectively. This means that bikers significantly agreed more that biking was a safer mode of transportation during the COVID-19 pandemic. This finding supports the study of Budi et al. (2021), which states that the pandemic mainly caused a boom of cyclists around the world due to the people looking for a safer mode of transportation.

For questions under transportation costs, only question 14, or "I am more likely to bike when gas prices and public transportation fares go up," was found to be significantly different between the two groups at 4.24 and 3.69 for bikers and non-bikers respectively. This means

that bikers are significantly more willing to bike if the costs of private and public transportation went up. This also supports the positive relationships of gas prices and bike travel found in the studies of Skufca (2008), Dunn (2009) and Newhall (2013). While the transportation cost factor did not yield significant value in predicting the likelihood of biking according to the regression model, the ANOVA result for this question in particular showed a significant difference between bikers and non-bikers. This was perhaps due to the regression model being influenced by the other two questions, namely "It is cheaper to travel by bike compared to other modes of transportation" and "Purchasing and maintaining a bike is expensive," which were found to have no significant difference in the ANOVA test.

Lastly, the ANOVA results for questions under time valuation revealed that questions 16 and 17 were significantly different between groups. Question 16, or "It takes longer to travel to my usual destinations by bike." had average Likert scores of 3.50 and 3.82 for bikers and non-bikers respectively. This means that non-bikers significantly found biking to be more time consuming as a mode of transportation. These findings support Ohio, Akar, Flynn, and Namgung (2012), who find a negative correlation between value for time and bike travel. A significant difference was also found for question 17, or "I bike to avoid traffic," wherein the biker respondents had a mean score of 3.91 while non-bikers had an mean score of 4.29. This means that non-bikers significantly agreed more that biking is a viable means of avoiding traffic, and may also imply that bikers did not simply bike to avoid it. This reflects on the open-ended answers, in which several non-bikers found riding a bike to be time consuming. Additionally, it was also mentioned by the non-bikers in focus group discussion that they were discouraged to bike because they found it inconvenient and time consuming, especially in Baguio City compared to places with relatively flatter roads.

4.4 Thematic Analysis

To verify and provide further insights to the survey questionnaire results, both biker and non-biker focus group discussion participants were initially asked what they thought would encourage more people to bike in Baguio City, wherein both groups had similar answers. These included promoting the positive attitudes and images towards biking, such as biking being healthy, fun, time and resource efficient, and eco-friendly, promoting electric alternative modes of transportation such as e-bikes and e-scooters, increasing bike facilities or infrastructure in Baguio City, promoting Baguio City's friendly biking community and conducive climate, and making bikes more accessible. However, both biker and non-biker participants also mentioned several factors that discouraged biking, which were also similar between groups. These included the Baguio City's steep terrain and the close encounters and conflicts with vehicles experienced by bikers or observed by non-bikers.

Preferences, comments, and suggestions on Baguio City's biking facilities were also found to be similar between the biker and non-biker participants. First, both groups saw Baguio City's new bike lanes to be helpful and encouraging for existing bikers to ride more and non-bikers to try out biking due to increased safety on the road. Among the city's existing bike lanes and shared roads, the bike lane along Military Cut-off in particular was considered to be ideal due to its sufficient width for bike travel and distinct color. Thus, they wish for more of these bike lanes to traverse more practical travel routes such as those along the central business district, and also for the construction of more bike parking spaces in essential establishments. However, both bikers and non-bikers still observed cases of biker-vehicle conflicts on shared roads due to close encounters, and even in bike lanes where some drivers would still park or hazard their vehicles on the lanes itself, obstructing the bikers from using the lanes intended for them. Because of this, both bikers and non-bikers suggested prioritizing

active travelers such as bikers and pedestrians when it came to designing infrastructure, and slowly transitioning away from treating automobile travel as the primary mode of transportation.

Similarly, the preferences, comments and suggestions on Baguio City's biking policies were also similar between the biker and non-biker participants. First, participants from both groups stated that they were already aware that biking ordinances were already implemented in the city, and it is only a matter of better enforcing them alongside the city's existing traffic policies that apply to pedestrians and vehicles. In order to achieve this, they also recommended including bike travel in the scope and activities of the Land Transportation Office (LTO) and Land Transportation Franchising and Regulatory Board (LTFRB) to better integrate bike travel in the city's overall transportation system. Other suggestions for future policies included designating one-way bike routes especially for narrow roads that could no longer be widened, and incentivizing establishments and building owners that accommodate bikers. Additionally biking can be further promoted in Baguio City through better informationdissemination through different methods such as putting up road signs for bikers, implementing and promoting bike clinics for all age groups, and maximizing the use of onlineplatforms such as social media and websites.

4.5 Synthesis

Table 6 summarizes similar significant findings across the binomial logistic regressions, ANOVA, and focus group discussions conducted in the study. Sub-categories that were foundto be significant across at least two data collection methods were included. These include age and sex for demographics, infrastructure, topography, and land use for environmental considerations, and public attitude, public image, time valuation, safety perception, and transportation costs for subjective considerations

Table 6.Synthesis of Results

Category	*Significant Sub-category*	*Binomial Logistic Regression*	*ANOVA*	*Focus Group Discussion*
Demographics	Age	for every unit increase in age (in years), the respondent is more likely to be a biker by 8.3%		challenging terrain and slopes made biking difficult especially for those who were less fit to such as women, children, and beginners
	Sex	females are 72.5% less likely to be bikers		
Environmental Considerations	Infrastructure	respondents are 2.1 times more likely to bike if bike lanes, bike trails, and bike parking were available	bikers saw greater significance in bike lanes and parking spaces in biking	building more bike facilities such as bike lanes and bike parking would encourage biking
	Topography	respondents were 0.5 times less likely or 45.8% less likely		steep slopes made biking difficult especially for those

		to bike if the road was steep		who were less fit to such as women, children, and beginners
	Land Use	respondents are 2.3 times more likely to bike if destinations were accessible by bike and if natural views and greeneries are present	presence of natural views and greeneries was determined to be an important factor especially for bikers	incorporate more bike parking spaces in essential establishments such as the public market and the city's central business district
Subjective Considerations	Public Attitude	respondents were 2.2 times more likely to bike if the general attitude towards biking in general was more positive	bikers significantly agree more that biking is a fun recreational activity bikers significantly agree more that biking is a practical means of traveling in the city non-bikers found biking as inconvenient, and time and energy consuming.	community and peer influence have an impact when convincing someone to bike
	Public Image	respondents were 2.1 times more likely to bike if the public's image towards bikers was more positive	biking helps preserve the environment compared to non-bikers	in order to convince more people to bike, the benefits of biking should be promoted more, such as biking being good for the health, biking being a fun recreational activity, biking being a means of saving time and resources, and biking being eco-friendly
	Time Valuation	respondents were 0.5 times or 45.5% less likely to bike if they valued their time more	non-bikers significantly found biking to be more time consuming as a mode of transportation	
	Safety Perception		bikers significantly agree more that biking in Baguio	close encounters and conflicts with drivers discourage biking,

			City is safe non-bikers felt like they were more likely to become a victim of crime when biking	especially for beginner or less experienced bikers
	Transportation Costs		bikers are significantly more willing to bike if the costs of private and public transportation went up	rising gas prices in particular has made biking even more appealing, especially to non-bikers

5. CONCLUSION

As Baguio City continues to develop and improve its sustainable modes of transportation, this study attempted to determine the factors affecting bikers and non-bikers in Baguio City by looking at the demographics, environmental considerations, and subjective considerations that significantly affected both groups' tendency to bike in the city. Additionally, it also aimed to identify the preferences of bikers and non-bikers on the city's biking facilities and policies. The significance of these considerations were determined through data collected from a survey questionnaire conducted on a sample of a sample of 111 bikers and 102 non-bikers,and was analyzed through a binomial logistic regression to predict likelihood of biking according to these three factors and a one-way ANOVA to determine the differences in answers between the biker and non-biker respondents. To triangulate these results, focus group discussions for both biker and non-biker groups were conducted and were analyzed through a thematic analysis. These discussions were also used to know their preferences onthe city's biking facilities and policies.

Based on the logistic regression results according to demographics, the likelihood of becoming a biker was significantly affected by age and sex assigned at birth, in which an individual was more likely to become a biker if he was older and male, or is less likely to be female or of the other genders. Based on environmental considerations, the likelihood of becoming a biker was significantly affected by land use, bike infrastructure, and topography. This means that an individual was more likely to become a biker if destinations were more accessible by bike, natural views and greeneries were present, bike lanes and bike parking spaces were available, and if roads were flatter and smoother. Based on subjective considerations, the likelihood of becoming a biker was significantly affected by public attitude, public image, and time valuation. This means that an individual was more likely to become a biker if the public's attitude towards biking in general and the public's image towards bikers was more positive. Inversely, for time valuation, individuals were also less likely to bike if they valued their time more.

According to the one-way ANOVA results on environmental considerations, bikers saw greater importance in bike infrastructures, particularly on-street bike lanes and bike parking spaces, compared to non-bikers, as well as greater significance for natural views and greeneries. As individuals that already choose to bike in the current conditions, this implies that they indeed have a greater desire to improve the overall biking experience in Baguio City

compared to non-bikers. For subjective considerations, this group also showed more agreement towards biking as a fun recreational activity, as well as a cost-efficient mode of travel. Compared to non-bikers, they also found biking to be a safer means of travel in general, wherein they felt Baguio City was a safe place to bike, biking did not really increase the chances of becoming a victim of crime, and that biking was a safer means of travel during the COVID-19 pandemic. This implies that while bikers acknowledge that these risks exist, it will not stop them from continuing to bike.

On the other hand, the non-bikers showed more agreement towards biking being an impractical means of travel in Baguio City. In relation to this, they also agreed more that it takes longer to travel to destinations by bike. This suggests that non-bikers view biking as an impractical and time-consuming mode of transportation. Ironically however, they also showed more agreement compared to bikers towards biking being a practical means of avoiding traffic, as well as an environmentally-friendly mode of transportation. This implies that although non-bikers may find biking as impractical and time-consuming, it is still a convenient means of navigating through traffic. Additionally, this may also mean that non-bikers recognize the plausibility of bike travel in solving Baguio City's traffic andpollution problems.

The results of focus group discussions were found to support several findings of the survey questionnaire. Encouraging factors from both biker and non-biker participants included the positive attitudes and images towards biking, promoting electric alternative modes of transportation such as e-bikes and e-scooters, increasing bike facilities or infrastructure in Baguio City, promoting Baguio City's friendly biking community and conducive climate, and making bikes more accessible. However, both groups also mentioned factors that discouraged biking, such as the steep terrain of the city and close encounters and conflicts with drivers, which were especially challenging and unappealing for less athletic andexperienced bikers.

For preferences on biking facilities, both bikers and non-bikers saw Baguio City's newbike lanes as helpful and encouraging due to increased safety when biking on the road. Among the city's existing bike lanes, the bike lane in Military Cut-off in particular was considered to be the standard due to its sufficient width and distinct color. Thus, they wish for more of these bike lanes to pass more practical travel routes such as those in the central business district, and the increase of bike parking spaces in essential establishments. However,both bikers and non-bikers also observed cases of biker-vehicle conflicts on shared roads and even bike lanes where some drivers would still park or shoulder their vehicles. Because ofthis, both groups also suggested prioritizing bikers and pedestrians when it came to designing infrastructure while also moving away from treating automobile travel as the primary mode oftransportation.

In terms of preferences on biking policies, most bikers and some non-bikers mentioned that they were already aware of the existing biking ordinances in the city and it is only a matter of enforcing them properly with the city's existing traffic policies applied to pedestrians and vehicles. Because of this, they also suggested including bike travel in the scope of the LTO and LTFRB to better integrate biking in the city's transportation system. Other policy suggestions included designating one-way bike routes especially for narrow roads, incentivizing building owners that accommodate bikers, and encouraging the use of bike side-mirrors. Additionally biking can be further promoted in Baguio City through better information dissemination through means such as road signs, bike clinics, and the use of online platforms.

6. RECOMMENDATIONS

Future studies can consider looking specifically into social and cultural factors that affect likelihood to bike. Although this has been briefly discussed in the literature review, along with being a significant factor affecting both bikers and non-bikers in Baguio City, further research on the culture and history of biking in Baguio City and the Philippines can be a topic of interest. Improvement can also be done on the logistic regression models by further studying which factors can be included or excluded in order to better predict the likelihood of biking. Larger sample sizes could improve the accuracy and reliability of these findings and the inclusion of respondents who are not from BLISTT such as tourists may also provide additional information and insights. The focus group discussion can also be improved on by specifically interviewing different kinds of bikers, especially veteran and utilitarian bikers to get their insights on biking as a sustainable mode of transportation. Additionally, future studies can be conducted in collaboration with the city council to further enrich the government and people's understanding on biking and sustainable transportation in the city.

For recommendations and suggestions on the city's infrastructure, creating spaces for bikers to travel and park safely should be prioritized. Although these efforts such as the construction of bike lanes and shared-road markings are already underway, these should be expanded to more practical travel routes. Similarly, more bike parking spaces should be built in essential establishments such as government buildings, the public market, and areas located in the central business district. Since the presence of natural views and greeneries were deemed to be significant, the city should also work on creating more green spaces that enhance active modes of travel such as biking and walking. Consequently, both bikers and non-bikers would more likely be encouraged to bike not just for recreational purposes, but also for practical purposes such as shopping and doing errands. This can also have a positive effect on automobile travel by reducing traffic congestion, since fewer vehicles would be on the road when people are freely able to bike around the city.

Based on the regression results on demographics, biking should also be promoted more to women and youth since the majority of the city's bikers consist of older males. Further enforcing laws that punish perpetuators of catcalling and sexual harassment can also encourage more women to bike. As public attitude and public image also had a positive effect on the likelihood of becoming a biker, educational seminars to be conducted by LTO or LTFRB could help motorists and drivers better understand how to coexist with bikers. Strict implementation of laws and ordinances pertaining to road safety should also be sought. This addresses concerns of safety and security of bikers on the road. Taking into account these issues, a close coordination and consultation to future research is helpful in order to study specific factors and effects of policies created and implemented.

As Baguio aspires to be a clean, green, and sustainable city, implementing sustainable transportation is one of the essential steps in accomplishing that goal. Thus, creating spaces that prioritize walking, biking, and mass transportation will not only help encourage the use of these modes of transport but will also help in transitioning and integrating a more sustainable framework for the city's transportation system. Along with the enforcement of the city's current laws and ordinances, the city's future transportation policies should also prioritize the rights of these travelers. Thus, to better understand their needs, it is also necessary to continuously collect data through observations and consultations such as this study.

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