PROBLEMS AND CHALLENGES IN INTRODUCING BICYCLE AS A POTENTIAL MODE OF TRANSPORT IN DHAKA CITY

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ABSTRACT

The traffic system of Dhaka city is cursed with intolerable traffic congestion, serious air pollution and excessive use of natural resources. Therefore, effective and sustainable measures should be taken to mitigate the problem; otherwise it will become a dead city. Bicycle as a space efficient mode can be helpful to improve the situation. Though bicycle is a cheap and sustainable mode of transportation, at present road users are not attracted to cycling. In this paper, the hindrances to make bicycle as a popular mode for both commuters and non-commuters have been investigated. In this regard, primary and secondary data have been collected from different zones of Dhaka city. User's perceptions have been obtained by questionnaire survey among different cross section of people. Non-bicycle user's survey has also been conducted to find out the reasons for their indifference to cycling. Collected data have been used to establish a multinomial model with different parameters. From the model it is found that the bike lane is the most dominant factor to make this fuel free mode of transportation attractive to the road users. Analyzing the data some recommendations are proposed so that bicycle can be an effective alternate to minimize the present unbearable condition of Dhaka city.

Keywords: *sustainable, user's perception, bike lane*

1. INTRODUCTION

Dhaka is one of the most unlivable and overcrowded cities in the world (Economists Intelligence Unit, 2013). Here, congestion is so acute that the commuter and non-commuter have to spend most of their valuable time in traffic jam. As a result, the economic health of our country has not been improved in a desired way. After the liberation war in 1971, the transportation infrastructures have not been developed matching with the travel demand as well as proper planning. Recently, some flyovers have been inaugurated but their outcome to reduce congestion is not significant. So some sustainable and proper planning is a crying need for this city. Bicycle can be an efficient mode to reduce the problem to some extent. Bicycle is the cheapest as well as very space efficient and most importantly it is an environmental friendly mode of transport. It takes only one quarter and one tenth of cost of bus and rickshaw respectively (Strategic transport plan for Dhaka.2005). Typically bicycle is found to be very effective in urban areas, particularly for a compact city like Dhaka where the amount of daily trip with less than 3 km length is about 40% (DTCA, 2010). Essentially this implies that there is a huge potential to carry these larger amount of shorter trips by a well-planned and integrated bicycle based transport system and thereby can contribute in reducing traffic congestion.

In many cities of the world, bicycle is proved as an effective tool to reduce congestion. Countries like Denmark, Netherland, China make their policies with giving most importance to bicycle. In Amsterdam, 48.5% of total vehicles is bicycle (Future of Transport report, 2011). China has the largest bike sharing network (Susan and Guzman, 2011). Recently in Bangladesh it is becoming popular especially among youth. 39% of total family have bicycle in our country whereas in India, our neighbour country the percentage is 62 (Pew Research Center Report). Developing the infrastructure facility as well as safety provision for bicycle it is hoped to have better number of bicycle user on road of Dhaka city and thus reducing the congestion with the improvement of environment and fuel consumption.

The overall objective of this study is to illustrate demand of bicycle user as well as non-bicycle user. Then a Multinomial logit model has been established indicating the prime requisite steps to develop bicycle as an attractive mode.

2. METHODOLOGY

To find out the user perception, questionnaire survey has been conducted through an online survey using Google docs along with face to face survey. The initial survey has been done by face to face survey and discussion among the bicycle companies, stores and bicycle group which indicates the overall scenario of bicycle condition in Dhaka city. From the responses of non-bicycle user a Multinomial logit model (MNL) has been formed. Multinomial logit models are used to model relationships between a polytomous response variable and a set of regression variables. Some types of models are appropriate only for ordinal responses; other models may be used whether the response is ordinal or nominal. If the response is ordinal, we do not necessarily have to take the ordering into account, but it often helps if we do. Using the natural ordering can of the above models; the MNL is the simplest and most popular model (Ben-Akiva,2010).

3. DATA ANALYSIS

The responses of 290 bicycle users and 310 non users have been used to analyse the data. Both the bicycle users and non-users have been asked some fundamental questions such as gender, age and profession. Addition of these questions, the bicycle users have been asked about their trip length, the problems faced by them in roads and their suggestions about the improvement of this mode. Likewise, the non-users perception have been analysed by asking them why they don't use bicycle for commuting and non-commuting. Their responses help to find out the lacking which make it unpopular in Dhaka city.

3.1 Perception Analysis of Bicycle User

Among the respondents, 96, 2% were male and 3.8% were female user. All the female user were student. In total, student and jobholders have been contributed 75.5% and 24, 4% data respectively.

3.1.1 Reason for Choosing Bicycle

Among the total respondents, who have other options for their trip, 27.2% were used for saving money.24.5% were used for reducing trip time, 16.9% for recreation, 15.9% for keeping their health fit, 8.9% for keeping the environment pollution free and 66% for reducing traffic congestion.

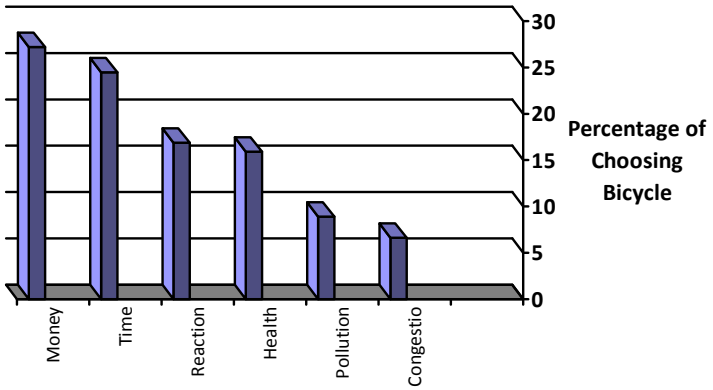

Figure 1: Bar chart showing reason for cycling

3.1.2 Purpose of Using Bicycle

154 respondents, which is 53.1% of total, use bicycle for commuting while 35.2% use it for spending free time. The rest 11.7% give their information on shopping and exercise.

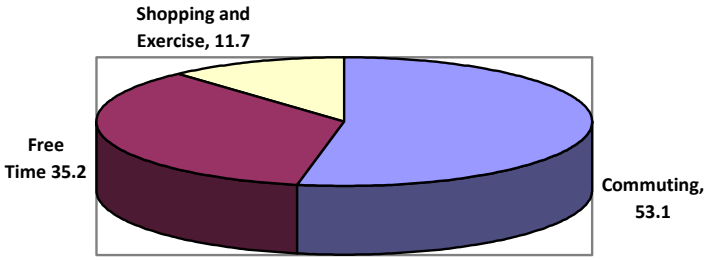

Figure 2:Pie chart showing purpose of cycling

3.1.3 Problems Faced by Bicyclist

A transport mode can lose its attraction, when its users do not find sufficient facility as well as faces many problems. Two of the major problems faced by the respondents is the absent of bike lane and insecure bike stand (35.2 and 40.7% respectively). Bad Street lighting (10.3%) and unsafe intersection (13.8%) are also create trouble to the respondents.

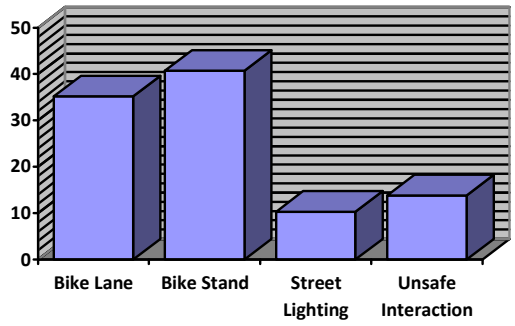

Figure 3: Bar chart showing poblems faced by bicycle user

3.2 Perception Analysis of Bicycle Non-User

From the questionnaire it has been found, 60% of total respondents of non-bicycle users will use bicycle if there are bike lanes, 17.7% if there are safe bike stands, 10.6% if cost of bicycle is reduced. Other 6.5% and 5.2% recommended for safe sign and intersections and improved lighting respectively. From them, it is also found that 71.9% will use bicycle instead of rickshaw, 13.5% instead of walking, 4.8% will leave C.N.G, 9% leave bus and only 0.8% stop using car if proper measures can be implemented.

3.2.1 Multinomial Logit Model

These data have been used to form a multinomial logit model which has indicated the effective measures for individual modal shift by bicycle. The data have been analysed by SPSS 20.0 MNL program. Recommendations have been taken as an independent variable and types of modal shifts have taken as a dependent variable.

Table 1:Case Processing Summary

		N	Marginal Percentage
Recommendation	bike lane	186	60.0%
	safe bike stand	55	17.7%
	reducing bicycle cost	33	10.6%
	safe signal and intersection	21	6.8%
	provide lighted area	15	4.8%
mode replaced by bicycle	Rickshaw	221	71.3%
	Walk	40	12.9%
	C.N.G	16	5.2%
	Bus	30	9.7%
	Car	3	1.0%
Valid		310	100.0%
Missing		0	
Total		310	
Subpopulation		5	

The Cox and Snell R^2 measure operates like R^2, with higher values indicating greater model fit. This measure is limited in that it cannot reach the maximum value of 1. So Nagelkerke proposed modification that had the range from 0 to 1. Nagelkerke‟s measure is relied for indicating the strength of the relationship.

Table 2: Pseudo R-Square

Cox and Snell	.145
Nagelkerke	.160
McFadden	.066

Table 3 shows the model fitting information about the model. This is the Likelihood Ratio (LR) Chi-Square test that at least one of the predictors regression coefficients is not equal to zero in the model. This test is analogous to the F-test for R^2value in multiple regressions which test whether or not the improvement in the model associated with the additional variables is statistically significant. In this model, chi-square value of 48.666 has significance (0.000) and is less than 0.001, so there is a significant relationship between the dependent variable and the set of independent variables

Table 3: Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	141.992			
Final	93.325	48.666	16	.000

The parameter estimates of the minimum acceptable model are given in Table. The degrees of freedom (df) of the chi-square distribution used to test the LR Chi-Square statistic and is defined by the number of predictors in

the model. The term 'Significance' is the probability getting a LR test statistic being as extreme as, or more so, than the observed statistic under the null hypothesis; the null hypothesis is that all of the regression coefficients in the model are equal to zero. In other words, this is the probability of obtaining this chi-square statistic (48.666), or one more extreme, if there is in fact no effect of the predictor variables. This p-value is compared to a specified alpha level, our willingness to accept a type I error, which is typically set at 0.05 or 0.01. The small p-value from the LR test, <0.00001, would lead us to conclude that at least one of the regression coefficients in the model is not equal to zero. The parameter of the chi-square distribution used to test the null hypothesis is defined by the degrees of freedom in the prior column.

Table 4: Parameter Estimates

Recommendation		B	Std. Error	Wald	df	Sig.
safe bike stand	Intercept	-20.493	1.520	181.747	1	.000
	[rickshaw]	19.265	1.530	158.440	1	.000
	[Walk]	20.261	1.566	167.395	1	.000
	[C.N.G]	16.332	2.893	31.874	1	.000
	[Bus]	16.653	.000	.	1	.
	[Car]	0[b]	.	.	0	.
reducing bicycle cost	Intercept	-21.003	.404	2699.376	1	.000
	[rickshaw]	19.240	.461	1741.603	1	.000
	[Walk]	13.680	9.764	1.963	1	.161
	[C.N.G]	16.332	3.193	26.156	1	.000
	[Bus]	20.145	.000	.	1	.
	[Car]	0[b]	.	.	0	.
safe signal and	Intercept	-21.455	2.444	77.071	1	.000
intersection	[rickshaw]	19.286	2.458	61.553	1	.000
	[Walk]	20.934	2.478	71.356	1	.000
	[C.N.G]	19.615	2.579	57.837	1	.000
	[Bus]	16.653	.000	.	1	.
	[Car]	0[b]	.	.	0	.
provide lighted area	Intercept	-14.554	835.373	.000	1	.986
	[rickshaw]	9.963	835.373	.000	1	.990
	[Walk]	12.450	835.373	.000	1	.988
	[C.N.G]	13.366	835.373	.000	1	.987
	[Bus]	9.416	835.378	.000	1	.991
	[Car]	0[b]	.	.	0	.

a. The reference category is: bike lane.

b. This parameter is set to zero because it is redundant.

3.2.2 Interpretation of Result

3.2.2.1 *Bike lane Relative to Safe Bike Stand*

The multinomial log-odds of modal shift from rickshaw preferring bike stand relative to bike lane would be expected to increase by 19.265 units while holding all other variables in the model constant. The Wald test statistic for the predictor rickshaw is 158.440 an associated p-value of 0.000., the regression coefficient for

rickshaw has been found to be statistically significant.. The Wald test statistic for the predictor walking, C.N.G is 167.395, 31.874 respectively, with an associated p-value of 0.000, which is less than 0.05. Hence it would significant to accept the null hypothesis and conclude that the commuters and non commuters using rickshaw,walking,C.N.G prefer bike lane more than bike stand.So the modal indicates that for modal shift from rickshaw,walking,C.N.G to bicycle, bike lane is more necessary than bike stand.

3.2.2.2 *Bike lane Relative to Reducing Bicycle Cost*

The multinomial log-odds of modal shift from rickshaw,C.NG preferring cost reduction of bicycle relative to bike lane would be expected to increase by 19.240 and 16.332 units respectively while holding all other variables in the model constant. The Wald test statistic for the predictor rickshaw and C.N.G is 1741.603,26.156 respectively with an associated p-value of 0.000., the regression coefficient for cost has been found to be statistically significant.. Hence it would significant to accept the null hypothesis and conclude that modal shift from rickshaw C.N.G to bicycle, bike lane is more necessary than reducing bicyle cost.

3.2.2.3 *Bike Lane Relative to Safe Signal and Intersection*

The coefficient of Intercept is -21.455 with an associated p-value of 0.000., hence it would significant to accept the null hypothesis and conclude that the commuters are less likely to prefer bike lane than safe signal and intersection.

3.2.2.4 *Bike Lane Relative to Lighted Area*

The p- value of modal shift from rickshaw, walking, C.N.G and bus are greater than 0.05, hence these are not significant. So improving lighting condition has no significant effect on increasing bicycle use.

4. CONCLUSION

The Multinomial logit model for effective measure to increase bicycle use has been development. Bike lane, Safe bike stand, safe signal and intersection have significant influence on modal shift to cycle. The investigation has been conducted through a comprehensive analysis of transportation, and personal statistics, principally with the aid of the logit model. Findings from this study can be summarized as follows:

a) Main influencing factor of using bicycle is for saving money (27.2%).
b) About half of total use of bicycle is for commuting purpose (53.1%).
c) Most of the bike users (40.7%) face problem because of insecure bike stand.
d) About two third (60%) bicycle non users recommend for bike lane for modal shift to bicycle.
e) A huge number of rickshaw user will be shifted to cycle if proper measures is taken.
f) Bike lane is the most important factors to attract the commuters and lighted area has no significance to the users.
g) For modal shift from rickshaw to bicycle, both bike lane and safe bike stand are necessary.

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