

**FACTORS AFFECTING ON CUSTOMER CHOICE OF DEDICATED NON-MOTORIZED VEHICLE HIGHWAY IN COLOMBO CITY**

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**AND TRANSPORTATION**

**By**

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**TITLE PAGE**

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**ABSTRACT**

This dissertation is written to present the essence of the achievements during the four-year study period at Logistics and Transportation in CINEC campus, Malabe. This paper is the concluding part of the degree in BSc (Hons) Logistics and Transportation.

First and foremost, I would like to express my sincere gratitude to my supervisor Mrs. Wajira Rathnayake for her continuous support to complete my thesis in a better way, for her patience, motivation, enthusiasm and immense knowledge. Her guidance helped me in all the time of research and writing of this thesis. I could not have imagined having a better advisor and mentor for my study.

At the completion of this dissertation it is with a great pleasure I convey my gratefulness for dedication and admiration made by many individuals in making this a success. I’m grateful to the Department of Logistics and Transport, CINEC campus and all academic and nonacademic members for the tremendous service rendered throughout.

Finally, I would like to thank my parents for their support for the successful completion of this work and I would also like to thank my batch mates for their views and opinions throughout this dissertation. Also I thank my family members and for friends for their love, support and understanding during this dissertation writing.

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In present day context the traffic congestion in Colombo city has become a serious issue which has led to number of negative impact such as increasing time which has to be spent on the road, in vain wastage of fuel, decrease in productivity and increasing environmental pollution due to the emission of gases and unnecessary sounds. Government has carried out number of initiatives in order to overcome these issues but yet those have not achieved long term solution to these issues. Therefore modal split from motorized transportation to non-motorized transportation can be considered as a better solution. This helps in terms of reducing number of private vehicles on the road, reduce environmental pollution, reduce dependency on fossil fuel and also brings out many positive effects on health. In this research main objectives were to identify the affecting on customer choice of non – motorized vehicle highway in Colombo city. Thereby identify the relationships among those factors, to identify the willingness among people to select bicycle as a mode of transportation and finally to propose ways and means to promote this kind of mode of transportation. The significance of the study is this is important when seeking a better solution for the issues such as gradual increase of private vehicle ownership in Sri Lanka as a result increase of fossil oil dependency and GHG emission. As the sampling technique simple random sampling has been used and for the analysis method factor analysis has been used. Based on the information gathered from a structured questionnaire which was distributed it was found that there is a positive potential among people to use non – motorized mode of transportation for that there is a necessity in governmental intervention in provision of more facilities, enforcing more safety rules and regulations at the same time there is a need of marketing as a source of stimulation.

Key words: Modal split, Motorized transportation, Non – motorized transportation, GHG emission, and structured questionnaire.

**Table of Contents**

[**DECLARATION** 4](#_Toc533053698)

[**ABSTRACT** 5](#_Toc533053699)

[**ACKNOWLAGEMENT** 6](#_Toc533053700)

[**1** **CHAPTER ONE: INTRODUCTION** 16](#_Toc533053701)

[**1.1** **Introduction to the Chapter** 16](#_Toc533053702)

[**1.2** **Background of the Study** 16](#_Toc533053703)

[**1.3** **Research Problem and Justification** 19](#_Toc533053704)

[**1.4** **Research Objectives** 20](#_Toc533053705)

[**1.5** **Research Questions** 20](#_Toc533053706)

[**1.6** **Hypothesis** 21](#_Toc533053707)

[**1.7** **Significance of the Study** 21](#_Toc533053708)

[**1.8** **Chapter Outline** 23](#_Toc533053709)

[**1.9** **Chapter Summary** 24](#_Toc533053710)

[**2** **CHAPTER TWO: LITERATURE REVIEW** 25](#_Toc533053711)

[**2.1** **Introduction to the Chapter** 25](#_Toc533053712)

[**2.2** **Transportation** 25](#_Toc533053713)

[**2.3** **Non-Motorized Transportation** 25](#_Toc533053714)

[**2.4** **Implications of Cycling in Other Countries** 26](#_Toc533053715)

[**2.5** **Benefits of Non-Motorized Transportation** 27](#_Toc533053716)

[**2.6** **Determinants of Customer Choice in Cycling** 29](#_Toc533053717)

[**2.6.1** **Distance and Travel Time** 34](#_Toc533053718)

[**2.6.2** **Attractive and Comfortability** 35](#_Toc533053719)

[**2.6.3** **Experience** 35](#_Toc533053720)

[**2.6.4** **Age** 35](#_Toc533053721)

[**2.6.5** **Trip Purpose** 36](#_Toc533053722)

[**2.6.6** **Gender** 36](#_Toc533053723)

[**2.6.7** **Environmental Factors** 36](#_Toc533053724)

[**2.6.8** **Safety and Security** 37](#_Toc533053725)

[**2.6.9** **Infrastructure and Facilities** 37](#_Toc533053726)

[**2.6.10** **Household nature** 38](#_Toc533053727)

[**2.7** **Chapter Summary** 39](#_Toc533053728)

[**3** **CHAPTER THREE: METHODOLOGY** 40](#_Toc533053729)

[**3.1** **Introduction to the Chapter** 40](#_Toc533053730)

[**3.2** **Research Design** 40](#_Toc533053731)

[**3.3** **Type of the Study** 40](#_Toc533053732)

[**3.4** **Nature of the Study** 41](#_Toc533053733)

[**3.5** **Conceptual Framework** 41](#_Toc533053734)

[**3.6** **Independent and Dependent Variables** 43](#_Toc533053735)

[**3.7** **Dependent Variable** 44](#_Toc533053736)

[**3.8** **Questionnaire Design** 44](#_Toc533053737)

[**3.9** **Scaling Techniques** 45](#_Toc533053738)

[**3.10** **Sampling** 48](#_Toc533053739)

[**3.10.1** **Target Population** 48](#_Toc533053740)

[**3.10.2** **Sampling Unit** 48](#_Toc533053741)

[**3.10.3** **Sampling Method** 48](#_Toc533053742)

[**3.10.4** **Sampling Size and Time Frame** 49](#_Toc533053743)

[**3.11** **Data Collection Method** 49](#_Toc533053744)

[**3.12** **Validity and Reliability** 49](#_Toc533053745)

[**3.13** **Pilot Survey** 50](#_Toc533053746)

[**3.14** **Method of Data Analysis** 51](#_Toc533053747)

[**3.15** **Descriptive Analysis** 51](#_Toc533053748)

[**3.16** **Cross Tabulation** 51](#_Toc533053749)

[**3.17** **Factor Analysis** 52](#_Toc533053750)

[**3.18** **Bartlett’s Test** 52](#_Toc533053751)

[**3.19** **The KMO Index** 52](#_Toc533053752)

[**3.20** **Rotated Component Matrix** 53](#_Toc533053753)

[**3.21** **Kruskal – Wallis Test** 53](#_Toc533053754)

[**3.22** **Chapter Summary** 54](#_Toc533053755)

[**4** **CHAPTER FOUR: DATA ANALYSIS AND DISCUSSION** 55](#_Toc533053756)

[**4.1** **Introduction to the Chapter** 55](#_Toc533053757)

[**4.2** **Demographic Profile and Preference Analysis** 55](#_Toc533053758)

[**4.2.1** **Age Group** 55](#_Toc533053759)

[**4.2.2** **Gender** 56](#_Toc533053760)

[**4.2.3** **Employment** 57](#_Toc533053761)

[**4.2.4** **Employment Sector** 57](#_Toc533053762)

[**4.2.5** **Monthly Income** 58](#_Toc533053763)

[**4.2.6** **Bicycle Ownership** 59](#_Toc533053764)

[**4.2.7** **Most Frequent Type/s of Mode Using for Travelling** 59](#_Toc533053765)

[**4.2.8** **Response on whether they have used bicycle for travelling during the past month** 61](#_Toc533053766)

[**4.2.9** **Reasons for Not Using** 61](#_Toc533053767)

[**4.2.10** **Purposes of Using** 63](#_Toc533053768)

[**4.2.11** **Willingness in Using** 64](#_Toc533053769)

[**4.2.12** **Preferred Frequency of Cycling** 64](#_Toc533053770)

[**4.2.13** **Preferred Distance** 65](#_Toc533053771)

[**4.2.14** **Suitable Infrastructure** 66](#_Toc533053772)

[**4.2.15** **Preferred for Using** 67](#_Toc533053773)

[**4.3** **Independent Variables Profile and Frequencies** 68](#_Toc533053774)

[**4.4** **Descriptive Statistics** 71](#_Toc533053775)

[**4.5** **Reliability Analysis** 72](#_Toc533053776)

[**4.5.1** **Reliability of the Full Data Set** 72](#_Toc533053777)

[**4.6** **Factor Analysis** 72](#_Toc533053778)

[**4.6.1** **KMO and Bartlett’s Test** 73](#_Toc533053779)

[**4.6.2** **Communalities** 74](#_Toc533053780)

[**4.6.3** **Scree Plot** 75](#_Toc533053781)

[**4.6.4** **Total Variance Explained** 76](#_Toc533053782)

[**4.6.5** **Component Matrix** 78](#_Toc533053783)

[**4.6.6** **Rotated Component Matrix** 79](#_Toc533053784)

[**4.6.7** **Factor Rename** 80](#_Toc533053785)

[**4.6.8** **Component Coefficient Matrix** 81](#_Toc533053786)

[**4.6.9** **Construction of Equations for Factors** 82](#_Toc533053787)

[**4.7** **Reliability Test for the Factors Developed in the Model** 82](#_Toc533053788)

[**4.7.1** **Infrastructure Facilities** 82](#_Toc533053789)

[**4.7.2** **Personal Consideration** 83](#_Toc533053790)

[**4.7.3** **Mobility and Cost Factors** 83](#_Toc533053791)

[**4.7.4** **External Environment and Social Influence** 83](#_Toc533053792)

[**4.7.5** **Construction and Policy Making** 84](#_Toc533053793)

[**4.8** **Cross Tabulation** 84](#_Toc533053794)

[**4.9** **Hypothesis Testing** 88](#_Toc533053795)

[**4.9.1** **Hypothesis Testing for Infrastructure facilities** 88](#_Toc533053796)

[**4.9.2** **Hypothesis Testing for Personal Consideration** 89](#_Toc533053797)

[**4.9.3** **Hypothesis Testing for Mobility and cost factor** 90](#_Toc533053798)

[**4.9.4** **Hypothesis Testing for External environment and Social influence** 91](#_Toc533053799)

[**4.9.5** **Hypothesis Testing for Construction and Policy Making** 92](#_Toc533053800)

[**4.9.6** **Hypothesis Testing for Environmental Consciousness** 93](#_Toc533053801)

[**4.10** **Chapter Summary** 94](#_Toc533053802)

[**5** **CHAPTER FIVE: FINDINGS AND SUGGESTIONS OF THE STUDY** 96](#_Toc533053803)

[**5.1** **Introduction to the Chapter** 96](#_Toc533053804)

[**5.2** **Limitations of the Study** 96](#_Toc533053805)

[**5.3** **Findings of the Research** 97](#_Toc533053806)

[**5.3.1** **Findings from the Demographic Factors** 97](#_Toc533053807)

[**5.3.2** **Findings from Independent Variables** 98](#_Toc533053808)

[**5.3.3** **Findings from Hypothesis Testing** 99](#_Toc533053809)

[**5.4** **Recommendations** 100](#_Toc533053810)

[**5.5** **Conclusion** 101](#_Toc533053811)

[**5.6** **Directions for Future Research** 102](#_Toc533053812)

[**6** **References** 103](#_Toc533053813)

[**7** **Appendix** 106](#_Toc533053814)

[**8** **Appendix 1 (Questionnaire)** 106](#_Toc533053815)

[**9** **Appendix 2 (Frequency tables of demographic variables)** 114](#_Toc533053816)

[**10** **Appendix 3 (Factor analysis raw tables)** 124](#_Toc533053817)

[**11** **Appendix 4 (Raw tables of Kruskal Wallis Test)** 126](#_Toc533053818)

List of Tables

[Table 4.1: Total respondents 59](#_Toc533005148)

[Table 4.2: Modes of travel distribution of the respondents 60](#_Toc533005149)

[Table 4.3: Total respondents 61](#_Toc533005150)

[Table 4.4: Frequencies of the respondents who are not using with their reasons 62](#_Toc533005151)

[Table 4.5: Total respondents 63](#_Toc533005152)

[Table 4.6: Frequencies of respondents using bicycle for different purposes 63](#_Toc533005153)

[Table 4.7: Total respondents 66](#_Toc533005154)

[Table 4.8: Frequency of the respondents who selected different infrastructures 66](#_Toc533005155)

[Table 4.9: Total respondents 67](#_Toc533005156)

[Table 4.10: Frequency of the respondents selected different purposes 67](#_Toc533005157)

[Table 4.11: Frequencies of the independent variables 68](#_Toc533005158)

[Table 4.12: Descriptive statistics of the independent variables 71](#_Toc533005159)

[Table 4.13: Reliability test statistics of full data set 72](#_Toc533005160)

[Table 4.14: Kaiser – Meyer – Olkin and Bartlett’s Test 73](#_Toc533005161)

[Table 4.15: Communalities 74](#_Toc533005162)

[Table 4.16: Total Variance Explained 76](#_Toc533005163)

[Table 4.17: Component Matrix 78](#_Toc533005164)

[Table 4.18: Rotated Component Matrix 79](#_Toc533005165)

[Table 4.19: Factor groups with Variables 80](#_Toc533005166)

[Table 4.20: Component Coefficient Matrix 81](#_Toc533005167)

[Table 4.21: Reliability Test Statistics of Infrastructure facilities factor 82](#_Toc533005168)

[Table 4.22: Reliability Test Statistics of Personal Consideration factor 83](#_Toc533005169)

[Table 4.23: Reliability Test Statistics of Mobility and Cost Factors 83](#_Toc533005170)

[Table 4.24: Reliability Test Statistics of External environment and Social Influence factor 83](#_Toc533005171)

[Table 4.25: Reliability Test Statistics of Construction and Policy making 84](#_Toc533005172)

[Table 4.26: Chi – Square Test Statistics of Willingness to use vs infrastructure factors 84](#_Toc533005173)

[Table 4.27: Chi – Square Test Statistics of Willingness to use vs personal consideration 85](#_Toc533005174)

[Table 4.28: Chi – Square Test Statistics of Willingness to use vs mobility and cost factors 86](#_Toc533005175)

[Table 4.29: Chi – Square Test Statistics of Willingness to use vs construction and policy making 86](#_Toc533005176)

[Table 4.30: Chi – Square Test Statistics of Willingness to use vs Environmental consciousness 87](#_Toc533005177)

[Table 4.31: Chi – Square Test Statistics of Willingness to use vs External environment and social influence factor 87](#_Toc533005178)

[Table 4.32: Pearson Chi – Square values of demographic factors Vs Infrastructure facilities 88](#_Toc533005179)

[Table 4.33: Pearson Chi – Square values of demographic factors Vs Personal consideration 89](#_Toc533005180)

[Table 4.34: Pearson Chi – Square values of demographic factors Vs Mobility and cost factor 90](#_Toc533005181)

[Table 4.35: Pearson Chi – Square values of demographic factors Vs External environment and Social influence 91](#_Toc533005182)

[Table 4.36: Pearson Chi – Square values of demographic factors Vs Construction and policy making 92](#_Toc533005183)

[Table 4.37: Pearson Chi – Square values of demographic factors Vs Environmental consciousness 93](#_Toc533005184)

List of Figures

[Figure 1.1: Worldwide shares of petroleum and other liquids use by different sectors 17](#_Toc533002243)

[Figure 1.2: Energy related Carbon dioxide emission 17](#_Toc533002244)

[Figure 1.3: Increase of private vehicle ownership 18](#_Toc533002245)

[Figure 1.4: combined co2 emission from energy sector in Sri Lanka 19](#_Toc533002246)

[Figure 1.5: Vehicle and passenger populations in Colombo City Limits 22](#_Toc533002247)

[Figure 2.1: Factors affecting bicycle use 30](#_Toc533002248)

[Figure 2.2: Path diagram to explain the use of bicycle as a function of latent variables (circles) and their indicators (boxes) 31](#_Toc533002249)

[Figure 2.3: Conceptual framework on bicycle ownership 32](#_Toc533002250)

[Figure 2.4: Summary of factors associated with bicycle ownership and use 33](#_Toc533002251)

[Figure 2.5: Factors affecting on changes in walking and bicycling behavior 34](#_Toc533002252)

[Figure 3.1: Conceptual framework 43](#_Toc533002253)

[Figure 4.1: Age group distribution of the respondents 55](#_Toc533002254)

[Figure 4.2: Gender distribution of the respondents 56](#_Toc533002255)

[Figure 4.3: Employment distribution of the respondents 57](#_Toc533002256)

[Figure 4.4: Employment sector distribution of the respondents 58](#_Toc533002257)

[Figure 4.5: Monthly income distribution of the respondents 58](#_Toc533002258)

[Figure 4.6: Bicycle ownership of the respondents 59](#_Toc533002259)

[Figure 4.7: Distribution of respondents have used bicycle 61](#_Toc533002260)

[Figure 4.8: Percentage of respondents who are willing to use 64](#_Toc533002261)

[Figure 4.9: Preferred frequency of cycling 65](#_Toc533002262)

[Figure 4.10: Frequency of preferred distance 65](#_Toc533002263)

[Figure 4.11: Scree Plot 75](#_Toc533002264)

List of Equations

[Equation 1: Cronbach’s Alpha 50](#_Toc532992599)

[Equation 2: Bartlett’s test statistics 52](#_Toc532992600)

[Equation 3: KMO Index 53](#_Toc532992601)

List of Abbreviations

GHG – Greenhouse gases

NMT – Non motorized transportation

NMV – Non motorized vehicles

# **CHAPTER ONE: INTRODUCTION**

## **Introduction to the Chapter**

In this chapter focuses on the background of the study, research problem and justification, research objectives, research questions, hypothesis, significance of the study and chapter outline.

## **Background of the Study**

With the gradual increase of population, the needs and wants of people are increasing at a rapid phase. Simultaneously it has led to increasing levels of awareness on carbon dioxide emissions as well. One of the vital needs of people is “transportation”, which has a significant take part in the increasing consumption of energy. Transportation is considered to be a derived demand which occurs when people move from one place to another either for commuting activities or for leisure. Relationship between transportation and environment is paradoxical in nature where transportation leads to a social and economic benefit while adversely impacting the environment. This adverse effect is a result of unlimited dependency on non-renewable energy sources. These endless energy needs are satisfied from continues burning of fossil fuels. High dependency on fossil fuel has become the major donor for the greenhouse gas emissions which contributes for environmental pollution on the other hand. All modes of transportation more or less contribute to adverse environmental impacts and when it comes to the road transportation both public and private transportation are equally significant in the context of CO2 emissions.

According to (IEO, 2017) the transportation sector remains the largest consumer of refined petroleum and other liquids as their use for travel and freight services increases at a faster rate than their use in other application between 2015 and 2040. Furthermore it is stated that the worldwide transportation sector accounts for 55% of total end use sector liquid fuels consumption in 2014, about the same as its share in 2015. The use of refined petroleum and other liquid fuels in the transportation sector continues to increase through 2040. The worldwide petroleum and liquid fuel shares in different sectors are demonstrated in the below figure.

Figure 1.1: Worldwide shares of petroleum and other liquids use by different sectors

Source: (IEO, 2017)

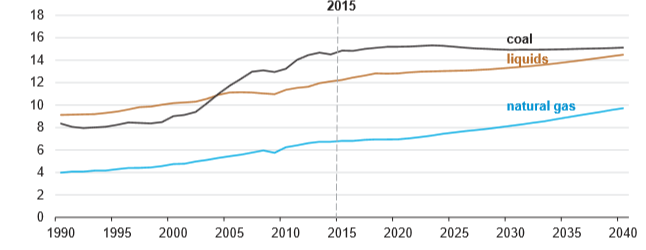


Figure 1.2: Energy related Carbon dioxide emission

Source: (IEO, 2017)

According to (IEO, 2017) there is an increase in energy related carbon dioxide from 2015 to 2040. It is mentioned that coal related co2 emissions are projected to increase at an average rate of 0.1% year between 2015 and 2040. Liquids related co2 emissions grow an average 0.7% year between 2015 and 2040.

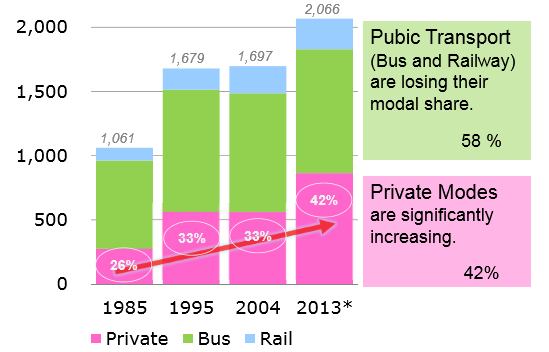


Figure 1.3: Increase of private vehicle ownership

Source:(Draft Urban Transport Master Plan; Colombo Metropolitan Region and Suburbs, 2013)

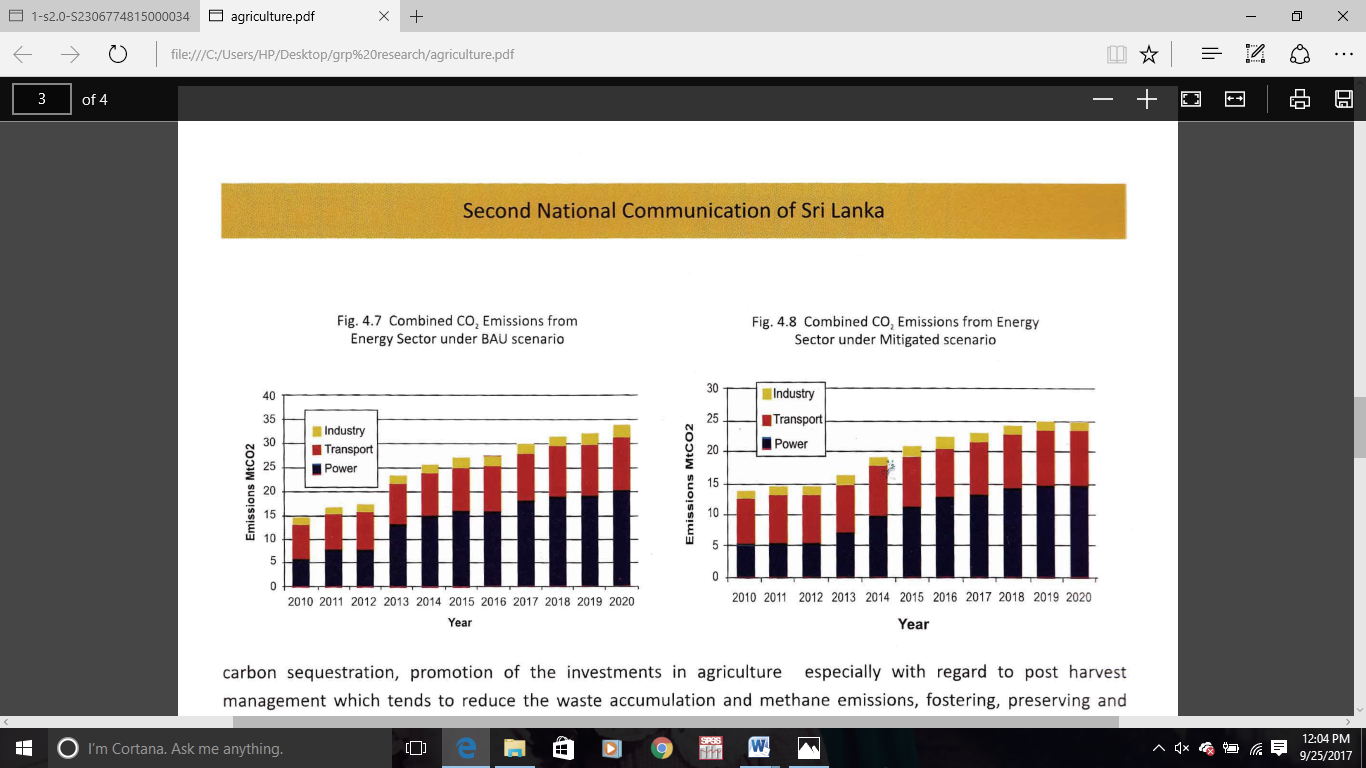
With the growth of the economy and becoming urban areas more populated, the increase of motor vehicle use gradually increases ultimate result is the increase of traffic congestion and thereby increase pollution and greenhouse emissions. In Colombo the proportion of the population using private transportation has increased from 26% in 1985 to 42% in 2013.Travel speed at peak hours average has become less than 15km per hour. Without energy efficient and space efficient transport solutions this problem will rise gradually at the same time the population of the Western province is expected to rise from 5.8 million to 8.7 million by 2035 which means the rise in need of transport will continue.

Figure 1.4: combined co2 emission from energy sector in Sri Lanka

Source*:* (UNFCC, 2012)

Despite the fact that Sri Lanka, being a small country its contribution to GHG emission is significant. Therefore it affects the environment as much as any other country which is clearly depicted in the figure above. Hence without any doubt it is clearly evident that carbon dioxide emission in transportation sector is a timely and imperative matter to be addressed further. As a solution to overcome the vast levels of CO2 emissions in transport sector promotion of non-motorized transportation can be applied. As mentioned in (Silva, 2017) in the Megapolis Transport Development plan under the category of environmental sustainably transportation it is planned to promote non-motorized transportation. The estimated cost is about 229 million USD.

According to the (Draft Urban Transport Master Plan; Colombo Metropolitan Region and Suburbs, 2013) it has stated about seven corridors from which vehicles are entering the Colombo city. Galle, Horana, Negombo, Kandy, Low Level, High Level and Malabe corridors were identified and it has been estimated that over one million people are entering the Colombo city through these seven corridors. A highest number of private vehicles are entering to the Colombo city via Malabe corridor. One possible approach to reduce congestion in these highly congested corridors is to change the modal split by reducing motorized transport thereby strengthening non-motorized transport. But in most occasions congestion reduction focuses on motorized transport and does not take non-motorized methods into account. Cycling is one such method of non-motorize transportation. In highly dense areas for travelling short distances, the car is an inefficient and unsuitable mode of transport. Improvement of multimodal transport options that include non-motorize transport methods take lower cost for implementation and potential to influence a mode share shift also lead to create a sustainable mobility function. Cycling makes transport more affordable, improves personal health, reduces air and noise pollution and is less expensive than car-dominated urban transport.

## **Research Problem and Justification**

Sri Lanka being categorized as a developing country is hugely depending on its transport sector. Day today mobility is a must for the people and to provide goods and services from one point to another. Since transport is a derived demand it is a must that proper transport means are available to the public. If proper transport means are not available people are unable to achieve their other requirements such as educations work and other. Due to poor services and conditions in public transportation people tend to use their own vehicles. Ultimate results will be the increase in congestion and increasing the emission of harmful gases,

In relevance to Sri Lanka it can be observed that there is a rising levels of private vehicle ownership signifies the poor quality public transportation. Along with this scenario the fossil fuel burnt per person is at the verge of increasing exponentially in near future. In return it affect to the country’s economy as Sri Lanka does not have housed sources of fossil fuels, and has to bear the cost of importing and purification of fuel. Therefore, Sri Lankan economy face a difficulty in catering the growing transportation needs of the population where fossil fuel dependency has become a must. Transportation sector has a GHG emission rate of 14% according to the world GHG emissions in year 2015 (IPCC, 2014). Therefore promotion of motorized vehicles should be reduced while enhancing the promotion of no motorized vehicle usage. Through this research it is aimed to find out the willingness of people and factors affecting towards promoting non-motorized vehicles.

## **Research Objectives**

1. To identify the factors affecting on customer choice of non-motorized vehicle highway in Colombo City area.
2. To identify the relationship among those factors,
3. To identify the willingness of the users to select bicycle as a mode of transportation
4. To find ways and means to promote non-motorized vehicles

## **Research Questions**

The following research questions are formulated to be answered through the study as means of achieving the aforementioned objectives.

1. What factors impact on customer choice of dedicated non-motorized vehicle highway in Colombo City
2. What are the relationships among those factors?

## **Hypothesis**

The dependent variable of study is the “**customer** **choice of non-motorized vehicle highway**

H0 : Choice of non-motorized vehicle highway independent from ith variable

H1 : Choice of non-motorized vehicle highway is depending on ith variable

ith  variable - Attitude of respondents, Demographic factors of respondents, Easiness in accessibility, Respondents’ environmental concerns/ Environmental awareness, Transportation needs of respondents, Frequency of cycling, Quality, Image derived by cycling, Saving fuel cost , Positive effects on the environment, Positive effects on health, Congestion reduction on roads Distance, Security, Time and the weather of the day, Availability of infrastructure facilities (parking, lighting)

## **Significance of the Study**

Promotion of cycling over the use of private vehicles help to improve the quality of cities, because the bicycles do not use fossil fuels (non-renewable resources), do not emit harmful gases which cause air pollution, do not produce any noise, have a very sustainable life cycle and also at the end of their life they are very easy to recover and reuse, need little surface to circulate. Therefore, the transfer between users of private vehicles to the bicycle brings significant environmental benefits and many advantages in the aspects of financial and physical to the users. Apart from that this study will also help to promote policy level changes where it will encourage construction of dedicated facilities for non-motorized vehicles. This study will ultimately become a means to reduce the usage of conventional high fossil fuel dependent vehicles by non-fossil fuel consuming and no emission vehicles which would indirectly lead to enhance green practice in the transportation sector as well. Compared with strategies such as roadway expansion, the strengthening of walking and cycling is considered more effective in the long-term. By building more and or wider roads, congestion can be reduced on the short term and rise again due to induced traffic that is attracted by the free flow conditions Poor conditions for walking and cycling result in low shares for these modes and people tend to use cars even for short trips.

The modernization of urban transport does not require total motorization, but it would be much effective by the integration of walking, non-motorized vehicles (NMV) modes and motorized transport. According to the statistics of (Statistics:Department of Motor Traffic, 2018) the vehicle population of Sri Lanka has increased over passed years from 2012 to 2017 in figures of 4,877,027 vehicles to 7,247,122 vehicles respectively. This leads to increase in fossil fuel consumption and deterioration of air quality especially in highly congested city limits such as in Colombo city. For the fact of Colombo being the capital of Sri Lanka, it has also become the heart of most number of industrial activities as well as the central holder of many blooming industries. In other hand Colombo city holds a population of 648,034 (World population review, 2018)

Hence it is a well clear fact that Colombo holds the most number of vehicles, in terms of both public and private vehicles due to the large population housed within Colombo city. According to the statistics 509,248 numbers of vehicles enter Colombo City limits almost every day. Out of that 443, 586 number of vehicles are private vehicles while 29,064 vehicles being the public or mass transport modes (INDI.CA, 2015)

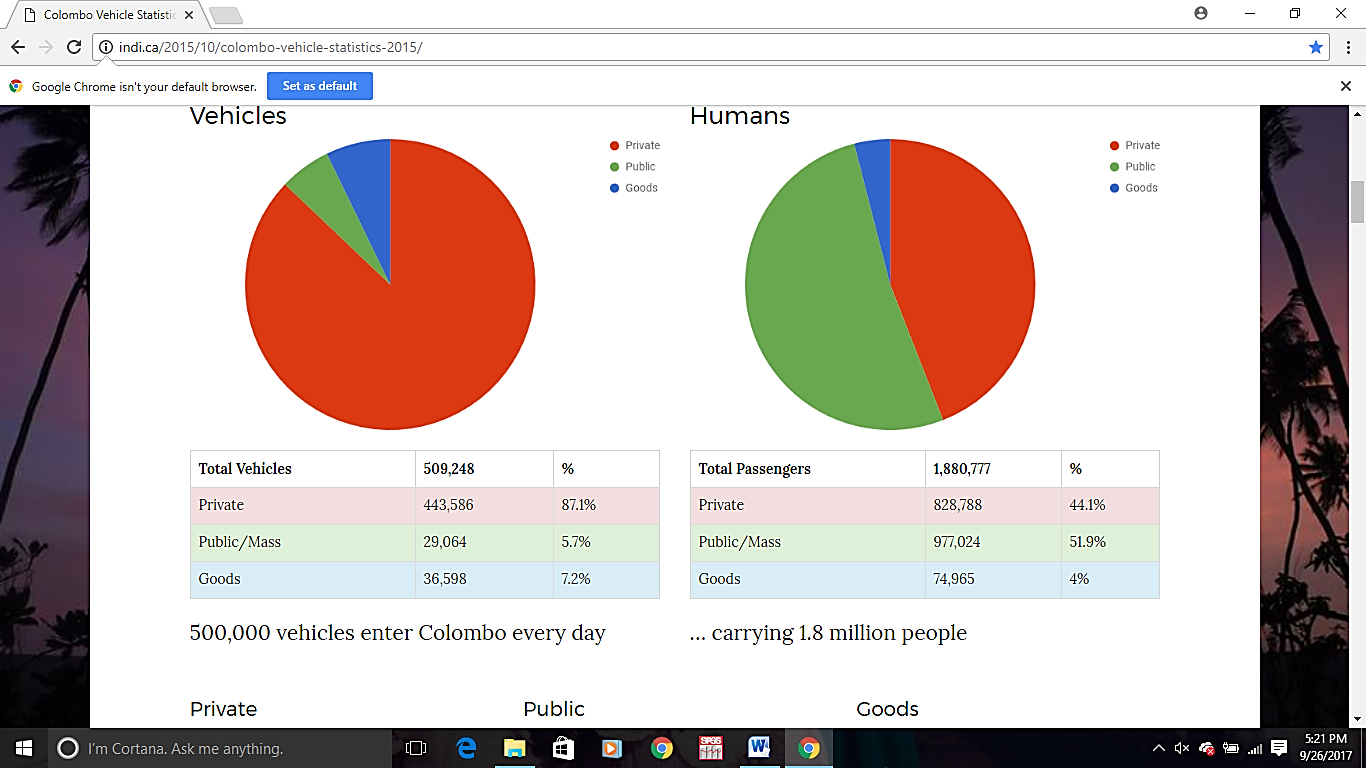


Figure 1.5: Vehicle and passenger populations in Colombo City Limits

Source: (INDI.CA, 2015)

Hence this study is confined to the Colombo city limits which accounts for most number of vehicle owners. At the same time Colombo being a highly industrialized zone; it is a clear fact that the environmental consciousness is a factor considered by most of the car users. Hence this study draws its attention to address Colombo City limit as there is a significant number of vehicle users in Colombo City. Therefore, this study will be important to promote non-motorized vehicle usage in Colombo city limits.

## **Chapter Outline**

Chapter 01: Introduction

The introduction chapter of this study provides the background of the research and the research topic. Further this chapter will elaborate on the research objectives, research question and also about the significance of the research.

Chapter 02: Literature Review

This chapter provides a comprehensive elaboration on the past researches, empherical studies, essays relating to the research topic and its background. Most importantly, the foundation for the research and the structure if the research will be laid in this chapter

Chapter 03: Methodology

This chapter provides the structure of the research which will be built based in the past literatures reviewed in order to reach the research objectives and the research questions. The structure of the research will be discussed based on several topics such as the Research design, Conceptual framework, Sampling, Data collection, Analysis method and etc.

Chapter 04: Analysis

This chapter provides the results of the data analysis done by using the statistical software SPSS. This chapter will include inferential statistics and descriptive statistics. Reliability test, Factor analysis and the Hypothesis testing will be carried out under this chapter and each and every output will be interpreted in this chapter.

Chapter 05: Conclusions and Recommendations

This chapter will be the last chapter in the study outline which will provide the overall conclusion of the study. Further in this chapter the recommendations regarding the choice of non-motorized vehicle highway will be based on the studies and the conclusion of the researcher. In addition to that limitations carried out by the study will be mentioned by providing an opportunity to the future researchers to carry on future analysis

## **Chapter Summary**

Under this chapter background of the study, research problem and justification, research objectives, research questions, hypothesis, significance of the study and chapter outline were elaborated. Under the topic background of the study aspects such as increase of energy consumption in transportation sector, increase in carbon dioxide emission, increase of private vehicle ownership in Sri Lanka, combined co2 emission from different energy sectors in Sri Lanka and current congestion level around Colombo city were discussed. Under research problem and justification scenarios such as increase of private vehicle ownership due to the fact that poor quality in public transportation therefore the increase of dependency of fossil fuel and as a result increase of emission of GHG were discussed. Under the significance of the study factors such as benefits of promoting non-motorized transportation, the importance of promoting non-motorized transportation for Colombo city limits, the importance of increasing the awareness on environment friendly modes of transportation in Sri Lankan context were discussed.

# **CHAPTER TWO: LITERATURE REVIEW**

## **Introduction to the Chapter**

This chapter provides a comprehensive elaboration on the past researches, empherical studies, essays relating to the research topic and its background. Most importantly, the foundation for the research and the structure of the research will be laid in this chapter

## **Transportation**

According to (Onderwater & Kishoon, 2017) it has mentioned that transportation is a derived demand originated due to economic and social activities. According to (Thalagala & Kalukottege, 2015) it has defined transportation as carrying passengers or goods from one place to another by modes such as land, air or water. In early period of time people have used non-motorized modes such as walking, animal riding, cycling and etc. in order to full fill their needs. However with the rapid development of transport infrastructure these practices were changed. With that evolution transportation pattern in Sri Lanka also has changed. At present the road transportation in Sri Lanka is highly based on motorized modes such as cars, vans, buses, motorbikes, three-wheelers and etc. Furthermore (Chandrakumara, 2015) has divided transportation in Sri Lanka into five categories. Those categories are public bus transport services, railway transport, hired vehicle transportation, Private vehicle transportation and finally comes the non-motorized transportation which comes in means of cycling and walking.

## **Non-Motorized Transportation**

Mobility is considered as a basic right for everyone. Mobility is most often related with motorized transportation. Motorized modes of transportation consists of cars, buses, jeeps and etc. These vehicles misuse urban space largely and consume enormous resources and finally it become a burden to the environment in the terms of environmental pollution. Though the infrastructure developments are done for minimizing transportation problem the solutions are not working for a long term manner. Because with the development of those infrastructure facilities private vehicle ownership is increasing rapidly. In order to prevent this, reduction in motorized vehicle use has become necessary. For that from motorized transportation to non-motorized transportation modal split can be done. Cycling is one of the non-motorized transport mode (Kurt, 2008). The term Non-motorized transport (NMT) is known for the active transport and human powered transport. It is used to indicate walking, cycling. Non-motorized transport plays an important role in mobility management. When vehicles are reduced, many trips shift to walking and cycling (Litman, 2010). An increased bicycle brings out many advantages for individual aspect, for society and for the environment. Some of these advantages come from use of cycling itself, other arise when decreasing automobile use (Kurt, 2008). According to (Replogle, 1992). Transport planning and investment in most of Asian countries have focused mainly on the motorized transport sector and has often ignored the need of non-motorized transport. As mentioned in (Wang, Mirza, Cheung, & Moradi, 2014) a safe, well-developed cycle ways, policies to discourage car use, and a good public transportation system integrated with cycling facilities are the factors which have a significant impact on promoting bicycle as a mode of transport. In case for highly dense areas and for short distances uses of motorized vehicles is in vain. For such instances cycling can be integrated. According to (Orden, Linares, Velasco, Diez, & Rojo, 2014) it is mentioned that cycling together with public transport and walking are considered as the main components of sustainable mobility.

## **Implications of Cycling in Other Countries**

According to (Kurt, 2008) it is mentioned that the ownership of non-motorized vehicles is growing rapidly throughout Asia because cycling is a clean mode and uses scarce space in a very efficient manner, also release no pollutants to the environment. As mentioned in (Replogle, 1992) in most of the cities of Japan, Netherlands, Germany and several other European nations bring out the fact that modernization of urban transport does not exactly require total motorization, rather than that it is more appropriate combination of walking, non-motorized modes and motorized transport.

Another one such example is the Copenhagen. There cycle super highways have constructed for the use of people. It is mentioned that cycle super highways gave provided Copenhagen a faster, continuous and continuous way of commuting to various purposes (Gleaves, 2012). Furthermore it has defined the cycle super highway as a large, nonstop, asphalted and well-designed off road cycle path.

According to (Koska & Rudolph, 2016) it is mentioned that there is a high tendency for using the cycle highway by the cyclists who are using electric bicycle. Also it has created more preference in people to cycle than to use the car or public transport. With the use of electric bicycles speed is increased as a result journey time is decreased. Furthermore it is stated that cycle highways in Netherlands has allowed for a shift of mode from car trips and public transport towards cycle based trips. This has brought a great relief for the heavily trafficked roads in Netherlands, thereby also saved the travel time of private vehicle users. Also it is mentioned that the installation of the cycle highways and an increased use of electric bicycles in the Netherlands have a positive effect on its mobility.

As mentioned in (Replogle, 1992) Japan also has experienced a major growth of bicycle use than increased motorization. Measures they have adapted were provision of extensive bicycle networks, providing bicycle parking at public transportation stations and charging high fees for the parking of motorized vehicles. Furthermore it has mentioned that Japan has offered subsidies for the commuter who are cycling to the work for several decades. Also they have developed a domestic bicycle manufacturing industry and also has allocated an extensive urban street space for non-motorized vehicle traffic. These strategies have reduced the growth of public and private vehicle use while enhancing the use of cycles as a mode of transportation. Another example mentioned in (Koska & Rudolph, 2016) is Germany. There also a cycle highway has built in a most densely populated area. The aim of this development was to reduce overall traffic level with an increased cycling capacity while bringing an opportunity for a mode share shift. The aim of providing sufficient cycling facilities will to make an impact on making travel decisions thereby enhancing the mode shift away from the use of private vehicles.

According to (Koska & Rudolph, 2016) it is mentioned that compared with strategies such as roadway expansion, the strengthening of walking and cycling is considered to be more effective in the long term. This is due to by building, more and or wider roads, congestion can be reduced on the short term. And the same issue will arise due to induced traffic that is attracted by the free flow conditions.

## **Benefits of Non-Motorized Transportation**

According to (Fernando, 2016) road transport is responsible for the biggest producer of greenhouse gases. Here no only the car buses, three wheels and all the other motorized vehicles cause the emission of greenhouse gases. According to (IPCC, 2014) 14% of greenhouse emissions in 2010 were occur due to transportation. The greenhouse emissions from the transport sector includes fossil fuels burned for road, rail, air and marine transportation. Furthermore it is stated that 95% emissions of the world’s transportation energy comes from petroleum based fuels, gasoline and diesel. As mentioned in (Orden, Linares, Velasco, Diez, & Rojo, 2014) the main air pollutants associates with road transport are greenhouse gases (GHG), Carbon monoxide (CO), Non-methane volatile organic compounds (NMVOC), Nitrogen oxides (NOx), Total suspended particulate (TSP), Sulfur dioxide (SO2) and Ammonia (NH3). These gases are highly toxic and bring various environmental impacts such as production of acid rain, impact on the ozone layer, cause global warming and lead to several health issues in people. Because bicycles don’t use fossil fuels but only depend on muscle power they don’t produce harmful substances. Therefore they don’t contribute for the problems causing air pollution, global warming, acidification, harmful smog, producing fine particles and etc. As a remedy it is mentioned in (Kurt, 2008) that several studies have found that co2 emissions due to traffic can be reduced by substituting short car trips by bicycle trips.

As mentioned in (Orden, Linares, Velasco, Diez, & Rojo, 2014) the benefits of building a network of cycle super highway are reduction of emission of CO2, saving money on societal health costs, significant reduction in congestion, do not produce any noise, have a very sustainable life which is in the terms of easiness in manufacturing, repairing, recovering, reusing and need a little surface to circulate. Therefore the transfer between users of private vehicles to the bicycle brings significant environmental benefits.

According to (Kurt, 2008) it is mentioned that by promoting cycling more space is saved for the motor vehicles that are necessary to enter to the cities. More number of cyclists can move over the same amount of road space compared to car occupants. Furthermore, it is stated that automobile manufactures will never be able to solve this problem regarding acquiring excess space by vehicles which are driven or parked in cities with more scarce space. When cycling is promoted more space is left for those vehicles that are really necessary in city centers. So it’s clear that far more cyclists can be moved over the same amount of road space compared to car occupants. Car manufacturers will never be able to solve the problem of the excessive space taken for driving and parked cars for the scarce space in cities. (Kurt, 2008).

Another fact mentioned in (Kurt, 2008) is that cycling is considered as the most energy efficient way of propulsion and therefore help to reduce the dependency on fossil fuels. It is clear that transferring private car users to cycling involves significant energy savings. Currently most of the energy used to transport people and goods comes from imported petroleum of third countries. So, its reduction would bring us both economic and environmental benefits for people as well as for the country as a whole (Orden, Linares, Velasco, Diez, & Rojo, 2014)

With regard to health effects cycling strengthens the heart, lungs and respiratory system and cures depression. Fats are burnt while cycling induce weight control and minimize stress (Kurt, 2008). The bicycle is an inexpensive means of transportation well within the (financial) reach of almost everyone. As such the bicycle makes a wider range of destinations possible for more people. As a main transportation mode it should be able to compete with cars for (relative) short distances. In combination with public transportation it can even take on the competition with the car over large distances. (Kurt, 2008) Bicycles are an inexpensive means of transportation with low cost to purchase and no need for fuel. Furthermore, there are usually no parking fees needed for bicycles. Therefore, a bicycle is affordable for many people.

## **Determinants of Customer Choice in Cycling**

According to the study (Heredia, Monzon, & Diaz, 2014) following are the main factors affecting on the choice of bicycles as a mode. These factors can mainly be divided into nine groups which are Socio demographic factors, Attitude towards cycling, Cyclists context conditions, Nature of the trip, Structural features, Environmental factors, Subjective factors, General transport costs and Mobility costs. Further each of these group can be divided into sub categories. Socio demographic factors are subdivided into age, income, gender, family size and vehicle ownership. Attitude towards cycling can be subdivided into need for flexibility, sensitivity to time, need for fixed schedule, desire for economy and environmental awareness. Cyclist context condition is subdivided into cyclist culture, cyclist policy, mobility governance and motorized traffic restrictions. Trip related factors are subdivided into time availability, distance, trip cost and trip purpose. Structural related factors can be subdivided into bicycle network, availability of additional facilities and safe parking areas. Subjective factors mentioned in here are risk perception and exercise opportunity. Environmental factors are weather, topography and urban form. There are two types of cost related factors. They are general transport costs and cyclist mobility costs. General transport cost is subdivided into private vehicle costs and public transport supply. Cyclists mobility cost is subdivided into out of pocket cost, safety, travel time, theft risk, injury risk and comfort.

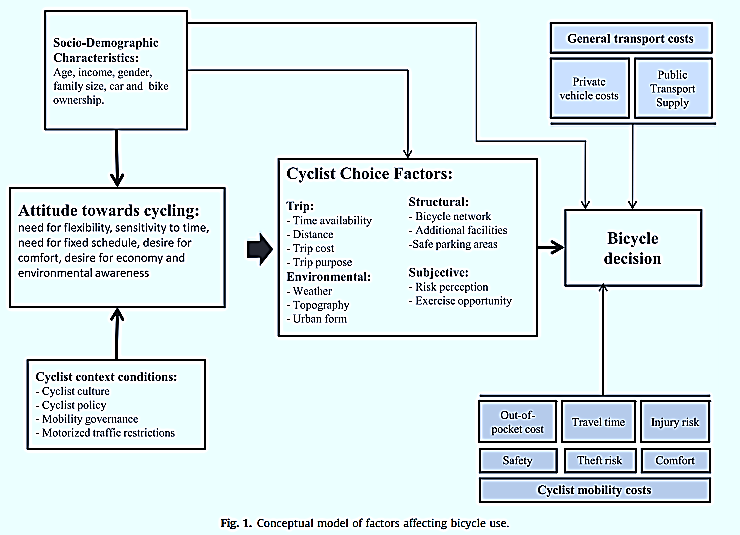


Figure 2.1: Factors affecting bicycle use

Source: (Heredia, Monzon, & Diaz, 2014)

Factors related to bicycle use and used can be classified in terms of whether they are perceived as a barrier or as an incentive to bicycle use. (Titze, Stronegger, Janschitz, & Oja, 2008) These factors were taken in the study (Heredia, Monzon, & Diaz, 2014) and they have further elaborated these. For factors which promote bicycle they have showed efficiency, flexibility, economical, ecological, healthy and fun. Bicycles are efficient in terms of avoid traffic problems such as traffic jams, easy to park, enables door to door transport and is competitive with other modes of transport over certain distances. It is flexible in terms of there are no time or frequency restrictions. It is economical in terms of no fuel expense, the purchase and maintenance of the bicycle are economical. It is ecological because does not emit pollutants or greenhouse gases, hardly makes any noise and takes up little space. It is healthy because it is an active transport that encourages people to exercise. Factors that inhibit bicycle use are distance, danger, orography, fitness, climate, vandalism, facilities and comfort. Distance in terms of if it is too long. Danger in terms of perception of risk in relation to accidents or falls. Orography means the availability of mountainous or hilly topography. Fitness means in terms of poor physical condition. Climate in terms of weather limitations such as rain, wind, low or high temperatures. Vandalism in terms of the bicycle being stolen. Facilities in terms of need for complementary facilities for personal hygiene, bicycle parking area at the destination point, to keep the bicycle at home. Comfort means not as comfortable as other modes of transport.

Based on these factors in the study (Heredia, Monzon, & Diaz, 2014) developed a path diagram to show how commuters create their intention to use bicycles. It is showed in Figure 2.2.

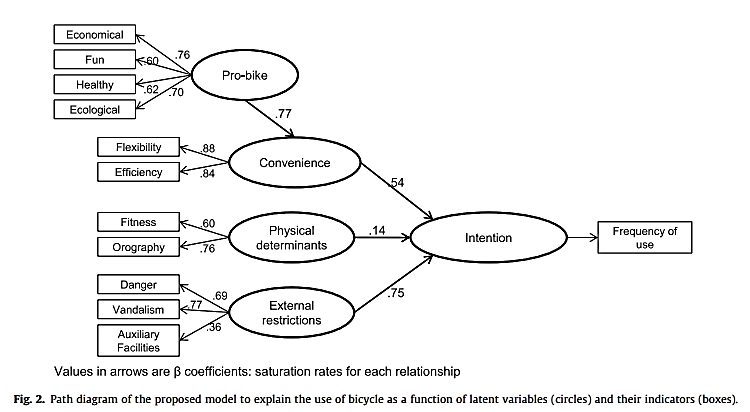


Figure 2.2: Path diagram to explain the use of bicycle as a function of latent variables (circles) and their indicators (boxes)

Source: (Heredia, Monzon, & Diaz, 2014)

According to the study (Handy, Xing, & Buehler, 2010) the factors affecting on bicycle ownership is mainly divided in to three groups namely individual factors, social environment factors and physical environment factors. The relevant conceptual is given in figure 2.3. Individual factors are subdivided into age, gender, bicycling preference, bicycling comfort and etc. Social environment factors mentioned in here are other bicyclists and other vehicle drivers. Under physical environment factors bicycle infrastructure, land use mix factors are mentioned.

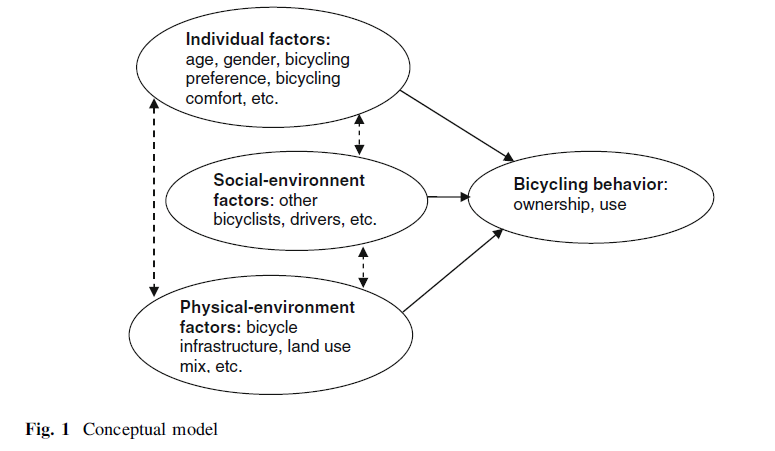


Figure 2.3: Conceptual framework on bicycle ownership

Source: (Handy, Xing, & Buehler, 2010)

In the study (Handy, Xing, & Buehler, 2010) it has developed a summary on factors affecting bicycle ownership based on previous studies.

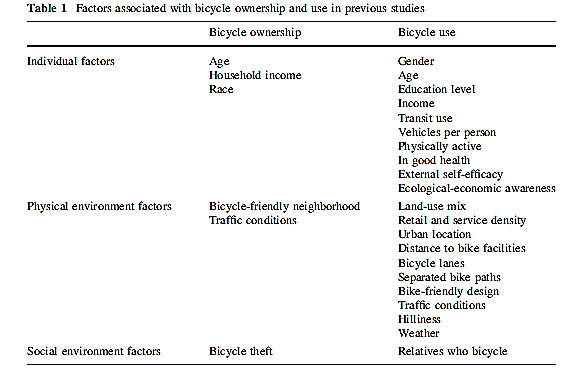


Figure 2.4: Summary of factors associated with bicycle ownership and use

Source: (Handy, Xing, & Buehler, 2010)

According to the study (Krizek, Handy, & Forsyth, 2009) the walking and cycling behavior is influenced by different factors at multiple levels. They are individual, interpersonal, environmental levels and interpersonal relationships in the form of household interactions and social networks. At first it is begin with the interplay between individual, interpersonal and environmental factors. Along with these perspectives walking and cycling interventions falls under two measures. They are soft measures and hard measures. Examples for soft measures are providing education, encouragement or enforcement. Examples for hard measures are infrastructure investments. Another aspect is that cycle can be increased through psychological changes such as increased desire, motivation or through complex social interactions, for example by instigating the exchange of information with peer groups (Eg: Someone else at work told me how was it was to bike to work) in other words it is kind of a social learning.

The interventions from the hard category consist of changes in the built environment including transportations infrastructure as land use patterns. Behavioral changes theoretically result from the increase in access, attractiveness, safety, comfort and security that these infrastructure improvements offer. As well as they stimulate changes in perceptions, attitudes and other psychological factors similar to those anticipated by soft measures.

Primary impacts occurring in the short term take place on the form of replacement of trips previously made by motorized modes, generation of new cycling trips or lengthening of the total time or distance of cycling trips. Increased levels of use at the individual level lead to secondary effects over the long term at the individual level such as changes in auto ownership, increases in transit ridership or improved health. In addition to that a number of secondary benefits may also serve to the community as a whole over the longer term. Secondary effects at both the individual and community level each contribute to other desired policy outcomes such as improved air quality, reduced health costs and increased livability.

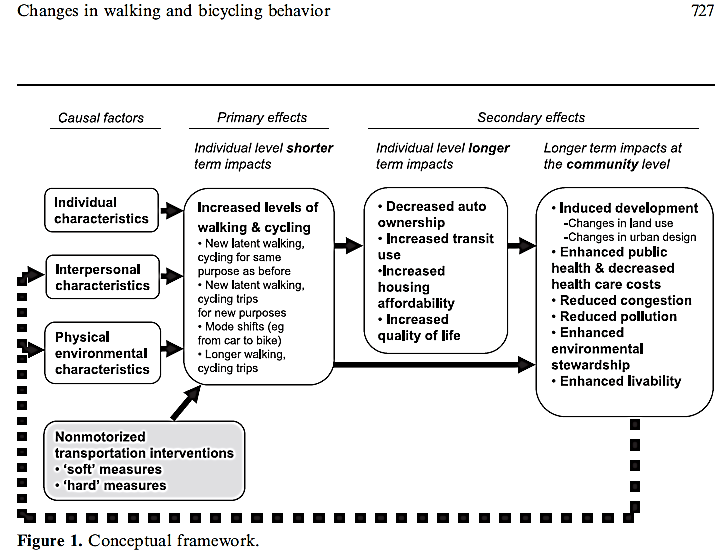


Figure 2.5: Factors affecting on changes in walking and bicycling behavior

Source: (Krizek, Handy, & Forsyth, 2009)

### **Distance and Travel Time**

The distance (and time) travel in urban areas is usually in most trips less than 5-6 km (about twenty minutes). Above these values, for many people, bike is not anymore as an alternative. (Orden, Linares, Velasco, Diez, & Rojo, 2014). Bicycle networks should be designed and built to meet, as best as possible with the following criteria: security, connectivity (evidence of a real network), accessibility, direct, attractive, comfortable and integrated with the public transport system. (Orden, Linares, Velasco, Diez, & Rojo, 2014). The network has to be within reduced walking distance, easy to access from the rest of the city parts, and has to link with the major trip attraction and generation points. According to (Orden, Linares, Velasco, Diez, & Rojo, 2014; Spyropoulou & Konstanitinidou, 2016) in urban areas most popular bicycle trips are less than 5-6km (about twenty minutes). Above these values, for many people, bike is not anymore as an alternative. Bicycle use decreases sharply when the trip distance increases above 5 km. Nevertheless, some bicycle trips are much longer (Kurt, 2008)

Increasing trip length has an important and significant negative effect on the attractiveness of cycling (Hunt & Abraham, 2007). According to the study (Rahula & Vermab, 2013) there was a drastic reduction in the users who are using bicycle over twenty minutes and who are using above 5km of distance. This shows that people prefer walk and cycle for short trips. Low speed and excessive physical effort are two main reasons why people prefer walk and cycle for short distances.

### **Attractive and Comfortability**

To attract users, the bicycle network has got to be attractive and comfortable. If the network is giving, safety, a nice image and pleasant experience, the number of users will be increased or can be easily maintained. According to (Orden, Linares, Velasco, Diez, & Rojo, 2014) in order to attract users the bicycle network has to be attractive and comfortable. In addition to safety if the network is giving a nice image and pleasant experience the number of users will be increased and can be maintained. Another aspect is that after arriving at the destination, if the bicycle user is not happy with parking availability and he/she is afraid of the theft or vandalism that particular user will reluctant to use this mode of transport. In the (Titze, Stronegger, Janschitz, & Oja, 2008) study they have found out that if the bicycle conditions are composed of lot of greens, laid along gardens there is a high tendency for commuters to use bicycles. In the study (Gleaves, 2012) it has found out that respondents are even ready to change their route in order to cycle through a green space.

### **Experience**

According to (Heredia, Monzon, & Diaz, 2014) there is a clear impact of experience on the choice of bicycle. Users that have cycling experience show a greater tendency on this modal choice than the people those who don’t have that experience. According to the study (Gleaves, 2012; Stinson & Bhat, 2004) it has found that those who have more than six months experience attract more for cycling than those are with little experience. Those with more experience prefer to cycle on difficult routes and prefer to cycle with other cyclists.

### **Age**

Age is an important determinant in aspect of cycling. As in many countries cycling is an attractive transport mode for younger people. Student status is an important modifier of cycling behavior. Cities with a higher proportion of students have in general higher cycling rates. (Rietveld & Daniel, 2004) Areas with higher proportion of young people (15-19 years) and the presence of a higher education

institutes show a higher bicycling share. According to the study (Rahula & Vermab, 2013) an increase in age is associated with a decrease in walk and cycle preference.

### **Trip Purpose**

According to (Spyropoulou & Konstanitinidou, 2016) selected parameters like trip purpose, trip distance and cycling infrastructure influence on traveler propensity to cycle. It is mentioned that when it comes to the factor trip purpose, even in countries where proportion of cycling is rather low there is a high propensity to cycle for work trips and for educational purposes. As mentioned in the study (Rahula & Vermab, 2013) trips with purpose education had a positive likelihood compared with work on choosing bicycle mode.

### **Gender**

The effect of gender on cycling propensity is also ambiguous. In many countries especially in those with a low bicycle use females are less likely to cycle than men. According to the results of (Moudon, et al., 2005) older age, female gender, lower education and higher income factors were associated with low tendency to engage in cycling. Also it has found out that about 2/3 of cyclists are male in USA. (Garrard, Rose, & Lo, 2008) Concluded that in countries where cycling is popular gender does not affect cycling use, whereas in countries with low cycling percentages men cycle more than women. Most important factors in choosing a commute mode are travel time, convenience, needing a car for work, purposes and cost. Other than the above factors determinants to cycle include dangerous traffic conditions, lack of bicycle infrastructure facilities, physical exertion especially in hilly terrains and adverse weather conditions (Kurt, 2008).

### **Environmental Factors**

Among the environmental factors, the weather is the most complex. This is seen differently depending on the type of rider. A regular or frequent rider will appreciate it as a lower barrier than an occasional cyclist. A clear example of this situation is shown in many countries of the European Union where with a more unfavorable climate, bike modal percentage is low. The wind, the precipitation and the extreme temperatures are traditional barriers to bicycle use, especially when they appear together or combined with other factors. Similarly, the rapid changes in the weather throughout the day affect its everyday use (Kim, Shin, Im, & Park, 2011). Also most of the users don’t like to expose their bicycles to heavy weather. Therefore it is necessary to build specific parking areas in the origin and the destination points.

### **Safety and Security**

Another fact mentioned in (Litman, 2010) is that in some cities in order to prevent theft registration services for bicycles have been launched where authorities records a number on the bike along with the data such as name, phone or address of the owner, type or characteristics of the bike and etc. to facilitate its recovery in the event if theft. Also it is stated in (Gleaves, 2012) that those who are with little cycling experience are more safety conscious when cycling, and they prefer to travel in routes with less traffic n avoid more difficult junctions.

Measures that reduced dangerous interactions between non-motorized and motorized traffic and increased safety in terms of reduced casualties (e.g. the cases with wider bike lanes and sidewalks, access restrictions, longer pedestrian traffic light phases) make pedestrians and cyclists feel safer and in doing so also help to promote a modal shift (Koska & Rudolph, 2016).

### **Infrastructure and Facilities**

According to (Kurt, 2008) bicyclists (both experienced and inexperienced) tend to avoid routes with links on which parallel parking is permitted, presumably because parked cars can pose a safety threat to bicyclists with car doors swinging open or cars pulling out in front of the bicyclist’s path. Bicyclists have a preference for routes designed for bicycle use, that offer some or total separation from motorized traffic. (Kurt, 2008) Especially inexperienced cyclists value a separate path or a bicycle lane more than experienced users. (Stinson & Bhat, 2004) found that a higher stop frequency (more places where cyclists have to stop) or hindrance frequency (badly placed posts and narrowings) reduce bicycling. In the study (Rahula & Vermab, 2013) it is stated that lack of infrastructural provision can cause in reduction in density of using bicycles. According to the study (Stinson & Bhat, 2004) bicyclists have a preference for routes designed for bicycle use, with a bicycle lane being the most preferred facility types, followed by a separate path. Bicyclists prefer routes that offer some or total lateral separation from motorized traffic.

Some of the experts also recommended implementing measures supportive of walking and cycling in combination with car-restrictive measures such as raising costs (for parking, car ownership, road tolls etc.), reducing the space provided (for moving and/or parked cars), and reallocating time for the different modes (e.g. by changing the signaling to create longer red phases for cars). (Koska & Rudolph, 2016). Compared with strategies such as roadway expansion, the strengthening of walking and cycling is considered more effective in the long-term. By building more and or wider roads, congestion can be reduced on the short term – only to rise again due to induced traffic that is attracted by the free flow condition. Providing auxiliary facilities like changing rooms, lockers, showers/bathrooms enhance the use of bicycles.

### **Household nature**

Availability of a car has a significant impact on the cycle use. The cycling takes place in multi car households remains at a very low level. In (Pucher & Buehler, 2011) it is stated that due to the higher overall cost of owning and operating a car in Canada compared to the USA and the lower per-capita incomes bicycling rates in Canada are higher. According to (Stinson & Bhat, 2004)also found that the propensity to bicycle commuting is greater among individuals who have fewer cars in their household. In the study (Rahula & Vermab, 2013) also found that individuals belonging to high income households had a less probability of walk and cycle. In the same way private vehicle owners also had a less affinity towards walk and cycle. It is also suggested that there is a need of policy intervention, restricting private vehicles to promote non-motorized transport among high income households and private vehicle owners.

## **Chapter Summary**

Under this chapter an introduction was given about the transportation and its present day context related to Sri Lanka. There the factors such as gradual increase of private vehicle ownership, due that the increase of congestion, increase of dependency on fossil fuel and increase of environmental pollution were discussed based on past researches. After that it has discussed about non-motorized transportation in terms of modes which come under this category and its importance were discussed. For the third step it has discussed about the examples for implications of cycling in other countries with examples and their strategies used to promote cycling as a mode of transportation. As the fourth step benefits of promoting non-motorized transportation were discussed in terms of reducing congestion, reducing dependency on fossil fuel and reducing environmental pollution. Then determinants of customer choice in cycling were discussed. All the factors were based on past researches. Basically these determinants can be divided as individual factors, physical environment factors and social environment factors. Each and every these factors were discussed in this chapter. Then the determinants were discussed separately and justification was done based on past researches. Factors which were discussed are age, gender, household nature, distance and travel time, attractiveness and comfortability, previous experience in cycling, trip purpose, environmental factors, safety and security and infrastructure facilities. Based on these key factors it has found in previous studies that the customer choice of using non-motorized vehicle highway changes.

# **CHAPTER THREE: METHODOLOGY**

## **Introduction to the Chapter**

This chapter reviews the structure of the research. The structure of the research is mainly based on the past literatures reviewed in the previous chapter. Further the research will be structured in order to achieve the research objectives and questions. Based on the investigated past literatures key factors were identified which are considered to be affected on the consumer choice of dedicated non-motorized highway. In order to recognize the statistical relationship among those factors a standard methodology was followed. With the use of several topics such as research design, research framework, hypothesis to be tested, independent/dependent variables and questionnaire design it is the aim of this chapter to explain the methodology.

## **Research Design**

A research design is important for a research to make sure that all the findings enable to address the pre-determined research question and thereby achieve the research objectives in a logical and effective manner. This research takes the nature of a casual design where there is the conditional statements, if “X” changes what happens to “Y”. The “X” can be identified as “Independent variable” and the “Y” can be identified as the “Dependent variable” (Labaree, 2013). The design of the research will be discussed under following sections.

## **Type of the Study**

The purpose of this research is to identify the factors that influence on the consumer choice of dedicated cycle super highway in Colombo city. The research will investigate the effect of several factors such as Infrastructure factors, Personal consideration, Mobility and cost factors, External environment and social influence, Construction and policy making and Environmental consciousness. Hence, this takes the nature of casual research.

## **Nature of the Study**

The research explains the nature of certain relationship between the dependent and independent variables. Therefore this study will be analytical and descriptive in nature. The research will not merely describe the characteristics but will explain the way it is happening and with the reasons.

## **Conceptual Framework**

The conceptual framework for this study was developed by the researcher based on the theory of factors affecting on walking and cycling behavior as discussed by (Krizek, Handy, & Forsyth, 2009) and (Heredia, Monzon, & Diaz, 2014) which are similar studies and with the help of other researches reviewed during the previous chapter : Literature Review. The variables for the research were identified bases on those past researches.



Figure 3.1: Conceptual framework

## **Independent and Dependent Variables**

1. Good for health: This refers to the health benefits gain from cycling
2. Transportation needs: This refers to the needs that have to be fulfilled through transportation
3. Number of times: This refers to how many times that the particular user has to do cycling
4. Comfortability: This refers to whether the mode cycling make comfortable the user when using it
5. Image/status derived: This refers to the social recognition achieved by the user when using it
6. Travel time: This refers to how long does the user has to do cycling in order to reach his/her desired destination
7. Environmental friendly: This refers to cycling in the aspects of no harmful gas emission, no noise pollution and non-dependency on fossil fuels.
8. Day/s of the week: This is with regard to the particular days of the week on which roads are busier than on usual days. For an example on Monday and Friday the number of vehicles on the road is high. On such days users can move to alternative modes like cycling to avoid traffic congestion.
9. Quality of the bicycle: This refers to the condition of the bicycles.
10. Saving fuel cost: This refers the fact that there is no dependency on fossil fuel the money spend on fuel can be saved.
11. Safety and security: This is with regard to users are safe from accidents, theft and other harmful incidents.
12. Distance: This refers to the distance they are willing to ride by bicycle.
13. Parking Facilities: This refers to the availability of parking facilities for their private vehicles and bicycles when using the bicycles.
14. Accessibility: This refers how easy it is to reach cycle super highway is.
15. Connectivity to public modes: This refers to the condition whether the user can switch to another public transportation mode, if he/she wants, after using the cycle super highway.
16. Electric bicycles: This refers to whether users are willing to use electric bicycles so that they can travel longer distances.
17. Speed limit: This refers to under which minimum and maximum speed limits the particular user can use in the cycle super highway.
18. Time period of the day: This refers to the particular time on which the user is willing to use this facility. This can be in the morning, in the evening, in peak hours, in off peak hours and etc.
19. Opinion of the other mode users: This is with regard to the attitudinal effect that can cause by the society when using this mode. For an example some can say it is good and some can say it is worthless. Based on these criticisms users’ mind can change either positively or negatively.
20. Congestion: This refers to when the number of vehicles on the road is decreasing the congestion also starts to reduce.
21. Weather: This refers to nature of the surrounding.
22. Nature of the cycle super highway: This regard to the fact that the highway is of good condition with a uniform surface without any hilly or hole structures.

## **Dependent Variable**

The choice of dedicated non-motorized vehicle highway will be considered as the dependent variable for this research.

## **Questionnaire Design**

The questionnaire is a comprehensive three page tool with eighteen (18) questions. (Refer Appendix – A). In the part A, the first part carried the explanation of the survey. It described what the survey is, why it is being done, by whom it is done, a thanking statement to the respondent. The next part covered the demographical attributes of the respondent which include age group, gender, education, employment sector and monthly income level. Also this asked about the ownership of a bicycle, what travel modes are used frequently to travel, Whether the respondent has engaged in cycling during past month, if he/she has engaged what were the purposes and if hasn’t what were the reasons affected. This part ended with the question which demonstrate the dependent variable of the study, whether the respondent is willing to select cycling as a mode of transportation in future.

In the part B, it entirely captured all the independent variables of the study. Those questions were followed by five point Likert scale questions.

In the part C, it asked some general questions regarding in what frequency does the respondent like to do cycling, distance he/she prefer to travel, respondents opinion on most suitable infrastructure to promote cycling in Sri Lanka, What is/are the purposes respondent using cycling for, changes recommending in the community level to improve the awareness of bicycles. This part ended with the question on what are the most suitable location/route to develop bicycle highway within Colombo city. Respondents were asked to write down the answers for this particular question.

## **Scaling Techniques**

There were different types of questions which were asked from the respondents in the questionnaire. Depending on the type of question and he segments which they belong different types of measurements or scaling techniques were used.

To capture the age of respondents Interval scaling technique was used. There were five age categories for the respondents to choose. The age category started from 18 years since a person need to be minimum years to take a correct decision.

1. 18 – 25 age group
2. 26 – 35 age group
3. 36 – 45 age group
4. 46 – 55 age group
5. Above 55 age group

Nominal scaling was to capture was used to capture the gender of the respondent where they were given two responses as Female and Male.

To capture the education level of the respondents, six responses were given in the questionnaire. Nominal scaling technique was used here.

Similar to the education, the employment were also captured by six responses. To capture this nominal scaling technique was used.

Monthly income of the respondent was captured by giving them six responses mentioned below;

1. 0 – 20,000
2. 20,001 – 40,000
3. 40,001 – 60,000
4. 60,001 – 80,000
5. 80,000 – 100,000
6. Above 100,000

Interval scaling technique was used to capture the monthly income of the respondents.

To capture the fact, whether the respondent owns a bicycle a dichotomous question was asked. Where he/she has to select either yes or no.

To capture the most frequent mode uses by the respondent nominal scaling was given. Seven responses were given here.

To capture whether the particular respondent has done cycling for travelling throughout the past month a dichotomous question was asked where he/she has to select ether yes or no.

To capture the reasons why he/she hadn’t engaged in cycling throughout the last month nine responses were given to select. Nominal scaling technique was used here.

To capture for what purposes he/she had engaged in cycling seven responses were given to select. The scaling technique which was used here was nominal scaling technique.

The dependent variable of the study was captured by a dichotomous question asking whether the respondent has the willingness to select cycling as a mode of transportation in future.

To capture the independent variables of the study five point Likert scale was used. The five point Likert scale technique is a frequently used technique in most of the techniques.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

To capture the frequency which particular respondent is willing to do cycling Nominal scaling technique was used. Here five responses were given to select.

To capture the distance which the respondent mostly preferred to travel by bicycle Interval scaling technique was used. Five responses were given to choose and they are mentioned below.

1. Less than 1km
2. 1 – 2 km
3. 3 – 3 km
4. 5 km
5. Above 5km

To capture the opinion on most suitable infrastructure type to promote cycling in Sri Lankan context Nominal scaling technique was uses. Two responses were given to respondents to choose.

To identify the purposes for which the particular respondent is preferred to uses cycling as a mode of transportation seven responses were given and in the seventh response he/she was given the liberty to mention the purpose which was not mention among the other six responses. The scaling technique which was used here was the nominal scaling technique.

In order to identify the changes which are recommended by the respondents to be made within our community five responses were given to select. The scaling technique which was used was nominal scaling technique.

In the final question regarding the most suitable location/route to develop a bicycle highway within the Colombo city respondents were given the freedom to write down their own answers.

## **Sampling**

### **Target Population**

The population of interest in this study was the Colombo city limit of Sri Lanka. Basically targeted at the public /private vehicle users along with prospectus and current bicycle users.

### **Sampling Unit**

The population for this study was public and private vehicle users along with prospectus and current bicycle users in the Colombo city. Colombo city is selected because it is comprised of highest population in 2016 among all the other cities. According to (Central Bank of Sri Lanka, 2017) the figure of the population in Colombo city in year 2016 is around 2,395,000. People in the Colombo city represent a homogenous group with similar lifestyles in terms of private and public transport dependent with frequent movements. According to the article “Civil engineers seek solutions to reduce congestion in Colombo” published in (Dr.Liyanage, 2018) by Dr. Liyanage, he has mentioned that over 2.2 million passengers cross the Colombo city boundary through 12 main road corridors within a say in both directions. These passengers are carried by nearly 600,000 vehicles which including buses. Furthermore he has stated that nearly 50 percent of the passengers are carried by the bus fleet only consuming 10 percent of the road space on main corridors while the private passenger vehicles consume over 62 percent of the road space and carry only 45 percent of the passengers.

### **Sampling Method**

Simple random sampling is used as the sampling method since it is convenient to the researcher to carry out the study within the given frames, budgets and other resources. Another reason was that the difficulty in collecting data from a specifically identified group or cluster.

### **Sampling Size and Time Frame**

The data collection was carried out for a period of 45 days. With referring to the similar studies conducted earlier and based on the population statistics in Colombo city the sample size was selected as 400. For the purpose of gathering data 400 questionnaires were distributed and only 325 were returned. After conducting the data cleaning process only 253 responses were taken as valid and used for the study. Therefore the valid response rate remains at a percentage of 77.8% which is almost 78%.

## **Data Collection Method**

A structured questionnaire was used as the tool to collect primary data for the study. Since the population consist of all the public vehicle users and private vehicle users in Colombo city which has a larger population, exactly determining the population size was difficult. Therefore it is practical to do a cross sectional study by collecting data from a representative subset of population. Two kinds of data namely primary and secondary data were gathered for the purpose of conducting the survey. Secondary data was mainly used for the conceptualization of the study. Sources of secondary data are scholarly articles, journals, reports and web pages which were based on the choice of non-motorized transportation. In addition to that secondary data was helpful in determining the sample size, developing the questionnaire, scaling questions and also in analyzing data.

## **Validity and Reliability**

A pilot survey was carried out to check the validity and reliability of the data collected. The questionnaire was distributed among private and public vehicle users. For the pilot survey 52 completed questionnaires were collected. Those questionnaires were used in testing the reliability by means of Cronbach’s Alpha. The reliability was within the required satisfactory levels.

Cronbach’s Alpha was used to test the reliability and the validity of the data gathered. In the article (Tavakol & Dennik, 2011), in their article, Making sense of Cronbach’s Alpha stated Cronbach’s Alpha was developed by Lee Cronbach in 1951 to provide a measure of the internal consistency of a test or scale; it is expressed as a number between 0 and 1. Further explain that internal consistency is the extent to which all the items in a text measure the same concept or construct.

The Cronbach’s Alpha is a widely spread convenient statistical technique or tool to measure the internal consistency (reliability) of a psychometric test. When Likert questions are incorporated in the questionnaire survey Cronach’s Alpha is frequently used to determine if the scale is reliable. It was named in1951 by Lee Cronbach. Cronbach’s Alpha can be described as below formula (01)

Equation 1: Cronbach’s Alpha

N = Number of items

C- bar is average inter item covariance among the item

V- bar is equal to average variance

## **Pilot Survey**

Pilot survey is a method that is generally used to find the faults and flaws that will lead to failures when it is put into practice. Before doing mass data collection through questionnaires pilot survey can be used to find the errors in design, wording, structure, instructions, content and etc. and amend the necessary things if necessary.

The pilot survey for this research was conducted by convenient distribution of questionnaire to 60 respondents where 52 completed questionnaires were received and the Cronbach’s Alpha was calculated using the statistical software SPSS. Then the internal consistency of the questionnaire was found to be within the required level.

## **Method of Data Analysis**

Data collected through the questionnaire survey was fed into the statistical software tool IBM SPSS Statistics 20.0 to generate a comprehensive analysis of the study. Those findings will be discussed in the next chapter. Following statistical data analysis methods were used in analyzing the data obtained.

## **Descriptive Analysis**

Descriptive statistics is the analytical tool that helps to describe, shoe and summarize data in a meaningful way. For a research presenting raw data is not appropriate and it will be hard to visualize the raw data. Therefore the use of Descriptive statistics is vital. With that it will be easy to present data in more meaningful way. Statistics such as frequencies of demographic data and screening questions has been obtained. Graphical and table representation was used in the study.

## **Cross Tabulation**

Further researcher has run a cross tabulation analysis that will summarize categorical data to create a contingency table and a Chi-square test of association statistics. This is also known as the Pearson’s chi square test of association. The reason behind running a Chi square test is to see whether there is a relationship or association between two categorical variables. Hypothesis testing was carried using Chi square test as two variables are categorical variables.

In hypothesis testing following hypothesis were tested;

H0: The variables are independent from each other

H1: The variables are dependent on each other

From the above test the researcher will get an idea that there is a dependency between the variables. Therefore as the next step the researcher went for a factor analysis.

## **Factor Analysis**

Factor analysis is a statistical tool which is used to identify factors among observed variables. In this study factor analysis will be used to the factors that affect the customer choice of cycle super highway in Colombo city. The main purpose of the factor analysis is data reduction and the classification of variables into few factors or variables. Usually factor analysis is carried out when there are large number of variables. Then by factor analysis the variables having similar characteristics will be grouped into a one factor. Then there will be small number of factors from larger number of variables which can be used to explain the observed variance in the larger number of variance.

There are certain advantages of factor analysis. One is the reduction in number of variables and one of the other advantage is the identification of group’s interrelated variables. The basic step of the factor analysis is generating Correlation matrix for all the variables.

In the factor analysis, the Bartlett’s test, Kaiser-Meyer-Olkin (KMO) test, Communalities, Total Variance and Rotated Component Matrix is computed and analyzed using IBM SPSS Statistics 20.0 software.

## **Bartlett’s Test**

The Bartlett’s test compares the observe correlation matrix to the identify matrix. In the Bartlett’s test two hypothesis are built. They are;

H0: The correlation matrix is an identify matrix

H1: The correlation matrix is not an identify matrix.

Equation 2: Bartlett’s test statistics

## **The KMO Index**

The KMO Index compare the values of correlation between variables. KMO value measures the adequacy of sample. Normally KMO should be greater than 0.5 to accept the factor analysis. Higher KMO values are good because higher correlations between pairs of variables. 0.5 is the barely accepted value. Value between 0.7-0.8 is the acceptable level and if the KMO value is above 0.9 it can be highly accepted.

Equation 3: KMO Index

## **Rotated Component Matrix**

After extracting factors it is difficult to interpret and name the factors based on their factor loading. Factor rotation is identified as a solution for this difficulty. Factor rotation will improve the interpretation of the factors by altering the pattern of factor loading.

Then a reliability test was done to test the reliability of the newly formed factors. The factors whose reliability was less were rejected for further analysis.

## **Kruskal – Wallis Test**

The Kruskal – Wallis Test also known as “One – Way ANOVA” is a non-parametric test that is used to determine significance differences between two or more variables. It is generated against the independent variable and the dependent variable. Output of the Kruskal – Wallis Test is used to test the null hypothesis between the independent variable and the dependent variable. This test is more suitable under the following circumstances,

* Should contain more than three conditions test
* Should have independent observations which means there is no relationship between observation between groups or on each group

Kruskal – Wallis test generates the chi square, degree of freedom (df) and the significance between independent variable and the dependent variable.

Subsequently the association between the demographic factors and the newly formed variables were tested using this analysis.

## **Chapter Summary**

The chapter discussed the structure and the methodology of the research with the aim of achieving the research objectives based on the past literatures reviewed. The dependent variable of the research is the customer choice of cycle super highway in Colombo City Where as independent variables comes under six factor groups which are Infrastructure facilities, Personal consideration, Mobility and cost factors, External environment and social influence, Construction and policy making and Environmental consciousness. Both primary and secondary data was gathered for the purpose of capturing factors affecting customer choice of “cycle super highway”. A total of 253 questionnaires will be used in the analysis, in accordance with the characteristics of the data set, a combination of descriptive statistics, cross tabulation, factor analysis, reliability test were performed in the analysis.

# **CHAPTER FOUR: DATA ANALYSIS AND DISCUSSION**

## **Introduction to the Chapter**

This chapter describes the results of the Data Analysis. The collected data was fed into the statistical software IBM SPSS 20 in order to do the analysis. This chapter will include inferential statistics and descriptive statistics. The factor analysis, reliability analysis and the hypothesis testing has been done under the inferential statistics. Descriptive statistics were used to represent the analyzed data in s meaningful way. The chapter initiates with a comprehensive description of the sample of study by utilizing various frequencies and descriptive statistics. In addition, this chapter comprises the reports of the statistical outputs generated from the statistical software SPSS in respect of the analysis techniques and tools discussed in previous chapters. Further each and every output will be interpreted accordingly for clear understanding. For gathering data 400 questionnaires were distributed and only 325 were returned. After conducting the data cleaning process only 253 responses were taken as valid for the study.

## **Demographic Profile and Preference Analysis**

### **Age Group**

Figure 4.1: Age group distribution of the respondents

As shown in the figure majority of the respondents fall in to the age category between 18-25 which is 182 or 71.9% of the sample. The second highest age category fall between 26-35 which is 35 or 13.8% of the sample. The third highest age category fall between 36-45 which is 21 or 8.3% of the sample. Smallest number of respondents fall into the age groups of 46-55 and Above 55 respectively which are of 14 and 1 in numbers respectively while the percentages are 5.5% and 0.4% respectively.

### **Gender**

Figure 4.2: Gender distribution of the respondents

As shown in the figure 4.2 highest number of respondents belong to male category which is 144 in number and 56.9% in percentage. Out of 253 respondents 109 are belong to the female category and it is 43.1% in percentage.

### **Employment**

Figure 4.3: Employment distribution of the respondents

As shown in the figure 4.3 highest number of respondents are students which is 143 in number and 56.5% as a percentage. Second highest number of respondent belong to the group employed which is 66 in number and 26.1% as a percentage. Third highest number of respondents belong to the unemployed group which is 35 in number and 13.8% as a percentage. Lowest number of respondents belong to the groups underemployed and employed at the same time studying where they are 5 and 4 in number respectively and 2% and 1.6% in percentages respectively.

### **Employment Sector**

Figure 4.4: Employment sector distribution of the respondents

In the figure 4.4 it shows highest number of respondents work in the private sector which is 113 in number and 44.7% as a percentage. Second highest number of respondents recorded in not applicable which is 109 in number and 43.1% as a percentage. Respondents who are working the public sector and semi government are equal in number which in 11 and 4.3% as a percentage. Lowest number of respondents are belong to the self-employed category which is 9 in number and 3.6% in percentage.

### **Monthly Income**

Figure 4.5: Monthly income distribution of the respondents

As shown in the figure 4.5 highest number of respondents belong to the income category of 0 – 20,000 which is 166 in number and 65.6% as a percentage. Second highest number of respondents belong to the income category of 20,001 – 40,000 which is 30 in number and 11.9% as a percentage. Third highest number of respondents belong to the income category of 40,001 – 60,000 which is 24 in number and 9.5% as a percentage. Lowest number of respondents fall into the income category of 60,001 – 80,000 which is 9 in number and 3.6% as a percentage.

The most respondents are in the lower income category-this may be useful in deciding the fees/ tolls and etc.

### **Bicycle Ownership**

Figure 4.6: Bicycle ownership of the respondents

As shown in the figure 4.6 highest number of respondents said “yes” to the question whether they own a bicycle which is 129 in number and 51% as a percentage. Out of 253 respondents 124 said “No” which is 124 in number and 49% as a percentage. More than half of the respondents possess a bicycle.

### **Most Frequent Type/s of Mode Using for Travelling**

Table 4.1: Total respondents

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Case Summary** | | | | | | |
|  | Cases | | | | | |
| Valid | | Missing | | Total | |
| N | Percent | N | Percent | N | Percent |
|  | 253 | 100.0% | 0 | 0.0% | 253 | 100.0% |

Table 4.2: Modes of travel distribution of the respondents

|  |  |  |  |
| --- | --- | --- | --- |
| Modes which are using frequently for travelling | Responses | | Percent of cases |
| **Number** | **Percentage** |
| Bus | 174 | 42.3% | 68.8% |
| Car | 82 | 20.0% | 32.4% |
| Three Wheeler | 64 | 15.6% | 25.3% |
| Motorcycle | 38 | 9.2% | 15.0% |
| Bicycle | 18 | 4.4% | 7.1% |
| Walking | 18 | 4.4% | 7.1% |
| Van | 17 | 4.1% | 6.7% |
| Total | 411 | 100.0% | 162.5% |

According to the table 4.1 and 4.2 all the respondents have answered to this question. Those respondents have given this total number of responses which is 411 in number. This implies that respondents have selected more than one responses. Highest number of response which is recorded as 174 in number was the bus. Out of all the responses it is 42.3% as a percentage. From the respondents 68.8% of them selected bus as their mode of transportation. Second highest number of response is recorded as 82 in number and fall into the category of car. It is to be 20% of all the responses and from all the respondents a percentage of 32.4% selected car as a mode of transportation. Lowest number of response is recorded in the category of van which is 17 in number and as a percentage of all the responses it is 4.1%. Out of all the respondents only 6.7% of them selected van as a mode of transportation. A lowest number of response is recorded in the category bicycle users which is 18 in number and as a percentage of all the responses it is 4.4%. Out of all the respondents only 7.1% of them have selected bicycle. It is visible that it has a less frequency and there is a need of a stimulation to encourage more use of bicycles.

### **Response on whether they have used bicycle for travelling during the past month**

Figure 4.7: Distribution of respondents have used bicycle

According to the figure 4.7 it shows that, out of 253 respondents only 63 have used bicycle during the past month which is 24.9% as a percentage. Out of respondents 190 of them haven’t used bicycle during the past month which is 75.1% as a percentage. Here also it is visible that relatively a less number of people have used bicycle therefore there is a need of stimulation in order to encourage more use of it.

### **Reasons for Not Using**

Table 4.3: Total respondents

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Case Summary** | | | | | | |
|  | Cases | | | | | |
| Valid | | Missing | | Total | |
| N | Percent | N | Percent | N | Percent |
|  | 190 | 100.0% | 0 | 0.0% | 190 | 100.0% |

Table 4.4: Frequencies of the respondents who are not using with their reasons

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequencies** | | | | |
|  | | Responses | | Percent of Cases |
| N | Percent |
| Reasons for not using | Too Busy | 48 | 14.9% | 25.3% |
| Disability/Health Issues | 3 | 0.9% | 1.6% |
| Bad Weather | 20 | 6.2% | 10.5% |
| It does not match to personal image/status | 32 | 9.9% | 16.8% |
| Age | 18 | 5.6% | 9.5% |
| No safe place to ride | 64 | 19.9% | 33.7% |
| Need to carry stuff/kids | 16 | 5.0% | 8.4% |
| Not owning a bicycle | 75 | 23.3% | 39.5% |
| Don't know how to ride | 46 | 14.3% | 24.2% |
| Total | | 322 | 100.0% | 169.5% |

According to the table 4.3 and 4.4 for this question 190 out of 253 participants have answered this question. Highest number of response was recorded in the group not owning a bicycle which is 75 in number and among all the responses it is 23.3% as a percentage. Out of all the respondents 39.5% have selected “not owning a bicycle” as a reason for not doing cycling during past month. Second highest number of responses is recorded for the response “no safe place to ride” which is 64 in number and as a percentage it is 19.9% of all the responses. Out of all the respondents 33.7% have selected this as a reason for not doing cycling during the past month. It shows, people are more safety concerned, this is good for internal construction /policy makers' decision and also in advertising Next highest number of responses were recorded for the response “don’t know how to ride a bicycle” which is 46 in number and as a percentage it is 14.3%. Out of all the respondents as a percentage 24.2% selected this as a reason for not doing cycling during the past month. Lowest number of responses were recorded in the group “disability/health issues” which is 3 in number and as a percentage it is 0.9% of all the responses. Out of all the respondents 1.6% of them selected “disability/health issues” as a reason for not doing cycling during the past month.

### **Purposes of Using**

Table 4.5: Total respondents

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Case Summary** | | | | | | |
|  | Cases | | | | | |
| Valid | | Missing | | Total | |
| N | Percent | N | Percent | N | Percent |
|  | 63 | 100.0% | 0 | 0.0% | 63 | 100.0% |

Table 4.6: Frequencies of respondents using bicycle for different purposes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequencies** | | | | |
|  | | Responses | | Percent of Cases |
| N | Percent |
| Purposes of using | Exercise | 53 | 39.3% | 84.1% |
| Entertainment | 46 | 34.1% | 73.0% |
| Daily household activities | 12 | 8.9% | 19.0% |
| Social visits | 15 | 11.1% | 23.8% |
| School/Education | 9 | 6.7% | 14.3% |
| Total | | 135 | 100.0% | 214.3% |

According to the table 4.5 and 4.6 out of participants 63 have answered to this question. The highest number of responses were recorded for the purpose “exercise” which is 53 and 39.3% as a percentage. Out of all the respondents 84.1% of them have selected “exercise” as a purpose. Second highest number of responses were recorded for the purpose “entertainment” which is 46 and as a percentage it is 34.1% of all the responses. Out of all the respondents 73% of them selected “entertainment” as a purpose. Lowest number of responses were recorded for the purpose “school/education” which is 9 and as percentages 6.7%. Out of all the respondents 14.3% of them selected “entertainment.

### **Willingness in Using**

Figure 4.8: Percentage of respondents who are willing to use

According to the figure 4.8 it shows that 156 of respondents are willing to use bicycle as a mode of transportation in future which is as a percentage 61.7% of all the respondents. More than half of the respondents showed a positive response here. Only 97 of them said “No”, which is 38.3% as a percentage of all the respondents.

### **Preferred Frequency of Cycling**

Figure 4.9: Preferred frequency of cycling

According to the figure 4.9 it shows that highest number of respondents prefer to engage in cycling “once a week” which is 86 and as a percentage it is 34%. Second highest number is recorded for the response “daily” which is 70 and as a percentage 27.7%. Lowest response is recorded for “once in a month” which is 20 and as a percentage 7.9%.

### **Preferred Distance**

Figure 4.10: Frequency of preferred distance

According to the figure 4.10 it shows that highest number of responses were recorded for the distance range “1-2 km” which is 80 and as a percentage it is 31.6%.Second highest number of responses were recorded for the distance range “3-4km” which is 67 and as a percentage it is 26.5%. Lowest number of responses were recorded for the distance 5km which is 32 and as a percentage it is 12.6%.

### **Suitable Infrastructure**

Table 4.7: Total respondents

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Case Summary** | | | | | | |
|  | Cases | | | | | |
| Valid | | Missing | | Total | |
| N | Percent | N | Percent | N | Percent |
|  | 253 | 100.0% | 0 | 0.0% | 253 | 100.0% |

Table 4.8: Frequency of the respondents who selected different infrastructures

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequencies** | | | | |
|  | | Responses | | Percent of Cases |
| N | Percent |
| Suitable Infrastructure | Bicycle Highway | 144 | 51.6% | 56.9% |
| Bicycle lanes | 135 | 48.4% | 53.4% |
| Total | | 279 | 100.0% | 110.3% |

According to the table 4.7 and 4.8 it shows that all the respondents have answered this question and majority of them have selected “Bicycle highway” which is recorded as 144 responses. As a percentage of all responses it is 51.6%. Out of all the respondents 56.9% of them have selected “Bicycle highway”. For “Bicycle lanes” 135 responses were recorded and it is as a percentage 48.4% of all the responses. Out of all the responses 53.4% of them have selected “Bicycle lanes”. Here the total number of responses are greater than the total number of respondents because some of them selected both types. Selecting “Bicycle highway” by a high number of people is a positive aspect regarding there is an opportunity for implementing this in Sri Lanka.

### **Preferred for Using**

Table 4.9: Total respondents

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Case Summary** | | | | | | |
|  | Cases | | | | | |
| Valid | | Missing | | Total | |
| N | Percent | N | Percent | N | Percent |
|  | 253 | 100.0% | 0 | 0.0% | 253 | 100.0% |

Table 4.10: Frequency of the respondents selected different purposes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequencies** | | | | |
|  | | Responses | | Percent of Cases |
| N | Percent |
| Preferred for using | Exercise | 158 | 41.0% | 62.5% |
| Entertainment | 75 | 19.5% | 29.6% |
| Work | 45 | 11.7% | 17.8% |
| Household act. | 47 | 12.2% | 18.6% |
| Social Visits | 19 | 4.9% | 7.5% |
| Education | 18 | 4.7% | 7.1% |
| Other | 23 | 6.0% | 9.1% |
| Total | | 385 | 100.0% | 152.2% |

According to the table 4.9 and 4.10 it shows that highest preference is recorded for “exercise” which is 158 and as a percentage of all the responses it is 41%. Out of all the respondents 62.5% have selected this. It shows that the people are more health conscious and they like to engage in physical activities which are good for health whenever possible. Second highest preference is recorded for “entertainment” which is 75 and as a percentage it is 19.5%. Out of all the respondents it is 29.6% have selected this. Lowest number of responses recorded for “Education” which is 18 and as a percentage of all the responses it is 4.7%. Out of all the respondents only 7.1% have selected this.

## **Independent Variables Profile and Frequencies**

Table 4.11: Frequencies of the independent variables

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Strongly Agree** | **Agree** | **Neutral** | **Disagree** | **Strongly Disagree** | **Total of Agree & Strongly agree** | **Total of Disagree& Strongly disagree** |
| **Environmental friendly** | 58.50% | 37.20% | 4.30% | 0 | 0 | 95.7% | 0% |
| 148 | 94 | 11 | 0 | 0 |  |  |
| **Other's opinions** | 26.10% | 46.60% | 24.90% | 1.20% | 1.20% | 72.7% | 2% |
| 66 | 118 | 63 | 3 | 3 |  |  |
| **Travel time** | 75.50% | 17.40% | 5.10% | 1.20% | 0.80% | 92.9% | 2% |
| 191 | 44 | 13 | 3 | 2 |  |  |
| **Transportation needs** | 11.10% | 50.60% | 35.20% | 1.20% | 2.00% | 61.7% | 3% |
| 28 | 128 | 89 | 3 | 5 |  |  |
| **Number of times** | 11.10% | 46.60% | 32.80% | 5.50% | 4% | 57.7% | 10% |
| 28 | 118 | 83 | 14 | 10 |  |  |
| **Quality** | 26.90% | 41.10% | 20.20% | 7.50% | 1.60% | 68.0% | 9% |
| 75 | 104 | 51 | 19 | 4 |  |  |
| **Reduce congestion** | 11.10% | 20.90% | 32.40% | 24.10% | 11.50% | 32.0% | 36% |
| 28 | 53 | 82 | 61 | 29 |  |  |
| **Nature of weather** | 8.30% | 21.70% | 56.50% | 9.10% | 4.30% | 30.0% | 13% |
| 21 | 55 | 143 | 23 | 11 |  |  |
| **Fuel cost** | 52.20% | 34.40% | 9.50% | 2% | 2% | 86.6% | 4% |
| 132 | 87 | 24 | 5 | 5 |  |  |
| **Nature of the highway** | 21.30% | 48.60% | 23.30% | 3.20% | 3.60% | 69.9% | 7% |
| 54 | 123 | 59 | 8 | 9 |  |  |
| **An appropriate mechanism** | 19.40% | 37.50% | 31.20% | 5.10% | 6.70% | 56.9% | 12% |
| 49 | 95 | 79 | 13 | 17 |  |  |
| **Time period of the day** | 47% | 39.50% | 11.90% | 1.20% | 0.40% | 86.5% | 2% |
| 119 | 100 | 30 | 3 | 1 |  |  |
| **Providing electric bicycles** | 32% | 33.60% | 21.30% | 8.70% | 4.30% | 65.6% | 13% |
| 81 | 85 | 54 | 22 | 11 |  |  |
| **Availability of parking facilities** | 30% | 40.30% | 14.20% | 3.20% | 12.30% | 70.3% | 16% |
| 76 | 102 | 36 | 8 | 31 |  |  |
| **Connectivity to public modes** | 27.30% | 37.50% | 19.80% | 6.70% | 8.70% | 64.8% | 15% |
| 69 | 95 | 50 | 17 | 22 |  |  |
| **Day/s of the week** | 17% | 41.10% | 34% | 2.80% | 5.10% | 58.1% | 8% |
| 43 | 104 | 86 | 7 | 13 |  |  |
| **Improve health** | 26.10% | 49.80% | 22.50% | 0.80% | 0.80% | 75.9% | 2% |
| 66 | 126 | 57 | 2 | 2 |  |  |
| **Safety and security** | 21.70% | 49% | 22.50% | 2.80% | 4% | 70.7% | 7% |
| 55 | 124 | 57 | 7 | 10 |  |  |
| **Other costs** | 39.10% | 44.30% | 11.10% | 1.20% | 4.30% | 83.4% | 6% |
| 99 | 112 | 28 | 3 | 11 |  |  |
| **Maximum/minimum speed limit** | 34.80% | 44.30% | 16.20% | 2.40% | 2.40% | 79.1% | 5% |
| 88 | 112 | 41 | 6 | 6 |  |  |
| **Comfortability** | 26.50% | 39.50% | 28.10% | 2.80% | 3.20% | 66.0% | 6% |
| 67 | 100 | 71 | 7 | 8 |  |  |
| **Distance that have to travel** | 20.90% | 51.80% | 22.90% | 2.80% | 1.60% | 72.7% | 4% |
| 53 | 131 | 58 | 7 | 4 |  |  |
| **Accessibility** | 25.30% | 49.80% | 19% | 2.80% | 3.20% | 75.1% | 6% |
| 64 | 126 | 48 | 7 | 8 |  |  |
| **Distance of the highway** | 21.30% | 50.60% | 22.90% | 0.80% | 4.30% | 71.9% | 5% |
| 54 | 128 | 58 | 2 | 11 |  |  |
| **Image/status derived** | 17.40% | 49.40% | 23.30% | 5.50% | 4.30% | 66.8% | 10% |
| 44 | 125 | 59 | 14 | 11 |  |  |

According to the table 4.11 it is clearly evident that majority of the respondents agree or strongly agree to the fact that “Environmental friendly” when selecting cycle super highway which is as a percentage 95.7.9%. Second highest factor is the “Travel time” which has a percentage of strongly agree or agree percentage. This pattern can be observed in other variables like “Good for health”, “Fuel cost”, “Time period of the day” and “Other costs”. The percentages of agree or strongly agree are greater than 80% in all the above mentioned variables. For the variables like other’s opinions, quality, availability of parking facilities, good for health, security & safety, speed limit, distance that have to travel, accessibility, and distance of the highway the percentages of agree or strongly agree are greater than 70%. For the factors like number of times, nature of the highway, an appropriate mechanism, providing electric bicycles, connectivity to public modes, day/s of the week, comfortability, and image/status derived the percentages of agree or strongly agree are greater than 50%. For the factors like travel time, transportation needs, other’s opinions, number of times, quality, fuel cost, nature of the highway, time period of the day, day/s of the week, environmental friendly, good for health, safety & security, other costs, speed limits, comfortability and image/status derived, the percentages of disagree or strongly disagree are less than 10%. The percentage of disagree or strongly disagree to the fact “reduce congestion” is 36% as a percentage. The percentage of disagree or strongly disagree to the fact “nature of weather” is 13% as a percentage. The percentage of disagree or strongly disagree to the fact “an appropriate mechanism” is 11.8% as a percentage. The percentage of disagree or strongly disagree to the fact “providing electric bicycles” is 13% as a percentage. The percentages of disagree or strongly disagree to the facts “availability of parking facilities” and “connectivity to public modes” are 16% and 15% respectively.

## **Descriptive Statistics**

Table 4.12: Descriptive statistics of the independent variables

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | N | Minimum | Maximum | Mean | Std. Deviation |
| Environmental friendly | 253 | 3 | 5 | 4.54 | .580 |
| Travel time | 253 | 1 | 5 | 4.66 | .705 |
| Transportation needs | 253 | 1 | 5 | 3.68 | .765 |
| Number of times | 253 | 1 | 5 | 3.55 | .905 |
| Quality | 253 | 1 | 5 | 3.90 | .966 |
| Reduce congestion | 253 | 1 | 5 | 2.96 | 1.164 |
| Nature of weather | 253 | 1 | 5 | 3.21 | .880 |
| Fuel cost | 253 | 1 | 5 | 4.33 | .877 |
| Nature of the highway | 253 | 1 | 5 | 3.81 | .928 |
| An appropriate mechanism | 253 | 1 | 5 | 3.58 | 1.069 |
| Time period of the day | 253 | 1 | 5 | 4.32 | .758 |
| Providing electric bicycles | 253 | 1 | 5 | 3.80 | 1.113 |
| Availability of parking facilities | 253 | 1 | 5 | 3.73 | 1.266 |
| Connectivity to public modes | 253 | 1 | 5 | 3.68 | 1.194 |
| Days of the week | 253 | 1 | 5 | 3.62 | .971 |
| Other's opinions | 253 | 1 | 5 | 3.95 | .815 |
| Improve health | 253 | 1 | 5 | 4.00 | .769 |
| Safety and security | 253 | 1 | 5 | 3.82 | .938 |
| Other costs | 253 | 1 | 5 | 4.13 | .964 |
| Maximum/minimum speed limit | 253 | 1 | 5 | 4.07 | .904 |
| Comfortability | 253 | 1 | 5 | 3.83 | .957 |
| Distance that have to travel | 253 | 1 | 5 | 3.88 | .824 |
| Accessibiity | 253 | 1 | 5 | 3.91 | .913 |
| Distance of the highway | 253 | 1 | 5 | 3.84 | .918 |
| Image/status derived | 253 | 1 | 5 | 3.70 | .966 |
| Valid N (listwise) | 253 |  |  |  |  |

According to the table 4.12 it is evident that “Travel time” and “Environmental friendly” are the most highly agreed factors when selecting the cycle super highway which have the means 4.66 and 4.54 respectively. Third and fourth highly agreed factors are the “fuel cost” and “time period of the day” which have the means of 4.33 and 4.32 respectively.

## **Reliability Analysis**

Reliability analysis allows the researcher to study the properties of measurements and scales and the items that compose scales. Reliability analysis calculates number of commonly used individual items in the scale. Cronbach’s Alpha value is widely spread convenient statistical technique or tool to measure the internal consistency (reliability) of a psychometric test. If the Crobach’s Alpha is higher than 0.7 it is in an acceptable level.

### **Reliability of the Full Data Set**

Table 4.13: Reliability test statistics of full data set

|  |  |
| --- | --- |
|  | |
| Cronbach's Alpha | N of Items |
| .795 | 72 |

According to the table 4.13 the value of Cronbach’s Alpha is 0.795. This value is within the satisfactory Crobach’s Alpha value. Therefore the reliability of the variables is in the acceptable level therefore the data set can be accepted.

## **Factor Analysis**

In this study factor analysis will be used to analyze the factors that affect the customer of cycle super highway in Colombo city. The main purpose of the factor analysis are data reduction and the classification of variables into few factors or variables. Usually factor analysis is carried out when there are number of variables. Then by factor analysis the variables which are having similar characteristics will be grouped into a one factor. Then there will be small number of factors out of large number of variables which can be used to explain the observed variance in the large number of variance.

### **KMO and Bartlett’s Test**

Table 4.14: Kaiser – Meyer – Olkin and Bartlett’s Test

|  |  |  |
| --- | --- | --- |
| **KMO and Bartlett's Test** | | |
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .835 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 2889.045 |
| df | 300 |
| Sig. | .000 |

Kaiser-Meyer-Oklin (KMO) Measure of Sampling Adequacy and Bartlett’s test is used to measure the relationship among variables. KMO test measure the adequacy of the sample. Since KMO measure is 0.835 it can be conclude that the sample is adequate to carry out the factor analysis. KMO should be greater than 0.5 for a satisfactory factor analysis.

The Bartlett’s test is another test which indicate the strength of the relationship among the variables. For the Bartlett’s the following hypothesis can be built.

H0: The correlation matrix is an identity matrix

H1: The correlation matrix is not an identity matrix

According to the table the value of the Bartlett’s test is 0.000 therefore null hypothesis is rejected. It can be concluded that the correlation matrix is not an identity matrix.

### **Communalities**

Table 4.15: Communalities

|  |  |  |
| --- | --- | --- |
|  | | |
|  | Initial | Extraction |
| Environmental friendly | 1.000 | .816 |
| Travel time | 1.000 | .541 |
| Transportation needs | 1.000 | .678 |
| Number of times | 1.000 | .577 |
| Quality | 1.000 | .423 |
| Reduce congestion | 1.000 | .713 |
| Nature of weather | 1.000 | .503 |
| Fuel cost | 1.000 | .616 |
| Nature of the highway | 1.000 | .551 |
| An appropriate mechanism | 1.000 | .369 |
| Time period of the day | 1.000 | .485 |
| Providing electric bicycles | 1.000 | .651 |
| Availability of parking facilities | 1.000 | .791 |
| Connectivity to public modes | 1.000 | .672 |
| Days of the week | 1.000 | .597 |
| Other's opinions | 1.000 | .580 |
| Improve health | 1.000 | .789 |
| Safety and security | 1.000 | .669 |
| Other costs | 1.000 | .522 |
| Maximum/minimum speed limit | 1.000 | .517 |
| Comfortability | 1.000 | .535 |
| Distance that have to travel | 1.000 | .586 |
| Accessibiity | 1.000 | .686 |
| Distance of the highway | 1.000 | .711 |
| Image/status derived | 1.000 | .566 |
| Extraction Method: Principal Component Analysis. | | |

Communalities show how much of the variance in the variables has been accounted for, by the extracted factors. According to the table 81.6 % of the variance in “Environmental friendly” is accounted for and 78.9% of the variance in “Improve health” is accounted. Only 36.9% of the variance in “An appropriate mechanism” is accounted here.

### **Scree Plot**

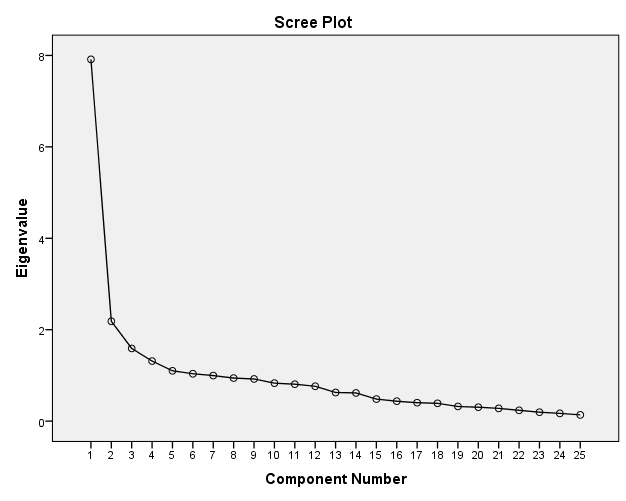


Figure 4.11: Scree Plot

The scree plot is a graph of the eigenvalues against all the factors. The graph is useful for determining how many factors to retain. The point of interest is where the curve starts to flatten. It can be seen that the curve begins to flatten between factors 5 and 6. In the table 4.16 it is visible that from factor 6 onwards the eigenvalues are less than 1.

### **Total Variance Explained**

Table 4.16: Total Variance Explained

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | |
| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
| Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 7.916 | 31.662 | 31.662 | 7.916 | 31.662 | 31.662 | 3.618 | 14.472 | 14.472 |
| 2 | 2.184 | 8.737 | 40.399 | 2.184 | 8.737 | 40.399 | 3.525 | 14.100 | 28.572 |
| 3 | 1.593 | 6.371 | 46.770 | 1.593 | 6.371 | 46.770 | 2.885 | 11.542 | 40.114 |
| 4 | 1.316 | 5.264 | 52.035 | 1.316 | 5.264 | 52.035 | 2.195 | 8.781 | 48.895 |
| 5 | 1.101 | 4.404 | 56.439 | 1.101 | 4.404 | 56.439 | 1.683 | 6.731 | 55.626 |
| 6 | 1.036 | 4.145 | 60.583 | 1.036 | 4.145 | 60.583 | 1.239 | 4.957 | 60.583 |
| 7 | .997 | 3.988 | 64.571 |  |  |  |  |  |  |
| 8 | .942 | 3.767 | 68.338 |  |  |  |  |  |  |
| 9 | .923 | 3.690 | 72.028 |  |  |  |  |  |  |
| 10 | .831 | 3.322 | 75.351 |  |  |  |  |  |  |
| 11 | .807 | 3.228 | 78.579 |  |  |  |  |  |  |
| 12 | .763 | 3.052 | 81.631 |  |  |  |  |  |  |
| 13 | .627 | 2.509 | 84.141 |  |  |  |  |  |  |
| 14 | .617 | 2.469 | 86.610 |  |  |  |  |  |  |
| 15 | .479 | 1.916 | 88.525 |  |  |  |  |  |  |
| 16 | .436 | 1.743 | 90.268 |  |  |  |  |  |  |
| 17 | .405 | 1.622 | 91.890 |  |  |  |  |  |  |
| 18 | .389 | 1.557 | 93.447 |  |  |  |  |  |  |
| 19 | .320 | 1.281 | 94.728 |  |  |  |  |  |  |
| 20 | .303 | 1.212 | 95.941 |  |  |  |  |  |  |
| 21 | .279 | 1.114 | 97.055 |  |  |  |  |  |  |
| 22 | .234 | .937 | 97.992 |  |  |  |  |  |  |
| 23 | .196 | .783 | 98.775 |  |  |  |  |  |  |
| 24 | .169 | .678 | 99.453 |  |  |  |  |  |  |
| 25 | .137 | .547 | 100.000 |  |  |  |  |  |  |
| Extraction Method: Principal Component Analysis. | | | | | | | | | |

The above table 4.16 shows the eigenvalues associated with each linear component (factor) before extraction, after the extraction and after rotation. Before extraction SPSS software has identified 25 factors within the data set. Eigenvalues associated with each factor represent the variance explained by that particular linear component. SPSS output also shows the eigenvalue in terms of the percentage variance explained. The extraction sums of squared loading part shows factors which met the criterions. SPSS extract all factors with eigenvalue greater than one. The “% of variance” column of the extraction sums of squared loading part tells how much pf the total variability can be accounted for by each of these factors. Factor 1 explains 31.66% of the variance. Factor 2 explains 8.73% of the variance. Factor 3 explains 6.37% of the variance. Factor 4 explains 5.26% of the variance. Factor 5 explains 4.40% of the variance. Factor 6 explains 4.14% of the variance. The entire model explains 60.5 (61%) of the total variance.

### **Component Matrix**

Table 4.17: Component Matrix

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Component | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Environmental friendly | .264 | -.138 | .358 | -.094 | .471 | .606 |
| Travel time | .375 | -.517 | .176 | .287 | .140 | -.013 |
| Transportation needs | .717 | -.202 | .168 | -.216 | -.011 | -.219 |
| Number of times | .634 | .150 | .212 | -.227 | .206 | .114 |
| Quality | .611 | -.063 | .000 | .122 | .174 | -.031 |
| Reduce congestion | .342 | .472 | .406 | -.132 | .379 | -.217 |
| Nature of weather | .190 | .530 | .333 | -.053 | -.061 | -.263 |
| Fuel cost | .424 | -.390 | .254 | .393 | -.245 | -.070 |
| Nature of the highway | .369 | .164 | .378 | .156 | -.370 | .290 |
| An appropriate mechanism | .352 | .374 | .151 | .276 | -.077 | -.020 |
| Time period of the day | .453 | -.387 | .337 | .050 | -.115 | .033 |
| Providing electric bicycles | .580 | .326 | -.021 | .356 | -.252 | .134 |
| Availability of parking facilities | .636 | .398 | -.235 | .242 | .195 | .277 |
| Connectivity to public modes | .663 | .372 | -.289 | .060 | .064 | .057 |
| Days of the week | .694 | .193 | .167 | -.053 | .044 | -.215 |
| Other's opinions | .675 | .098 | .030 | .071 | .070 | -.324 |
| Improve health | .691 | -.371 | -.050 | -.405 | -.036 | .075 |
| Safety and security | .657 | -.174 | -.035 | -.393 | -.109 | -.200 |
| Other costs | .571 | -.324 | -.194 | .059 | .213 | -.072 |
| Maximum/minimum speed limit | .507 | -.339 | .028 | .333 | .119 | -.137 |
| Comfortability | .542 | .047 | .169 | -.179 | -.398 | .142 |
| Distance that have to travel | .704 | -.035 | -.012 | -.162 | -.177 | .180 |
| Accessibiity | .654 | -.059 | -.426 | .238 | .100 | -.082 |
| Distance of the highway | .713 | .034 | -.447 | -.009 | -.013 | .039 |
| Image/status derived | .534 | .109 | -.347 | -.300 | -.194 | .144 |
| Extraction Method: Principal Component Analysis. | | | | | | |
| a. 6 components extracted. | | | | | | |

Table 4.17 component matrix summarizes the loadings of all 25 variables of the six factors extracted. The higher the absolute value of the loading, the more the factor contributes to the variable.

### **Rotated Component Matrix**

Table 4.18: Rotated Component Matrix

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | |
|  | Component | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Environmental friendly |  |  |  |  |  | .882 |
| Travel time |  |  | .707 |  |  |  |
| Transportation needs |  | .620 |  |  |  |  |
| Number of times |  | .419 |  |  |  |  |
| Quality |  |  | .391 |  |  |  |
| Reduce congestion |  |  |  | .806 |  |  |
| Nature of weather |  |  |  | .640 |  |  |
| Fuel cost |  |  | .686 |  |  |  |
| Nature of the highway |  |  |  |  | .700 |  |
| An appropriate mechanism |  |  |  |  | .366 |  |
| Time period of the day |  |  | .537 |  |  |  |
| Providing electric bicycles |  |  |  |  | .546 |  |
| Availability of parking facilities | .799 |  |  |  |  |  |
| Connectivity to public modes | .725 |  |  |  |  |  |
| Days of the week |  |  |  | .527 |  |  |
| Other's opinions |  |  |  | .449 |  |  |
| Improve health |  | .794 |  |  |  |  |
| Safety and security |  | .747 |  |  |  |  |
| Other costs |  |  | .477 |  |  |  |
| Maximum/minimum speed limit |  |  | .660 |  |  |  |
| Comfortability |  | .512 |  |  |  |  |
| Distance that have to travel |  | .568 |  |  |  |  |
| Accessibiity | .703 |  |  |  |  |  |
| Distance of the highway | .700 |  |  |  |  |  |
| Image/status derived |  | .568 |  |  |  |  |

Table 4.18 rotated component matrix shows the significance value of all 25 variables for newly generated six factors. The most significance value of the each variable belong to respective factor mentioned in the top most columns of the table.

### **Factor Rename**

Output of rotated component matrix generated six new factors. Those factors include several variables. Each of these factors and their variables are stated below.

Table 4.19: Factor groups with Variables

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **1)**  **Infrastructure facilities** | **2)**  **Personal consideration** | **3)**  **Mobility and cost factors** | **4)**  **External environment and social influence** | **5) Construction and policy making** | **6)**  **Environmental consciousness** |
| Parking facilities | Distance have to travel | Travel time | Nature of the weather | Appropriate mechanism by the government | Environmental friendly |
| Connectivity to public modes | Transportation needs | Quality | Other’s opinions | Providing electric bicycles |  |
| Accessibility | Number of times | Fuel cost | Reduce Congestion | Surrounding of the highway |  |
| Distance of the highway | Comfortability | Time period of the day | Days of the week |  |  |
|  | Image derived | Other costs |  |  |  |
|  | Safety and security | Speed limit |  |  |  |
|  | Improve health |  |  |  |  |

### **Component Coefficient Matrix**

Table 4.20: Component Coefficient Matrix

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | |
|  | Component | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Environmental friendly |  |  |  |  |  | .760 |
| Travel time |  |  | .331 |  |  |  |
| Transportation needs |  | .200 |  |  |  |  |
| Number of times |  |  |  |  |  | .263 |
| Quality |  |  | .124 |  |  |  |
| Reduce congestion |  |  |  | .477 |  |  |
| Nature of weather |  |  |  | .360 |  |  |
| Fuel cost |  |  | .321 |  |  |  |
| Nature of the highway |  |  |  |  | .503 |  |
| An appropriate mechanism |  |  |  |  | .191 |  |
| Time period of the day |  |  | .194 |  |  |  |
| Providing electric bicycles |  |  |  |  | .336 |  |
| Availability of parking facilities | .334 |  |  |  |  |  |
| Connectivity to public modes | .255 |  |  |  |  |  |
| Days of the week |  |  |  | .245 |  |  |
| Other’s opinions |  |  |  | .227 |  |  |
| Improve health |  | .324 |  |  |  |  |
| Safety and security |  | .322 |  |  |  |  |
| Other costs |  |  | .159 |  |  |  |
| Maximum/minimum speed limit |  |  | .305 |  |  |  |
| Comfortability |  |  |  |  | .330 |  |
| Distance that have to travel |  | .178 |  |  |  |  |
| Accessibiity | .270 |  |  |  |  |  |
| Distance of the highway | .237 |  |  |  |  |  |
| Image/status derived |  | .249 |  |  |  |  |
|  | | | | | | |

### **Construction of Equations for Factors**

* Factor 1 (Infrastructure facilities) = 0.334 (Availability of parking facilities) + 0.255 (Connectivity to public modes) + 0.270 (Accessibility) + 0.237 (Distance of the highway)
* Factor 2 (Personal consideration) = 0.200 (Transportation needs) + 0.263 (Number of times) + 0.324 (Improve health) + 0.322 (Safety and security) + 0.178 (Distance that have to travel) + 0.249 (Image/Status derived)
* Factor 3 (Mobility and cost factors) = 0.331 (Travel time) + 0.124 (Quality) + 0.321 (Fuel cost) + 0.194 (Time period of the day) + 0.159 (Other costs) + 0.305 (Maximum/minimum speed limit)
* Factor 4 (External environment and social influence) = 0.477 (Reduce congestion) + 0.360 (Nature of weather) + 0.245 (Days of the week) + 0.227 (Other’s opinions)
* Factor 5 (Construction and policy making) = 0.503 (Nature of the highway) + 0.191 (An appropriate mechanism) + 0.336 (Providing electric bicycles) + 0.330 (Comfortability)
* Factor 6 (Environmental consciousness) = 0.760 (Environmental friendly)

## **Reliability Test for the Factors Developed in the Model**

### **Infrastructure Facilities**

Table 4.21: Reliability Test Statistics of Infrastructure facilities factor

|  |  |
| --- | --- |
|  | |
| Cronbach's Alpha | N of Items |
| .822 | 4 |

According to the table 4.21 the value of Cronbach’s Alpha is 0.822. This value is within satisfactory Cronbach,s Alpha value. That shows that Factor 1- Infrastructure factor is a reliable factor.

### **Personal Consideration**

Table 4.22: Reliability Test Statistics of Personal Consideration factor

|  |  |
| --- | --- |
|  | |
| Cronbach's Alpha | N of Items |
| .831 | 7 |

According to the table 4.22 the value of Cronbach’s Alpha is 0.831. This value is within satisfactory Cronbach,s Alpha value. That shows that Factor 2- Personal Consideration is a reliable factor.

### **Mobility and Cost Factors**

Table 4.23: Reliability Test Statistics of Mobility and Cost Factors

|  |  |
| --- | --- |
| **Reliability Statistics** | |
| Cronbach's Alpha | N of Items |
| .732 | 6 |

According to the table 4.23 the value of Cronbach’s Alpha is 0.732. This value is within satisfactory Cronbach,s Alpha value. That shows that Factor 3- Mobility and Cost Factors is a reliable

### **External Environment and Social Influence**

Table 4.24: Reliability Test Statistics of External environment and Social Influence factor

|  |  |
| --- | --- |
|  | |
| Cronbach's Alpha | N of Items |
| .658 | 4 |

According to the table 4.24 the value of Cronbach’s Alpha is 0.658. This value is within satisfactory Cronbach,s Alpha value. That shows that Factor 4 –External environment and Social influence is a reliable factor.

### **Construction and Policy Making**

Table 4.25: Reliability Test Statistics of Construction and Policy making

|  |  |
| --- | --- |
|  | |
| Cronbach's Alpha | N of Items |
| .528 | 3 |

According to the table 4.25 the value of Cronbach’s Alpha is 0.528. This value is within satisfactory Cronbach,s Alpha value. That shows that Factor 5 – Construction and Policy Making is a reliable factor.

## **Cross Tabulation**

**Hypothesis 01 - Willingness to use vs infrastructure factors**

Table 4.26: Chi – Square Test Statistics of Willingness to use vs infrastructure factors

|  |  |  |  |
| --- | --- | --- | --- |
|  | | | |
|  | Value | df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square | 35.307a | 13 | .001 |
| Likelihood Ratio | 39.926 | 13 | .000 |
| Linear-by-Linear Association | .320 | 1 | .571 |
| N of Valid Cases | 253 |  |  |
|  | | | |

H0: Willingness is not dependent on infrastructure factors

H1: Willingness is dependent on infrastructure factors

Since the p value 0.001 is less than the significance value 0.05, the null hypothesis is rejected. Therefore, it is evident that willingness is dependent on infrastructure factors.

**Hypothesis 02 - Willingness to use vs personal consideration**

Table 4.27: Chi – Square Test Statistics of Willingness to use vs personal consideration

|  |  |  |  |
| --- | --- | --- | --- |
|  | | | |
|  | Value | df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square | 39.684a | 19 | .004 |
| Likelihood Ratio | 48.116 | 19 | .000 |
| Linear-by-Linear Association | .605 | 1 | .437 |
| N of Valid Cases | 253 |  |  |
|  | | | |

H0: Willingness is not dependent on personal consideration

H1: Willingness is dependent on personal consideration

Since the p value 0.004 is less than the significance value 0.05, the null hypothesis is rejected. Therefore, it is evident that willingness is dependent on personal consideration.

**Hypothesis 03 - Willingness to use vs mobility and cost factors**

Table 4.28: Chi – Square Test Statistics of Willingness to use vs mobility and cost factors

|  |  |  |  |
| --- | --- | --- | --- |
|  | | | |
|  | Value | df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square | 27.379a | 14 | .017 |
| Likelihood Ratio | 29.889 | 14 | .008 |
| Linear-by-Linear Association | 4.046 | 1 | .044 |
| N of Valid Cases | 253 |  |  |
|  | | | |

H0: Willingness is not dependent on mobility and cost factors

H1: Willingness is dependent on mobility and cost factors

Since the p value 0.017 is less than the significance value 0.05, the null hypothesis is rejected. Therefore, it is evident that willingness is dependent on mobility and cost factors.

**Hypothesis 04 - Willingness to use vs construction and policy making**

Table 4.29: Chi – Square Test Statistics of Willingness to use vs construction and policy making

|  |  |  |  |
| --- | --- | --- | --- |
|  | | | |
|  | Value | df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square | 16.962a | 10 | .075 |
| Likelihood Ratio | 19.329 | 10 | .036 |
| Linear-by-Linear Association | 2.022 | 1 | .155 |
| N of Valid Cases | 253 |  |  |
|  | | | |

H0: Willingness to use in not dependent on construction and policy making

H1: Willingness to use is dependent on construction and policy making

Since the p value 0.075 is greater than the significance value 0.05, the null hypothesis is accepted. Therefore, it is evident that willingness to use is not dependent on construction and policy making.

**Hypothesis 05 - Willingness to use vs Environmental consciousness**

Table 4.30: Chi – Square Test Statistics of Willingness to use vs Environmental consciousness

|  |  |  |  |
| --- | --- | --- | --- |
|  | Value | df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square | .075a | 2 | .963 |
| Likelihood Ratio | .075 | 2 | .963 |
| Linear-by-Linear Association | .014 | 1 | .907 |
| N of Valid Cases | 253 |  |  |
|  | | | |

H0: Willingness to use is not dependent on Environmental consciousness

H1: Willingness to use is dependent on Environmental consciousness

Since the p value 0.963 is greater than the significance value 0.05, the null hypothesis is accepted. Therefore, it is evident that willingness to use is not dependent on Environmental consciousness.

**Hypothesis 06 - Willingness to use vs External environment and social influence factors**

Table 4.31: Chi – Square Test Statistics of Willingness to use vs External environment and social influence factor

|  |  |  |  |
| --- | --- | --- | --- |
|  | | | |
|  | Value | df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square | 30.279a | 13 | .004 |
| Likelihood Ratio | 33.679 | 13 | .001 |
| Linear-by-Linear Association | .310 | 1 | .578 |
| N of Valid Cases | 253 |  |  |
|  | | | |

H0: Willingness to use is not dependent on External environment and social influence factors

H1: Willingness to use is dependent on External environment and social influence factors

Since the p value 0.004 is less than the significance value 0.05, the null hypothesis is rejected. Therefore, it is evident that willingness to use is dependent on External environment and social influence factors.

## **Hypothesis Testing**

Hypothesis testing has been carried out for demographic factors using Kruskal Wallis Test as described below,

### **Hypothesis Testing for Infrastructure facilities**

Table 4.32: Pearson Chi – Square values of demographic factors Vs Infrastructure facilities

|  |  |
| --- | --- |
| **Demographic Factor** | **Pearson Chi- Square(P value)** |
| Age | 0.048 |
| Gender | 0.000 |
| Employment | 0.098 |
| Bicycle ownership | 0.360 |
| Have used bicycle before | 0.855 |
| Preferred frequency of cycling | 0.003 |
| Preferred distance | 0.207 |

**Hypothesis 01 – Demographic factors Vs Infrastructure factors**

H0: Infrastructure facilities factor is not dependent on ith demographic factor

H1: Infrastructure facilities factor is dependent on ith demographic factor

ith Variable: Age, Gender, Employment, Bicycle ownership, Have used bicycle before, Preferred frequency of cycling, Preferred distance

According to the table 4.32 p- value (Significance value) of bicycle ownership, have used bicycle before, employment and preferred distance are greater than 0.05. Since the p- vale is greater than 0.05 the null hypothesis is accepted. Therefore it is evident that Infrastructure facilities factor is not dependent on the above factors.

According to the table p- value (Significance value) of age, gender and preferred frequency of cycling are less than 0.05. Since the p- vale is less than 0.05 the null hypothesis is rejected. Therefore it is evident that Infrastructure facilities factor is dependent on the above factors.

### **Hypothesis Testing for Personal Consideration**

Table 4.33: Pearson Chi – Square values of demographic factors Vs Personal consideration

|  |  |
| --- | --- |
| Demographic Factor | Pearson Chi- Square(P value) |
| Age | 0.072 |
| Gender | 0.431 |
| Employment | 0.209 |
| Bicycle ownership | 0.457 |
| Have used bicycle before | 0.023 |
| Preferred frequency of cycling | 0.033 |
| Preferred distance | 0.000 |

**Hypothesis 02 – Demographic factors Vs Personal Consideration**

H0: Personal consideration factor is not dependent on ith demographic factor

H1: Personal consideration factor is dependent on ith demographic factor

ith Variable: Age, Gender, Employment, Bicycle ownership, Have used bicycle before, Preferred frequency of cycling, Preferred distance

According to the table 4.33 p- value (Significance value) of age, gender, employment and bicycle ownership are greater than 0.05. Since the p- vale is greater than 0.05 the null hypothesis is accepted. Therefore it is evident that Personal consideration factor is not dependent on the above factors.

According to the table p- value (Significance value) of have used cycle before, preferred frequency of cycling and preferred distance are less than 0.05. Since the p- vale is less than 0.05 the null hypothesis is rejected. Therefore it is evident that Personal consideration factor is dependent on the above factors.

### **Hypothesis Testing for Mobility and cost factor**

Table 4.34: Pearson Chi – Square values of demographic factors Vs Mobility and cost factor

|  |  |
| --- | --- |
| Demographic Factor | Pearson Chi- Square(P value) |
| Age | 0.538 |
| Gender | 0.877 |
| Employment | 0.045 |
| Bicycle ownership | 0.963 |
| Have used bicycle before | 0.400 |
| Preferred frequency of cycling | 0.039 |
| Preferred distance | 0.002 |

**Hypothesis 03 – Demographic factors Vs Mobility and Cost factors**

H0: Mobility and Costfactor is not dependent on ith demographic factor

H1: Mobility and Costfactor is dependent on ith demographic factor

ith Variable: Age, Gender, Employment, Bicycle ownership, Have used bicycle before, Preferred frequency of cycling, Preferred distance

According to the table 4.34 p- value (Significance value) of age, gender, bicycle ownership, and have used bicycle before are greater than 0.05. Since the p- vale is greater than 0.05 the null hypothesis is accepted. Therefore it is evident that Mobility and cost factor is not dependent on the above factors.

According to the table p- value (Significance value) employment, preferred frequency of cycling and preferred distance are less than 0.05. Since the p- vale is less than 0.05 the null hypothesis is rejected. Therefore it is evident that Mobility and cost factor is dependent on the above factors.

### **Hypothesis Testing for External environment and Social influence**

Table 4.35: Pearson Chi – Square values of demographic factors Vs External environment and Social influence

|  |  |
| --- | --- |
| Demographic Factor | Pearson Chi- Square(P value) |
| Age | 0.020 |
| Gender | 0.353 |
| Employment | 0.098 |
| Bicycle ownership | 0.844 |
| Have used bicycle before | 0.318 |
| Preferred frequency of cycling | 0.000 |
| Preferred distance | 0.127 |

**Hypothesis 04 – Demographic factors Vs External environment and Social influence**

H0: External environment and Social influence factor is not dependent on ith demographic factor

H1: External environment and Social influence factor is dependent on ith demographic factor

ith Variable: Age, Gender, Employment, Bicycle ownership, Have used bicycle before, Preferred frequency of cycling, Preferred distance

According to the table 4.35 p- value (Significance value) of gender, employment, bicycle ownership, have used bicycle before and preferred distance are greater than 0.05. Since the p- vale is greater than 0.05 the null hypothesis is accepted. Therefore it is evident that External environment and Social influence factor is not dependent on the above factors.

According to the table p- value (Significance value) age and preferred frequency of cycling are less than 0.05. Since the p- vale is less than 0.05 the null hypothesis is rejected. Therefore it is evident that External environment and Social influence factor is dependent on the above factors.

### **Hypothesis Testing for Construction and Policy Making**

Table 4.36: Pearson Chi – Square values of demographic factors Vs Construction and policy making

|  |  |
| --- | --- |
| Demographic Factor | Pearson Chi- Square(P value) |
| Age | 0.015 |
| Gender | 0.323 |
| Employment | 0.002 |
| Bicycle ownership | 0.791 |
| Have used bicycle before | 0.015 |
| Preferred frequency of cycling | 0.041 |
| Preferred distance | 0.004 |

**Hypothesis 05 – Demographic factors Vs Construction and policy making**

H0: Construction and policy making factor is not dependent on ith demographic factor

H1: Construction and policy making factor is dependent on ith demographic factor

ith Variable: Age, Gender, Employment, Bicycle ownership, Have used bicycle before, Preferred frequency of cycling, Preferred distance

According to the table 4.36 p- value (Significance value) of gender and bicycle ownership are greater than 0.05. Since the p- vale is greater than 0.05 the null hypothesis is accepted. Therefore it is evident that Construction and policy making factor is not dependent on the above factors.

According to the table p- value (Significance value) age, employment, have used bicycle before, preferred frequency of cycling and preferred distance are less than 0.05. Since the p- vale is less than 0.05 the null hypothesis is rejected. Therefore it is evident that Construction and policy making factor is dependent on the above factors.

### **Hypothesis Testing for Environmental Consciousness**

Table 4.37: Pearson Chi – Square values of demographic factors Vs Environmental consciousness

|  |  |
| --- | --- |
| Demographic Factor | Pearson Chi- Square(P value) |
| Age | 0.172 |
| Gender | 0.754 |
| Employment | 0.100 |
| Bicycle ownership | 0.005 |
| Have used bicycle before | 0.013 |
| Preferred frequency of cycling | 0.087 |
| Preferred distance | 0.016 |

**Hypothesis 06 –Demographic factors Vs Environmental Consciousness**

H0: Environmental Consciousness factor is not dependent on ith demographic factor

H1: Environmental Consciousness factor is dependent on ith demographic factor

ith Variable: Age, Gender, Employment, Bicycle ownership, Have used bicycle before, Preferred frequency of cycling, Preferred distance

According to the table 4.37 p- value (Significance value) of age, gender, employment and preferred frequency of cycling are greater than 0.05. Since the p- vale is greater than 0.05 the null hypothesis is accepted. Therefore it is evident that Environmental consciousness factor is not dependent on the above factors.

According to the table p- value (Significance value) bicycle ownership, have used bicycle before and preferred distance are less than 0.05. Since the p- vale is less than 0.05 the null hypothesis is rejected. Therefore it is evident that Environmental consciousness factor is dependent on the above factors.

## **Chapter Summary**

For the analysis 253 structured questionnaires were used which collected by online as well as hand filled. First demographic profile of factors such as age group, gender, employment, employment sector, monthly income, bicycle ownership, types of modes which are used frequently for travelling, whether have a previous experience on using bicycle, reasons for not having used, if have used for what purposes it have used willingness in use, preferred frequency of cycling and preferred distance were discussed. After that from the responses it was visible that there is a high positive potential among people for the cycle super highway than dedicated bicycle lanes on the road. Based on the common question based on what purposes they are preferred to use most of them have selected for exercise, to carry out household activities and to commute to work they prefer most to use bicycles as a mode of transport. Then a description on independent variables was given. According to that it was concluded that highest percentage of the respondents have strongly agree or agree with the factors that “cycling is an environmental friendly mode of transport “and “travel time” is an important condition they consider when using this mode. Then a reliability test was carried out for the full data set and it came out that cronbach’s alpha is 0.795 which is within the acceptable level. After that factor analysis was carried out. There the KMO and Batlette’s Test value came as 0.835 which fulfilled the conditions such as sample adequacy and correlation matrix is not being and identify matrix. Under this communalities, scree plot, Total variance explained, component matrix, rotated component matrix and component coefficient matrix were discussed. Based on rotated component matrix six factor groups were identified. There were renamed as infrastructure facilities, accessibility, personal consideration, mobility and cost factors, external environment and social influence, construction and policy making and environmental consciousness. Reliability was carried out for each these factors and results are discussed in the chapter. After that cross tabulation was carried out to check whether willingness to use is dependent on these factors and the results are explained in the chapter. Finally a hypothesis testing was carried out for demographic factors using Kruskal Wallis Test and the results are discussed in the chapter.

# **CHAPTER FIVE: FINDINGS AND SUGGESTIONS OF THE STUDY**

## **Introduction to the Chapter**

This chapter describes the Limitations of the study, key findings of the study, and Suggestions of the research, Conclusion and directions for Future research.

## **Limitations of the Study**

The main limitation of the research was deciding the sample size of the study and gathering data accordingly. This sample size of 400 was selected based on total population statistics in Colombo city and based on previous researches. Out of 400 questionnaires which were distributed only 325 were returned. After conducting the data cleaning process only 253 responses were considered as valid and used for the study.

The next limitation was difficulty in collecting data from a specifically identified group or a cluster. Here it was difficulty to decide a specifically group to distribute the structured questionnaires. Therefore questionnaires were distributed randomly within the sample.

Next limitation was that, since this survey was based on the choice of the respondents. When collecting data to this kind of study, data collection can be subject to misinterpretation due to the factors like no time to fill these kind of questionnaires, questions were not applicable to them and etc.

Another limitation was that since the respondents doesn’t have any exposure with these type of implementation which is “Cycle super highway” it was difficult for the researcher to explain the purpose and what is the base of the research. With the time frame it was difficult to collect data since it took longer time than the planned. With the busy routine of people most of them are reluctant to fill questionnaires.

## **Findings of the Research**

### **Findings from the Demographic Factors**

Bicycle ownership analysis revealed that 51% of total respondents have bicycles at their homes. Due to the busy schedule in their lives most of them don’t get a proper use of it. Most frequent type/s of mode using for travelling analysis revealed that most popular type of mode is bus transportation along with other types of motorized transportation. Bicycle which is a non-motorized mode of transportation was recorded as used by very low number of people.

According to the analysis whether they have used bicycle for travelling during the past it was revealed that most of the respondents which is 75% as a percentage have used bicycle. In the analysis for what purposes they have used it was revealed that majority of them have used bicycle for exercise. Similar number of respondents have used bicycle for the entertainment purpose. This highlights the fact that people are more health conscious. Almost similar number of respondents have used this for carrying out daily household activities and to do social visits. But this number was relatively small compared to the number of respondents who have used this for exercise and entertainment purposes. Least number of respondents have used this for approaching to the school or any other educational institute.

According to the analysis reasons for not using it was revealed that major reason for not using was that there is no safe place to ride. This highlights the fact that people are more conscious on their safety. This brings out the necessity of a separate infrastructure where they can engage in cycling safely. It is evident that there is no proper use of bicycle lanes which are drawn on the roads currently. This may be due the fact that people are more safety conscious. Another fact is that in most of the situations vehicles are parked within those bicycle lanes whenever they have to park along the road. This is a huge hindrance to the cyclists. Because there is no space for them to ride as well as whenever the doors of the vehicles are opened or closed it can cause harm to them. According to previous studies also they have found out that cyclists prefer a path which doesn’t have above mentioned types of disturbances for regular cycling.

Another aspect stated in previous studies is that cyclists prefer routes with less or no junctions. Even though separated bicycle path is constructed on roads those cannot avoid junctions. This also suggests that "cycle super highway” is more suitable. From the analysis willingness in using as a mode of transportation in future it was revealed that 62% of the respondents told that they are willing to use. This is a positive potential within the respondents. 38% of the respondents said that they don’t have the willingness to use this as a mode of transportation. It is the duty of policy makers and infrastructural developers to attract these respondents to use “cycle super highway”.

In the preferred frequency of cycling analysis it was revealed that majority of the respondents like to engage in cycling on daily basis or once a week. This indicates that they have a positive potential towards this aspect. According to the analysis on preferred distance it was revealed that most preferred distance ranges of the respondents are between 3 – 4 km and between1 – 2 km. This fact is important for the construction and policy maker’s decision. Majority of the respondents have identified that the most suitable infrastructure type is the “Cycle super highway” than “Bicycle lanes”. This may be due to the fact that they are more safety conscious.

### **Findings from Independent Variables**

According to the analysis it was revealed that majority of the respondents have agreed to the fact that cycling is completely an environmental friendly mode of transportation. There is no emission of harmful gases, no dependency on fossil fuel and also no emission of loud noises. As the second important fact it was revealed that majority of them consider the travel time. When travelling on the road on Colombo city most of the time have to struggle with the heavy congestion issue. If this kind of infrastructure is implemented users can save their time.

It was revealed that most of the respondents agreed to the fact that this save their cost on fuel. Sri Lanka is currently spending large sum of money on fossil fuel. This can be reduced by introducing these kind of infrastructures which promote non-motorized transportation. According to the study it was revealed that respondents are more concerned about the quality of the highway, the environmental nature of the highway which implies whether it has a calm and environmental friendly nature, availability of parking facilities for their private vehicles as well as for bicycles, Connectivity to public modes of transportation, so that they can easily transfer to other modes in order to reach their destination. These aspects can be taken into consideration by the constructors and policy makers when implementing this kind of infrastructure.

It was revealed that most of the respondents consider about the easiness in accessibility, distance of the highway and maximum/minimum speed limit when travelling in the cycle super highway. With the ego level of people it was revealed that certain number of people concern about the image/ status derived by using this facility as well as the opinions of the other people. It was revealed that more that 60% of the respondents were agreed to travel more distance if electric bicycles are provided on rental basis. This is a positive potential which can be used to promote “cycle super highway”

According to the analysis it was revealed that more than 75% of the respondents agreed to the facts that cycling improve their health which also confirm the fact that people are more health conscious. Another fact which was revealed was that more that 70% of the respondents are concerned about their safety and security when using this facility. So that it is important to take necessary measures to prevent theft and vandalism. Availability of a proper lighting system is a must when developing this type of facility. The value obtained for the reliability test for the data set was 0.795, which has met the standard requirement and therefore considered as very reliable. So that the data set was considered as acceptable.

With reference to the KMO and Bartlett’s test, outputs indicate that KMO sampling adequacy value is 0.835 and Bartlett’s significance level is 0.000. Therefore the null hypothesis was not accepted. So that minimum requirements were fulfilled to carry out the factor analysis. According to the rotated component matrix new six factors were generated and under each factor all the 25 variables were included. Six factors are namely infrastructure factors, personal consideration, mobility and cost factors, external environment and social influence, construction and policy making and environmental consciousness.

### **Findings from Hypothesis Testing**

It was revealed that age has a significant impact on infrastructure factors, external environment and social influence and construction and policy making. Age has no significant impact on the factors like personal consideration, mobility and cost factors, and environmental consciousness. When it comes to the gender, it was revealed that it has a significant impact on factor infrastructure factor. It has no significant impact on all the other factors namely personal consideration, mobility factors, external environment and social influence, construction and policy making and environmental consciousness.

It was revealed that bicycle ownership has a significant impact on environmental consciousness while all the other factors don’t have a significant impact from it. It was revealed that have used bicycle before has a significant impact on the factors like infrastructure factors, personal consideration, construction and policy making and environmental consciousness. Factors like mobility and cost factors, external environment and social influence were not impacted by the fact that have used bicycle before.

When it comes to the preferred frequency it was revealed that it has a significant impact on factors like infrastructure factors, personal consideration, mobility and cost factors, external environment and social influence and construction and policy making. Factor environmental consciousness wasn’t have an impact by preferred frequency. From the analysis it was revealed that preferred distance has no significant impact on the factors like infrastructure factors and external environment and social influence. It had a significant impact on the factors such as personal consideration, mobility and cost factors, construction and policy making and environmental consciousness.

From the cross tabulation analysis it was revealed that willingness to use is dependent on the factors namely infrastructure factors, personal consideration, mobility and cost factors and environmental consciousness. Furthermore it revealed that willingness to use is not dependent on the factors such as external environment and social influence and construction and policy making.

## **Recommendations**

Majority of the respondents have recommended that more facilities should be provided in order to improve the use and awareness of bicycles. Facilities in the sense providing them a separate safe place to engage in cycling. According to the findings of the research as people are conscious about their safety these facilities should have a proper lighting system, security from theft and vandalism and with the minimum number of physical constraints. Providing electric bicycles can improve the potential among people to use the “cycle super highway”.

Another suggestion is to change laws related to cycling and motorists. At the same time enforce new laws to ensure the safety of cyclists. Policy makers can take this into their consideration and enact specific speed limit for the cyclists. In case of any emergency incident occurred along the cycle super highway there should be a proper mechanism to report that to the authorities.

Before using this kind of facility users should be given a proper education on their safety, proper use of bicycles and about personal protective equipment like helmets, knee guards they have to wear. This can be done through initiating cycling clubs.

In order to take this concept into the community in large scale mass media communication can be used. According to this study also it was revealed that people are more conscious on their safety and health aspects. Therefore, these facts can be highlighted when advertising. Also several events can be hold from time to time and awards can be given to the winners. By initiating cycling clubs these activities can be performed. Other than that online services and web applications can be introduced to the people. Can provide loyalty benefits to the regular users.

Also another suggestion from the respondents regarding the most suitable locations/routes for this kind of facility were Kollupitiya, Nugegoda, Bambalapitiya, Rajagiriya, Malabe, Baseline road Battaramulla, along with Marine drive, Japan Lanka road, and Race course. According to (Draft Urban Transport Master Plan; Colombo Metropolitan Region and Suburbs, 2013)report of Sri Lanka Ministry of Transport they have identified seven corridors from which vehicles are entering the Colombo city. Galle, Horana, Negombo, Kandy, Low Level, High Level and Malabe corridors were identified and it has been estimated that over one million people are entering the Colombo city through these seven corridors. A highest number of private vehicles entering the Colombo city via Malabe corridor. One possible approach to reduce congestion in Malabe which is a highly congested corridor is to change the modal split by reducing motorized transport thereby strengthening non-motorized transport.

## **Conclusion**

This study gives an approach to promote non-motorized transportation in Colombo city as a remedy for several issues such as high congestion level and high environmental pollution level prevailing in that region. But in most occasions congestion reduction focuses on motorized transport and does not take non-motorized methods into account. Cycling is one such method of non-motorize transportation. In highly dense areas for travelling short distances, the car is an inefficient and unsuitable mode of transport. Improvement of multimodal transport options that include non-motorize transport methods take lower cost for implementation and potential to influence a mode share shift also lead to create a sustainable mobility function. Cycling makes transport more affordable by saving fuel cost and dependency on fossil fuel, improves personal health, reduces air and noise pollution and is less costly in maintenance than car-dominated urban transport.

## **Directions for Future Research**

For the future research the base will be what are the different areas or districts which are suitable for the implementation of this kind of a facility. For that a large sample size will be selected at first to detect more relationships and effects. There were many researches based on this topic which were conducted for the foreign countries. This study was developed for the Sri Lankan context. Present study was developed with the support of those previous researches which were conducted in other countries. This research perceives wide range of researchable events, which can be extend further. One such is about the strategies which can be applied to promote this type of facility. From this study it was revealed that there is a positive potential within our community to use this kind of a facility. Therefore the authorities have to build up a potential within them to move on to this type of facilities.

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# **Appendix**

# **Appendix 1 (Questionnaire)**

Dear sir/Madam,   
I am Dulanga Wijayasinghe from CINEC Campus, reading a degree on BSc. (Hons) in logistics and Transport. This survey is carried out in order to identify **Factors Affecting on Customer Choice of Dedicated Non-motorized vehicle highway in Colombo City** as a requirement of the undergraduate program.

Please be kind enough to complete the survey and help to improve the quality of transportation system in Colombo city. The estimated time to complete this survey will take only less than 10 minutes. Note that the responses you have provided will be strictly confidential and will be protected by law.

Thank You!  
Dulanga Wijayasinghe  
Undergraduate, CINEC Campus.

A Cycle Super Highway is a cycle highway, where only the bicycle commuters’ needs have been given the highest priority. These routes offer fast, comfortable and safe service. These highways connect areas with many workers and students to their homes, and to public transportation possibilities as well.



**Part A**

(Please “√”the cage representing the most appropriate response for you, in respect of the following questions)

1. My age group is?

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 18-25 |  | 26-35 |  | 36-45 |  | 46-55 |  | Above 55 |

1. I am a ,

|  |
| --- |
|  |
|  |

Male

Female

1. Currently I am,

|  |  |
| --- | --- |
| Employed |  |
| Unemployed |  |
| Underemployed |  |
| Retired |  |
| Student |  |
| Employed at the same time studying |  |

1. My employment sector is?

|  |  |
| --- | --- |
| Public sector |  |
| Private sector |  |
| Semi-government |  |
| Self employed |  |
| Retired |  |
| Not applicable |  |

1. My monthly income level in Rs. is (If available)

|  |  |
| --- | --- |
| 1. 20,000 |  |
| 20,001 – 40,000 |  |
| 40,001– 60,000 |  |
| 60,001– 80,000 |  |
| 80,001 – 100,000 |  |
| Above 100,000 |  |

1. I own a bicycle (push cycle) currently

|  |  |
| --- | --- |
| Yes |  |
| No |  |

1. The most frequent mode that I am using to travel is/are,

|  |  |
| --- | --- |
| Bus |  |
| Car |  |
| Van |  |
| Three wheeler |  |
| Bicycle |  |
| Motorcycle |  |
| Walking |  |

1. I have done cycling (used bicycle) for travelling throughout the last month

|  |  |
| --- | --- |
| Yes |  |
| No |  |

1. Reason/s for why I have answered “No” ,

|  |  |
| --- | --- |
| Too busy |  |
| Disability / health issues |  |
| Bad weather |  |
| It does not match to personal image/status |  |
| Age |  |
| No safe place to ride |  |
| Need to carry stuff / kids |  |
| Not owning a bicycle |  |
| Other |  |

If other please mention,

……………………………………………………………………………………………

1. I have answered “Yes” and following is/are the purpose for which I have used bicycling as a mode of transportation?

|  |  |
| --- | --- |
| Exercise |  |
| Entertainment |  |
| Work |  |
| Daily house hold activities |  |
| Social visits |  |
| School/education |  |
| Other |  |

1. I am willing to select cycling as a mode of my transportation in future?

|  |  |
| --- | --- |
| Yes |  |
| No |  |

**Part B**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **In case of introducing a cycle super highway, in which I will be using a bicycle I consider / believe,** |  | Strongly agree | Agree | Neutral | Strongly disagree | Disagree |
| a. | My health condition can be enhanced through cycling |  |  |  |  |  |
| b. | I think cycling is more environmental friendly |  |  |  |  |  |
| c. | I consider about the transportation needs that I have to fulfill |  |  |  |  |  |
| d. | I consider about number of times I have to do cycling |  |  |  |  |  |
| e. | I consider about the quality of the bicycle highway & the bicycle |  |  |  |  |  |
| f. | Cycling is more comfortable for me than other modes of transportation |  |  |  |  |  |
| g. | I consider about the image derived from cycling |  |  |  |  |  |
| h. | I think more fuel cost can be saved from cycling |  |  |  |  |  |
|  | I consider about other costs Eg: parking charges, tolls and etc |  |  |  |  |  |
| i. | I think opinions of the other mode users as important |  |  |  |  |  |
| j. | I think congestion on roads can be reduced by promoting cycling |  |  |  |  |  |
| k. | I concern about my safety & security when cycling |  |  |  |  |  |
| l. | I consider about the distance I have to travel by bicycle |  |  |  |  |  |
| m. | I think about the nature of weather of the day |  |  |  |  |  |
| n. | I consider about the particular day/s of the week on which I am using the bicycle  Eg: Monday ,Wednesday, Friday |  |  |  |  |  |
| o. | I concern about the availability of parking facilities |  |  |  |  |  |
| p. | I consider about the easiness in accessibility |  |  |  |  |  |
| q. | I concern about connectivity to other public transportation modes |  |  |  |  |  |
| r. | I think I can travel more distance if electric bicycles are introduced |  |  |  |  |  |
| s. | I will prefer more if cycle super highway has a greeny and calm environment |  |  |  |  |  |
| t. | I think it is an appropriate mechanism to improve the quality of the transportation system in Colombo city |  |  |  |  |  |
| u. | I consider about what time period of the day I have to do cycling |  |  |  |  |  |
| v. | I consider abouts the travel time |  |  |  |  |  |
| W. | I consider about the distance of cycle super highway |  |  |  |  |  |
| y. | I consider about the maximum/minimum speed limit |  |  |  |  |  |

**Part C**

1. Frequency that I would like to do cycling?

|  |  |
| --- | --- |
| Daily |  |
| Once a week |  |
| Thrice a week |  |
| Once in a month |  |
|  |  |
| Once in a while |  |

1. Distance that I prefer most to travel by bicycle?

|  |  |
| --- | --- |
| Less than 1km |  |
| 1 – 2 km |  |
| 2- 4 km |  |
| 5 km |  |
| Above 5 km |  |

1. According to my opinion the most suitable infrastructure to promote cycling in Sri Lanka is?

|  |  |
| --- | --- |
| Separate bicycle highway |  |
| Dedicated bicycle lanes on the road |  |

1. I prefer to use cycling as a mode of transportation for,

|  |  |
| --- | --- |
| Exercise |  |
| Entertainment |  |
| Work |  |
| Daily house hold activities |  |
| Social visits |  |
| School/education |  |
| Other |  |

If other, please specify ……………………………………………………………………………………………

1. Following are the changes I would recommend to be made in our community to improve the use/awareness of bicycles

|  |  |
| --- | --- |
| Providing more facilities |  |
| Change laws related to bicycling and motorists |  |
| Enforce new laws governing bicycling |  |
| Initiating bicycle safety education for the community Eg: Cycling clubs |  |
| Mass media communication |  |

If other, please specify ……………………………………………………………………………………………

1. According to my opinion the most suitable location / route to develop a bicycle highway within Colombo city is/are?

...........................................................................................................................................

**Thank you very much for taking part in this survey.**

# **Appendix 2 (Frequency tables of demographic variables)**

Age

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 18-25 | 182 | 71.9 | 71.9 | 71.9 |
| 26-35 | 35 | 13.8 | 13.8 | 85.8 |
| 36-45 | 21 | 8.3 | 8.3 | 94.1 |
| 46-55 | 14 | 5.5 | 5.5 | 99.6 |
| Above55 | 1 | .4 | .4 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Gender

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Male | 144 | 56.9 | 56.9 | 56.9 |
| Female | 109 | 43.1 | 43.1 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Employment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Employed | 66 | 26.1 | 26.1 | 26.1 |
| Unemployed | 35 | 13.8 | 13.8 | 39.9 |
| Underemployed | 5 | 2.0 | 2.0 | 41.9 |
| Student | 143 | 56.5 | 56.5 | 98.4 |
| Employed at the same time studying | 4 | 1.6 | 1.6 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Employment sector

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Public sector | 11 | 4.3 | 4.3 | 4.3 |
| Private sector | 113 | 44.7 | 44.7 | 49.0 |
| Semi government | 11 | 4.3 | 4.3 | 53.4 |
| Self employed | 9 | 3.6 | 3.6 | 56.9 |
| Not applicable | 109 | 43.1 | 43.1 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Monthly income

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 0-20,000 | 166 | 65.6 | 65.6 | 65.6 |
| 20,001-40,000 | 30 | 11.9 | 11.9 | 77.5 |
| 40,001-60,000 | 24 | 9.5 | 9.5 | 87.0 |
| 60,001-80,000 | 9 | 3.6 | 3.6 | 90.5 |
| 80,001-100,000 | 10 | 4.0 | 4.0 | 94.5 |
| Above 100,000 | 14 | 5.5 | 5.5 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Bicycle ownership

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 129 | 51.0 | 51.0 | 51.0 |
| No | 124 | 49.0 | 49.0 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Bus users

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 174 | 68.8 | 68.8 | 68.8 |
| No | 79 | 31.2 | 31.2 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Car users

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 82 | 32.4 | 32.4 | 32.4 |
| No | 171 | 67.6 | 67.6 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Van users

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 17 | 6.7 | 6.7 | 6.7 |
| No | 236 | 93.3 | 93.3 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Three wheel users

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 64 | 25.3 | 25.3 | 25.3 |
| No | 189 | 74.7 | 74.7 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Bicycle users

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 18 | 7.1 | 7.1 | 7.1 |
| No | 235 | 92.9 | 92.9 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Motorcycle users

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 38 | 15.0 | 15.0 | 15.0 |
| No | 215 | 85.0 | 85.0 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Walking

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 18 | 7.1 | 7.1 | 7.1 |
| No | 235 | 92.9 | 92.9 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Used bicycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 63 | 24.9 | 24.9 | 24.9 |
| No | 190 | 75.1 | 75.1 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Too Busy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 45 | 17.8 | 17.8 | 17.8 |
| No | 208 | 82.2 | 82.2 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Disability/Health Issues

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 4 | 1.6 | 1.6 | 1.6 |
| No | 249 | 98.4 | 98.4 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Bad Weather

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 19 | 7.5 | 7.5 | 7.5 |
| No | 234 | 92.5 | 92.5 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

It does not match to personal image/status

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 32 | 12.6 | 12.6 | 12.6 |
| No | 221 | 87.4 | 87.4 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Age

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 18 | 7.1 | 7.1 | 7.1 |
| No | 235 | 92.9 | 92.9 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

No safe place to ride

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 62 | 24.5 | 24.5 | 24.5 |
| No | 191 | 75.5 | 75.5 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Need to carry stuff/kids

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 17 | 6.7 | 6.7 | 6.7 |
| No | 236 | 93.3 | 93.3 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Not owning a bicycle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 76 | 30.0 | 30.0 | 30.0 |
| No | 177 | 70.0 | 70.0 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Don't know how to ride

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 46 | 18.2 | 18.2 | 18.2 |
| No | 207 | 81.8 | 81.8 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Exercise

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 98 | 38.7 | 38.7 | 38.7 |
| No | 155 | 61.3 | 61.3 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Entertainment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 71 | 28.1 | 28.1 | 28.1 |
| No | 182 | 71.9 | 71.9 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Work

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 4 | 1.6 | 1.6 | 1.6 |
| No | 249 | 98.4 | 98.4 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Daily household activities

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 17 | 6.7 | 6.7 | 6.7 |
| No | 236 | 93.3 | 93.3 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Social visits

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 39 | 15.4 | 15.4 | 15.4 |
| No | 214 | 84.6 | 84.6 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

School/Education

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 36 | 14.2 | 14.2 | 14.2 |
| No | 217 | 85.8 | 85.8 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Other

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 5 | 2.0 | 2.0 | 2.0 |
| No | 248 | 98.0 | 98.0 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Willingness to use

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Yes | 156 | 61.7 | 61.7 | 61.7 |
| No | 97 | 38.3 | 38.3 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

Suitable location / route

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Frequency | Percent | Valid Percent | Cumulative Percent |
|  | Wellawatta to Gallface | 2 | .8 | .8 | .8 |
| Thimbirigasyaya, Nawala, Maharagama, Nuge | 1 | .4 | .4 | 1.2 |
| Rajagiriya, Nugegoda | 1 | .4 | .4 | 1.6 |
| Rajagiriya-Colombo,Maradana,Athurugiriya | 2 | .8 | .8 | 2.4 |
| Rajagiriya to Fort / Wattala to Fort / Mou | 3 | 1.2 | 1.2 | 3.6 |
| Rajagiriya | 4 | 1.6 | 1.6 | 5.1 |
| Race Course | 6 | 2.4 | 2.4 | 7.5 |
| Piliyandala-Bambalapitiya | 2 | .8 | .8 | 8.3 |
| nice concept | 2 | .8 | .8 | 9.1 |
| Marine drive, Galle road | 1 | .4 | .4 | 9.5 |
| Marine Drive | 6 | 2.4 | 2.4 | 11.9 |
| Maradhana to Rajigiriya. | 4 | 1.6 | 1.6 | 13.4 |
| Maradana,Pettah | 1 | .4 | .4 | 13.8 |
| Maradana | 5 | 2.0 | 2.0 | 15.8 |
| Malabe,Kollupitiya | 1 | .4 | .4 | 16.2 |
| Malabe, Nugegoda | 1 | .4 | .4 | 16.6 |
| Malabe, Bttaramulla | 1 | .4 | .4 | 17.0 |
| Malabe-Bambalapitiya | 4 | 1.6 | 1.6 | 18.6 |
| Malabe to Borella | 5 | 2.0 | 2.0 | 20.6 |
| Malabe around universities | 1 | .4 | .4 | 20.9 |
| Malabe | 10 | 4.0 | 4.0 | 24.9 |
| Makumbura-Kottawa | 2 | .8 | .8 | 25.7 |
| Kottawa, Nugegoda,Rajagiriya | 1 | .4 | .4 | 26.1 |
| Kottawa to Pettah with interchanges | 3 | 1.2 | 1.2 | 27.3 |
| Kottawa | 3 | 1.2 | 1.2 | 28.5 |
| Kollupitiya, Nugegoda, Bambalapitiya | 3 | 1.2 | 1.2 | 29.6 |
| Kollupitiya | 2 | .8 | .8 | 30.4 |
| Keshaw-Pettah | 1 | .4 | .4 | 30.8 |
| Kadawatha | 3 | 1.2 | 1.2 | 32.0 |
| Japan lanka road | 2 | .8 | .8 | 32.8 |
| Highly traffic areas. Such as Rajigiriya | 3 | 1.2 | 1.2 | 34.0 |
| Gampaha, Malabe | 1 | .4 | .4 | 34.4 |
| Gallface | 2 | .8 | .8 | 35.2 |
| Galle road,Bloomendal road | 1 | .4 | .4 | 35.6 |
| Galle road | 1 | .4 | .4 | 36.0 |
| Fort to Bambalapitiya | 6 | 2.4 | 2.4 | 38.3 |
| Everywhere possible | 2 | .8 | .8 | 39.1 |
| Dehiwala to Kollupitiya | 1 | .4 | .4 | 39.5 |
| Dehiwala to fort | 2 | .8 | .8 | 40.3 |
| Colombo, Malabe | 1 | .4 | .4 | 40.7 |
| Colombo 3 | 3 | 1.2 | 1.2 | 41.9 |
| Colombo 01-Colombo 14 | 2 | .8 | .8 | 42.7 |
| Colombo | 6 | 2.4 | 2.4 | 45.1 |
| Borella | 3 | 1.2 | 1.2 | 46.2 |
| Battaramulla | 6 | 2.4 | 2.4 | 48.6 |
| Batharamulle | 3 | 1.2 | 1.2 | 49.8 |
| baseline to high level | 3 | 1.2 | 1.2 | 51.0 |
| Baseline road | 2 | .8 | .8 | 51.8 |
| Bambalapitiya | 2 | .8 | .8 | 52.6 |
| Around schools | 2 | .8 | .8 | 53.4 |
| Areas where the traffic conjestion is high | 1 | .4 | .4 | 53.8 |
| Along with marine drive | 2 | .8 | .8 | 54.5 |
| Along with marine | 1 | .4 | .4 | 54.9 |
|  | 114 | 45.1 | 45.1 | 100.0 |
| Total | 253 | 100.0 | 100.0 |  |

# **Appendix 3 (Factor analysis raw tables)**

**Rotated Component Matrix**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | |
|  | Component | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Environmental friendly | .024 | .077 | .157 | .036 | .073 | .882 |
| Travel time | .040 | .084 | .707 | -.066 | .009 | .167 |
| Transportation needs | .125 | .620 | .424 | .308 | .052 | .032 |
| Number of times | .256 | .419 | .109 | .410 | .125 | .375 |
| Quality | .390 | .233 | .391 | .208 | .038 | .139 |
| Reduce congestion | .089 | .059 | -.028 | .806 | -.015 | .227 |
| Nature of weather | .006 | .020 | -.151 | .640 | .237 | -.120 |
| Fuel cost | .015 | .098 | .686 | -.035 | .354 | -.090 |
| Nature of the highway | .049 | .108 | .112 | .133 | .700 | .129 |
| An appropriate mechanism | .300 | -.083 | .078 | .362 | .366 | -.036 |
| Time period of the day | -.091 | .320 | .537 | .034 | .254 | .145 |
| Providing electric bicycles | .539 | .051 | .145 | .184 | .546 | -.065 |
| Availability of parking facilities | .799 | .043 | .028 | .207 | .216 | .245 |
| Connectivity to public modes | .725 | .247 | -.011 | .255 | .142 | .028 |
| Days of the week | .309 | .376 | .242 | .527 | .156 | .008 |
| Other's opinions | .381 | .306 | .353 | .449 | .045 | -.116 |
| Improve health | .172 | .794 | .299 | -.041 | .000 | .195 |
| Safety and security | .157 | .747 | .223 | .179 | -.012 | -.059 |
| Other costs | .383 | .328 | .477 | -.014 | -.177 | .092 |
| Maximum/minimum speed limit | .261 | .105 | .660 | .052 | .006 | .014 |
| Comfortability | .105 | .512 | .073 | .103 | .495 | .022 |
| Distance that have to travel | .337 | .568 | .174 | .061 | .311 | .140 |
| Accessibiity | .703 | .227 | .359 | .002 | -.058 | -.095 |
| Distance of the highway | .700 | .443 | .151 | -.011 | .031 | -.039 |
| Image/status derived | .449 | .568 | -.141 | -.054 | .131 | -.016 |
| Extraction Method: Principal Component Analysis.  Rotation Method: Varimax with Kaiser Normalization. | | | | | | |
| a. Rotation converged in 8 iterations. | | | | | | |

**Component Score Coefficient Matrix**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | |
|  | Component | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 |
| Environmental friendly | .000 | -.068 | -.013 | -.063 | .009 | .760 |
| Travel time | -.033 | -.115 | .331 | -.038 | -.036 | .089 |
| Transportation needs | -.134 | .200 | .093 | .140 | -.084 | -.078 |
| Number of times | -.020 | .092 | -.068 | .147 | -.040 | .263 |
| Quality | .088 | -.055 | .124 | .062 | -.083 | .066 |
| Reduce congestion | -.065 | -.053 | -.017 | .477 | -.180 | .138 |
| Nature of weather | -.100 | -.006 | -.061 | .360 | .075 | -.153 |
| Fuel cost | -.088 | -.096 | .321 | -.062 | .238 | -.152 |
| Nature of the highway | -.081 | -.025 | -.016 | -.069 | .503 | .067 |
| An appropriate mechanism | .074 | -.159 | .033 | .131 | .191 | -.064 |
| Time period of the day | -.165 | .058 | .194 | -.026 | .148 | .046 |
| Providing electric bicycles | .164 | -.140 | .008 | -.051 | .336 | -.089 |
| Availability of parking facilities | .334 | -.181 | -.074 | -.037 | .048 | .212 |
| Connectivity to public modes | .255 | -.031 | -.106 | .018 | -.013 | .004 |
| Days of the week | -.025 | .050 | .041 | .245 | -.037 | -.080 |
| Other's opinions | .032 | -.004 | .122 | .227 | -.116 | -.182 |
| Improve health | -.082 | .324 | -.035 | -.107 | -.068 | .096 |
| Safety and security | -.110 | .322 | -.033 | .056 | -.103 | -.138 |
| Other costs | .107 | .008 | .159 | -.035 | -.217 | .034 |
| Maximum/minimum speed limit | .053 | -.133 | .305 | .017 | -.075 | -.049 |
| Comfortability | -.111 | .211 | -.101 | -.077 | .330 | -.046 |
| Distance that have to travel | .008 | .178 | -.076 | -.109 | .162 | .062 |
| Accessibiity | .270 | -.077 | .105 | -.073 | -.137 | -.110 |
| Distance of the highway | .237 | .076 | -.058 | -.126 | -.064 | -.061 |
| Image/status derived | .110 | .249 | -.229 | -.163 | .057 | -.032 |
| Extraction Method: Principal Component Analysis.  Rotation Method: Varimax with Kaiser Normalization. | | | | | | |

# **Appendix 4 (Raw tables of Kruskal Wallis Test)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test Statisticsa,b** | | | | | | |
|  | Infrastructurefactors | Personalconsideration | Mobilityandcostfactors | Ridingenvironmentandcongestion | Constructionandpolicymaking | Socialinfluence |
| Chi-Square | 9.609 | 8.607 | 3.122 | 11.718 | 12.364 | 8.611 |
| df | 4 | 4 | 4 | 4 | 4 | 4 |
| Asymp. Sig. | .048 | .072 | .538 | .020 | .015 | .072 |
| a. Kruskal Wallis Test | | | | | | |
| b. Grouping Variable: Age | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test Statisticsa,b** | | | | | | |
|  | Infrastructurefactors | Personalconsideration | Mobilityandcostfactors | Ridingenvironmentandcongestion | Constructionandpolicymaking | Socialinfluence |
| Chi-Square | 12.633 | .620 | .024 | .861 | .977 | .098 |
| df | 1 | 1 | 1 | 1 | 1 | 1 |
| Asymp. Sig. | .000 | .431 | .877 | .353 | .323 | .754 |
| a. Kruskal Wallis Test | | | | | | |
| b. Grouping Variable: Gender | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test Statisticsa,b** | | | | | | |
|  | Infrastructurefactors | Personalconsideration | Mobilityandcostfactors | Ridingenvironmentandcongestion | Constructionandpolicymaking | Socialinfluence |
| Chi-Square | 7.829 | 5.869 | 9.716 | 7.826 | 17.160 | 7.767 |
| df | 4 | 4 | 4 | 4 | 4 | 4 |
| Asymp. Sig. | .098 | .209 | .045 | .098 | .002 | .100 |
| a. Kruskal Wallis Test | | | | | | |
| b. Grouping Variable: Employment | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test Statisticsa,b** | | | | | | |
|  | Infrastructurefactors | Personalconsideration | Mobilityandcostfactors | Ridingenvironmentandcongestion | Constructionandpolicymaking | Socialinfluence |
| Chi-Square | .839 | .554 | .002 | .039 | .070 | 7.868 |
| df | 1 | 1 | 1 | 1 | 1 | 1 |
| Asymp. Sig. | .360 | .457 | .963 | .844 | .791 | .005 |
| a. Kruskal Wallis Test | | | | | | |
| b. Grouping Variable: Bicycle Ownership | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test Statisticsa,b** | | | | | | |
|  | Infrastructurefactors | Personalconsideration | Mobilityandcostfactors | Ridingenvironmentandcongestion | Constructionandpolicymaking | Socialinfluence |
| Chi-Square | .033 | 5.140 | .710 | .997 | 5.885 | 6.117 |
| df | 1 | 1 | 1 | 1 | 1 | 1 |
| Asymp. Sig. | .855 | .023 | .400 | .318 | .015 | .013 |
| a. Kruskal Wallis Test | | | | | | |
| b. Grouping Variable: Used bicycle | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test Statisticsa,b** | | | | | | |
|  | Infrastructurefactors | Personalconsideration | Mobilityandcostfactors | Ridingenvironmentandcongestion | Constructionandpolicymaking | Socialinfluence |
| Chi-Square | 15.937 | 10.484 | 10.112 | 20.137 | 9.984 | 8.122 |
| df | 4 | 4 | 4 | 4 | 4 | 4 |
| Asymp. Sig. | .003 | .033 | .039 | .000 | .041 | .087 |
| a. Kruskal Wallis Test | | | | | | |
| b. Grouping Variable: Frequency of cycling | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test Statisticsa,b** | | | | | | |
|  | Infrastructurefactors | Personalconsideration | Mobilityandcostfactors | Ridingenvironmentandcongestion | Constructionandpolicymaking | Socialinfluence |
| Chi-Square | 5.894 | 20.575 | 16.426 | 7.166 | 15.598 | 12.194 |
| df | 4 | 4 | 4 | 4 | 4 | 4 |
| Asymp. Sig. | .207 | .000 | .002 | .127 | .004 | .016 |