POTENTIAL FOR BIKE-SHARE IN UPPER HILL AREA, NAIROBI, KENYA

BY:

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Declaration

This is my original work and has never been presented to University of Nairobi or any university for the award of degree or other Academic Award

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The research project has been submitted for examination with our approval as University of Nairobi Supervisor(s).

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Dedication

This project is dedicated to my family that has encouraged me all the way to be persistent to accomplish my Master's studies.

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Abstract

Commuters using motorized transport in Nairobi walk long distances to connect to their destinations from public transit stops which makes them lose a lot of valuable time and is uncomfortable. The use of bike share can improve access but there is a gap in understanding willingness to use the bicycles by commuters in Upper Hill. The purpose of this study was to investigate factors that influence the adoption and hence potential of bike share in Nairobi's Upper Hill, with specific objectives being to examine the characteristics of potential bike share users in Nairobi's Upper Hill area, to determine whether the time taken to travel from drop-off to destination influences use of bike share and to discuss the perceptions that influence the use of bicycles.

The study sought to test the null hypotheses, 'there is no significant difference between willingness to use bike share and time taken to travel from drop-off to destination; and 'there is no significant difference between willingness to use bicycles and the perceptions. Primary data was obtained through questionnaire surveys. Random sampling technique was used to select the study subjects. A total of 126 commuters participated in the study. Data was analysed and presented in the form of percentages, charts and tables. The study used the Chi-square ($\chi 2$) test as a quantitative measuring technique to test the hypotheses. The study found that the potential of bike share is influenced a number of factors that comprise the time commuters take to travel from drop-off to their destination. Commuters were found to be more willing to ride bicycles for shorter journeys that take them 30 minutes or less. Matatus were found to be the mode of transport used by most commuters in the study area. The study also found that potential of bike share is influenced by the perceptions that commuters have on the use of bicycles with the majority being comfortable to be seen riding a bicycle. The availability of walking and cycling lanes was also found to influences the potential of bike share. Lack of walking and cycling lanes discourages both pedestrian and cyclist from using bicycles.

The study recommended that planning of a bike share system in a city should target connecting shorter journeys as people are more willing to ride bicycles for shorter journeys, conducting awareness campaigns to improve perceptions on cycling amongst residents and to integrate bike share with public transport to reach more potential users. The study also recommended policy-makers to invest in the provision of networks of good quality segregated pedestrian and cycling lanes in the city and embark on education, information and communication on precautions when sharing the road with cyclists and other non-motorised transport users. The study also recommended future research on the potential for bike share on a city-wide scale and potential of bike share targeting a specific group such as people going to work or university students.

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Acronyms

GHG	Greenhouse gas
GPS	Global Positioning System
ITDP	Institute for Transportation and Development Policy
IT	Information Technology
NMT	Non-motorised transport
RFID	Radio-frequency Identification
TPB	Theory of Planned Behaviour
USD	United State Dollar
WHO	World Health Organisation

CHAPTER ONE: INTRODUCTION

1.0 Background of the Study

Worldwide, cities strive to ease transport-related problems of congestion, air pollution, noise, greenhouse gas emission and road traffic accidents. The increased demand for travel in cities due to steady growth of population has caused large-scale proliferation of motor vehicles. Motorisation facilitates people to easily reach destinations but it is the unprecedented growth in private motor vehicles in the context of insufficient infrastructure that is attributed to traffic congestion and related problems. Traffic congestion is increasingly becoming a major problem in both developed and developing countries' cities (UN-Habitat, 2013). The transport sector which relies on use of fossil fuels is responsible for 24 % of energy- related greenhouse gases (GHG) that are a major factor in climate change (I E A, 2017). The sector contributes majorly to ambient air pollution which is linked to chronic illnesses such as asthma, bronchitis, heart attacks and stroke. (WHO, 2018). Road accidents are cited as a serious cause of fatalities and disability due to injury (WHO, 2013). Additionally, there is increasing recognition of other negative impacts of private car use in terms of community severance and reductions in physical activity (Fishman, 2016). Public transport that comprises buses, trains and trams is seen as a plausible solution to the burgeoning transport problems in cities because of their ability to transport larger volumes of passengers in a more economic use of the limited road space (UN-Habitat, 2013). There is need to explore the use of other modes of transport such as non-motorised means that are more environmentally friendly.

Use of bicycles as a means of transport is emerging globally as a key part of the solution to urban transport problems and has been gaining increasing attention in the past few years as planners and policy makers are becoming more aware of the environmental and health benefits of this means of transport (Shaheen et al., 2010). There is a range of interventions to promote the use of bicycles in cities such as policy and infrastructure interventions. A vastly growing concept all over the world is the development of bike share schemes. The use of shared public bicycles has become popular across cities of the world contributing to the growth in cycling as a mode of transport, offering bike users convenient, affordable, and on-demand access to bicycles. (ITDP, 2018). The economic, health and societal gains of bike share have been confirmed in many cities. These comprise rising recognition of use of bicycle as a means of transport to meet daily travel needs, improved connection to the public transit, reduction of pollution and carbon emissions, and better fitness for the bicycle riders (Moon-Miklaucic et al. 2018 in Venter C et al., 2019; Shaheen, Guzman, and Zhang 2010). While bike share schemes have been successful in many developed countries its feasibility in African cities has not been fully explored and little is known on the factors that influence commuters' choice to use bike share.

When compared to the use of personal bicycles as a means of transport, bike share presents users an opportunity to ride bicycles without the responsibilities that come with owning a bicycle such as ensuring the security of the bicycle and costs of using bike share are often low which can make bike share affordable to many users (ITDP, 2013). It offers an alternative to private car use for short trips. Bike share provides first-last kilometer connections for commuters that are often provided by informal modes such as motorbikes and auto-rickshaws which are not sustainable and contribute to the transport challenges such as congestion, pollution and carbon emissions (ITDP, 2017). A bike share scheme may potentially generate conflict if providers of first-last kilometer services perceive as being replaced by bike share (ITDP, 2017). Further introduction of bike share may compel the local authority to concurrently provide cycling lanes which improve the safety of cyclists and pedestrians (ITDP, 2013). Bike share increases the numbers of cyclists on the road which has been argued to improve safety for cyclists. The 'safety in numbers' argument is that more cyclists on the road force drivers to pay more attention to cyclists bringing increased safety not only for cyclists but for pedestrians as well (Fishman, 2014; Murphy and Usher, 2015; Jennings, 2014).

In African cities and many other developing countries non-motorised mobility, particularly walking is a dominant means of travel (UN-Habitat, 2013). Use of bike share is another effective non-motorised means but may be distraught by lack of infrastructure and the negative perception of the bicycle as a mode of transport. People spend a lot of time travelling to reach destinations which could be eased by use of bike share. Adaptation of the concept of bike share in Africa has been slow with Marrakesh in Morocco being the only city that launched a scheme in 2016. Other schemes have been introduced in controlled environments that include the University of Nairobi in 2017 with 20 bicycles and one central station and the University of Pretoria pilot scheme introduced in 2018 to test its feasibility and to help develop the capacity of the city planning authority on bike share (Venter C et al., 2019). There is a paucity of information on the reasons for the slow adoption of bike share in Africa despite the potential benefits of bicycle use and bike share. Many studies on bike share have focused on existing schemes with little research on potential users (Fishman, 2016). In Africa little is known on the factors that influence commuters' choice of bike share. This research explores the willingness to use bike share in an African city and the reasons that would influence willingness of commuters to use bike share.

1. 1 Statement of the Research Problem

Nairobi is experiencing rapid growth in the population, growing at 4% annually (WPR, 2020). The associated challenges in the urban transport sector include increasing traffic congestion, fuel consumption, air pollution, carbon emissions, safety problems and social exclusion. For example, Nairobi loses USD 50 million per year due to traffic congestion according to World Bank 2016. Public transport and walking are the dominant means of travel in Nairobi accounting for 80% of all trips daily according to Nairobi Non-Motorised Transport Policy, 2015. Further, use of bicycles is another mode of transport in Nairobi accounting for about 2% of the daily trips Nairobi Non-Motorised Transport Policy, 2015. Commuters often use more than one mode of transport to reach a destination. Walking is often the main mode of starting and completing journeys but is not comfortable for longer distances of say more than 2km.

In Upper Hill area, commuters walk long distances to connect to their destinations from public transit stops which is uncomfortable. On the other hand, those who opt to use motorized transport lose a lot of time in traffic congestion. As a result of these problems, there is a need to come up with alternative transport solutions. Bike share can potentially mitigate these problems but there is a gap in knowledge on the factors that would influence its use in an African city context. It is also important to understand what motivates people to use bicycles as a way to advocate the use of bicycles that can lead to the success of bike share.

In Nairobi walking and cycling is inadequately provided for, with most roads lacking sidewalks and cycling tracks. Bicycle users in Nairobi and similarly in the Upper Hill area are confronted with risks of involvement in accidents as they are forced to share the road space with speeding motor vehicles because of inadequate cycling infrastructure. Because of the unsafe streets and unequal allocation of road space for different road users, there is growing advocacy and protests. Recent protests in Nairobi by cyclists have been against reckless driving and reckless road users and a call for better laws and better infrastructure to protect cyclists from road accidents (KTN News, 2020). The Nairobi Critical Mass, a civil society cycling group in advocacy for safer cycling organises and conducts bicycle riding events regularly to raise awareness on safety for cyclists. Upper Hill is characterised by hilly terrain which can require cyclists to exert more effort and this can discourage the use of bicycles in the study area. Further there are negative perceptions in Africa on the use of bicycles as a mode for the poor which need to be understood.

In cities that have implemented bike share benefits have been driven such as availing users opportunity to ride bicycles without the responsibilities that come with owning a bicycle such as ensuring the security of the bicycle and costs of using bike share are often low which can make bike share affordable to many users (ITDP, 2013). Bike share provides first-last kilometre connections for commuters that are often provided by informal modes such as motorbikes and auto-rickshaws and thereby bike share has helped address the challenges of congestion, pollution and carbon emissions (ITDP, 2017). Further introduction of bike share has compelled concurrent provision of cycling lanes, improving the safety of cyclists and pedestrians (ITDP, 2013). Although there is no bike share scheme in Nairobi and the Upper Hill area there is potential to derive similar benefits that have been reported other cities which have motivated this study.

Bike share has been applauded for contributing to the growth in bicycling as a mode, offering bike users convenient, affordable, and on-demand access to bicycles. (ITDP, 2018). Economic, social and health benefits have been realized in some cities where it has been implemented including enhanced connection to public transit, reduction of pollution and carbon emissions, and better fitness and health for the bicycle riders (Moon-Miklaucic et al. 2018 in Venter C et al., 2019; Shaheen, Guzman, and Zhang 2010). While bike share schemes have been successful in many developed countries, feasibility of bike share in African cities has not been fully explored and little is known on what can be factors that influence commuters' choice to use bike share. This research explores the potential for bike share in Upper Hill area in Nairobi.

1.2 Research Questions

The research seeks to answer the following questions:

I. What are the characteristics of the potential bike share users in Nairobi's Upper Hill area?
II. Does time taken to travel from drop-off to destination influence the use of bicycles?
III. Do perceptions influence use of bicycles?

1. 3 Objectives of the Study

1.3.1 General Objective

The purpose of this study is to investigate factors that influence adoption of bike share in Nairobi's Upper Hill

1.3.2 Specific Objectives

The specific objectives are:

I. To examine the characteristics of the potential bike share users in Nairobi's Upper Hill area
II. To determine whether time taken to travel from drop-off to destination influences use of bike share
III. To discuss the perceptions that influence the use of bike share

1.4 Research Hypotheses

The research hypotheses for the study were:

H_1o- There is no significant difference between willingness to use bike share and time taken to travel from drop-off to destination

H_{2f0}- There is no significant difference between willingness to use bike share and the perceptions of commuters

1.5 Justification of the Study

A review of the studies on bike share reveals that limited attention has been given to potential for bike share in developing cities such as Nairobi where walking constitutes a significant share of trips. The study investigates factors that influence the use of bike share in a developing African country city. This study will contribute to knowledge and literature on bike share in an African context. The study will inform and support decision-makers on the potential for adopting some innovative solutions that can lead to acceptance of cycling in African cities. It will also provide information to further investigate the possibilities of using new mobility services to enhance the current public and private transport system as well as transform the cycling culture in a city. Bike share may be an opportunity to get more people on bikes in a city.

1.6 Scope and Limitation of the Study

This study analyses the potential for bike share in an African city context and will apply to a local neighbourhood, Upper Hill area in Nairobi. The study area is located 4 km on the western side of the Central Business District (CBD) of Nairobi ("Upper Hill, Nairobi," n.d.). Upper Hill area has been chosen because high volumes of pedestrians are noticeable in and out of the area, at the same time there are often high motor vehicle volumes, especially during peak hours. The area is largely dominated by mixed-use development of commercial and residential use. There is a possibility of numerous trip origins and destinations in and around the area that can be done by cycling. The study is based on a concept that has not been tested in Nairobi at a city-scale level. As a result, the study will rely on global lessons learnt. Due to limited financial resources and time, surveys during the study will be limited to one neighbourhood. It is acknowledged that the most successful bike share systems are city-wide in reach which may affect the results of the study.

1.7 Definition of Operational Terms

Accessibility: The ease or difficulty of reaching services or destinations offering opportunities

Bike share: "the shared use of a bicycle fleet" in an urban setting (Guo et al., 2017, p.2) that is often under ownership of a local municipal or transportation agency (Shaheen, Guzman and Zhang, 2010; DeMaio, 2009. Operation is often by a private bike share company

Bike Stations: Bicycles docking spaces and terminals

Docking spaces: Places at the station where bikes are parked and locked (ITDP, 2013).

Last-mile: The short distance between home and public transit or transit stations and the workplace

Matatu: A mini-bus or similar vehicle used as a taxi in Kenya

Non-motorised transport (NMT): Active transportation that is human-powered (UN-Habitat, 2013)

Sustainable transport: Transport that relies on renewable energy and NMT

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter reviews existing literature on bike share globally, specifically highlighting facilitators and barriers to bike share adoption, perceptions, impacts of bike share, feasibility and planning for bike share and demographic aspects. The review of existing literature presents findings at a global level and regional level. Identified gaps in the analysed studies are indicated and opportunities for further research specified.

2.1 Global Perspective on Studies of Bike share

2.1.1 Facilitators and Barriers

Fishman (2014) quantified the factors which enable or limit the use of bike share. The study was on two bike share programmes in Australia that are "CityCycle in Brisbane and Melbourne [Bike share] (MBS) in Melbourne" (Fishman, 2014, p.iv). The study sought to investigate factors that influence registration by individuals to a bike share scheme in Australia and the effect bike share has had on the use of private cars. Two principal data collection techniques that are focus groups and online surveys were employed incorporating both qualitative and quantitative methods. In Brisbane, target group discussions comprised riders (private bikes), non-riders and bike share members. The dialogue was designed to draw "views, attitudes and opinions regarding barriers and facilitators to [bike share and] an online survey formed the second data collection phase of this program of research." (Fishman, 2014, p. xi). A probabilistic sampling approach was used. A total of "372 MBS [Melbourne Bike share] members, 443 CityCycle subscribers, and 60 InSPiRS Panel Members" [participants of a Brisbane based research panel without any known connection to bike share] completed the survey (Fishman, 2014, p.xii) which is a corresponding response rate of "40.7%, 18.8% and 19.3%" (Fishman, 2014, p.114).

The study revealed three factors as key motivators to use of bike share as spontaneity, convenience and safety. According to Fishman, convenience relates to nearness of docking stations to home, work and other frequented locations and travel time competitiveness with other modes. Safe bikeways and motor vehicle speed were the main issues on safety (Fishman). Spontaneity issues have to do with the prolonged sign-up process and the Australian legal prerequisite to wear a helmet deterred the unprompted use of CityCycle (Fishman).

In a study to identify the “factors affecting [bike share] usage and degree of satisfaction in Ningbo, China”, (Guo et al., 2017.p1) examined “demographic characteristics, travel patterns, built environments, and user perceptions” (Guo et al., p3). Data was collected through questionnaires distributed a total of 986 participants. The study used random sampling method to select the subjects. To study simultaneously the factors a bivariate ordered probit (BOP) model was formulated. The model results demonstrated twelve variables as significant and reported in order of importance: “trip mode, familiarity with bike share, bike share station location, encouragement of green travel, great effort on the introduction to the public, travel time (< 30 min), gender, flexible route by bike share, wasting travel time by bike share, household bicycle/e-bike ownership, and satisfaction with bike share fees” (Guo et al., p17).

“The BOP model results showed that the usage of bike-sharing was affected by gender, household bicycle/e-bike ownership, trip model, travel time, bike-sharing stations location, and users’ perception of bike-sharing” (Guo et al., 2017, p.1). A parallel relationship between the use of bike share and level of contentment amongst the users was reported by the study. A limitation of the study is that it does not specify the population size from which the sample was drawn which may result in inaccurate conclusions. The findings by Guo et al are important results as they can enhance the researcher’s conception of the factors that can similarly affect willingness to ride bicycles in Nairobi.

2.1.2 Perceptions on Bike share

Using an online survey approach to research, Mateo-Babiano et al., (2016a) examined the perceptions of the subjects in the study on anticipated advantages, enablers and limitations to the adoption of bike share systems in Asia. The authors point out technical restraints that include inadequate cycling infrastructure and system design aspects such as the location of stations away from the users as the supreme obstacle to the adoption of bike share. On the other hand, Mateo-Babiano et al found that adoption of bike share would be facilitated by provision of adequate and well-connected cycling infrastructure, location of bike share stations close to public transit stations and location of bike share stations and infrastructure close to places of work and residential locations.

In the study by Mateo-Babiano et al., (2016a), the authors found that of the stated benefits by respondents, environmental benefits topped the list of benefits while economic benefits were the list stated benefits. This finding has been similarly presented by Guo et al., (2017) where pro-green travel participants in the study were more than 10% more likely to be regular users of bikes hare as a result of their environmental mindfulness. In comparing barriers to uptake of bike share, Mateo-Babiano et al interestingly reported cultural barriers and community perception to be comparatively weak restraints. This is demonstrated by the findings that “only 17% strongly agree that PBSP [Public Bike Share Program] is considered as a poor man’s transport option, 16% perceive vandalism, 21%, theft, and 21%, unsafe to use, as barriers to the introduction of PBSP” (Mateo- Babiano et al., 2016a,p.10). The authors suggest future research on bike share system in a developing country could focus on a specific group of potential users such as a university or factory. The findings on perception of bike share are important to inform this research which is interested in understanding purported benefits of bike share to willingness to use bicycles in Africa.

2.1.3 Topography and Bike share

Mateo-Babiano et al 2016b, in a separate study in Brisbane in Australia, analysed how the natural environment such as terrain and the built environment affected the use of CityCycle bicycles. The authors analysed CityCyle’s recorded data on how the bicycles were being used that included the date, time, origin and destination for 221 286 journeys taken within a year and the topographic data (Mateo-Babiano). The study used correlation and regression techniques to find the associations amongst variables under study. Further, the study analysed 150 bike share stations and to determine how topography variations impacted the use of bicycles the source-sink theory was applied. According to Mateo-Babiano, in this study the source were the origin stations where bicycles were picked by users and the sink refers to the destination stations where bicycles would be dropped-off. Using the source-sink model, the authors found that there were more bicycle trips starting from hilly areas towards the low areas than those starting from the bottom of hills going up. In using the Spearman’s correlation the authors reported that a strong association prevailed between elevation and the rate at bicycles were hired or returned at a station as demonstrated by a coefficient of 0.69. Mateo-Babiano argues that the problem of an unbalanced system was imminent because of CityCycle bicycle users avoided trips ending on hilltops. The authors suggested addressing the problem of rebalancing by giving incentives such as free time to users returning bicycles at stations located on elevated places. In this study, the researcher will explore if the terrain is a factor that impacts on the willingness to use bicycles in the Upper Hill area.

2.1.4 Travel Time and Cost

Campbell et al., (2016) studied the factors influencing the choice of shared bicycles and shared electric bikes in Beijing, China. The objective was to comprehend the reasons that made commuters switch from a prevailing means of transport to using bike share. According to Campbell, a stated preference survey was undertaken to find the choices of commuters and multinomial logit was used for modelling factors prompting users to shift from an existing means of transport to either conventional shared bikes or to e-bike. The study targeted adult travellers in Beijing's 4 core localities and analysed trips (total 498) and trip-link (total was 1188). According to Campbell et al, most of the journeys covered by bike share were close as demonstrated by mean distances of about 3km and median distances of 1.5 km. The study also found that more than half (70%) of the trips covered by the use of bike share were less than 5km. The authors concluded that the decision to choose bike share was influenced by the total level of effort one has to put to ride a bicycle and comfort which refers to exposure to heat or cold and the bad air quality. This implies travellers could only endure the uncomfortable heat or cold and bad air quality for shorter distances and which required less effort. Limitations of the study were use of subjective unquantified variables such as air quality which was categorised as good or bad. It would have more accurately forecasted perceptions of the respondents by quantifying the analysed variables.

Looking at the variable cost in the study by Guo et al., respondents who reported as effective in reducing their cost of travel were found to be more than 10% content with the bike share system and in-turn they indicated they would be more likely (4.85% more times likely) use the system than those who were not content. This finding is consistent with findings by Fishman (2016) where users reported financial savings as one of the benefits of bike share. The researcher in this study seeks to find variables that influence willingness to ride a bicycle that can include the cost of travel and others such as perception on fitness and health.

2.1.5 Safety and Bike share

In a study in Melbourne and Brisbane in Australia by Fishman (2014), reported safety concerns were inadequate bicycle infrastructure, speeding motor vehicles, rouge behavior of some car drivers. Interestingly in Brisbane, CityCycle bike share users reported observation that car drivers were more considerate to them when on CityCycle bikes compared to when they use private bikes (Fishman 2014). The author suggests this perception needs on-ground verification, for example, by obtaining objective measurements on distances maintained by private car drivers when passing bicycle riders. The study by Murphy and Usher (2015) illustrates a related issue in Dublin in Ireland. According to Murphy and Usher, out of the 80.5% of survey respondents who were also car drivers, 93.8% revealed that using the DublinBikes scheme had made them more conscious of cyclists on the road in instances when they drive.

Mandatory helmet law in Australia, ideally meant to improve the safety of users was found to discourage people from using bike share. “A logistic regression model revealed several significant predictors of membership, including reactions to mandatory helmet legislation” (Fishman, 2014, p.8) In Melbourne, 61% of the survey respondents pointed compulsory use of bike helmet as one of the reasons that makes using the bike share scheme unattractive and in Brisbane cyclists commonly echoed a similar concern of bike helmets (Fishman, 2014). This study will seek to find out the safety issues that can affect willingness to use bicycles in the study area.

2.1.6 Mode Substitution and Mode Choice

Through analysis of trip information generated by bike share programmes and huge-scale studies in the cities of Melbourne and Brisbane in Australia, Washington DC in USA, London in the UK and Minnesota in the USA, Fishman (2014) s the extent to which journeys by private automobiles were substituted by bike share. Typically reducing the use of private motor vehicles is one of the important reasons for setting up of bike share schemes. According to Fishman (2014), the study established the private motor vehicle kilometers substituted by bike share by adding up the distances of the journeys substituted. Additionally, the study collected and calculated the distances in kilometers covered by motor vehicles used in the redistribution of bike share bicycles across the scheme area. The author reported that the decrease in the use of private cars as a result of bike share was double the distance covered by operative support vehicles. The exception was London, where the replacement of car trips by bike share was low (Fishman 2014). The author argues that these studies prove that bike share can reduce driving.

In a study in Dublin in Ireland, Murphy and Usher (2015) examined the effect of bike share relative to the socio-economic characteristics of the users; effect of bike share on the choice of mode of transport; and the effect of bike share on driver alertness of cyclists. According to the authors, six bike share stations were randomly selected out of 40 stations for the collection of data. A total of 360 questionnaires were administered. A weakness of the study is that it does not provide justification for the selection of the stations and the number of questionnaires administered that may affect the accuracy of the results of the study used chi-square technique to access connections between variables. Murphy and Usher found that the bike share scheme was primarily used in conjunction with public transport modes where 56.3% of respondents used the train or tram for the main journey while 35.2% used the bus as the main mode of transport. Murphy and Asher claim that the use of bike share by mostly train and bus users in this study can be as a result of the nearness vicinity of the bicycle stations to rail and bus stations. Drawing from these studies the researcher is also interested in understanding the relationship between means of transport and willingness to use bicycles in the study area.

2.1.7 Age and Gender

In the study by Fishman (2014) on factors that enable or limit adoption of bike share in Melbourne and Brisbane in Australia bike share members were reported to be considerably younger and had friends and family who had bike share membership and most of them owned or had access to a bicycle at home. A weakness of the study is it is not clear if it analysed car ownership among these users as lower rates of car ownership among the younger population may be the reason for use of bike share. In the study by Murphy and Usher (2015) in Dublin in Ireland, the study found that most bike share users were male constituting more than 3 quarters (seventy-eight percent whilst less than a quarter (twenty-two percent) were female. Further, the authors report more than half of the bike share users (about fifty-eight percent were in the age range of 25–36) (Murphy and Usher 2015). The authors recommended future research to understand the reason for the low adoption of bike share by women in Dublin. The researcher will seek to understand if gender and demographic variables are significant in this study.

2.1.8 Users and Income

Murphy and Usher (2015) in their study in Dublin, Ireland, reported that close to sixty percent (57.3%) of bike share users earned a monthly salary that was above the average industrial wage in Ireland. The authors concluded that the bike share scheme in Dublin was dominated by the middle and higher-income group. According to Murphy and Usher, the low numbers of lo-income users may be an indication of numerous limitations to entry for the poor such as lack of credit or debit cards and limited access to the internet which are some of the prerequisites for registration. The authors recommended future research on reasons that limit low-income earners from adopting bike share and understanding their perceptions on the use of bicycles (Murphy and Usher). Similarly Guo et al., (2017) found that there was a positive association between income earned by individual users and the level of content with the bike share in Ningbo in China. In this study by Guo, users who earned higher incomes were reported to be more satisfied with bike share compared to those with lower incomes.

2.1.9 Bicycle Ownership and Bike share

The study by Guo et al., (2017) reported more frequent use of bike share by those who owned or had access to bicycles at home. The authors found that users who owned bicycles had a five percent chance higher to registers as bike share members than those who did not own bicycles. Guo et al concluded respondents who owned bicycles would be motivated to shift to bike share as it avails them opportunity to use bicycles without worrying about potential loss or vandalism of their own bicycles (Guo et al). Such findings are important as they can inform this study which seeks to investigate factors that influence the adoption of bike share.

2.1.10 Feasibility of Bike share

A study was undertaken in 2008 in the Vancouver Metropolitan area in Canada to assess the achievability of a bike share system (Quay Communications Inc., 2008). According to the authors, the study identified seven localities for assessment and the study included reviewing possible financing and administrative models, assessing expenditures and recommending a corporate strategy. The study found that bike share would be achievable in specific localities of the metropolitan area that are characterized by high employment and high residential densities, diverse land use, and a network of good quality cycling infrastructure. (Quay Communications Inc, 2008).

Such an environment would result in many short and medium-term trips. The study approach to assess potential of bike share in the metropolitan area was by ranking the localities in terms of variables such as density of the population, demographics such as age, density of the employment, existing share of cycling mode and existing share of the public transit mode. The authors recommend that in addition to assessed variables, a bike share system has to be large enough to capture many origins and destinations to be viable (Quay Communications Inc, 2008). The authors also recommend active municipal partnerships for the successful implementation of bike share. A limitation with this study is that it did not survey to understand the potential users' preferences and behavior, which is important in determining the success of a bike share and which this study intends to cover as part of studying the potential for bike share in Nairobi.

2.2 Regional Studies on Bike share

De Beer and Valjarevic (2015), undertook a study to assess the financial viability of a bike share scheme in the Alexandra- Sandton area in Johannesburg, South Africa to develop a sustainable business model. The study area was one of the 5 residential areas that had been identified for the potential to pilot a bike share scheme by the City of Johannesburg. According to De Beer and Valjarevic, the latent demand for the planned bike share scheme was estimated by analysing factors such as forecasted bike share trips and existing cycling trips in the study area. The study also analysed other variables that include purpose of travel in the study area and income levels of potential users, time and cost of cycling and available transport modes in the study area. The authors further assessed terrain of the study localities, and existing facilities for cycling. Considering the developed scenarios for the proposed bike share scheme which took into effect numerous variable stated earlier, De Beer and Valjarevic concluded that bike share would be technically feasible in the study areas but would require subsidies to cover the costs of operation. . They, therefore, recommend private-public partnership to ensure viability of the bike share scheme. A weakness of the study is it did not analyse the potential users' preferences. The authors recommended future studies to assess the potential demand for cycling and walking by conducting a stated preference survey as a way to develop more accurate demand models. University of Pretoria pilot scheme was introduced in 2018 to test its feasibility and to help develop the capacity of the city planning authority on bike share. Innovative aspects of the pilot included the inclusion of both electric and manual bicycles in a hybrid fleet, the development of a web-based booking and registration system, and the continuous GPS tracking of bicycles for security and data collection purposes. Although it is concluded that bike share schemes could be implemented successfully in South Africa, limited local data and applications are available to support assumptions about the demand for such schemes (Venter C et al., 2019).

Jennings (2011) undertook a study to assess potential of a bike share system in Cape Town, in South Africa. The author studied bike rental businesses in Cape Town as a proxy to a bike share scheme. The study found that bike share would be hindered by limited facilities for cycling, potential theft and vandalism of the bicycles, the mandatory requirement to wear helmets by bike share users, and insufficient public funding. The author underscores the potential of utility cycling to improve access in South Africa because most people (more than fifty percent) relied on public transport and many were low-income earners (estimated thirty percent of the residents live below the poverty line). Jennings found that the existing bike rental businesses were barely covering costs or breaking even and hence the author concluded that bike share may not be feasible in the study area. However, using bike rental as a proxy may not be a plausible approach that allows reliable comparison as bike rentals are for a longer duration and the bicycles should be returned at the same station where they have been picked. The study also is not clear on the potential number of bike share trips that can be generated from the study area and the preferences of potential users were not studied which may be an important factor in determining success.

In yet another related study, Jennings (2014) examined the extent bike share could meet the future transport needs of commuters in of Cape Town. from the study analysed secondary data sources such as peer-reviewed papers, policy documents, and conducted interviews with planners and policy-makers, bicycle rental services, bicycle activists and government departments such as for tourism and urban development. The author concluded that bike share in Cape Town will possibly succeed in middle-income areas that already have the infrastructure and at the same time are also served by public transport and the scheme will likely exclude the poor because of requisites for one to register such as possession of a credit card or smartphone. There are some absent components from the study such as bike share trips that can be generated, distances to be travelled and the time and cost of competing modes.

Adaptation of bike share in Africa has been slow, with Marrakesh in Morocco being the only city that launched a scheme in 2016. Other trial schemes have been in controlled environments that include the University of Nairobi in 2017 with 20 bicycles and one central station and the University of Pretoria pilot scheme introduced in 2018 to test its feasibility and to help develop the capacity of the city planning authority on bike share (Venter C et al., 2019). The United Nations Office in Nairobi launched a bike share in 2018 composed of 100 bicycles to allow staff and visitors to ride within their Nairobi compound (UN Environment, 2018). There is a paucity of information on bike share in Nairobi.

2.3 Local Studies

2.3.1 Non-Motorised Transport Policy and Streets and Roads Manual

The Nairobi City County government launched a Non-Motorised Transport (NMT) policy in 2015 with a vision of NMT as the preferred mode for short and medium trips. The NMT policy aims to advance and sustain a transport system that integrates fully NMT in Nairobi by such measures as the creation of a network of walking and cycling infrastructure that is safe and comfortable for the users. Further, the policy is projected to put laws and regulations that safeguard NMT users and the NMT facilities for instance from encroached by motorised modes of transport and other street users. The policy envisages a scenario where with improved infrastructure cycling being a mode of choice for medium trips up to 15 km (Nairobi NMT Policy). The objectives of this policy increasing safety, improve NMT facilities, increase recognition and image of NMT in Nairobi County and ensuring adequate budget allocation for walking and cycling facilities.

According to the Nairobi NMT policy NMT (walking and cycling) is the dominant mode of transport attributed to more than 40% of trips daily with cycling trips between 1- 3% of all travel. The policy highlights challenges faced by pedestrians and cyclists to include insufficient space, exposure to fast-moving and hostile motor vehicles, and hence increased accident risks. According to the Nairobi NMT policy out of 723 road crash fatalities recorded in Nairobi in the year 2014, a total of 17 (2% of total) were bicycle users and 507 (70%) were pedestrians. Such statistics demonstrate the inadequacies of the infrastructure for walking and cycling. Lack of implementation of existing policies has also been cited as a major draw-back to better walking and cycling environment. Further, the NMT policy provides action plans that are clear and implementation plans that can support the improvement of NMT.

It is important to note that the policy intended to develop a streets and roads design manual that would ensure consistency in the planning and designing of transport facilities. The streets and roads design manual is to ensure the design of infrastructure incorporates ‘complete streets’, that is, streets that cater for all road users. According to Mitullah and Opiyo (2016) in a study on institutional and policy issues to mainstreaming non-motorised transport in Nairobi, the walking and cycling facilities currently built across the city of Nairobi is not standard as a result of the absence of a manual to guide the design of the facilities at both national and local level. This has resulted in the design of infrastructure that varies in the city for example the width of NMT facilities is inconsistent even on one road.

There is growing interest and commitment to developing NMT. According to FIA Foundation (2017) a review of the progress of the NMT Policy was undertaken by the Nairobi City County Government and other stakeholders that include government ministries, residents association and non-governmental organisations. The review resulted in an action plan to haste implementation including advocating the enactment of the policy into law. Development of the NMT policy for Nairobi and the on-going formulation of the road and street design manual demonstrate an increasing interest in the advancement of walking and cycling by both planners and policymakers. Although the NMT policy is not specific about bike share it envisions improvement of cycling facilities, better policies to safe-guard cyclists and growth in the cycling modal share for which bike share can be a useful tool. The NMT policy is relevant to this study as cycling facilities and policies are important factors that influence bike share.

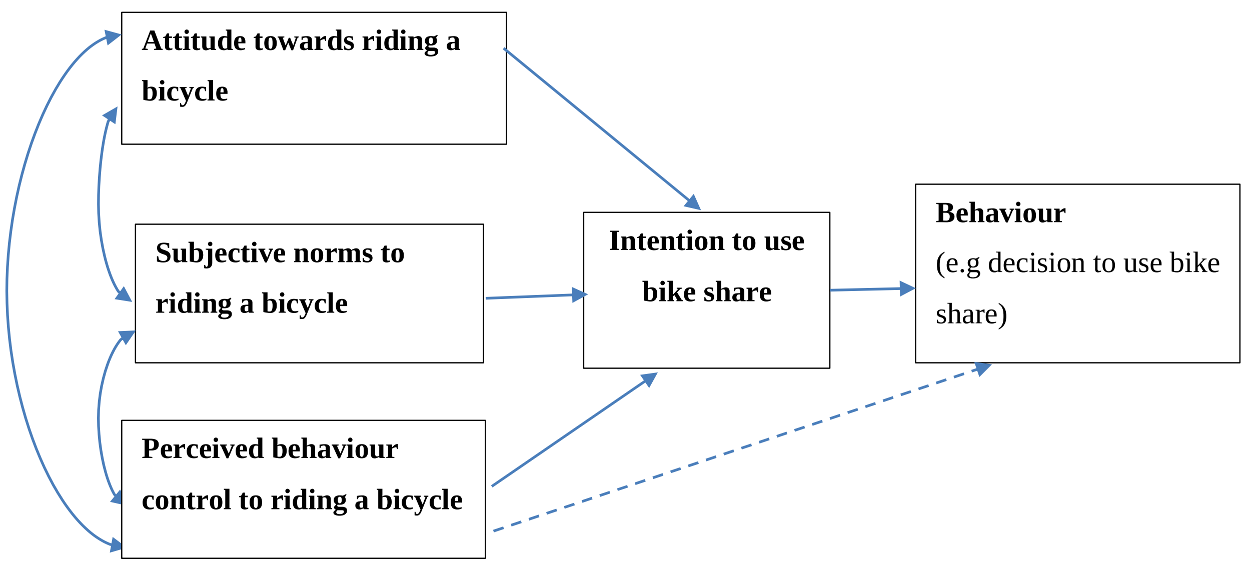
2.4 Theoretical Frameworks

This section looks at the theoretical framework that guides this study. The Theory of Planned Behavior (TPB) has been applied to envisage behavior in transport studies and can similarly be applied to bike share programmes where the attitude, social norms and behavioral control are studied (Ajzen, 1991; Fishman 2014). The Theory of Planned Behavior (TPB) has been adapted for this study.

2.4.1 Theory of Planned Behavior (TPB)

The TBP postulated by Ajzen in 1991 is a theory that links one's belief and behavior (Ajzen, 1991). The theory asserts that people's intention to participate in a specific activity is the determinant of whether the activity will actually be performed and hence, intentions are precursors of behavior (Ajzen, 1991). Figure 2.1 illustrates the three independent determining factors of intention and according to Ajzen are (i) attitude, (ii) subjective norms and (iii) perceived behavioral control. Attitude towards a behavior denotes how an individual evaluates a behavior, which can be positive or negative; subjective norms refers to the perceived social pressure to perform or not to perform the behavior; and perceived behavioral control refers to the perceived ease or difficulty of performing the behavior and it is informed by experience as well as anticipated impediments and obstacles (Ajzen 1991; Milkovic 2015). According to Ajzen, perceived behaviour control can influence behaviour directly.

Figure 2.1: Theory of Planned Behavior



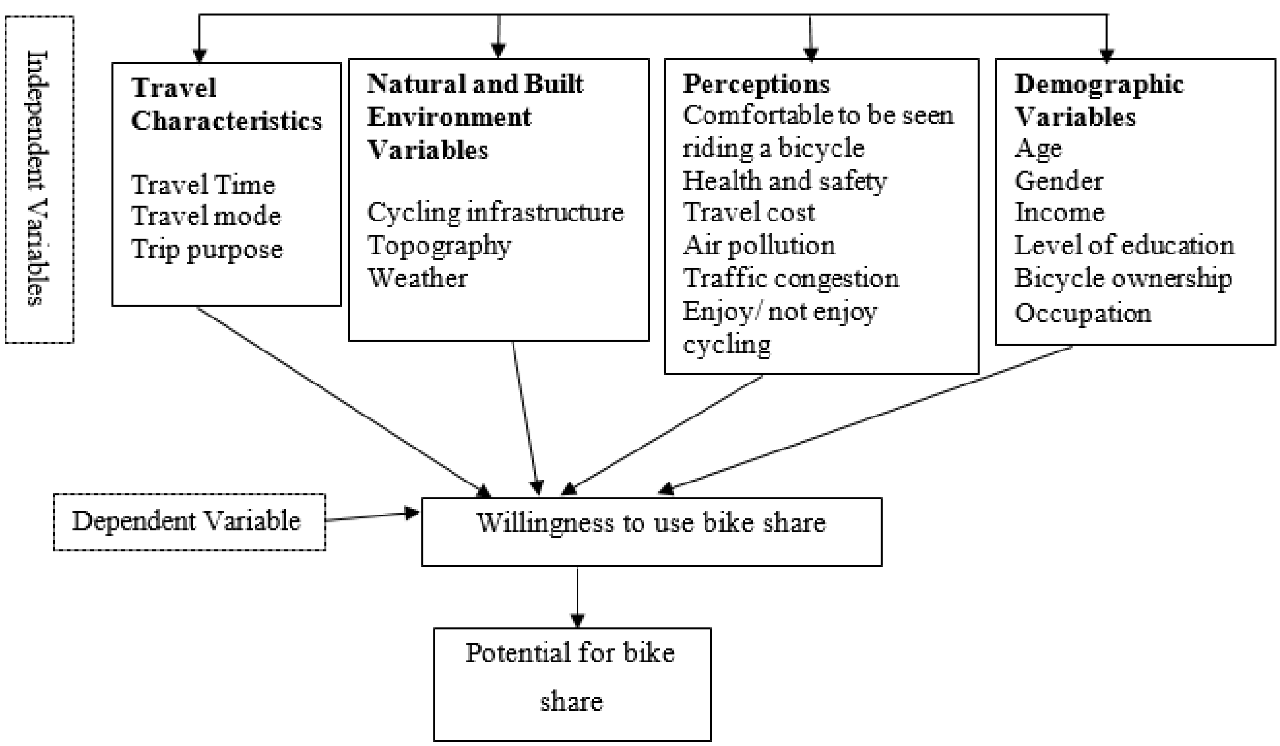
Adapted from Icek Ajzen 1991

In this study, the TPB offers a basis to understand commuters' willingness to ride or not to ride bike share bicycles (behavior). Willingness to use bike share may be influenced by the attitude of potential users that may be positive (e.g riding bicycles improves fitness and health, relaxing, pleasant) or negative (fear, pain, unpleasant). Willingness is also influenced by how potential users perceive the social acceptability of cycling (subjective norms e.g 'Are you comfortable to be seen riding a bicycle?') and their perceived ability to undertake the behavior even in the face of barriers or external factors (perceived behavioral control) (e.g. Are the bicycle routes perceived as safe?) influence intention to ride a bicycle (bike share bicycle) and ultimately behavior.

2.5 Conceptual Framework

The proposed conceptual model to explore the potential for bike share comprises three procedures which are inputs, processing and outcome. The input of the model is independent variables classified as travel characteristics, natural and built environment variables and perceptions. Data was collected using questionnaires. In the processing procedure, data was analysed in Ms excel to present relationships, frequencies and percentages. Chi-square statistical technique was used to test the hypothesis and identify significant factors. The conceptual model outcome is the willingness or intention of the commuters to ride the bike share bicycles as shown in Figure 2.2.

Figure 2.2: Conceptual Framework



Source: Author 2019

2.6 Research Gaps

The review of literature shows that preceding studies were more focused on factors on operations of existing schemes such as usage and the impact of bike share. These include studies by Fishman (2014), Guo et al., (2017), Campbell et al., (2016) and Mateo-Babiano et al., (2016) which have studied aspects relating to bike share such as factors limiting or facilitating an existing scheme and perceptions of bike share riders. Mostly bike share studies are retrospective and they obtain information from user surveys and bike share system-use generated data (Fishman, 2016). There is little research available on factors that influence the adoption of bike share where such a system has not yet been established. Furthermore, there is a paucity of research on the association between the willingness to use bicycles and variables such as travel time, mode of transport and perceptions of commuters on use of bicycles. These issues are examined in this paper and will respectively identify the significant variables.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter presents the methodology used in the study to address the stated research objectives and the research questions. It presents the design used during the research study, describes the study area, the population targeted for the study, the techniques adopted to sample in the study, the instruments used in gathering data and methodology used. Data analysis and presentation methods used in this study are also discussed.

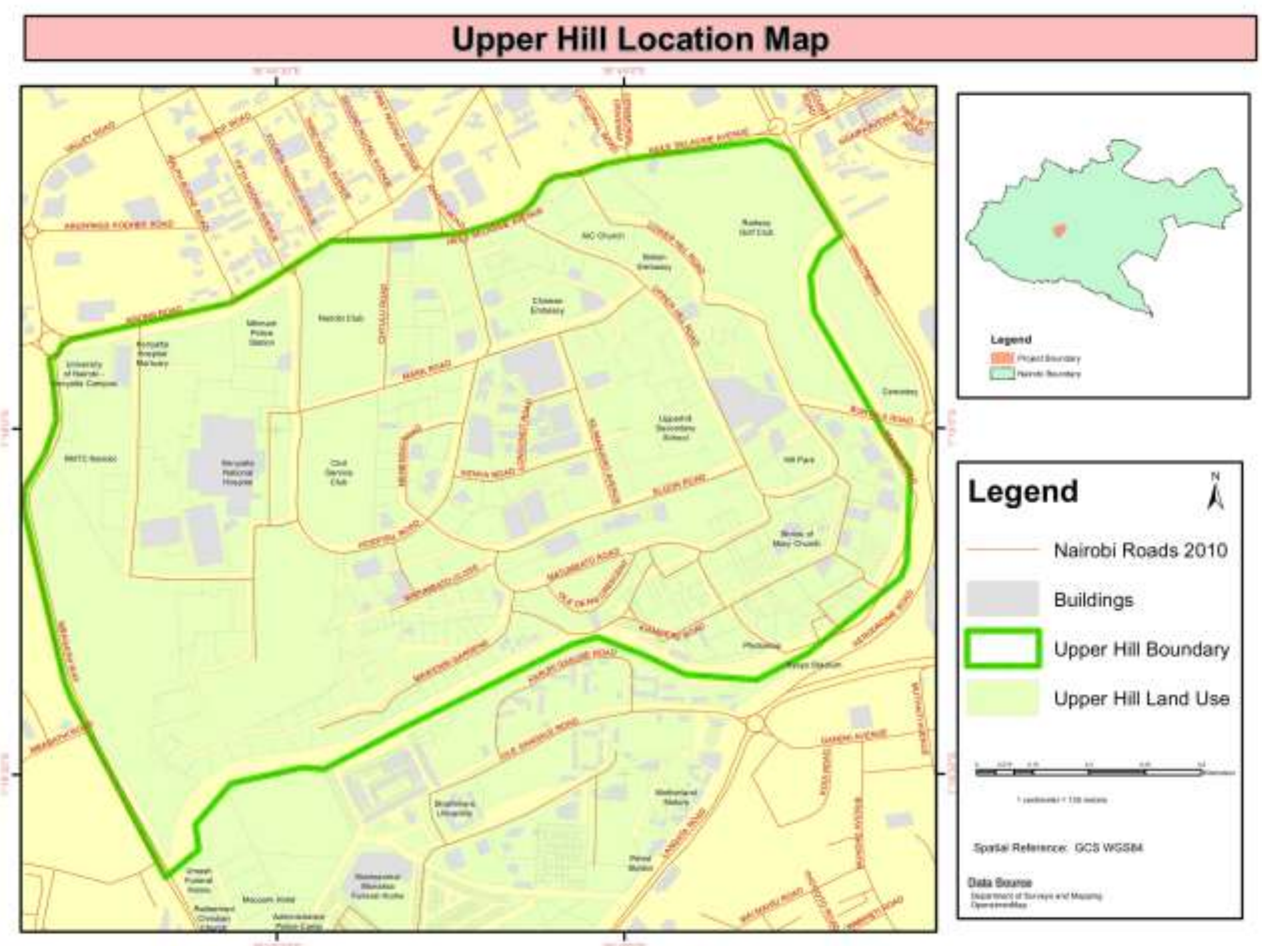
3.1 The Study Area

3.1.1 Location

Upper Hill is an area within Nairobi County. It is located 4 km to the west of the Central Business District (CBD) of Nairobi ("Upper Hill, Nairobi," n.d.). The study area is marked by Ngong road to the north up to the roundabout with Mbagathi way, Uhuru highway and Haile Selassie Avenue on the north-eastern side, Mbagathi way on the western side and the southern boundary is demarcated by the railway line from Uhuru highway to Mbagathi way. Figure 3.1 shows the location of the study area.

The study area is characterized by a dense, mixed-use commercial and residential developments. Many landmarks are found within the study area and include Kenyatta National Hospital, hotels, government offices such as the Ministry of Land, Housing and Urban Development; Ministry of Health; Ministry of Transport and Infrastructure; Ministry of Labour, Social Security and Services; and Ministry of Environment, Water and Natural Resources ("Upper Hill, Nairobi," n.d.). There are also several other offices such as Britam Tower (a 200m skyscraper) and UAP-Old Mutual tower (a 163m tower) ("Upper Hill, Nairobi," n.d.). High pedestrian volumes and traffic bottlenecks are noticeable in and out of Upper Hill, especially during peak hours and of which some of these trips can be replaced by bike share.

Figure 3.1: Location of the Study Area



Source: Author (2019)

3.2 Research Design

The study adopted a descriptive research design. Descriptive research is a procedure of gathering data to allow the testing of hypotheses and to find answers to questions raised in the study (Mugenda and Mugenda, 2003). According to McCombes (2019), the aim of descriptive research is to correctly and methodically describe the study population, phenomenon or situations. Contrary to experimental research McCombs states that in descriptive research design, the researcher only observes and record variables without manipulating or controlling them. Mugenda and Mugenda provide descriptive research steps as "formulating the objectives of a study; designing the methods of data collection; selecting the sample; data collection; and analyzing results" (p. 160- 161). Using this approach the researcher collected qualitative and quantitative data on study variables and reported findings as observed. The researcher also tested hypotheses in the study.

3.3 Target Population

The target population refers to the complete group about which one would like to collect information. The target population in this study are people who walk or use bicycles in and out of the study area to reach their destinations and transit stations. The city of Nairobi according to the 2019 Census has an estimated population of 4 396 828 and a surface area of 696 km^2 resulting in a calculated population density of 6 317 residents per km^2. Noting that the ITDP Bike share Planning Guide, 2013 recommends a minimum bike share system coverage area of $10km^2$, the target population was therefore calculated to be **63 170** (6 317 residents per km^2 x $10km^2$).

3.4 Sample Size

The study adopted Nasuirma (2000) model to determine the sample size where a study sample size can be determined by:

$n = (NCv^2) / (Cv^2 + (N - 1)\ e^2)$

Where, n	= the desired sample size,
N	= Target population.
Cv	= Coefficient of variation (take 0.5).
e	= Tolerance at desired level of confidence (0.05) at 95% confidence level.

Sample size equation

$n = (NCv^2) / (Cv^2 + (N - 1)\ e^2)$

$n = 63170 \times 0.5^2 / 0.5^2 + (63170\text{-}1)\ e^2)$

$n = 63170 \times 0.25 / 0.25 + 63169 \times 0.05^2$

$n = 15793 / 0.25 + 157.92$

$n = 15793/158.17$

$n = 99.84$

<u>n = 100</u>

3.5 Simple Random Sampling

The study involved people who walk or use bicycles as a means of transport to get to the study area whose representative sample was obtained from randomly sampled pedestrians and cyclists at entry points into the study area and other identified strategic locations. A simple random sampling method, which is a probability sampling was adopted to identify the respondents. This method avails each respondent an equal chance to be selected.

3.6 Sources of Data

The research used two sources, that is, primary and secondary sources of information. Primary data was gathered by administering questionnaires and observation in the field. The secondary sources of data included published reports, books, scholarly articles, journal articles and published guides on the field of study. The data collection needs of the study and sources are outlined in Table 3.1.

Table 3.1: Data Collection Matrix

Research Questions	**Research Objectives**	**Data needed**	**Data collection method**
I. What are the characteristics of potential bike share users in Nairobi's Upper Hill area?	To examine the characteristics of the potential bike share users in Nairobi's Upper Hill area	Age; Gender; Income; Level of education; Bicycle ownership; Occupation; Travel Time; Travel mode; Trip purpose	Questionnaire survey
II. Does the time taken to travel from drop-off to destination influence the use of bike share?	To determine whether time taken to travel from drop-off to destination influence use of bicycles	Time taken by a commuter to walk from public transport stop/ drop-off from any mode of transport to destination	Questionnaires surveys
III. Do perceptions influence use of bike share?	To discuss the perceptions that influence the use of bike share	Perceptions on cycling by potential users; perceptions on cycling by bicycle users	Questionnaire surveys

Source: Author (2019)

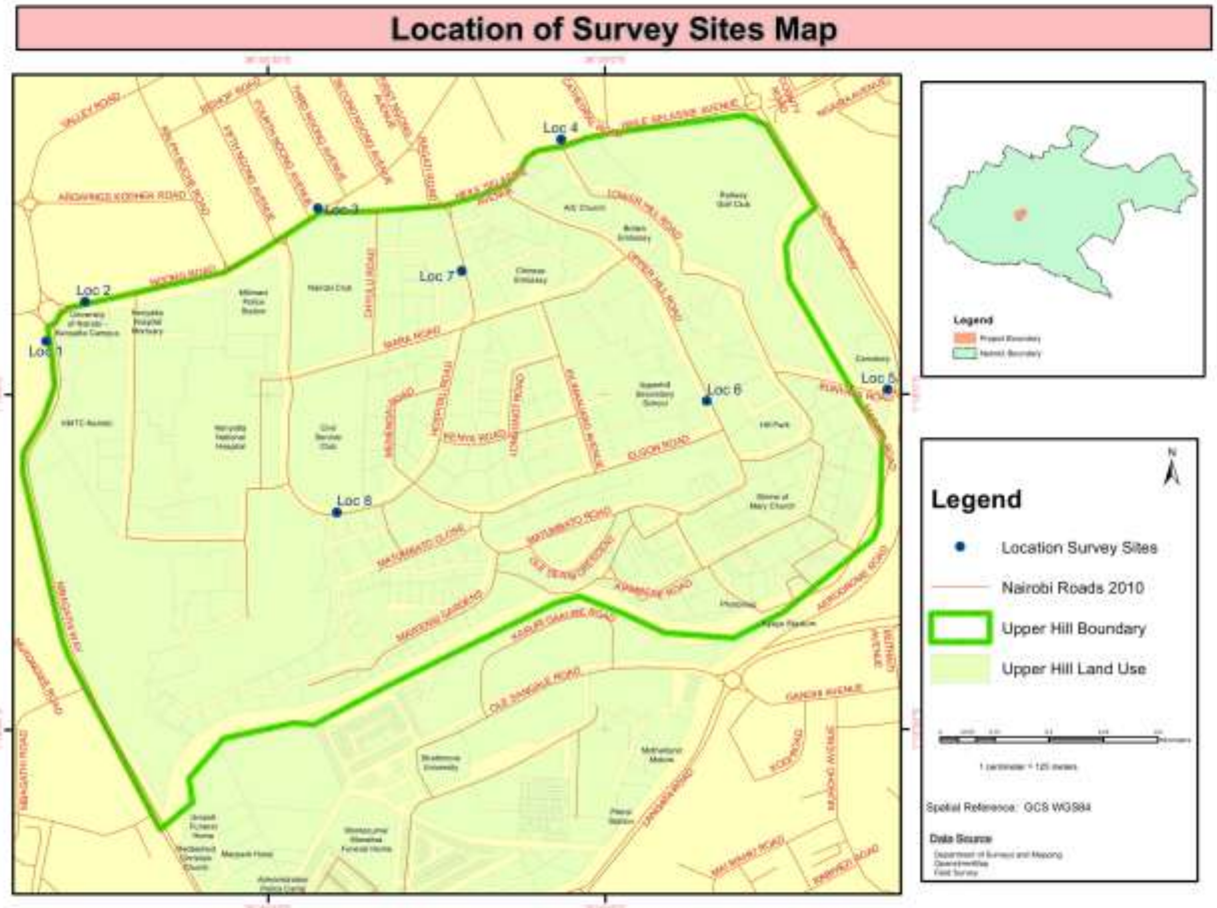
3.7 Data Collection

3.7.1 Primary Data

Primary data was collected through observation and administering standardized questionnaires to ask pre-determined questions. Two sets of separate questionnaires were prepared, as provided in Appendix 1 Road Side Interview Schedule for Pedestrians and Appendix 2 Road Side Interview Schedule for Cyclists. The questionnaires were designed into three sections to collect data on demographic details; travel patterns and modes of transport; and perceptions and infrastructure. The questionnaires comprised mostly closed-ended questions which allowed respondents to select the most suitable answer. A category 'Other' was often included to give respondents an option when their preferred answer is not listed in the given categories. The questionnaires were coded, whereby a code number was assigned to the anticipated responses to each question. This made it easier to enter into a computerized system and to analyse.

The survey stations were set along the study area boundary on roads used for entry or exit in the study area. The sites were selected to ensure that pedestrian and cyclist movements to and from different locations surrounding the study area were adequately covered. A total of five (5) survey station sites were set as shown on figure 3.2. To intercept more cyclists, additional sites: locations 6, 7 and 8 were also added.

Figure 3.2: Location of Survey Sites



Source: Author (2019)

Pedestrian and cyclist counts were conducted at the identified entry/ exit points for the study area to determine the number of people walking and bicycling. Pedestrians and cyclists were counted during morning and evening peak hours. The counts were recorded in terms of numbers of pedestrians and cyclists per hour per direction. Appendix 3 attached hereto is a tally sheet used to count and record the pedestrians and cyclists. The number of questionnaires administered at each survey station was as per the pedestrian volumes. Table 3.2 shows the pedestrian volumes at each of the survey stations. A percentage (2.5%) was applied at each station to establish the number of pedestrians that should be drawn at the different survey stations to reach the study sample size.

Table 3.2 Pedestrian Flow to Study Area (Morning Peak)

Location	**Number of Pedestrians into Study Area per Hour**	**Number of Pedestrians going out of Study Area per Hour**	**Total Number of Pedestrians**
Location 1	816	192	**1008**
Location 2	624	108	**732**
Location 3	1404	324	**1728**
Location 4	708	120	**828**
Location 5	300	72	**372**
Total	**3852**	**816**	**4668**

Source: Fieldwork Data 2019

Primary data was collected between 4- 13 November 2019, but only on week working days (Monday to Friday). The surveys were conducted during morning peak hours, 6.00 am- 9.00 am and evening peak hours, 4.00 pm- 7.00 pm. The researcher administered the questionnaires with the help of two (2) research assistants in the course of the field-work. Questionnaires were administered to pedestrians and cyclists who were intercepted randomly as they pass at the survey stations. A total of 126 respondents comprising 106 pedestrians and 20 cyclists were interviewed using the questionnaires during the study.

Plate 3.1 and 3.2: Photos of Research Data Collection

	
Plate 3.1: Photo of research assistant collecting data from a cyclist on Ngong road	Plate 3.2: Photo of researcher collecting data on Haile Selassie avenue

3.8 Data Analysis

The research applied both qualitative and quantitative research methods to assess the collected data. On completion of the fieldwork, data was coded, entered into computer system and cleaned. The data was analysed using the Statistical Package for Social Sciences (SPSS) Version 20 to generate frequency tables, cross-tabulations, pie charts and bar graphs. Inferential were made and a conclusion drawn on how accurately the findings reflect the population.

The hypothesis of the study was tested using Chi-square ($\chi2$) test. Chi-square was employed to establish significant relationships amongst variables. Chi-square assesses relationships between categorical variables. It determines whether a relationship exists between two categorical variables (Frost, 2019). The null hypothesis of the chi-square test assumes that no association exists between categorical variables in the population and hence they are independent. (Frost, 2019)

The chi-square test works by mathematically comparing observed frequencies to the expected values and boiling all these differences down into one number. The following formula is used to calculate chi-square:

$\chi 2 = \sum (O - E)^2 /E$

Where, $\chi 2$ is the Chi-square

$\sum$ is the summation

O is the observed values

E is the expected values

The technique was used because the population was not normally distributed. Chi-square test requires that the sample be drawn randomly from the population; data must be in form of frequencies for each of the categories; expected frequencies for each cell are greater than or equal to 5; and the measured variables must be mutually exclusive i.e independent of each other. Weaknesses of Chi-square include that the test does not show the strength of the relationship between variables and it is sensitive to sample size in that the observed and expected frequencies must not be too small as this would compromise the validity of the results.

3.9 Limitation of the Study

Due to limited financial resources, the researcher was prompted to limit the number of required Research Assistants to only two resulting in a hectic work schedule to meet the research target. Intercepting pedestrians for roadside interviews was a difficult task especially during the evening peak hours as many were in a rush and reluctant to participate. However, the researcher ensured that all the questionnaires were carefully completed to collect accurate data.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.0 Introduction

This chapter presents the findings of the study which answers the research questions and objectives. Data collected has been presented in charts and tables.

4.1 Demographic Characteristics of Pedestrians

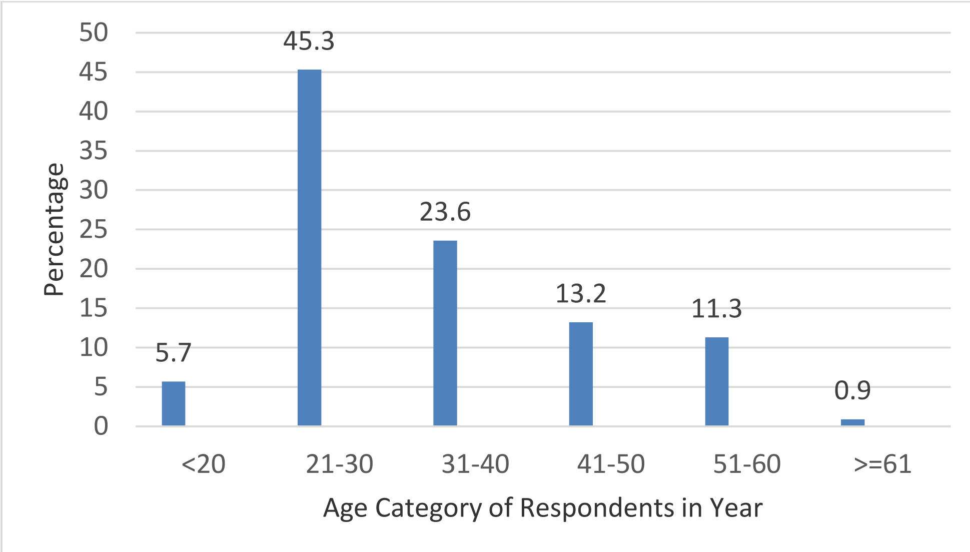
In total 126 respondents who travel to Upper Hill area as pedestrians or using bicycles were interviewed. This comprised of 106 pedestrians and 20 cyclists. The data collected is presented into two separate sections which are the findings on pedestrians and the findings on cyclists.

4.1.1 Respondents' Age Categories in Years

The ages of respondents interviewed in the study were classified into six (6) categories ranging from the less than or equal to 20 years category up to the 61 years and above category. Figure 4.1 presents the respondents' age categories.

The age categories of the respondents have been presented in frequencies in a bar chart. The age category 21- 30 had the highest number of participants with a frequency of 48 respondents and constituting 45.3% of the total pedestrians interviewed. The second highest group was the 31- 40 age group with a frequency of 25 respondents and constituting 23.6% of all pedestrians interviewed. The age bracket 41- 50 had 13.2% of the pedestrian respondents, while the 51- 60 age bracket had 11.3%. The least were the 20years or less age bracket with 5.7% and the 61years and above age-group that had 0.9% of the respondents.

Figure 4.1: Age Category



Source: Fieldwork Data 2019

4.1.2 Gender of Respondents

Table 4.1: Gender of Respondents

	Frequency	Percentage
Male	71	67.0
Female	35	33.0
Total	**106**	**100.0**

Source: Fieldwork Data 2019

Of the respondents 67% (71 persons) were male and 33% (35 persons) were female.

4.1.3 Respondents Level of Education

Table 4.2: Respondents' Level of Education

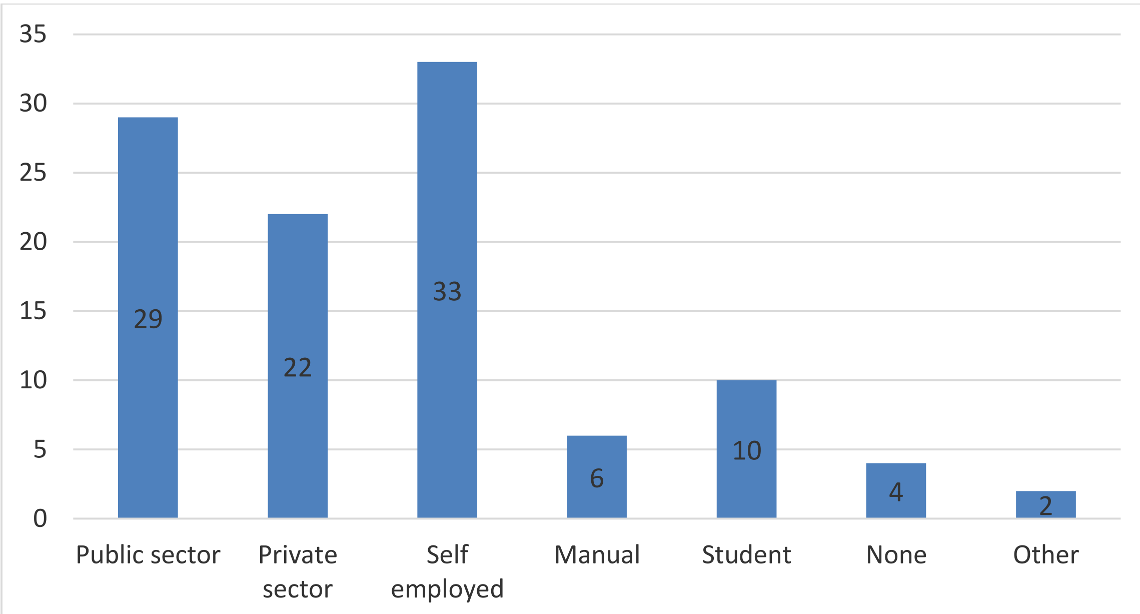
	Frequency	Percentage
Primary	4	3.8
Secondary	32	30.2
College/university (post-secondary)	70	66.0
Total	**106**	**100.0**

Source: Fieldwork Data 2019

Regarding the education level of the respondents, 66% (70) of respondents had attained tertiary (college and university) level of education and 30.2% (32) attained secondary level education. A total of 3.8% (4) had attained primary level education only.

4.1.4 Occupation of Respondents

Figure 4.2: Occupation of Respondents



Source: Fieldwork Data 2019

Participants employed in the formal sector were the majority with the public sector constituting 29% of the respondents and the private sector constituting 22%. A total of 33% of the respondents were self-employed, 10% were students, 4% had no occupation and 2% did not specify their occupation. The occupation of the respondents is shown in the bar chart.

4.1.5 Income Levels

Table 4.3: Income Levels

	Frequency	**Percentage**
No income(0)	10	9.4
Low income(< 30,000)	32	30.2
Middle income(30,000-150,000)	52	49.1
High income(>150,000)	4	3.8
Not willing to disclose	8	7.5
Total	**106**	**100**

Source: Fieldwork Data 2019

The study found out that 49.1% of the respondents were earning between Ksh 30,000- Ksh 150,000 which has been classified as the middle-income group (KNBS, 2018). Of the respondents, 30.2% were earning less than Ksh 30,000 per month and these have been classified as the low-income group whilst 9.4% had no income and similarly categorised in the low-income group. A total of 3.8% of the respondents earned above Ksh 150,000 per month which has been classified as the high-income group. Of the total respondent, 7.5 % declined to disclose their monthly income.

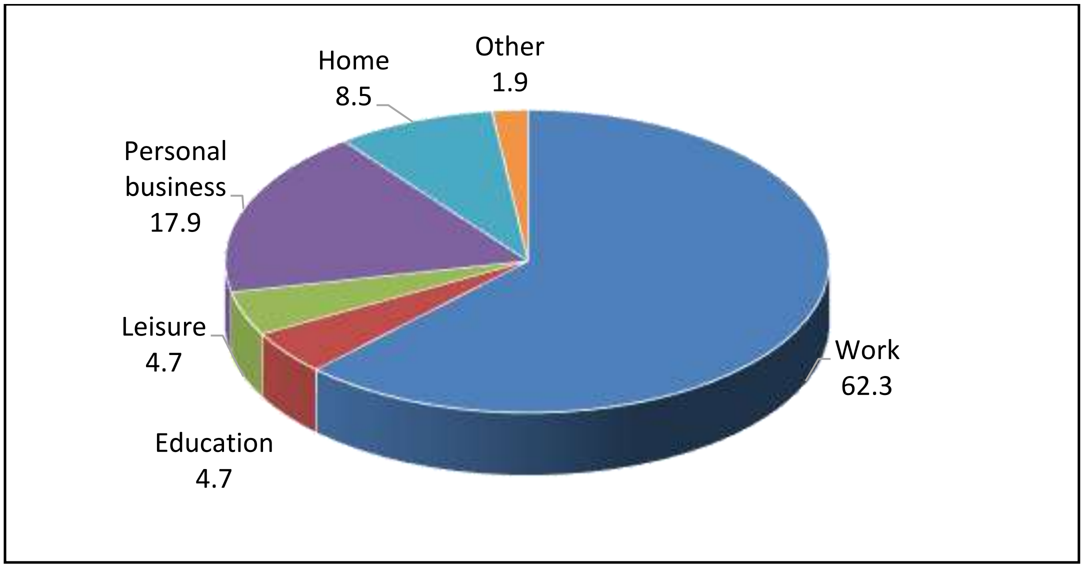
4.2 Travel Patterns

This comprises understanding the purpose of the trip of the respondents, the time they take to travel either walking or using a bicycle, comfort and means of transport they use.

4.2.1 Purpose of the Trip

The majority of respondents were travelling for work purposes, constituting 62.3% of the respondents, this was followed by personal business with 17.9% of the respondents and 8.5% were home trips that were recorded during the evening peak hours. Education purposes had a percentage of 4.7% and similarly, leisure trips constituted 4.7%. A total of 1.9% were travelling for other purposes not specified.

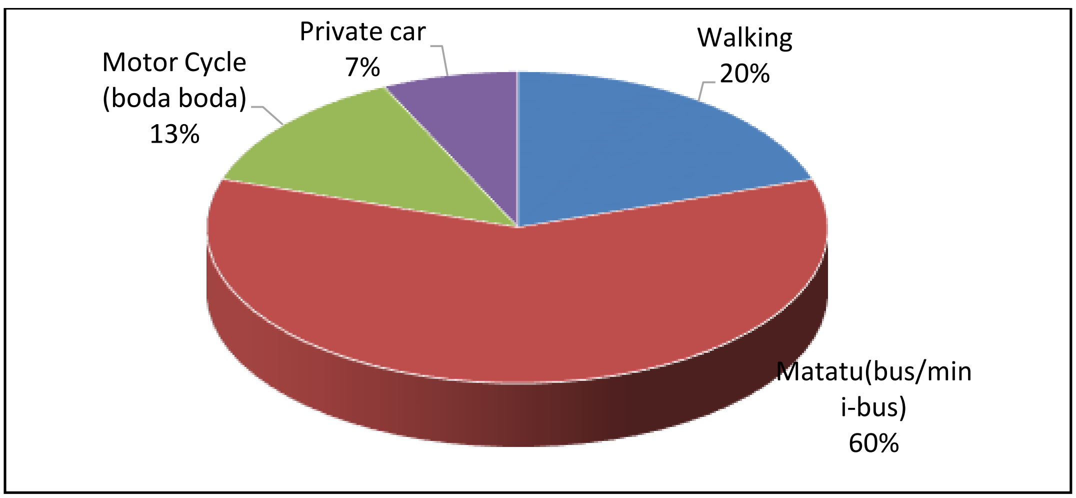
Figure 4.3: Purpose of the Trip



Source: Fieldwork Data 2019

4.2.2 Means of Transport Used

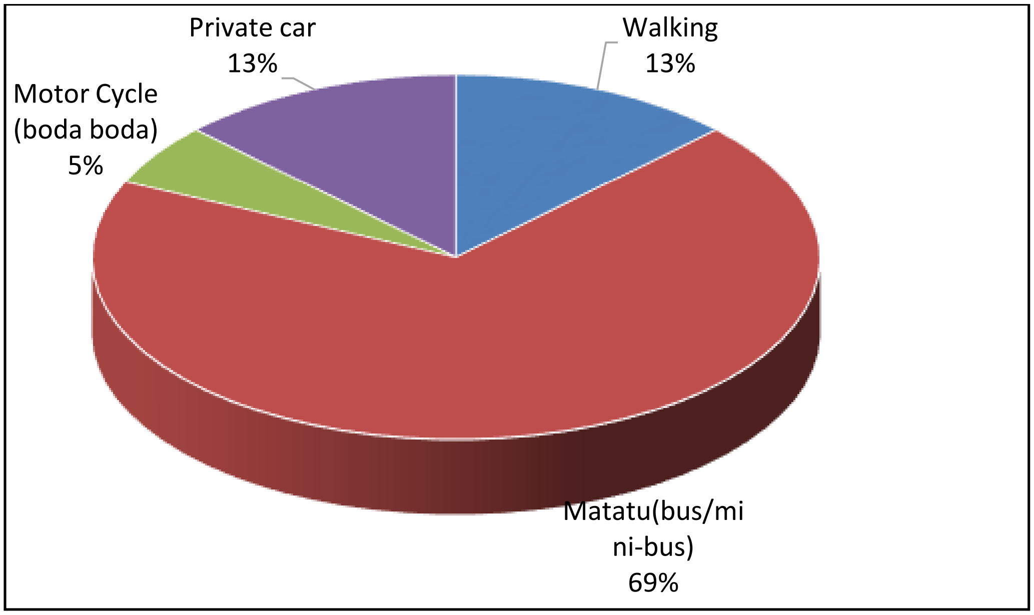
Figure 4.4: Means of Transport Used for Morning Peak



Source: Fieldwork Data 2019

The study sought to find out the means of transport used by respondents before the 'last mile' walk to their destination. Respondents interviewed during the morning peak hours between 6:30 am to 9:00 am, nominated matatu as their main mode of transport where 60% of the respondents used this means. A total of 13% of the respondents used motorcycle, whilst 20% walked from their origin to destination and 7% used a private car.

Figure 4.4: Mode of Transport Used (Evening Peak)

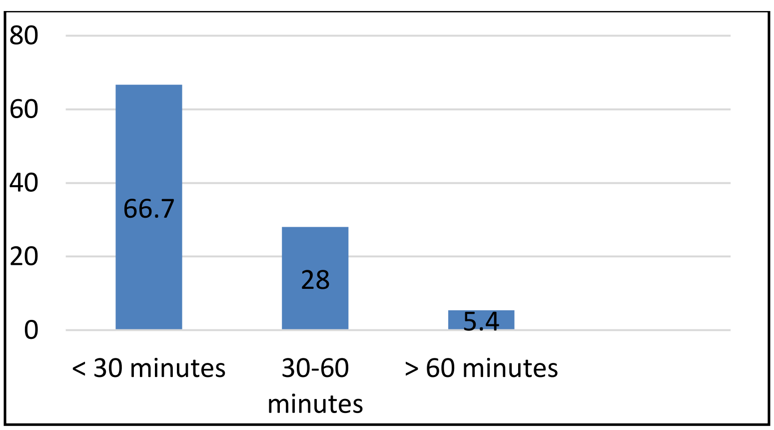


Source: Fieldwork Data 2019

Respondents interviewed during the evening peak hours which was from 4:30 pm to 7:00 pm similarly indicated matatu as the most used means of transport where 69% of the respondents used this mode. A total of 13% of the respondents used private cars, whilst 13% would walk from their origin to destination and 5% would use a motor cycle (boda boda).

4.2.3 Travel Time to Walk From a Bus Stop to Destination

Figure 4.6: Walking Time from Bus Stop to Destination



Source: Fieldwork Data 2019

The study reveals that many of the respondent, 66.7% take less than 30 minutes to walk from their drop-offs from one mode of transport to their destination, whilst 28% of the respondents take between 30- 60 minutes to reach their destination from a bus stop and 5.4% take more than 60 minutes walking from a bus stop to their destination.

Of those who take less than 30 minutes to walk from their drop-off to destination, 61.3% are willing to use bicycles and 38.7% are not willing. Whereas for those walking 30- 60 minutes, 30.8% are willing to use bicycles and 69.2% are not willing. 40% of those walking more than 60 minutes are willing to use bicycles and 60% are not willing.

4.2.4 Walking from Origin to Destination

Table 4.4: Walking as a sole mode of transport

Time Taken	Frequency	Percentage
< 30 minutes	6	55
30-60 minutes	2	18
> 60 minutes	3	27
Total	**11**	**100**

Source: Fieldwork Data 2019

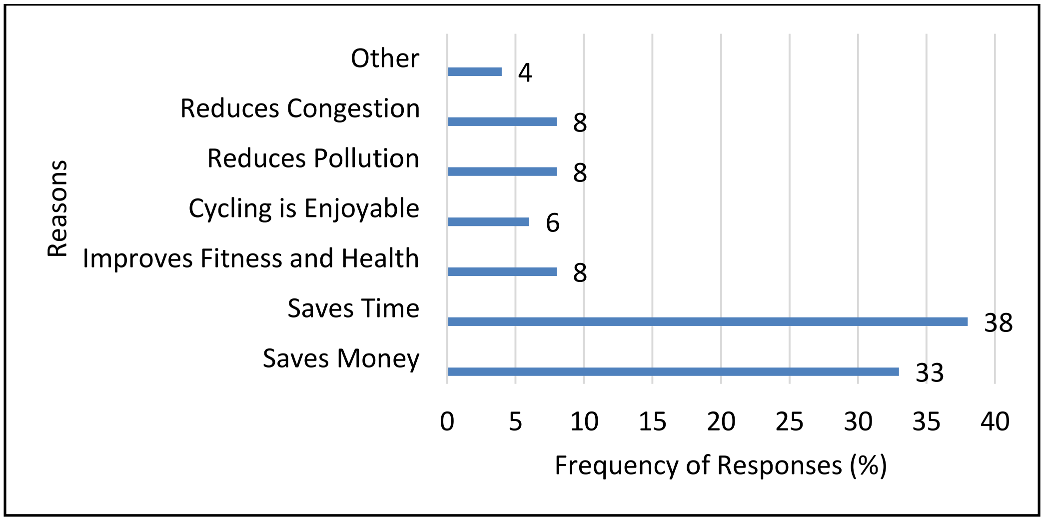
Of the respondents who walk from their origin to destination, 55% take less than 30 minutes, 18% take 30- 60 minutes and 27% of the respondents take more than 60 minutes to reach their destination.

4.3 Factors that Influence the Use of Bicycles

4.3.1 Motivation for Riding a Bicycle

The research sought to find out the reasons that would motivate respondents to ride a bicycle. The response saves time was the most frequently mentioned reason, cited 38 times. Saves money was cited 33 times, whilst the reasons improve fitness and health, reduces congestion and reduces pollution was mentioned by 8 respondents. A total of 6 of the respondents mentioned cycling as enjoyable and 4 respondents mentioned other reasons.

Figure 4.7: Motivation for Riding a Bicycle

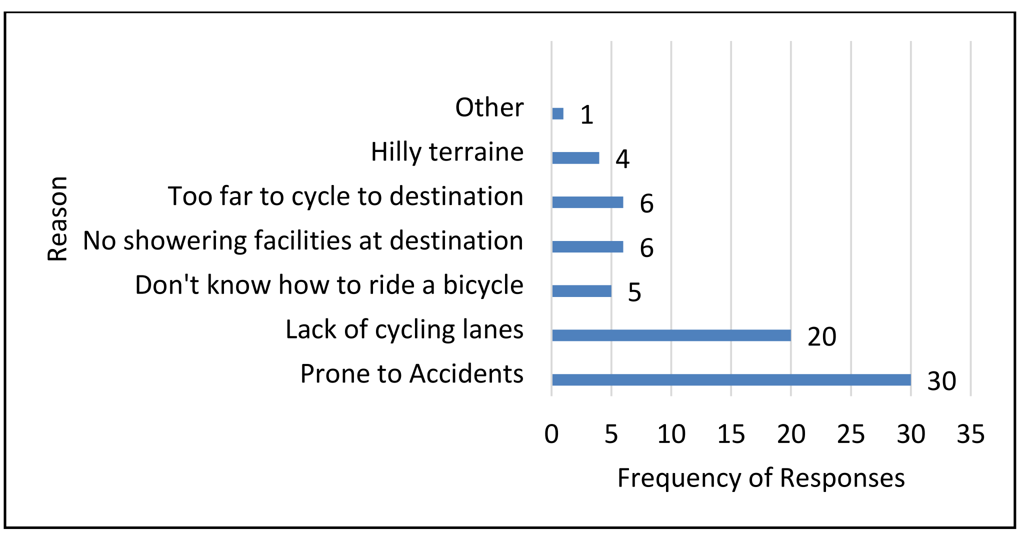


Source: Fieldwork Data 2019

4.3.2 Reasons for Not Wanting to Ride a Bicycle

Of the respondents who are not willing to ride bicycles, they cited prone to accidents frequently, with 30 respondents mentioning this reason. A total of 20 respondents cited a lack of cycling lanes as a deterrent for them to use bicycles. Lack of showering facilities and too far to cycle was cited by 6 respondents, with 4 respondents mentioning hilly terrain as a deterrent and only one respondent mentioning other reasons.

Figure 4.8: Reasons for Unwillingness to Ride a Bicycle



Source: Fieldwork Data 2019

4.4 Perceptions of Respondents to Riding Bicycles

4.4.1 Willingness to Ride a Bicycle to Destination

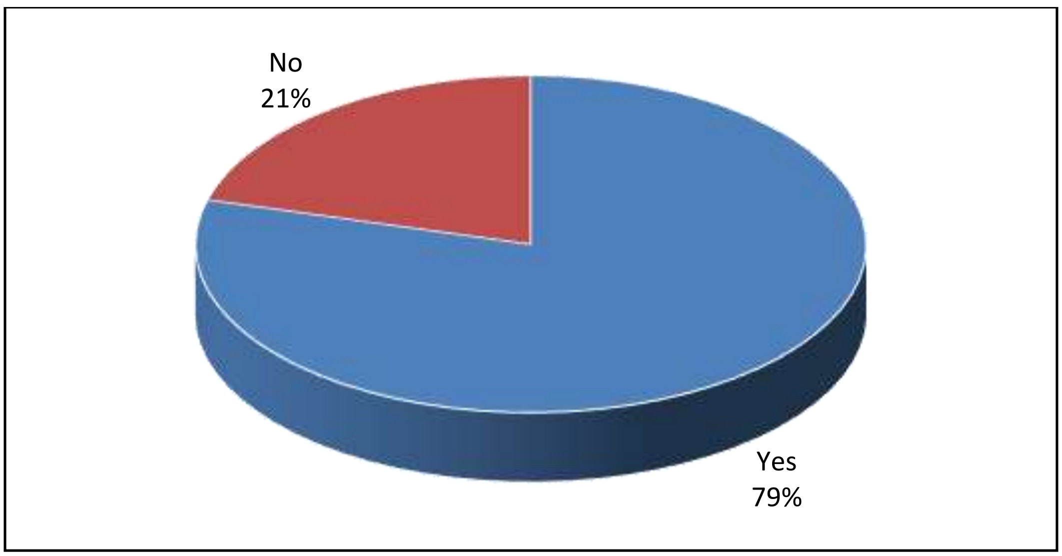
When asked if they will be willing to ride a bicycle from a bus stop to destination, 55.7% of the respondents indicated that they are willing and 44.3% of the respondents are not willing to ride a bicycle.

4.4.2 Ownership or Access to Bicycle at Home

When it comes to bicycle ownership 28% of the respondents own or have access to a bicycle at home, whilst 72% do not own and have no access to a bicycle at home.

4.4.3 Ability to Ride a Bicycle

Figure 4.9: Ability to Ride a Bicycle



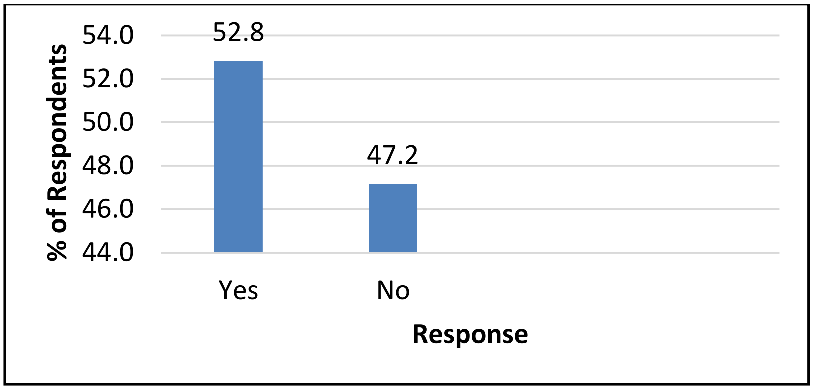
Source: Fieldwork Data 2019

The study revealed that many of the respondents, 79% could ride a bicycle, whilst only 21% of the respondents were not able to ride a bicycle.

4.4.3 Comfortable Being Seen Riding a Bicycle

A total of 52.8% of the respondents indicated that they were comfortable to be seen riding a bicycle, whilst 47.2% were not comfortable.

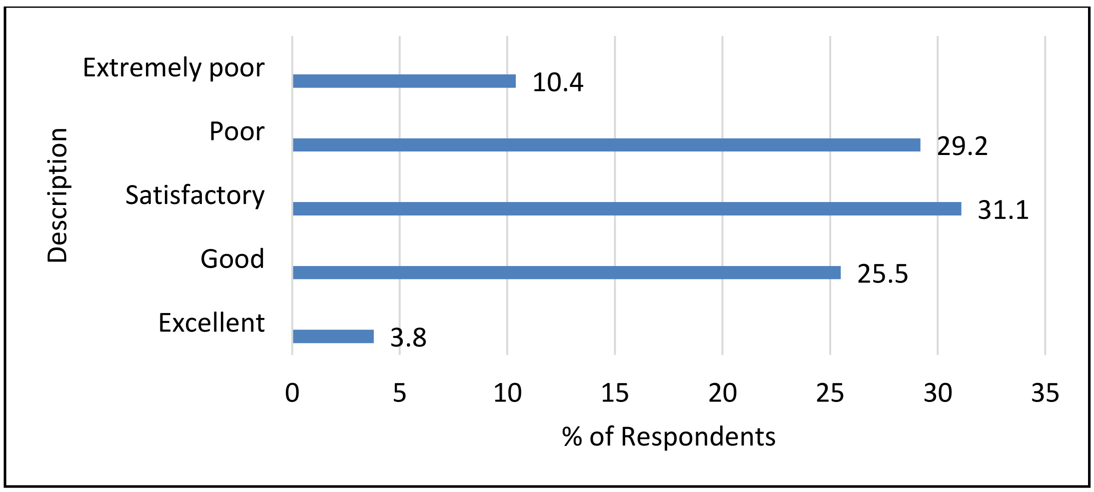
Figure 4.10: Comfortable Being Seen Riding a Bicycle



Source: Fieldwork Data 2019

4.4.4 Perception of Pedestrian Paths/Sidewalks in Study Area

Figure 4.11: Perception of Pedestrian Paths



Source: Fieldwork Data 2019

The study reveals that the majority of the respondents constituting 31.1% of the respondents perceive the pedestrian paths in the study area as satisfactory and 25.5% of the respondents perceived the pedestrian paths as good. A total of 29% of the respondents perceived the pedestrian paths as poor and a total of 10.4% mentioned the pedestrian paths are extremely poor. Only 3.8% of the respondents described the pedestrian paths as excellent but this perception indicates a lack of awareness by the respondents of the qualities of a good pedestrian path. While the level of pedestrian infrastructure has improved over the years in Nairobi the quality remains largely poor.

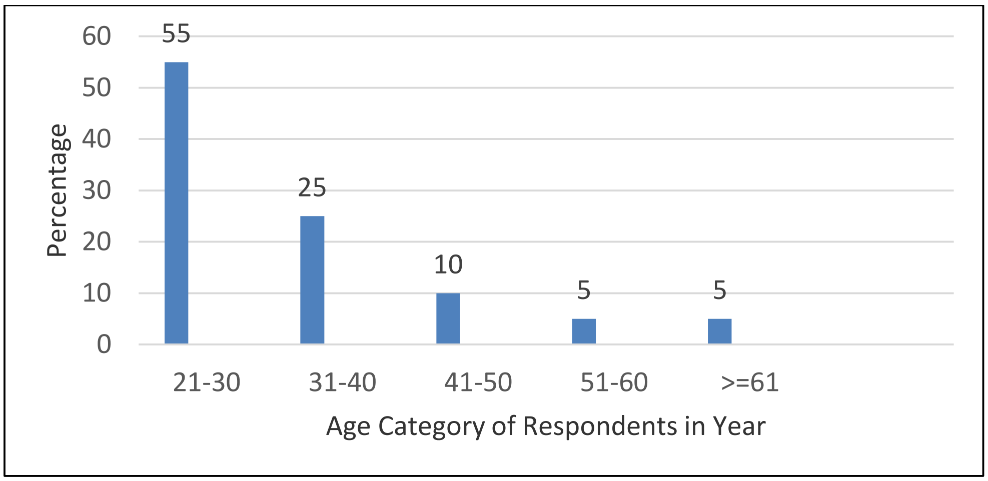
4.5 Demographic Characteristics Cyclists

The research studied cyclists in the study area. A total of 20 bicycle users in the study area were interviewed.

4.5.1 Age of Respondents

The age bicyclist respondents interviewed in the study were classified into six (5) categories ranging from the 21- 30 years category up to the 61 years and above category. The respondents' age categories are shown in figure 4.12.

Figure 4.12: Age Group of Cyclists



Source: Fieldwork Data 2019

The age categories of the respondents have been presented in frequencies in a bar chart. The age category 21- 30 had the highest number of participants constituting 55% of the total cyclist interviewed. The second highest group was the 31- 40 age group constituting 25% of the total cyclist interviewed. The age bracket 41- 50 had 10% of the bicyclist respondents while the 51- 60 age bracket had 5% and the 61years and above bracket that had 5% of the respondents as well.

4.5.2 Gender of the Cyclists

Bicycles users in the study area were disproportionately male. Only male respondents were interviewed as there were no female cyclists observed during the study times.

4.5.3 Level of Education of the Cyclists

Table 4.5: Level of Education of the Cyclists

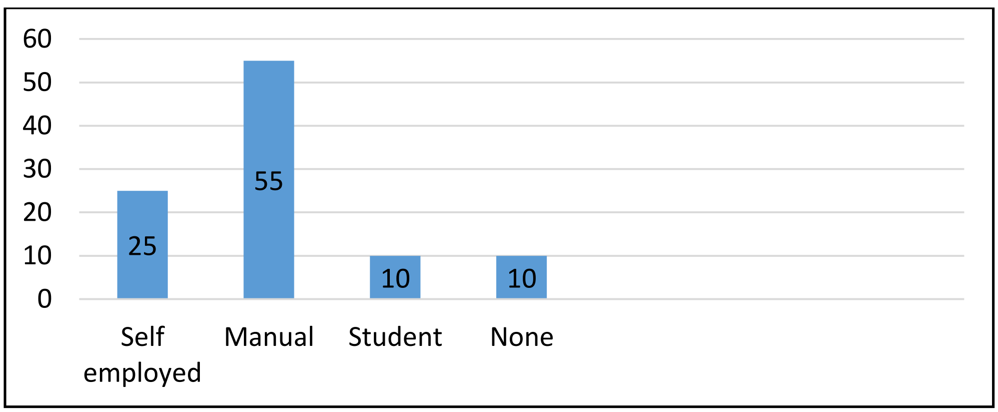
	Frequency	Percentage
Primary	5	25.0
Secondary	13	65.0
College/university	2	10.0
Total	**20**	**100.0**

Source: Fieldwork Data 2019

The research found that 65% of the cyclist had attained up to secondary school level of education, followed by primary school level where 5% of the respondents are within this category. Only 10% of the respondents had attained tertiary level education such as college or university.

4.5.4 Occupation of the Cyclists

Figure 4.13: Occupation of Respondents



Source: Fieldwork Data 2019

The research found that respondents using bicycles as a means of transport were in four categories of manual who maybe semi-skilled or unskilled (such as construction, excavation, carpentry, plumber, machine operator), self-employed, students and those without any occupation. The manual category constituted the highest number of respondents with 55% of the respondents followed by self-employed 25% of the respondents. Students and none (those without any occupation) had an equal frequency of 10%.

4.5.5 Income Level of the Cyclists

Table 4.6: Income of the Cyclists

	Frequency	Percentage
No income	4	20.0
≤ 30,000	9	45.0
30,001-70,000	4	20.0
Not willing to disclose	3	15.0
Total	**20**	**100**

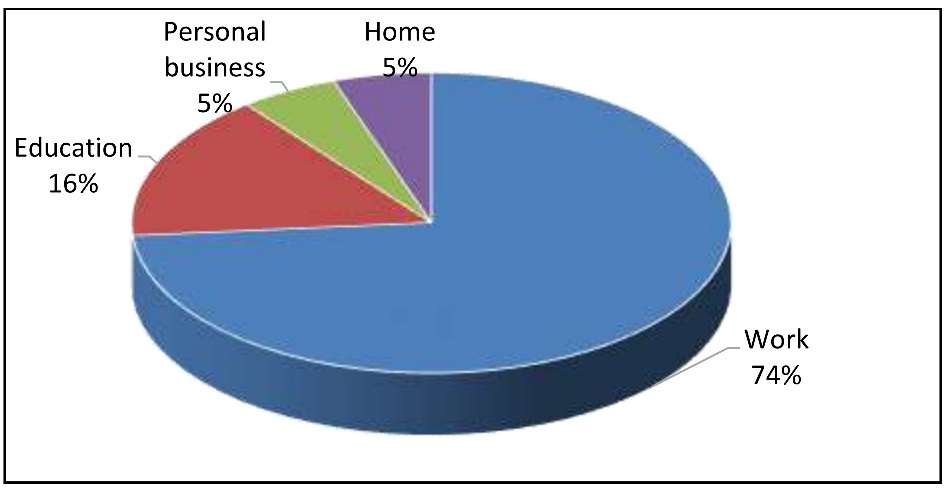
Source: Fieldwork Data 2019

The research found that the majority of the cyclist respondents constituting 45% were earning less than Ksh 30,000 per month and hence classified in the low-income category. The middle-income category constituting those earning between Ksh 30,001 – Ksh 70,000 per month with a percentage of 20% and a total 20% of the respondents had no income. A total of 15 % of the respondents were not willing to disclose their monthly income.

4.6 Travel Patterns of the Cyclists

4.6.1 Trip Purpose

Figure 4.14: Trip Purpose



Source: Fieldwork Data 2019

The majority of respondents were travelling for work purpose, constituting 74% of the respondents, 16% were travelling for education purpose while personal business and home had an equal share of 5% of the respondents.

4.6.2 Time Taken to Ride a Bicycle from Home to Destination

Table 4.7: Time Taken by Bicyclist to Ride from Origin to Destination

	Frequency	**Percentage**
30-60 minutes	5	25.0
> 60 minutes	14	70.0
Did not specify	1	5.0
Total	**20**	**100.0**

Source: Fieldwork Data 2019

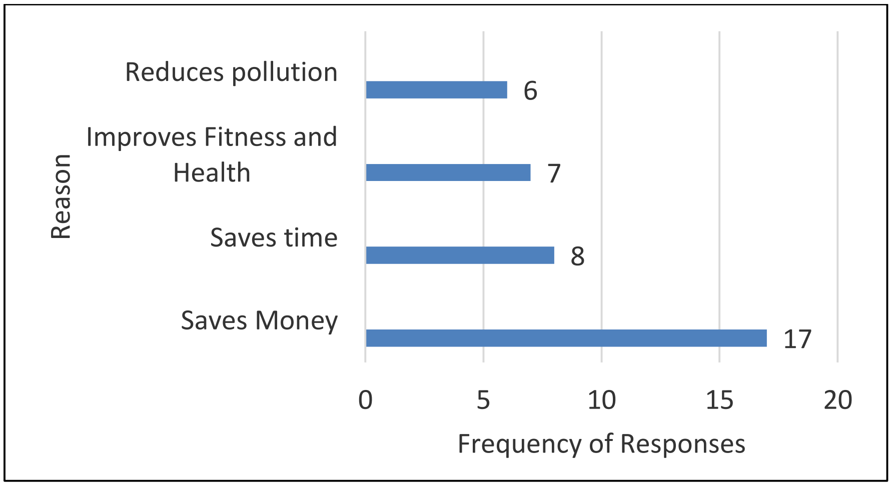
Majority of the respondent, totalling 70% of the bicycle users take more than 60 minutes to ride from their home to destination. A total of25% of the respondents take 30- 60minutes, whilst only 5% of the respondents were not certain of the time they take.

4.7 Factors that Influence the Use of Bicycles in Upper Hill

4.7.1 Riding Motivation

The research sought to find out the reasons that motivate respondents to ride a bicycle. The response saves money was the most frequently mentioned reason, cited 17 times. Saves time was cited 8 times, whilst the reason improves fitness and health was cited 7 times and reduces pollution was mentioned 6 times.

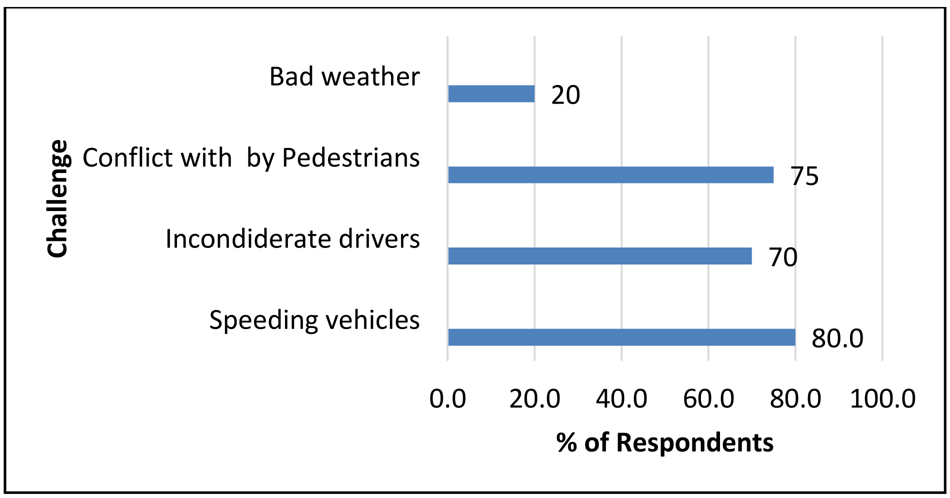
Figure 4.15: Riding Motivation



Source: Fieldwork Data 2019

4.7.2 Challenges Faced by Cyclists

Figure 4.16: Challenges Faced by Cyclist



Source: Fieldwork Data 2019

Respondents cited speeding vehicles mostly, where 80% of the respondents mentioned this as a challenge when cycling in the study area. This is followed by conflicting with pedestrians cited by 75% of the respondents, where they compete on using the same segregated space. Inconsiderate drivers were cited by 70% of the respondents and only 20% of the respondents cited bad weather.

4.8 Perceptions of Cyclists

4.8.1 Comfort with Time Taken to Ride from Home to Destination

Table 4.8 Comfort with Time Taken to Ride from Home to Destination

	Frequency	**Percentage**
Yes	17	85.0
No	3	15.0
Total	**20**	**100.0**

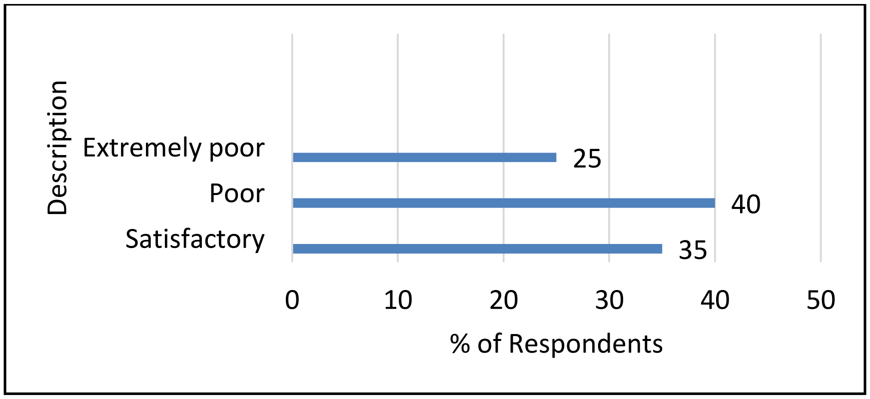
Source: Fieldwork Data 2019

A total of 85% of the respondents were at ease with the time they take to ride from origin to destination and 15% of the respondents were not comfortable with the time they take to ride from origin to destination.

4.8.2 Perceptions of Cycling Lanes

The study revealed that the majority of the respondents, 40%, felt the cycling paths in the study area were poor and 25% of the respondents felt the cycling paths were extremely poor. A total of 35% of the respondents felt the cycling lanes were satisfactory.

Figure 4.17: Description of conditions of Cycling Lanes



Source: Fieldwork Data 2019

4.8.3 Comfortable to be Seen Riding a Bicycle

Majority of the respondents, 95% mentioned that they are comfortable to be seen riding a bicycle while only 5% mentioned that they are not comfortable being seen riding a bicycle.

4.9 Hypothesis Testing

The research sought to analyse/ test hypotheses described in the following sections:

4.9.1 Test of Significant Difference between willingness to use bike share and time taken to travel from the drop-off

H_2o- There is no significant difference between willingness to use bike share and time taken to travel from drop-off to destination

The study tested the difference between willingness to use bike share and travel time which was tested at $\alpha = 0.05$. The study found that computed value of X^2 (4) = 10 276, $p < .05$ as shown in table 4.9. Since the p-value is smaller than our chosen significance level $\alpha = 0.05$ the study rejects the Null hypothesis. The study concludes that willingness to use bike share is dependent on the time that one takes to walk to/from public transit stop to destination.

Table 4.9: Association between willingness to use bicycles and time taken to travelled by commuters from the drop-off

	Pearson Chi-Square Value	df	Asymp. Sig. (2-sided)
Travel Time from drop-off	10.276[a]	4	0.036

Source: Author 2019

4.9.2 Test of significant difference of willingness to use bicycles and the perceptions

H_{20}- There is no significant difference between willingness to use bike share and the perceptions

The study tested the difference between willingness to use bike share and the perceptions of commuters which was tested at $\alpha = 0.05$. The study tested two variables, which are comfortable to be seen riding a bicycle and rating of walking and cycling lanes by the potential bike share users. For the variable comfortable to be seen riding a bicycle the study found that computed value of X^2

(2) = 29 921, p < .05 as shown in table 4.10. Since the p-value is smaller than our chosen significance level α = 0.05 the study rejects the Null hypothesis. The study concludes that willingness to use bike share is influenced by the comfort to be seen riding a bicycle.

Table 4.10 Association between willingness to use bicycles and perceptions

	Pearson Chi-Square Value	df	Asymp. Sig. (2-sided)
Comfortable to be seen riding a bicycle	29.921[a]	2	0.000
Rating of walking and cycling infrastructure by the potential bike share users	6.997[a]	8	0.537

Source: Author 2019

The study also tested the difference between willingness to use bike share and the rating of walking and cycling lanes by the potential bike share users which was tested at α = 0.05. The study found that the computed value of X^2 (8) =6.997, p < .05 as shown in table 4.14. Since the p-value is larger than our chosen significance level α = 0.05 the study fails to reject the Null hypothesis. The study concludes that there was not sufficient evidence to reject the Null hypothesis in favour of the alternative hypothesis.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter summarises the findings of the study which sought to investigate factors that influence the adoption of bike share in Nairobi's Upper Hill. Recommendations are provided for policy and planning and recommendations for further research based on the findings of the study.

5.1 Summary of the Research Findings

Majority of the pedestrian respondents who participated in this research were between 21- 30 years. There were more male participants than females. The study found that most commuters are willing to use bicycles to connect from public transport stop to their destinations. Adoption and hence potential of bike share would be impacted by the time commuters take to travel from drop-off to destination, perceptions on use of bicycles, availability of walking and cycling lanes. Cyclists in this study can be described as younger individuals with lower incomes and lower levels of education.

5.1.1 Summary of Findings on Characteristics of the Potential Bike Share Users in Nairobi's Upper Hill Area

This section summaries demographic characteristics of the respondents and their travel characteristics. Majority of the pedestrian respondents fall in the 21- 40 age group constituting 45.3%, then followed by the 31- 40 age group constituting 23.6%. With regards to willingness to use bike share, the 31-40 age group indicates that 64% of that age group is willing to use bike share. Majority of the respondents fall within the middle income group constituting 49.1% of the respondents. With regards to willingness to use bike share demonstrated more willingness with 70% of that willing to use bike share, followed by the low income group with 62.5% while the middle and high income had a similar share of 50% of those willing to use bike share. Matatus (buses and mini-buses) were found to be the dominant mode of transport where 60% and 69% of the respondents used this means for morning and evening peak hours respectively. Walking as a sole means of transport was also prominent constituting 20% and 13% of the respondents during morning and evening peak hours respectively.

5.1.2 Summary of Findings on Time Taken to Travel from Drop- off Point to Destination

The first objective of the study was ‘to determine whether the time taken to travel from drop-off to destination influences use of bike share. The study found most pedestrians (66.7%) walk for up to 30 minutes to reach their destinations from public transport stops or any other drop-off, whilst 28% walk for 30- 60 minutes and 5.4% walk more than 60 minutes. Of those willing to ride a bicycle, a greater proportion is those who walk less than 30 minutes from a transit stop to destination implying that people are willing to ride bicycles for shorter distances. A conclusion was drawn that most people are willing to ride bicycles for shorter distances. As traveling time increases they may be willing to use other alternatives such as public transport or private motor vehicles.

5.1.3 Summary of Findings on Perceptions

The third objective sought ‘to discuss the perceptions that influence the use of bicycles’.
Respondents demonstrated a positive attitude towards using bicycles as a mode of transport. A total of 52.8% of the pedestrians indicated that they were comfortable to be seen riding a bicycle, whilst 47.2% were not comfortable. The majority of the respondents have a positive perception of cycling as a mode of transport. Similarly, 95% of all cyclists are comfortable to be seen riding a bicycle and 5 % are not comfortable. More cyclists who are already using bicycles are willing to use bike share bikes compared to non-cyclists

Another variable to measure perception sought ‘to establish commuters’ rating of walking and cycling lanes in Nairobi’s Upper Hill’. The majority of pedestrians constituting 31.1% perceive pedestrian lanes in the study area as satisfactory whilst 25.5% of the respondents perceive the pedestrian paths as good. 29% of the respondents perceived the pedestrian lanes as poor. While the level of pedestrian infrastructure has improved over the years in Nairobi the quality remains largely poor to extremely poor in the study area with many streets lacking sufficient provision of space for pedestrians.

On the other hand majority of the cyclist respondents, 40%, perceive the cycling lanes in the study area to be poor and 25% of the respondents perceived the cycling lanes were extremely poor. A total of 35% of the respondents perceived the cycling paths were satisfactory. A perception of satisfactory cycling lanes shows a lack of awareness of good quality cycling lanes as the study area lacks paved cycling infrastructure and this forces cyclists to share the roads with speeding motor vehicles. Related to this objective, cyclists reported safety concerns such as speeding vehicles as the challenge they encounter, where 80% cited this problem. Conflict with pedestrians using cycling lanes where they existed was cited by 75% of the cyclists. Inconsiderate motor vehicle drivers who do not leave enough space when overtaking them was cited by 70% of the respondents. The behavior of other road users specifically motorists and pedestrians is, therefore, the main concern to the cyclists' safety when using the road. Pedestrians cited safety reasons for not willing to ride bicycles, with the majority raising concerns about the lack of cycling lanes and that cycling is prone to accidents.

5.2 Conclusion

The study concludes that the potential of bike share is influenced by the time commuters take to travel from drop-off to their destination. People are more willing to ride bicycles for shorter journeys. Planning for bike share will need to consider this. The study also concludes that the potential of bike share is influenced by perceptions that commuters have on the use of bicycles. Respondents demonstrated a positive attitude toward using bicycles as a mode of transport. The availability of walking and cycling lanes also influences the adoption of bike share. Lack of walking and cycling lanes discourages both pedestrian and cyclist from using bicycles. Therefore availability and good quality walking and cycling infrastructure is critical for the adoption of bike share. Most commuters use public transport and the majority are willing to use bicycles.

5.3 Recommendations

For bike share to be a success in Nairobi and African city context, the following recommendations are made based on the study findings:

5.3.1 Recommendations for Planners

Planning of a bike share system in a city should target connecting shorter journeys as people are more willing to ride a bicycle for shorter times of 30 minutes or less.

Create a positive cycling culture among the city residents for bike share to be a success. Awareness-raising campaigns may be an effective tool for residents to feel comfortable being seen riding bicycles.

Plan bike share integrated with public transport. Bike share stations should be sited at or proximity to the bus stations as most potential users are public transport users

5.3.2 Recommendations for Policy Makers

The city should invest in cycling and pedestrian infrastructure to address the safety concerns and perceptions of safety from this group of road users. This will entail providing a network of good quality segregated pedestrian and cycling lanes. Improved safety can attract more people especially women who are more hesitant to use bicycles. A city intending to implement a bike share scheme should provide adequate cycling infrastructure before the scheme is implemented or concurrently with the planning and design of the scheme.

Awareness-raising on road safety for different road users. Education, information and communication on precautions on sharing the road with cyclists and other non-motorised transport users who are often disproportionally vulnerable is necessary for success of bike share. This may help car drivers to be more considerate of bicycle users and hence improve safety

5.4 Recommendations for Further Research

Bike share is more feasible when provided at a sufficiently large scale and hence the researcher recommends a city-wide scale study. This presents a research gap that needs to be filled. Research that targets a specific group such as people going to work or university students is another potential area for research to make bike share successful.

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Appendix 1: Road Side Interview Schedule for Pedestrians

UNIVERSITY OF NAIROBI

Faculty of Arts

Department of Geography and Environmental Studies

I am a Masters student studying Transport Geography at the University of Nairobi's department of Geography and Environmental Studies. I am undertaking a study to know how people travel in and around Upper Hill area. The study will help to understand on possibilities to use bicycles as a means of transport to reach places of work or education and any other destinations.

"An Analysis of the Potential for Public Bicycles in an African City: The Case Study of Upper Hill Area, Nairobi, Kenya"

Appendix 1: Road Side Interview Schedule for Pedestrians

Questionnaire No______________ Date_________________________

Time: 6:30am to 9:00am ☐ Time 4:00pm- 7:00pm ☐

GPS Location_________________ Road Name______________________

Instructions to respondents

Please try to answer these questions as openly and honestly as possible. Attempt all questions.

SECTION A: Demographic profile of respondents

1. Age of respondent in years: ☐

<20=1
21-30=2
31-40=3
41-50=4
51-60=5
≥61=6

2. Gender (sex of respondent): ☐

Male=1
Female=2

3. Respondent's level of education: ☐

Never went to school=1
Primary=2
Secondary=3

College/ University =4

4. Occupation of respondent:

Formal Public Sector=1
Formal Private Sector=2
Self Employed =3
Manual=4
Student=5
None=6
Other=7

5. Income level of respondent per month (in Ksh)

No income=1
<30,000=2
30,001- 70,000=3
70,001- 110,000=4
110,001- 150,000=5
>150,000=6

Instructions to interviewer: *alternately probe if the respondent can indicate their class of income*

Low Income=1
Middle Income=2
High income=3

SECTION B: Respondent's travel pattern

6. What is the purpose of your trip?

Work=1
Education=2
Health=3
Shopping=4
Leisure =5
Personal business=6
Home= 7
Other=8

7. Prior to this walk what mode of transport did you use?

Walking=1
Bicycle=2
Matatu (bus/ mini-bus) =3
Motor Cycle (boda boda) =4
Private car=5
Other=6
Instruction to interviewer: *Question 8 applies to evening peak*

8. After this walk what mode of transport will you use?

Walking=1
Bicycle=2
Matatu (bus/ mini-bus) =3
Motor Cycle (boda boda) =4
Private car=5
Other=6

9. If answer to question 7 above is solely **walking** how much time do you take to reach your destination?

< 30 minutes=1
30- 60 minutes =2
> 60 minutes=3

10. If you used motorised means (i.e matatu, boda-boda, car or train) how much time do you take to walk to/from your drop-off (bus stop/ train station etc) to your destination (work place/ education etc):

< 30 minutes=1
30- 60 minutes = 2
> 60 minutes=3

11. Where do you drop off matatu/ bus/ boda boda/ car ___________________

12. Are you comfortable (at ease) with the time you take to walk to/from bus stop to your destination?

Yes=1
No=2

13. In which estate do you live? _______________________

SECTION C: Perceptions and Attitude

14. If a bicycle is made available for a fee would you be willing to ride from a public transport stop (bus stop) or from home to your destination (work place, education etc):

Yes=1
No=2
Maybe=3

15. If No, what are the reason?
Prone to accidents=1
Lack of cycling lanes=2
I don't know how to ride a bicycle=3
No showering facilities at destination=4
Too far to cycle to destination=5
Hilly terrain= 6
Other=7

16. What would you consider as the most important reasons to ride a bicycle as a means of transport?

Saves money=1
Saves time=2
Improve fitness and health=3
Cycling is enjoyable=4
Reduces pollution=5
Reduces congestion=6
Other=7

17. Do you own a bicycle or have access to a bicycle in your home?

Yes=1
No=2

18. Can you ride a bicycle?

Yes=1
No=2

19. Is bicycle a mode of transport that you would want to be seen using?

Yes=1
No=2

20. How would you describe the condition of pedestrian paths/ sidewalks that you use to reach your destination?

Excellent=1
Good=2
Satisfactory=3
Poor=4
Extremely poor=5

Thank you for participating in this research. Please be assured that all of your answers will be strictly used for academic studies.

Appendix 2: Road Side Interview Schedule for Cyclists

UNIVERSITY OF NAIROBI

Faculty of Arts

Department of Geography and Environmental Studies

I am a Masters student studying Transport Geography at the University of Nairobi's department of Geography and Environmental Studies. I am undertaking a study to know how people travel in and around Upper Hill area. The study will help to understand on possibilities to use bicycles as a means of transport to reach places of work or education and any other destinations.

"An Analysis of the Potential for Public Bicycles in an African City: The Case Study of Upper Hill Area, Nairobi, Kenya"

Appendix 2: Road Side Interview Schedule for Cyclist

Questionnaire No______________ Date__________________________

Time: 6:30am to 9:00am ☐ Time 4:00pm- 7:00pm ☐

GPS Location_________________ Road Name______________________

Instructions to respondents

Please try to answer these questions as openly and honestly as possible. Attempt all questions.

SECTION A: Demographic profile of respondents

1. Age of respondent in years: ☐

<20=1
21-30=2
31-40=3
41-50=4
51-60=5
≥61=6

2. Gender (sex of respondent): ☐

Male=1
Female=2

3. Respondent's level of education: ☐

Never went to school=1
Primary=2
Secondary=3
College/ University =4

4. Occupation of respondent:

Formal Public Sector=1
Formal Private Sector=2
Self Employed =3
Manual=4
Student=5
None=6
Other=7

5. Income level of respondent per month (in Ksh)

No income=1
<30,000=2
30,001- 70,000=3
70,001- 110,000=4
110,001- 150,000=5
>150,000=6

SECTION B: Respondent's travel pattern

6. What is the purpose of your trip?

Work=1
Education=2
Health=3
Shopping=4
Leisure=5
Personal business=6
Home= 7
Other=8

7. How much time do you take to ride from home to your destination?

< 30 minutes= 1
30- 60 minutes=2
> 60 minutes=3

8. Are you comfortable (at ease) with the time you take to ride from your home to your destination?:

Yes=1

No=2

SECTION C: Perceptions and Attitude

9. If a bicycle is made available for a fee would you be willing to ride from a public transport top (bus stop) or from home to your destination (work place, education etc):

Yes=1
No=2

10. What would you consider as the most important reasons to ride a bicycle as a means of transport?

Saves money=1
Saves time=2
Improve fitness and health=3
Cycling is enjoyable=4
Reduces pollution=5
Reduces congestion=6
Other=7

11. Is bicycle a mode of transport that you are comfortable to be seen using?

Yes=1
No=2

12. How would you describe the condition of cycling paths to reach your destination?

Excellent=1
Good=2
Satisfactory=3
Poor=4
Extremely poor=5

13. What challenges do you face when riding to/from work place/ school etc?

Speeding vehicles= 1
Inconsiderate drivers= 2
Destruction by pedestrians= 3
Hilly terrain= 4
Bad weather= 5
Other= 6

Thank you for participating in this research. Please be assured that all of your answers will be strictly used for academic studies

Appendix 3: Pedestrian and Bicycle Tally Sheet

Instructions to Enumerator

Pedestrians comprise those walking / running; using wheelchair/ assistive devices; Children in strollers; skateboards and roller blades. Count 10 minute intervals (1 or 2 ten minute intervals) in each hour and calculate averages

Time of the Day: Morning Peak (6:30- 9:00 am) Evening Peak (16:00- 19:00 pm)

Date ____________________________ **Day of the Week ________________**

Road ______________________ **GPS Location______________________**

Time	**Pedestrian**	**Bicycle**
Indicate time in 10 minute intervals for Morning Peak	**Total__________**	**Total__________**
Indicate time in 10 minute intervals for Evening	**Total______________**	**Total__________**

Appendix 4a: Introduction Letter to Conduct Research

UNIVERSITY OF NAIROBI

DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

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P.O. BOX 30197-00100
NAIROBI
KENYA

October 29, 2019

The Director,
National Commission for Science & Technology
Nairobi, Kenya.

Dear Sir/Madam,

RESEARCH PERMIT: PRISCILLA N. MUCHIBWA

This is to confirm that the above named is a Master of Arts student (Registration Number – C50/50871/2016) at the Department of Geography and Environmental Studies, University of Nairobi registered.

Ms. Muchibwa is currently undertaking research on a topic titled: **An Analysis of Potential for Bikeshare in an African City: A Case Study of Upper Hill, Nairobi.**

Any assistance accorded to her will be highly appreciated.

CHAIRMAN
Department Of Geography
and Environmental Studies
UNIVERSITY OF NAIROBI

Dr. Boniface Wambua
Chairman, Department of Geography & Environmental Studies

Appendix 4b: NACOSTI License to Conduct Research

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **920109**

Date of Issue: **08/November/2019**

RESEARCH LICENSE

This is to Certify that Miss.. Priscilla Muchibwa of University of Nairobi, has been licensed to conduct research in Nairobi on the topic: AN ANALYSIS OF THE POTENTIAL FOR BIKESHARE IN AN AFRICAN CITY: THE CASE STUDY OF UPPER HILL AREA, NAIROBI, KENYA for the period ending : 08/November/2020.

License No: **NACOSTI/P/19/2620**

920109

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is Guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014

CONDITIONS

1. The License is valid for the proposed research, location and specified period
2. The License any rights thereunder are non-transferable
3. The Licensee shall inform the relevant County Director of Education, County Commissioner and County Governor before commencement of the research
4. Excavation, filming and collection of specimens are subject to further necessary clearence from relevant Government Agencies
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