



**UNIVERSITI PUTRA MALAYSIA**

***BICYCLE STATION FACILITIES PREFERENCES OF BIKE RIDERS IN A  
MALAYSIAN PUBLIC UNIVERSITY***

**SHIRIN VOSOUGHI**

**FRSB 2015 2**



**UPM**  
UNIVERSITI PUTRA MALAYSIA  
BERILMU BERBAKTI

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MALAYSIAN PUBLIC UNIVERSITY**

**By**

**SHIRIN VOSOUGHI**

**This thesis submitted to the School of Graduate Studies, Universiti Putra  
Malaysia, in Fulfillment of the Requirements for the Degree of  
Master of Science**

**April 2015**

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Abstract of thesis presented to the senate of University Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

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**April 2015**

**Chairman: Mohd Johari bin Mohd Yusof, Ph.D.  
Faculty: Design and Architecture**

Universally, the community of scientists agrees that there are adverse global climate changes caused by industrialization and ever-increasing use of fossil fuel. In progressive nations, think tanks have focused on devising ways of “green” and “sustainable” lifestyles, to reduce usage of fossil fuel and related emission of carbon and other pollutants. A major contributor to air pollution is auto emissions especially in crowded major cities. During the recent decade, many progressive cities have successfully encouraged and facilitated using bicycles as a viable, clean mode of transportation. Hence, this study aims to understand bike riders’ preference of bicycle station facilities in Universiti Putra Malaysia (UPM) Serdang campus. In addition, it purposes to encourage students to use bicycles as a mode of transportation. The criteria of identifying factors influencing the cyclist preferences on designing a bicycle station and determining UPM students’ preferences regarding bicycle station facilities and its design in Serdang campus, and also recommending ways to enhance the design of a bicycle station in UPM Serdang campus is studied. Achieving these objectives was done by designing functional and aesthetically attractive “bicycle stations”, to be built on dedicated bicycle paths. The study instrument was based on a survey taken from 327 students and staffs of UPM who had bicycles, or used bicycles on campus. Their preference on the type of facilities in bicycle stations was solicited. This study revealed that bike riders are willing to use bicycles as a mode choice, if their need and preference provided. There should be shelter stations, lockdown stations and a main bicycle station with essential facilities. Also the motorized vehicles should be banned from entering campus area (except for taxis, minibuses and campus buses). It is advised to reward those students who use bicycles or other non-polluting transportation systems to have a superior hostel room condition. Safety is the most important priority and advertising is essential to promote cycling.

Key words: Design, users’ preference, in-campus transportation, bicycling.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia Sebagai memenuhi keperluan untuk ijazah Master Sains

## **KAJIAN KEHENDAK PENUNGGANG BASIKAL TERHADAP KEMUDAHAN STESYEN BASIKAL DI KAMPUS SERDANG, UPM**

Oleh

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Universal komuniti ahli sains bersetuju bahawa terdapat perubahan iklim global yang buruk disebabkan oleh pengindustrian dan meningkatkan penggunaan bahan api fosil. Di negara-negara maju, pemikir memberi tumpuan kepada pendekatan "hijau" dan kehidupan mampan, mengurangkan penggunaan bahan api fosil dan berkaitan pelepasan karbon dan lain-lain bahan pencemar. Penyumbang utama kepada pencemaran udara ialah pelepasan gas terutamanya di bandar-bandar besar yang sesak. Namun begitu, baru-baru ini, banyak bandar telah berjaya menggalakkan penggunaan basikal sebagai mod pengangkutan yang berdaya maju dan bersih. Oleh yang demikian, kajian ini bertujuan untuk mengenal pasti kehendak penunggang basikal terhadap kemudahan stesyen basikal di UPM. Di samping itu, kajian ini juga ingin menggalakkan pelajar menggunakan basikal sebagai mod pengangkutan di Kampus Universiti. Kajian ini mengenal pasti faktor yang mempengaruhi kehendak penunggang basikal dalam mereka bentuk sebuah stesyen basikal. Kajian ini juga mengkaji pandangan pengguna basikal mengenai sesebuah kemudahan stesyen basikal dan cadangan penambahbaikan untuk menggalakkan penggunaan basikal di UPM. Kajian kehendak ini adalah melalui suatu kaji selidik yang dijalankan bersama 327 orang pelajar dan staf UPM yang menggunakan atau mempunyai basikal di kampus. Hasil kajian menunjukkan pelajar dan staf UPM akan menggunakan basikal sebagai mod pengangkutan jika kemudahan disediakan kepada mereka. Kemudahan ini perlu dilengkapi dengan stesyen berteduh yang selamat dan mempunyai kemudahan asas yang lain. Hasil kajian juga menunjukkan pengguna basikal ingin melihat agar kenderaan bermotor lain tidak dibenarkan masuk ke kawasan kampus (kecuali teksi, bas dan pengangkutan awam yang lain). Insentif juga perlu diberikan kepada mereka yang menggunakan basikal sebagai mod pengangkutan selain faktor keselamatan yang perlu dititik beratkan dalam mempromosi penggunaan basikal sebagai mod pengangkutan.

Kata-kata kunci: rekabentuk, keutamaan pengguna, pengangkutan di kampus, Berbasikal.

## ACKNOWLEDGEMENT

This project would not have been possible without the support of many people. Many thanks to my supervisor, Dr. Mohd Johari bin Mohd Yusof, who studied my numerous revisions and helped make some sense of the confusion.

And finally, thanks to my parents, and friends who endured through this long process with me, always offering support and love.

I have especial thanks to Prof. Dr. Farivar Yaghmai to help me from the first step of my research to the end.



I certify that a Thesis Examination Committee has met on 29 April 2015 to conduct the final examination of Shirin Vosoughi on her thesis entitled "Bicycle Station Facilities Preferences of Bike Riders in a Malaysian Public University" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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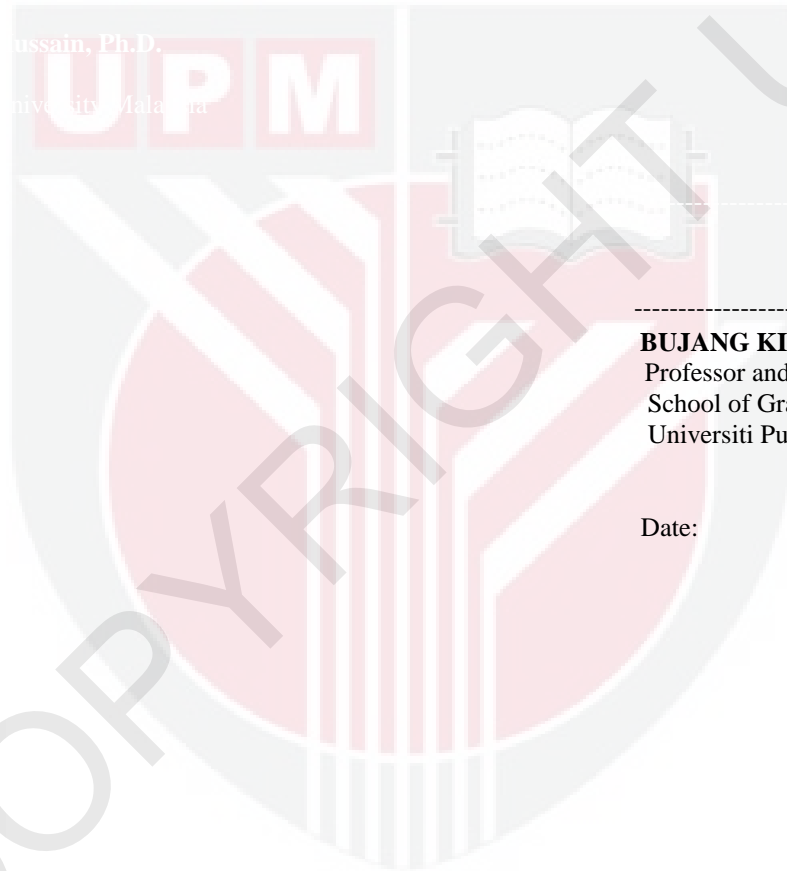
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## LIST OF ABBREVIATIONS

SPSS	Statistical Package for the Social Science
Formal Qualification	Level of Study
UKM	Universiti Kebangsaan Malaysia
UM	Universiti Malaya
UPM	Universiti Putra Malaysia
USM	Universiti Sains Malaysia
NMT	Non-Motorized Transportation
TMP	Transportation Management Program
E-Bike	Electric Bicycle
CSAF	Campus Sustainability Assessment Framework

# CHAPTER 1

## INTRODUCTION

### 1.1 Background of Study

Since the beginning of the era of “Industrial Revolution” over 100 years ago, ever-increasing use of machinery powered by fossil fuels, has gradually created mounting problems related to environmental pollution and climate changes. As a source of concentrated energy, all varieties of fossil fuel have been relatively inexpensive and readily available. The environmental damage and especially global warming were subtle and questionable at the outset, realized and publicized only by climatologists and some other scientists. In a recent paper published in the prestigious *Journal of Nature*, scientist from the University of Hawaii (USA) stated that if greenhouse emissions continue their steady escalation, by the year 2047 temperatures across most of the earth will rise to levels with no recorded precedent. This would be more severe in the tropics. To put it another way, for a given geographic area, the coldest year in the future will be warmer than the hottest year in the past (Camilo Mora, 2013). In the spring of 2014 an assembly of 60 scientists in Japan, in the meeting of Intergovernmental Panel on Climate Change had the task of writing a massive and authoritative report on the impacts of global warming. (Borenstein, S; Associated Press March 24, 2014). The big risks and overall effects of global warming are far more immediate and local than scientists once thought. It is not just about melting ice, threatened animals and plants. It is about the human problems of hunger, disease, drought, flooding, refugees, and war, becoming worse. Now environmental pollution and damage are universally accepted as a valid entity, and remedies are considered. The remedies include energy efficient products, utility of renewable sources of energy, "green designs", and "multi-purpose designs". Greenhouse gas emissions (including carbon dioxide, methane, and nitrous oxide, all expressed as carbon dioxide equivalents) by an average passenger car, are about 260 grams for every kilometre driven [(EPA (2013a). preventing this amount of greenhouse gases from entering the environment, by masses using bicycles will have a tremendous positive environmental impact.

Bicycle, is an important part of the transportation system especially after one hundred and forty years of innovations. If used widely as a mode of transportation, it can influence climate changes positively. Using bicycle in specific trips as an alternative to motorized vehicles can reduce environment pollution. Bicycle is an inexpensive, non-polluting alternative to driving, capable of logical use of limited roadway capacity. Cycling maybe a choice for all, especially for individuals who do not have the option of driving. Bicycle is a compelling transport, especially for trips too long for walking, or when there is no other transit service (Murphy & Knoblauch, 2004).

Many of the college campuses are akin to small cities, with independent energy supply, waste management system, and transportation facilities. College campuses are distinct

communities, where people of different backgrounds, income levels, lifestyles and sentiments and demeanors, do comes together to live, to study, to work, to recreate, and to grow. College campuses belong to all for restoration of cultural and social interactions; conceptually they can be considered as a public space (Movahed, Azad, & Zakeri, 2012). College campuses build societies that are at once transitory and lasting, and have an ideal human scale (Ojeda and Yudell, 1997). The traditional campus adheres to the basic principles of the neo-traditional towns, since it concentrates a variety of functions within reach of pedestrians (Dulken, 1992; Turner, 1995). Furthermore, college campuses are privileged places to communicate sustainability, and to help reshape society's transportation patterns (Balsas, 2003).

A viable solution to reduce damage to environment, and to decrease the global warming which has come to a focal point in many countries, is using bicycles, and the concept of bicycle sharing. A pioneering country in this is Netherlands. Since a few years ago the concept of bicycle riding with some variations is being adopted in cities around the world, especially in France, Germany, England, China, and USA. The study of Rabl & de Nazelle (2012) conducted in some European cities such as Barcelona, Basel, Copenhagen, Paris, Prague and Warsaw, and the research supported by the Coca-Cola Foundation, AGAUR, and CREAL, is revealing. In their studies the health impact of shifting from car use to cycling, outlined the benefits of use of bicycle in reduced carbon emissions, congestion and noise, and boosting health benefits for cyclists and the population as a whole.

It is extensively accepted that trends in motorization on college campuses, equate those experienced by society at large (Balsas, 2003). In the last decade, campus planners have struggled to provide access and mobility without destroying campus qualities as distinct communities (Balsas, 2003). College campuses may be located in rural or urban areas; their layouts vary according to their locations. A rural campus tends to present horizontal connectivity, while an urban campus tends toward vertical connectivity. Rural campuses are normally more automobile dependent than urban ones. Although most campuses do not totally exclude the automobile, walking is the expected way to get around even though other ways of transportation may also be possible. College campuses are a good example of a "people's place" (Balsas, 2003).

University Putra Malaysia (UPM) is a leader in sustainable development among the other Malaysian universities. UPM was ranked in the top 10 green metric universities in 2007, and presented several publications such as the following: In the field of sustainable design elements for urban areas (Tazilan, Salleh, Komoo, & Ismail, 2009); public participation for sustainable development (Dola, Mijan, Unit, & Planning, 2006); sustainable urban landscape (Roe & Kingdom, 2006); and sustainable architectural education (Shari, Fakri, & Jaafar, 2006). Developing and promoting bicycle riding is in the future plans of UPM. This research could serve as the initial step of developing plans for cycling. In addition, developing and promoting the culture of bicycling is highly desirable for students in terms of physical well-being and environmental friendliness. Hence this study was conducted to review and discuss UPM Serdang campus facilities and conditions, and to promote cycling with

consideration for student preferences, to encourage them using bicycle as a mode of transportation in UPM Serdang campus area.

## 1.2 Problem Statement

According to the interview with Prof. Dr. Ahmad Ismail from biology faculty of UPM University, currently, in UPM Serdang campus bicycling station facilities are insufficient. Well-connected bicycle lanes are important necessity to encourage people to use bicycle, and should be provided before the university's bicycle sales program. Since the bicycles in the sales program were less expensive compared to the off-campus prices, or at bicycle shops, students started to buy bicycles. Since there were insufficient cycling facilities and bicycle roads, students do not use their bicycles effectively and they are kept mostly unused in the shelter stations at UPM Serdang campus, or locked up inside the corridors of their hostel buildings. As UPM Serdang campus area is vast, there is a vast need of cycling facilities, not in place currently. In the main campus of UPM Serdang, there are some bicycle lanes connecting the main campus to student hostels. Inadequate bicycle parking facilities have caused substantial rusting and damage to the bicycles in this hot humid climate, as seen in Figure 1.1, Figure 1.2 and Figure 1.3.



**Figure 1.1 Parked Bicycles Inside Hostel Buildings because of Lack of Bicycle Station (Source: Author). Location: Serdang Campus Kolej 16/14.**



**Figure 1.2 Lack of Bicycle Station in UPM Serdang Campus, Caused Rusted Bicycle Parts. Location: Serdang Campus Tun Dr. Ismail College.**



**Figure 1.3 Bicycle Stations (Shelter Station) which are not Appropriate for Long Time Parking. Location: Serdang Campus 6<sup>th</sup> College Hostel cyg, Second College, Kolej Muhamad Rashid, Chancellor College.**

According to Kaplan, Kaplan and Rayan (1998) identifying peoples' preference is vital which is why the bicycle facilities should be designed and built largely based on the students' preferences and needs. However the question that remains is what is bicycle rider's preference on bicycle station design in UPM Serdang campus? The correct way to answer these questions is by studying the existing models, and above all by soliciting the input and opinion of a large number of students who currently ride bicycles, and also the input of potential riders.

In order to enhance and clarify the study plan further, answers to the following sub-questions would be helpful:

- i. What are the factors influencing the cyclist preferences on the design of bicycle station?
- ii. What are the facilities, which can support cycling on Serdang campus?
- iii. What is bike riders' design preference for the UPM Serdang campus bicycle station?

### **1.3 Research Objectives**

This study was carried out to identify the bike riders' preferences toward bicycle station facilities in UPM Serdang campus area. The study population consisted of UPM students who used bicycles as their main mode of transportation on campus.

To achieve the above aim, the following objectives were addressed in this study:

- i. To identify factors influencing the cyclist preferences on the design of bicycle station
- ii. To determine UPM students' preferences on bicycle station facilities and its design in Serdang campus; and
- iii. To list recommendations of ways to enhance the design of bicycle station in UPM Serdang campus.



#### **1.4 Scope and Limitations of Study**

Of the two campuses of UPM, the study selected the Serdang campus to conduct this research by interviewing the daytime student (and personnel) bicycle riders. This study was focused on finding students preferences toward bicycle facilities in the main bicycle station which is not considered a lock-down station or a shelter stations. The following three varieties of bicycle stations are important, and should be utilized together. The "lock down stations" should exist besides each building, for cyclist who might want to leave their bicycle for one hour or less. "Shelter stations" should be provided at the road sides at about one kilometer intervals. The "main station" is a large building with major facilities, one sufficing for the entire campus area.

The bicycle lanes, lighting and road facilities were excluded from this study. Bicycle lanes and roads are essential parts of cycling, but providing a bicycle station with appropriate and essential facilities is more effective to promote cycling.

All of the respondents owned bicycles, but not all of them were using their bicycle. This limited motivation to use bicycles for transportation was caused by insufficient facilities at the UPM Serdang campus. Some respondents were not active cyclists, and their lack of experience might have influenced the results. Unfortunately there has not been enough research on in-campus transportation and cycling in Malaysia. The data on in-campus cycling is limited to few done in other countries.

#### **1.5 Significance of Study**

Many studies related to bicycle riding have been published. To the best of the author's knowledge to date, there has been no published research addressing students' preferences, in Malaysia, regarding the design and facilities of bicycle station. There are some scholarly publications on bicycle routes, but none on bicycle stations. At UPM, there is inspiration and a palpable movement in regards to changing the Serdang campus transportation system from motorbikes and cars, in the favor of cycling. Currently due to lack of facilities, only a minor fraction of students use bicycle for transportation on campus. Well-equipped bicycle stations with facilities are imperative in this climate of high heat and humidity. Bicycling should be a pleasant experience to gain wide acceptance. Some consideration has been given to the users' preference in designing bicycle roads; more input is needed to attract more riders. According to Kaplan, Kaplan and Rayan (1998) identifying peoples' preference is vital, to prevent anger, fear, or destructive behavior. Consequently, identifying preferences of the students who ride bicycles, their suggestions, and opinion are of marked importance in their choice of the mode of transportation in campus area.

This study was designed in particular to result in improved cycling facilities, especially bicycle stations, with the users' preferences as the focal point. The aim was to encourage commuters to choose bicycle as a mode of transportation in the campus area. Moreover, our results may help serve as guidelines and a road map for other campuses, and even beyond. As the university campuses are small scale of cities, this study will hopefully contribute to help the municipalities in changing the existing city transportation, to a green transportation system.

Well-equipped bicycle station with facilities, such as restaurant, gathering area with seating, etc. will help promoting student interaction, communication, and exchange of ideas. Although the initial cost of such multipurpose station might be high, it would be a sound long-range investment and addition to the campus, as well as a significant step in green living.

## **1.6 Thesis Organization**

This thesis comprises five chapters, as illustrated in Figure 1.4. It is organized as follows:

The present chapter provides an introduction of the study. The first section addressed background of the study that contained global warming and environmental problems caused by industries and transportation pollutants, and the linkage between using bicycle and decreasing environment damages. It also included the statements of the problem, which was about the main problem, and the present situation of UPM Serdang campus cycling programs and facilities. The next section was about aims and objectives of this study, which contained factors influencing the cyclist's preferences on the design of bicycle station, UPM students' preferences on bicycle station facilities and its design in Serdang campus; and recommendations of ways to enhance the design of bicycle station in UPM Serdang campus. The significance of the study, why this study is useful and what will it do, was also discussed. The last section before organization of the dissertation was scope and limitation of the study.

The second chapter provides a review of the literature. It started with introduction and benefits of cycling, then the important factors which may influence cycling as a mode choice, followed. The most important factors are safety, convenience and easiness. From those factors and from some barriers against cycling, such as weather and environment conditions, the base of cycling facilities was provided. In addition, transportation systems in campus areas were introduced, and their advantages and disadvantages were reviewed. The first part of this section was examples of campuses cycling initiative. In this part examples of systems which were used in some countries to promote cycling among students of schools and universities, were introduced. The second part of this section was about solutions in campus area. In this part some solutions to reduce usage of private motor vehicle in campus areas were discussed. In addition, the Transportation Management Program (TMP) and its additional services in campus area were explained. Also addressed was campus public transportation and its

interaction with cycling, pointing that campus transport services reduced private vehicle use on campus. There was some example of solutions which could be applied in campus areas. Malaysian transportation systems, and their level of service and how it influenced the people's choice of transport mode were introduced. Accidents and insurance expense are a major disadvantage of private motor vehicles. In this part transportation system in UPM Serdang campus university buses, taxi, private car, motorbike, walking and cycling transport, were addressed, and compared with other three large universities in Malaysia. At the end, summary of the chapter was explained after research framework.

The third chapter discussed the methods used in this study. It started with introduction of the two methods literature and survey design used in the study. The literature suggests some important features and addition that result in increase in bicycle riding; the need for these facilities and their importance was covered. The most effective features gained from literature review were safety, comfort and friendliness. These were inside and outside CCTV, locker system, first aid kit, repair shop, shower, clothes changing area, rest and gathering place, drink and snack vending machine, free Wi-Fi system, water dispenser and food court or restaurant. Bicycle sharing system, was the factor which resulted in adding to the questionnaire list of students' preference, the locker system and ownership of bicycle questions.

The survey design described the planning involved in the study in detail; how it was conducted and the techniques used to analyze the data. The instrument used in this study was questionnaire to obtain UPM Serdang campus students' preference on cycling facilities in the bicycle station, to encourage them to use bicycle as a mode of transportation in Serdang campus area. Surveys are one of economical methods to get results regarding a huge population. A pre-test was conducted to determine validity and reliability of the questionnaire in the "The Design and Content of the Survey Questionnaire". The pre-test and its results, and how it could indicate the need to revise the questionnaire were explained. The aim of pre-test was to produce reliable results, and to validate final questionnaire of this study. The first part of questionnaire was the profile and background of respondents. This part involved questions about their name, email address, telephone number, age, the length of time that they have been affiliated with UPM university in Serdang campus, their field of study and educational level, and their position or job title if any.

The second part of questionnaire was to evaluate the respondents' opinions on bicycle station facilities for UPM Serdang campus. The fifteen facilities they were asked to choose from, was inspired by the review of literature. In the next part opinion of respondents on their choice mode of transportation system was asked. Their knowledge of bicycle sharing system and their willingness to share facilities with disabled people were asked. The respondents' opinions about features such as the cost, ease of use, comfort, security, accessibility, visibility, capacity, aesthetics, and user friendliness were asked. The last section of questionnaire asked about students' opinions and preference on three presented different designs and appearances for the main bicycle station at UPM Serdang campus.

To conduct the questionnaire, population and sampling were important. The location of study was UPM Serdang campus, and the sampled students were those who had bicycles, or rode bicycles inside this campus area. The survey process was started at the site of a conference in Faculty of Medicine and Health Science of UPM. Three other locations were chosen where the highest numbers of respondent cyclists were expected. The areas were Main cycling roads, the "the Basikal" shop near gate 5, and near the Coca-Cola building inside Faculty of Science. As about 2000 bicycles were sold in Serdang campus, the sample size chosen from Kaplan, Kaplan and Morgan (1970) table was about 327 samples. The survey was conducted at the peak of the commute, mostly at evenings. The last part of this chapter is about analysis. The SPSS software version 22.0 was used to analyze data from questionnaire. The first step was coding the data; the coded data were entered one by one and checked several times to avoid human errors. The reliability of the data was checked. The respondents background data, and all other parts of the questionnaire data were analyzed with descriptive analysis. The correlation of all parts with each other were analyzed, and where significant, correlations were mentioned and explained.

The fourth chapter presents the findings of the study, the discussion of the results, and the summary of its major findings. The first part of this chapter was introduction to the chapter. The analysis of respondents' profile and backgrounds were explained, and the reasons were given why six age groups were reduced to three. The majority of respondents according to age group were 21 to 29 years old. The respondents' background in regards to the number of years they have been associated with UPM, revealed this time span at approximately two and half years.

The fifth chapter discussed the significant findings of the study, their implication and the suggestions in providing the bicycle station in the campus area. It also contained a discussion of the findings, as it relates to the findings of the previous studies and the theoretical framework. Prior to the conclusion, a critical evaluation of the methods used in the present research was presented, and recommendations for future research studies are proposed.

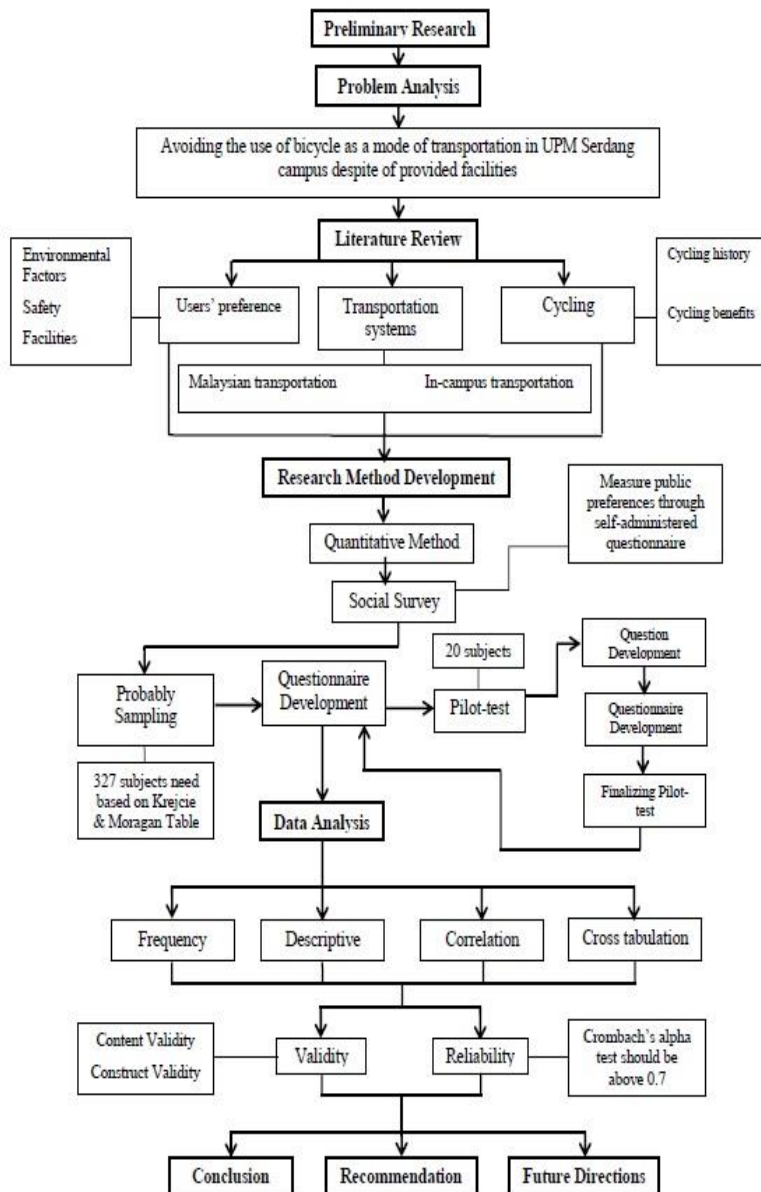


Figure 1.4: Research Framework.

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