

## FACTORS INFLUENCING BICYCLE USE IN INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA (IIUM) GOMBAK CAMPUS

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### ABSTRACT

The use of bicycles on-campus at higher learning institutions including International Islamic University Malaysia (IIUM) is at a very low level. It is imperative to understand what influences bicycle use on-campus. This paper identifies factors that influence bicycle use in IIUM from the opinion of bicyclists. The main data used in this paper were from literature reviews, observational surveys, and field survey questionnaires. Univariate and bivariate analysis techniques were applied to the data to achieve the objectives of this study. The major findings show that good conditions and adequate bicycle facilities are some of the main factors, among others, that encourage students to cycle on-campus. At the end of this paper, some recommendations are suggested to increase bicycle use among the IIUM community on-campus.

**Keywords:** Bicycle use, Cyclists' opinion, Questionnaire survey, IIUM, Gombak

### INTRODUCTION

In the International Islamic University Malaysia (IIUM) Gombak campus, various modes of transportation such as motorcars, motorcycles, walking, bicycles are used for commuting. However, motorcars and motorcycles have been the most preferable mode choices by both students and staff alike. As a result, the number of motor vehicles has been increasing proportionately with the increase in staff and student population. The number of registered motorcars on-campus had increased by 1.8% annually from the year 2007 to the year 2010 (Ismail et.al. 2012) and the allocation of motorcars stickers by 27% from the year 2017 to the year 2018 (Office of Security Management, IIUM, 2019). As a result, it invites problems such as traffic congestion during peak hours, noise and air pollution, and insufficient parking spaces. The main challenges in transportation management are unlimited vehicle accessibility inside the campus and lower rates of cycling practice among the campus population. In terms of sustainability, sustainable transport not only focuses on a single type of vehicle but also includes an integrated transportation system. Sustainability can be accomplished by incorporating all modes of transportation systems. Nowadays, higher academic institutions, globally and locally, have been taking initiatives to improve transportation management to support the Sustainable Development Goals. Educational institutions especially University have a large community that can become a part of the workforce to initiate and take part in realizing Malaysia's target to reduce 45% of carbon dioxide (CO<sub>2</sub>) emissions by 2030 to address climate change and global warming (Susskind et.al., 2020). One of the actions that can be taken to alleviate these problems is to encourage the use of the bicycle as the main travel mode in the IIUM Gombak campus. Bicycling provides many direct benefits to the IIUM community when practicing at a wider scale. A study undertaken at the University of Western Australia states that cycling can improve the health, fitness, and well-being of the community; saves money on driving expenses and parking; reduces carbon emissions and pressure on the local environment (Transportation and Parking Service, University of Western Australia, 2016).

In IIUM, bicycling is still not the main focus of commuting planning in terms of policy and project development. Based on initial observations, only a few numbers of students use bicycles as their travel mode for commuting on-campus. It is due to a lack of bicycle and supporting

infrastructure. Bicyclists are sharing traffic lanes with motorized vehicles without clear segregation between motorized and non-motorized traffic especially bicyclists. It allows most of the students to feel unsafe to commute by bicycle. Besides, bicyclists also need to travel long distances from one place to another because of the lack of alternative routes to reduce the travel distances. Additionally, lack of bicycle parking spaces and inappropriate parking locations are also the other major concerns that discourage students from using the bicycle. It was found that students have had to lock their bicycles at the pole of the streetlamps, trees, and railings to secure their bicycles without proper bicycle locking facilities. Moreover, students were seen parking their bicycles at motorcycle parking without any security for their bicycles. Furthermore, frequent changes in weather conditions have also affected the number of bicyclists on-campus.

In 2017, Malaysia's first dockless bike hire system known as O-Bike was launched at the IIUM Gombak campus. With the O-Bikes being distributed at bus stops and other convenient locations around the campus, it was expected to help students and others to reach their destinations within IIUM. The expected benefits from the use of O-Bike was to create a green environment by lessening the pollution and reducing the carbon footprint on the campus. However, O-Bike had suddenly become an issue in IIUM campus for taking over parking spaces designated for motorcyclists and also being parked at the pathways for disabled persons. These bikes were vandalized and also parked indiscriminately at the undesignated locations. Not long after O-Bike was launched on the campus, the IUM community has been introduced to another dockless bike hire system known as UNiRIDE. With modern technological and operational developments, both UNiRIDE and O-Bike employ bicycles with a lock that integrates a digital authentication code to automatically lock and unlock the bikes. This initiative also focuses on initiating clean urban transport through the implementation of Non-Motorised Transport (NMT) within the campus. It is a brilliant invention to encourage human-powered transportation like walking and bicycling because they are very cost-effective and environmentally friendly.

Contrarily, these e-bikes were created to augment human power but not replacing it entirely. Hence, the students can commute faster to their destinations without having to exert much energy except for controlling the handle of the bike. Riding UNiRIDE will shorten the number of time students need to spend when commuting to the destinations as compared to walking or cycling using a regular bicycle. The e-bike is still in use in IIUM now. Nonetheless, the provision of bicycle facilities and safety aspects for bicyclists is still needed to be considered in the IIUM transportation plan for wider use by the community. This paper investigates the factors that influence the use of the bicycle for commute trips within the campus among the IIUM community especially students. Students were asked to answer a questionnaire on the factors that encourage and restrain them from treating bicycling as a practical mode of transport in IIUM. Both univariate and bivariate analysis techniques were applied to know the clear views of the respondents on the existing use of the bicycle on the campus. This paper is divided into six sections. Section 1 introduces the topic and the purpose of this paper followed by section 2 on literature review, section 3 on goal, objectives, and methodology, section 4 on analysis, and findings, section 5 on discussion and recommendations, and finally section 6 on conclusions.

## **LITERATURE REVIEW**

### **Bicycle, Bicycle Use (Cycling), and Bicycle Users (Cyclists)**

Bicycles are non-motorized transportation that has many benefits, such as reducing environmental problems and reducing the costs of the journey. Aultman (2004) states that the

four main characteristics to define a bicycle are; a design vehicle; physical dimension, speeds, stopping distance, and climbing ability. The most amazing thing about bicycles is that among all machines and animals that move, they are the most efficient mode for transporting weight over a distance for a fixed amount of energy consumption (Wilson, 1973 as cited in Grava, 2003). While cycling is the use of bicycles, it is also used as a means of transport, a form of recreation and sport. It is used on roads and paths. Cycling involves the riding of bicycles, unicycles, tricycles, quadricycles, and other similar human-powered vehicles. Bicycling is one of the modes of sustainable transportation on campus which provides flexibility and produces no pollution. Many campuses are now considering the benefits of bicycling, for example, the study of Cleary and McClintock (Balsas, 2003) found that in the US, several campuses have already realized this opportunity and have undertaken many actions to provide safe cycling and walking conditions for their campus communities (Balsas, 2003). According to the Oxford English Dictionary, a cyclist means a person who cycles for a purpose of transport such as recreation or sport that carries a person across the land, through tunnels, or over bridges. From the definitions, it can be differentiated that the bicycle is the vehicle used for transport; cycling is riding a bicycle while the cyclist is the rider of a bicycle. The relationship between these three shows that there must be riders who will ride a bicycle. Therefore, when planning for bicycling, the main focus should be given to the cyclists because their needs as cyclists should be facilitated to encourage more cycling.

### **Bicycle Facilities**

The provision of appropriate bicycle facilities is very important to encourage more cyclists travel as well as to increase the comfort, convenience, and safety of cyclists. Additionally, lack of facilities is a major barrier to increase cycling (Forester, 1993 as cited in Litman et al, 2008). According to Toole and Zimny (1999, p. 602), *“transportation planners should not fail to provide facilities because of the concern that it would encourage bicycling in a dangerous location. Bicycle travel will occur regardless, and the burden of responsibility is to accommodate that travel in the best way possible”*. Therefore, the provision of proper bicycle facilities should be taken into consideration in planning for cyclists to ensure their needs for cycling. The significant type of facilities includes on-road facilities such as bicycle lanes as well as bicycle parking. To support the use of bicycles, there are four main factors which are 1) bicycle path (width, light, safety, traffic volume, surface, route, speed, crossroad, attractiveness), 2) bicycle parking, 3) personal factors (socioeconomic factors), and 4) other factors (weather, law, and policy, etc.) (Srisurapanon et.al, 2003, p. 19).

According to McClintock (2002b), the first cycle track was designed mainly to improve the cyclist's comfort. Planning for cyclists would be easy if the motor vehicles are low. For the reason of road safety, cyclists and motor vehicles were separated more often because cyclists are generally safe on cycle tracks along roads (Ploeger, 2003 and Krag. 2002). The type of bicycle paths can be divided into three categories (The American Association of State Highway and Transportation Officials [ASSHTO], 1991; as cited in Arunkamol, 2010, p. 34). The first is the bicycle path (Figure 1). A bicycle path is a path separated from motorized vehicular traffic by an open space or barrier. The second is the bicycle lane (Figure 2). It is a portion of the roadway that has been designated for exclusive use for bicyclists by pavement markings or signs. The third is a shared roadway where it is open to both bicycle and motor vehicle to travel (Figure 3). When designing bicycle paths, it is required to consider various factors associated with bike path design. This includes safety, security, pathfinding system, continuity of bike path, attractive cycling route, quality of flow on the bicycle path, and universal design (Litman, 2009; as cited in Suksen, 2009, p. 22).



**Fig. 1** Example of a bicycle path

Source: Ashland Electric Bikes, (2005)



**Fig. 2** Example of a bicycle lane

Source: Urban Toronto News (2011)



**Fig. 3** Example of shared roadway

Source: Urban Bikeway Design Guide, (2013)

Next, the provision of secured, convenient, and attractive bicycle parking facilities is vital for encouraging the use of bikes (McClintock, 2002c and Aultman, 2004). According to Forester (1994), colleges and universities have several different departments, and students mobile to and from campus and between distant buildings throughout the day. Thus, it is important to install bicycle stalls near the entrance of buildings, otherwise, bicycles get left near the doors without stalls, requiring much space and obstructing traffic (p. 277). However, Forester (1994) further added that bicycles can be parked almost anywhere, and they are parked in many unlikely places. This is where the perceptions from the cyclists come into view as it will determine what should be done and what they need to encourage cycling. This is because it is not necessary to plan for enormous bicycle parking structures in advance of need. In other words, it is rather not required to provide more and more facilities but, in the end, people are not using it. Therefore, it is important to determine where the demand for bicycle parking exists, and accordingly, it is strategically appropriate to start installing a few bicycle parking in the most likely places and observing how well they are used. Likewise, bicycle parking is an important part of a bicycle plan as it provides security for bicycle users at their destinations. According to Aultman (2004), the Association of Pedestrian and Bicycle Professionals (APBP) recommends that bicycle parking needs to be placed within 50 feet or 30 seconds from a building entrance.

### **Safety Aspects**

While discussing cycling from the perspective of the safety aspect, the concern is basically towards the road safety issues which include the fear of danger and personal vulnerability. Fear of accidents, being killed or injured by a motor vehicle, or attacked by another person (Forward, 2003). Due to this situation, cyclists pose little danger to themselves or others and it is primarily the presence of motor vehicles that makes cycling hazardous (Tolley, 1997a). Generally, a person's perception of safety is based on previous experience and that of others. Moreover, there are various explanations for the differences in cycle accident rates and the perception of cyclists about road safety. These include surface conditions, drivers' attitudes for speeding, and drivers' attitudes to vulnerable road users. Therefore, it is important to improve road safety, reduce the dominance of cars and make conditions for vulnerable road users' safety and more attractive bicycle path (McClintock, 2002a). According to Mercat (2003), theft is recognized, by all bicycle use surveys, as the most important factor limiting the development of cycling after road safety concerns. Moreover, for cyclists, it is not only personal safety that is important to them but also bicycle security. Therefore, the safety aspect is crucial and needs to be taken into consideration in planning for cycling to encourage bicycle travel as well as to promote safety for cyclists.

### **Cycling on-campus**

According to Bonham & Koth (2010), a bicycle is something that can be owned and is perfect for campus life. Green transport is often practiced as an active transport system that encourages students to walk or cycle on the campus. With this active transport practice, the use of private vehicles on campus is reduced and thus can be a strategy to reduce traffic congestion and pollution on the campus. Cycling also suitable transportation that can be practiced by those who stay in close distance. As a matter of interest, cycling does not create pollution nor wasted resources (Tolley, 1996). Among the successful universities which have encouraged the students and staff to use active transport is the University of California, Berkeley, in the United States. As for traveling on campus, 50% involves active transport, either by walking or a cycling trip, 20% use public transport and the remaining 30% use private vehicles (Siti et. al., 2019).

In Malaysia, the cycling nature on campus is still far behind from other countries. In the IIUM, cycling is not a prior choice for the community due to many factors. Meanwhile, the university authorities are still in the process of preparing a cycling planning development for a better environment and sustainability. At the University of Malaya (UM), the campaign on sustainable transport systems has been introduced in early 2018. By preparing guidelines and also the provision of infrastructure on the campus, this university seems to be very serious in achieving sustainable transport development. The shared lane road markings (sharrow) had been installed as a guide for cycling routes along part of the Lingkungan Budi route in the UM campus as an initiative to increase and encourage cycling activities among the campus community. They also have had introduced Public Bike Sharing Program (O-BIKE), Electric Scooter (E-SCOOTER@UM), and Electric Bike (UNIRIDE E-BIKE) to the community as a medium to use cycling on the campus. Meanwhile, the awareness programs were also conducted to educate and promote green transport usage in the UM campus by organizing roadshows on the promotion of Green Transport in the UM Campus and the introduction of shared lane road markings. A series of bicycle clinics were also conducted to introduce students to cycling skills and maintenance.

### **RESEARCH METHODOLOGY**

The goal of this study is to determine the factors affecting bicycle use in IIUM based on cyclists' opinions. In achieving the goal of this study, several objectives were formulated. The objectives are (1) to survey the existing cycling conditions in IIUM, (2) to evaluate students' opinions on bicycle use in IIUM campus, (3) to determine the factors influencing the use of cycling in IIUM, and (4) to recommend measures for increased use of cycling on the campus. The primary data were collected from site observation and questionnaire surveys targeting students who were using bicycles for commuting in the IUM Gombak campus. The observational survey was conducted to identify the existing cycling conditions in the study area and to support the views of the target group on cycling by administering a questionnaire survey. Some of the data that were collected are the availability of bicycle lanes on the campus, the route taken by the cyclists on the campus, the availability of bicycle parking on the campus (Kulliyyah, Mahallah, Library, Mosque, Clinic, Central complex, and Sports complex). The questionnaire survey was administered by using a revealed-preference approach that relates to the actual choices and behaviors of the target group in the real transportation environments. In this study, a revealed preference approach was used to identify the respondents' modes of transport and the routes taken to commute by bicycle around the campus. Some of the questions in the questionnaire used Likert-scale, in which the respondents were asked about their agreements on certain statements. These statements include the availability of adequate bicycle parking on-campus,

frequency of facing security issues, agreement on the provision of bicycle infrastructure, and the importance of encouraging students to use bicycles on-campus.

The site observation was conducted by observing the routes taken by the bicyclists to commute from their Mahallahs to other locations. It was observed by snapping photos and recording the routes on a base map. This method was used at five main road junctions that are expected to have a high number of bicyclists commuting from their Mahallahs to Kulliyahs or other places. The observation was conducted from 8 to 9 in the morning and 1:30 in the afternoon. During these times, the students were usually heading to the Kulliyahs for attending classes. The observation was also conducted on different days at each selected point. This observation was made five days to observe the commuting routes taken by the bicyclists on-campus. This method was also used to observe whether the bicyclists use either the main road or pedestrian walkways to reach their destinations. The availability of bicycle parking on the campus (at Kulliyah, Mahallah, Library, Mosque, Clinic, Central complex, and Sports complex) and the location where bicyclists usually parked their bicycles were also observed. A self-administered questionnaire survey was conducted to understand the perceptions of the cyclists on the existing bicycle infrastructure in the study area. This survey was carried out at various locations such as Kulliyahs, Mahallahs, Library, Sports complex, Central complex, and Clinic on weekdays. These locations were chosen presuming that the target group would commute to these places by using bicycles. The secondary data for this study were obtained from the Students Affairs and Development Division in IIUM. The data collected include a map of the IIUM Gombak campus to know the layout details of the study area. The primary data were analyzed by using both univariate and bivariate statistical techniques.

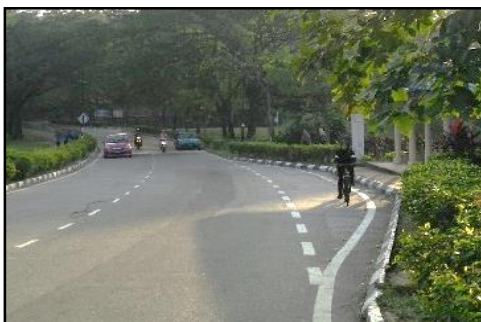
## DATA ANALYSIS AND FINDINGS

### 1) Observation Analysis

In this part of the analysis, an observation survey was carried out around the IIUM Gombak campus and the elements that have been observed were the provision of existing bicycle facilities on the campus. The safety aspects such as cyclists' safety while cycling within the campus were also observed, for example, the traffic conditions involving motorized vehicles.

#### Existing bicycle track

There were no proper bicycle tracks provided for the cyclists on the campus. Cyclists normally move on the shared roadways in which both cyclists and the motorists share the same travel lane of the road network. In other words, there is no special lane provided for the bicycle users on the campus (Figure 4 and 5).



**Fig. 4** Cycling on the major road



**Fig. 5** Cycling on the pedestrian walkway

### Existing bicycle parking

From the observation, it can be concluded that most of the cyclists parked their bicycles very near to the building entrance, and locked their bicycles by tying-up with trees or lamp posts (Figure 6 and 7). This was due to the lack of proper bicycle parking spaces provided for the cyclists on the campus. However, there were proper bicycle parking spaces provided for the cyclists at the Mahallahs (Figure 8).



**Fig. 6** Bicycle parked and locked at the lamp post



**Fig. 7** Bicycle parked and locked near the tree



**Fig. 8** Bicycle parking at Mahallah

### Safety Aspects

In terms of safety aspects, it was observed that the traffic speed of the motorists can affect the safety of other non-motorized transport users including cyclists and pedestrians. The speeding of motorized vehicles can expose increasing risks of an accident involving cyclists. Even though the maximum speed allowed for motorized vehicles on the campus is 30 km per hour but there were still motorists not following the speed limit on the campus. Additionally, it was also identified that certain drivers were found traveling against the one-way traffic direction on the campus. This behavior may create conflicts between motorized vehicles and cyclists affecting the safety of both users. Besides, there were no clear road signages provided in the study area to remind motorists about the shared travel lane with the cyclists. From the observation, it can be concluded that the provision of bicycle facilities in the study area especially bicycle track was not provided and bicycle parking spaces were very much lacking to serve the cyclists' needs. Moreover, the traffic conditions in the study area also do not promote safety for cyclists.

## 2) Analysis on Socio-Economic Characteristics of the Respondents

In this part of the analysis, the frequency distribution on the socio-economic variables of the targeted respondents was generated. The frequency analysis is a descriptive statistical method that shows the number of occurrences of each response chosen by the respondents on a variable.

### Background of respondents

#### *Gender*

The total number of samples chosen in this study was 100 samples. The majority of the respondents were male which is 58% and the remaining 42% were female. The male respondents were slightly higher than the female counterparts.

#### *Mahallah (Hostel)*

The respondents in the survey were selected from all the Mahallahs in IIUM. The highest number of respondents was from Mahallah Ali with 11 respondents (11 percent) out of 100 followed by Mahallah Bilal and Mahallah Faruq with nine respondents (9 percent) each. The least number of respondents were from Mahallah Hafsa and Mahallah Nusaibah with only two respondents each.

### *Kulliyah (Faculty)*

The highest numbers of respondents in the survey were from the Kulliyah of Engineering (KOE) which is 14 respondents followed by Kulliyah of Education (KOED) and Kulliyah of Law (AIKOL) with 13 respondents each. The least number of samples was from CELPAD constituting only seven respondents.

### *Year of study*

Most of the respondents were third-year students, followed by second-year students. The least number of respondents comes from other than fourth-year students with 2%.

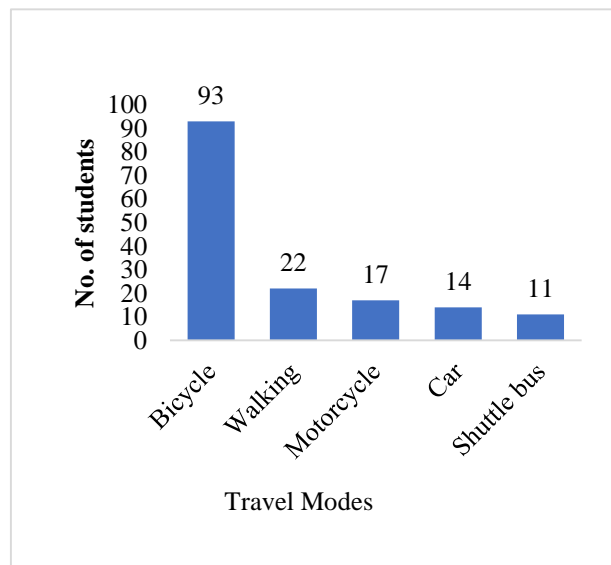
### *Type of transport owned by students*

Only six respondents do not own a bicycle whereas the other 94 respondents owned a bicycle. 17 percent of the respondents also owned a motorcycle and 18 percent owned a car. It shows that some of the respondents owned more than one mode of the vehicle.

## **Travel characteristics**

### *Main travel modes*

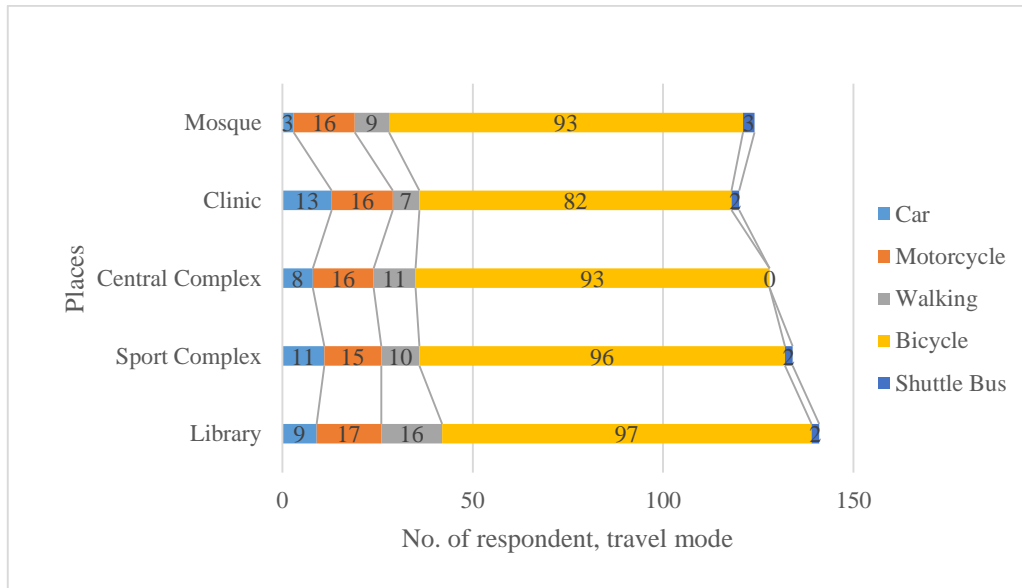
The findings from the sample show that the bicycle is the most common travel mode chosen by the respondents with 93 percent. Figure 9 also shows that the respondents not only use bicycle but also car (14%), motorcycle (17%), walking (22%), and shuttle bus (11%) to travel around the campus. The respondents were further asked about their travel mode choice to each of the places in IIUM such as mosque, clinic, central complex, sports complex, and library.



**Fig. 9** Main travel modes of respondent

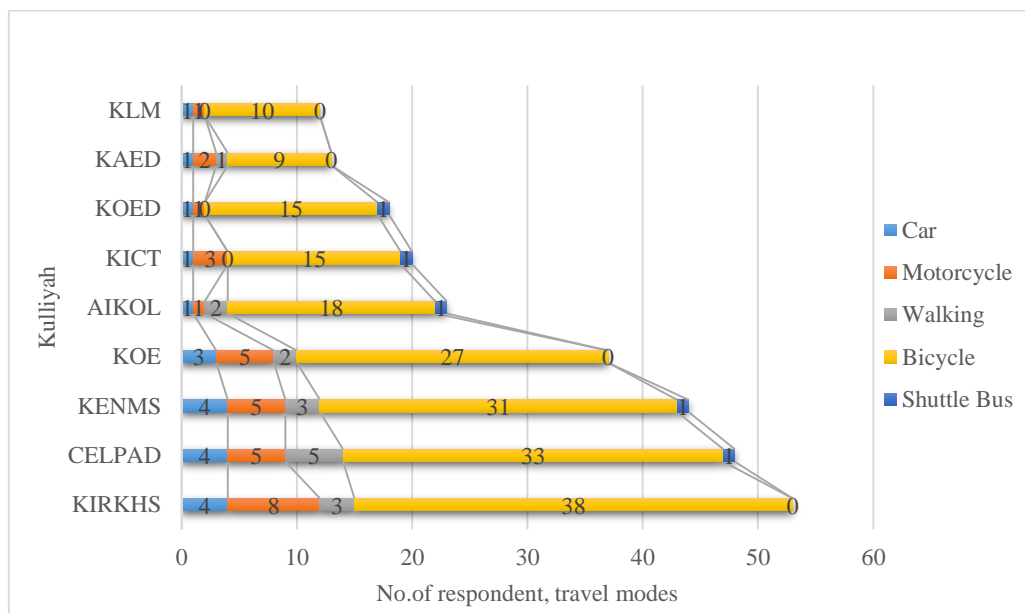
Based on Figure 10, the respondents were seen to be choosing bicycles to travel to each of these places. More than 80% of the respondents use bicycles to reach to these places. On the other hand, the number of shuttle bus users was the least among all the travel modes of transport.





**Fig. 10** Main travel modes used by respondents to visit places

Based on Figure 11, the respondents were predominantly used the bicycle to travel to Kulliyah, followed by motorcycles.



**Fig. 11** Main travel modes used by respondents to Kulliyahs

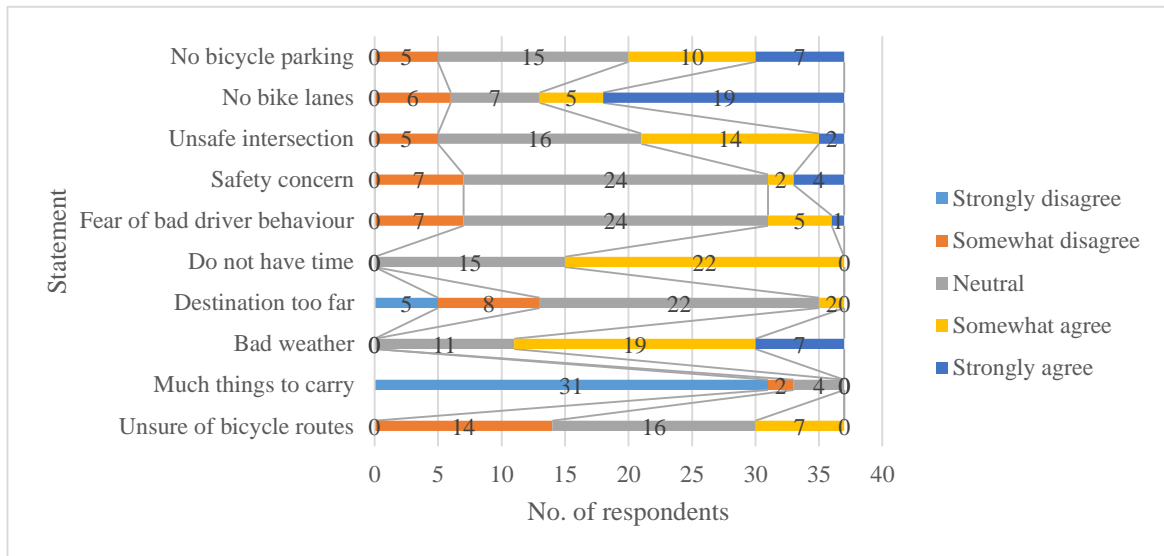
### Opinions on the use of bicycle

#### *Frequency of cycling*

The findings show that 37% of the respondents were cycling frequently on this campus. They use the bicycle for about three to five days a week. Next, 26% of respondents use bicycles very frequently, which is almost every day. 5% of the respondents use bicycles very rarely on this campus. 37% of the respondents use bicycles very rarely, rarely, and occasionally.

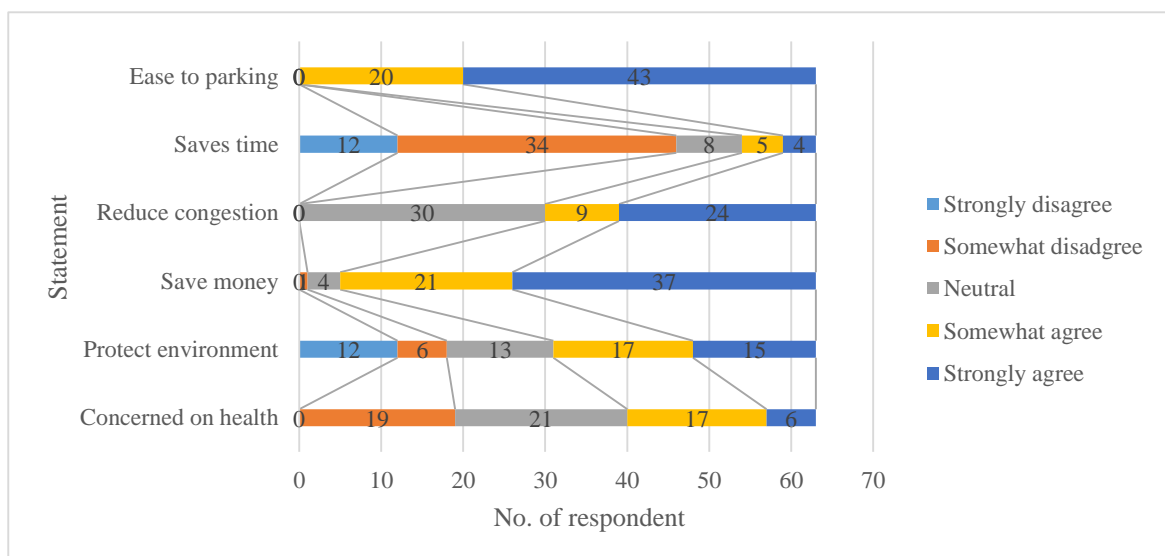
*Reasons that exhibit and inhibit from using bicycle on-campus*

Figure 12 shows the reasons for not using bicycles on-campus. The respondents were mostly neutral on each of the reasons against using cycling on-campus. Some respondents also somewhat agreed with all the given statements except “many things to carry”. 31 respondents strongly disagreed with the reason that they have “many things to carry” for not using cycling on-campus. Moreover, some of the respondents were neutral and agreed that “bad weather” is another reason for not cycling on-campus.



**Fig. 12** Reasons for not cycling on-campus

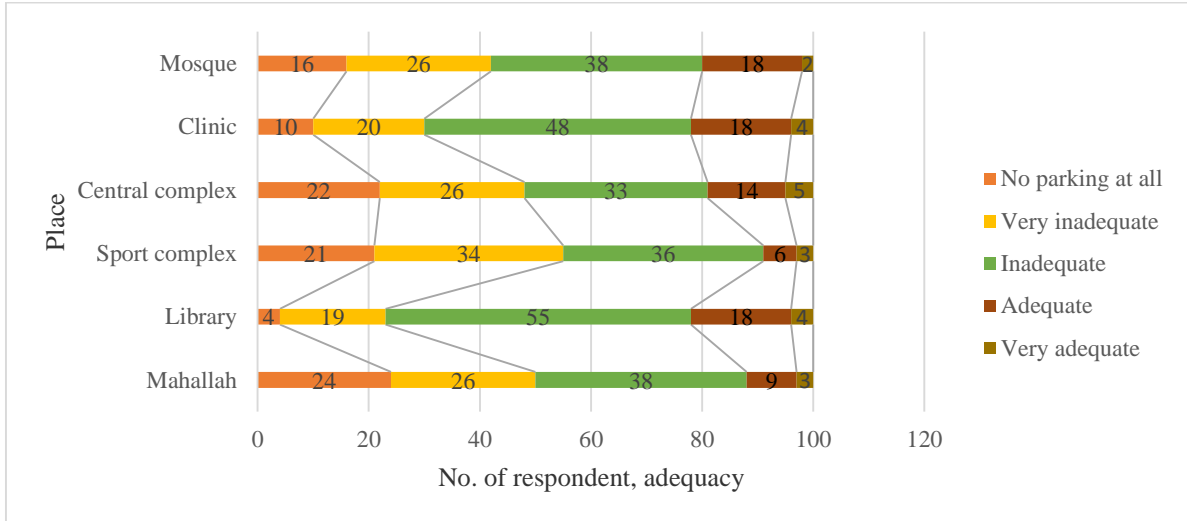
Regarding the reasons that motivate the respondents to use bicycles on-campus, the majority of them strongly agreed that the “ease to park bicycle” as one of the main reasons for using bicycle on-campus. They also somewhat disagreed on “cycling saves time” as the reason for using the bicycles for their travel on campus. On the other hand, “concern on health” is not the reason for using bicycles on-campus as perceived by a sizeable number of respondents. Figure 13 shows these findings.



**Fig. 13** Reasons motivate to use bicycle

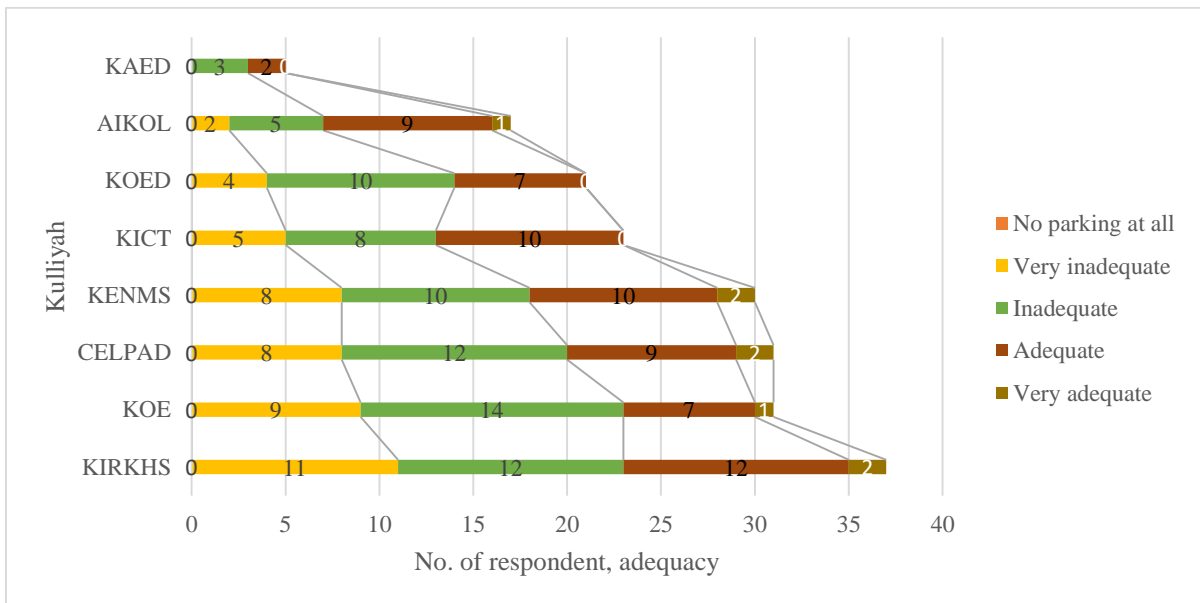
*Parking adequacy*

Figure 14 shows the respondents' opinion on parking adequacy near the Mosque, Clinic, Central Complex, Sports Complex, Library, and Mahallahs. It shows that all these places were having inadequate bicycle parking spaces. Some of the respondents also stated that there were no bicycle parking spaces at all near these places. It can be concluded that the bicycle parking spaces near all these places were either inadequate, very inadequate, or no parking spaces at all as stated by more than 80 percent of the respondents.



**Fig. 14** Parking Adequacy

Figure 15 shows that all the Kulliyahs have bicycle parking spaces, but, very inadequate except near the Kulliyah of Architecture and Environmental Design (KAED). A very low number of respondents stated that the bicycle parking at the Kulliyahs was very adequate. It means that most of the bicycle users had difficulties finding parking spaces to park their bicycles at the Kulliyahs.



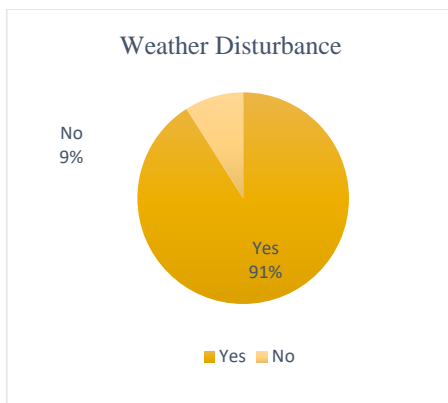
**Fig. 15** Parking adequacy by Kulliyahs

*Security issues*

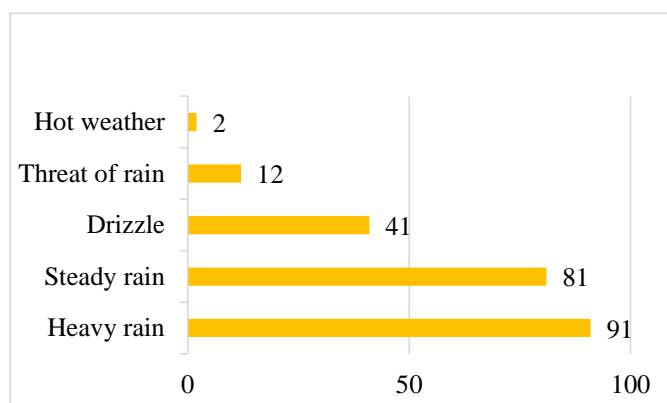
The questions on the security issues for example bicycle theft and vandalism were also asked to the respondents. A small number of respondents (13%) had experienced security issues. The remaining 87 percent did not experience any security issues when using bicycles. Only 13 respondents who had experienced security issues, seven of them experienced this issue at their Mahallahs. All seven cases occurred very rarely. Furthermore, a small number of respondents had also experienced this issue at their Kulliyahs. CELPAD has recorded the highest number of cases followed by AIKOL, KENMS, and KIRKHS.

*Weather Conditions*

The survey findings show that only nine percent of the respondents were not affected by adverse weather conditions. On the other hand, 91 percent of the respondents did not use their bicycles during adverse weather conditions. Only two respondents stated that they do not ride their bicycle during hot weather conditions.



**Fig. 16** Weather Disturbance



**Fig. 17** Conditions that prohibit cycling

*Bicycle routes chosen by the respondents*

Figure 18 and Figure 19 show the major routes chosen by the respondents to access Kulliyahs and other major places from their respective mahallahs. The respondents would, usually, choose the shortest route to reach their destinations by bicycle. It also shows that each of these places has different selected routes by bicycle users except to the Mosque and Library.

All these routes were seen using the main road as a connector road except to the male sports complex because this place can be accessed by a minor road from Mahallah Zubair to Mahallah Uthman (Refer to Figure 18). To reach various Kulliyahs, all the routes were through the main road except to Kulliyah of ICT (KICT) and Kulliyah of Education (KOED) where the respondents used pedestrian walkways (Refer to Figure 19).

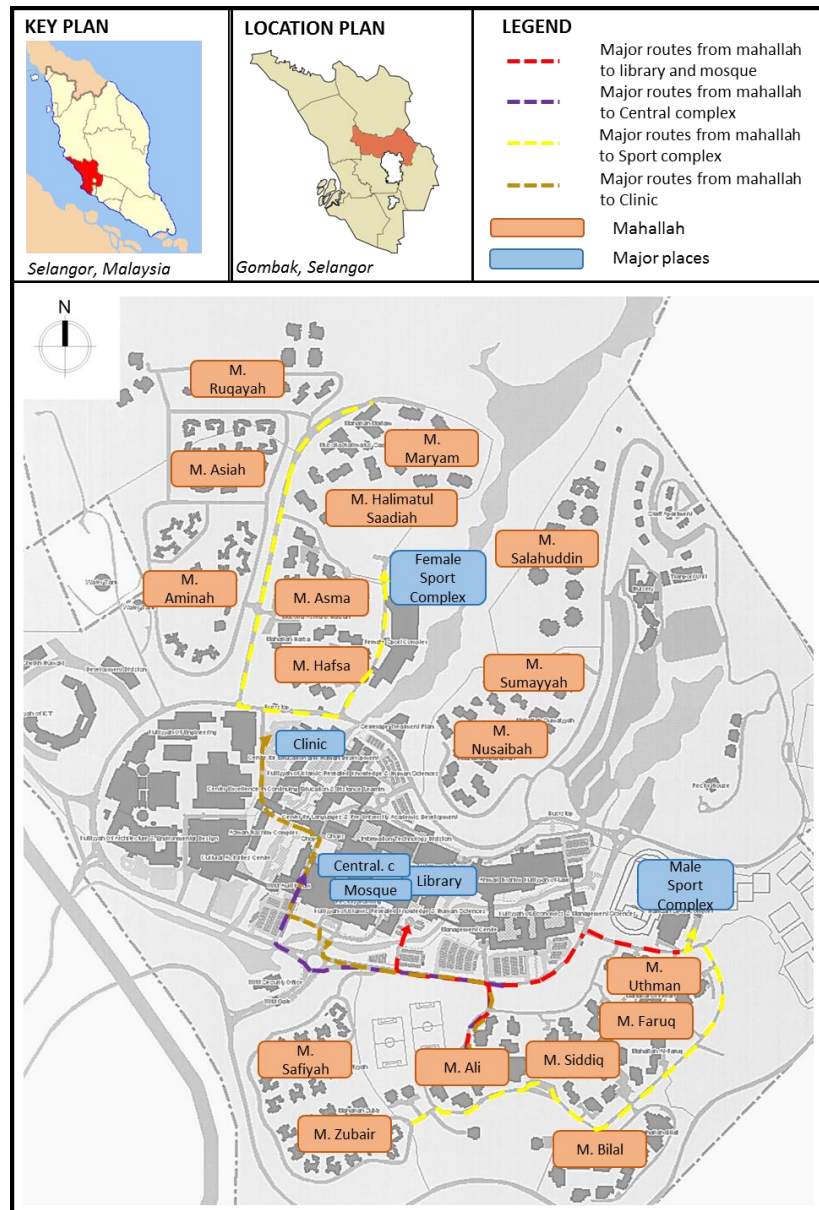


Fig. 18 Routes chosen by bicycle users to access various location

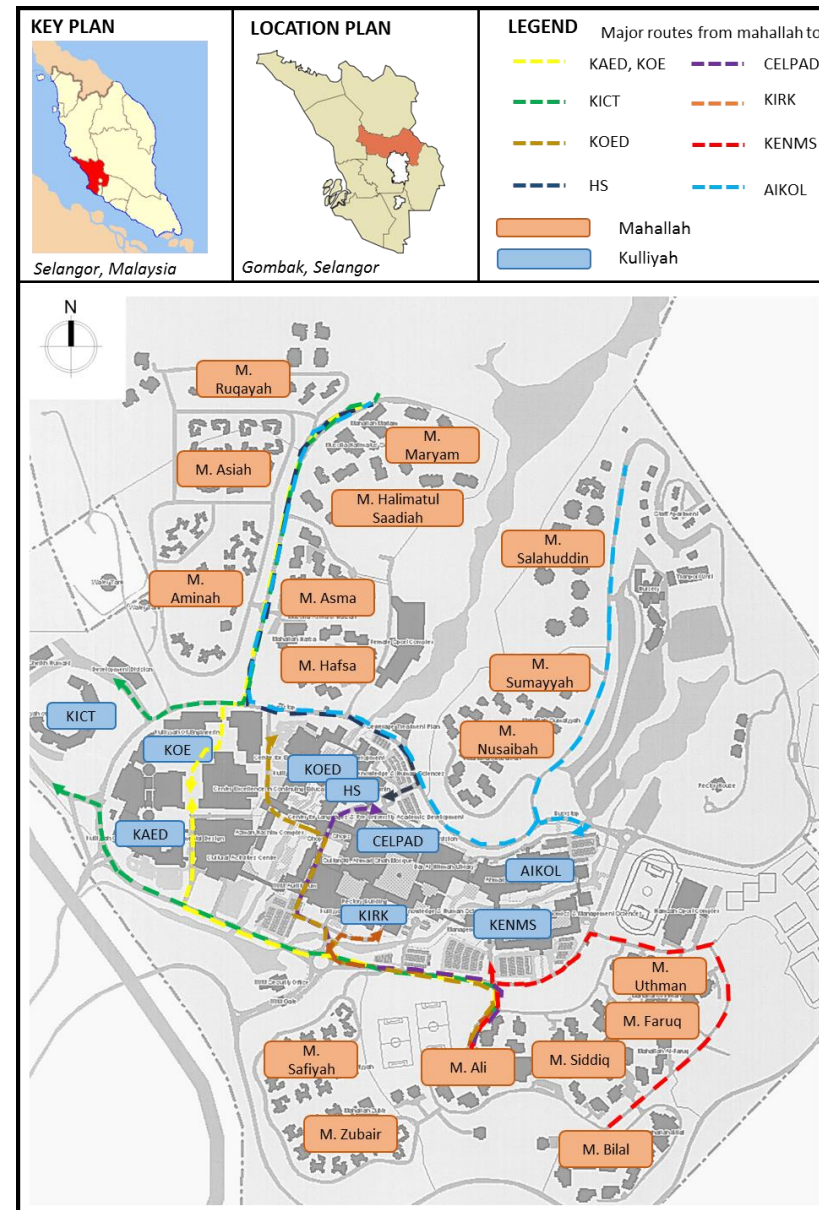


Fig. 19 Routes chosen by bicycle users to the Kulliyahs

*Factors that encourage students to bike more frequently*

The Relative Importance Index (RII) method was used to know the level of importance of the factors that encourage students to bike more frequently. These factors were ranked from 1 to 12 with 1 representing the most important factor and 12 the least significant factor. The findings on RII on each of the factors are shown in Table 1. “Maintenance of routes” is the most important factor that encourages the students to bike more frequently followed by “segregated cycle path” as the second most important factor. “Helping students to improve their biking skills and confidence” is the least important factor to encourage them to bike more frequently.

**Table 1** Factors that encourage to bike more frequently

Statements	Frequency of Respondents					RII**	Rank
	(1)*	(2)*	(3)*	(4)*	(5)*		
Maintenance of routes	0	0	12	42	46	0.868	1
Segregated cycle path	0	0	11	46	43	0.864	2
Shortest distance from the origin to destination	0	0	13	45	42	0.858	3
Improved security	0	0	14	44	42	0.856	4
Adequate bicycle infrastructure (bicycle parking, bicycle lanes)	0	0	15	43	42	0.854	5
Reducing vehicle speed/volume	0	2	14	42	42	0.848	6
Clear signage	0	4	45	23	28	0.750	7
Continuous route with little or no stopping	0	6	39	33	22	0.742	8
Wide cycle paths/cycle lanes	0	3	41	42	14	0.734	9
More courteous vehicle drivers	0	18	27	36	19	0.712	10
Discount to buy a bicycle	2	19	41	27	11	0.652	11
Help with improving my biking skills and confidence	12	27	28	21	12	0.588	12

\* (5) Very Important, (4) Important, (3) Moderately Important, (2) Slightly Important, (1) Not Important  
 \*\* RII = Relative Importance Index

**3) Bivariate Analysis**

*Relationship between gender and security issues experienced*

**Table 2** Relationship between gender and security issues experienced

		Security issues experienced		Total
		No	Yes	
Gender	Male	50 (57%)	8 (61%)	58
	Female	37 (43%)	5 (39%)	42
Total		87 (100%)	13 (100%)	100

The relationship between gender and security issues experienced shows that 61% of those who had experienced security issues were male whereas the remaining were female. It shows a higher possibility of bicycle theft or vandalism was found among the male students than the female counterparts. These findings are shown in Table 2.

*Relationship between cycling frequency and year of study*

**Table 3** Relationship between cycling frequency and year of study

		Cycling Frequency					Total
		Very Rarely	Rarely	Occasionally	Frequently	Very frequently	
Year of Study	ONE	3	1	2	7	9	22
	TWO	0	3	2	8	11	24
	THREE	1	5	6	9	4	25
	FOUR	1	4	4	6	1	16
	>FOUR	0	0	2	0	0	2
	CFS	0	1	2	7	1	11
Total		5	14	18	37	26	100

The relationship between these two variables shows that the second-year students were cycling more frequently than others. This is followed by first-year students with nine of them were cycling very frequently on campus. It can be concluded that most of the respondents who were cycling frequently on-campus were first to third-year students. Table 3 shows the findings on the relationship between these two variables.

*Relationship between cycling frequency and gender*

**Table 4** Relationship between cycling frequency and gender

		Cycling Frequency					Total
		Very Rarely	Rarely	Occasionally	Frequently	Very frequently	
Gender	Male	1	6	10	20	21	58
	Female	4	8	8	17	5	42
Total		5	14	18	37	26	100

The findings show that the male students were cycling very frequently than the female students. Among the female students, a high number of these students was found cycling frequently on-campus. The relationship between these two variables is shown in Table 4.

**DISCUSSION AND RECOMMENDATIONS**

Overall, the willingness to continue cycling in the future was overwhelmingly expressed by the students. To facilitate and increase the use of cycling among the IIUM community in the future, it is required to improve the bicycle infrastructure on the campus. The respondents stated that the bicycle parking facilities were inadequate, and the incidents of bicycle theft were also related to the lack of secured bicycle parking. The opinion of the respondents on the bicycle infrastructure, facilities, and services can influence an increase in the number of students using the bicycle for their commute on-campus. The provision of bicycle facilities especially bicycle track/lane on the main and secondary roads and bicycle parking is vital to increase the use of the bicycle on the campus. The bicycle lane should be provided with adequate road signages and road markings which would help to warn motorized vehicles to slow down their vehicles to improve the safety of the bicycle users.

The other recommendation on bicycle facility which is vital to encourage cycling activities is bicycle parking especially at the locations where the demand is high. From the survey, it was observed that the cyclists usually parked and locked their bicycles by tying-up with the trees, lamp posts, railings, and so on. Hence, it is important to pay careful attention when providing bicycle parking such as bicycle racks, so that the cyclists have more convenient places to park and lock their bicycles. The bicycle parking should be located near the building entrances to reduce the walking distances from the parking space to the buildings. These parking facilities should be located in an open space with shelter and sufficient security to protect from bicycle thefts. Organizing programs and campaigns is the other recommended measure to increase the awareness of the cyclists on the importance of cycling on-campus among the student population. Through this initiative, it is expected that the number of cyclists on-campus will be increased. These education programs can be organized by the student representative council in cooperation with the security units of the University. All of these initiatives are expected to realize in creating a low carbon campus and thus supporting the Sustainable Development Goals (SDG) policy.

## CONCLUSIONS

It is well understood globally that cycling is one of the sustainable modes of transport that must be used at a wider scale for greater benefits to the community. It helps to decrease the environmental damages that it may induce as a result of an increase in air pollution. Despite the various health and environmental benefits that are associated with cycling, its penetration level in many places including University campuses still stands at a very low level. Universities are the perfect places where the use of bicycles can be introduced at a wider scale because of the shorter commuting distances between one point of location to another point. This study is an attempt to gauge the perceptions of the cyclists on the existing supporting infrastructure and facilities that would help to increase the use of bicycles among the IIUM community on a wider scale. The responses from the cyclists indicate underlying issues about the use of bicycles on-campus. These issues must be addressed forthwith if there is a clear plan to increase the use of cycling on-campus. In line with the findings of this study, few recommendations were proposed to increase the use of bicycling on-campus. With these recommendations, it is expected that the use of bicycles on-campus will be increased proportionately. However, it depends very much on the level of enforcement being applied to minimize the use of motorized vehicles on-campus.

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