

## Quality of Bicycle Sharing Scheme and Its Impact on Level of Usage: A Study of Obike in University Malaya Campus

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**Abstract:** Recently in 2018, there is a hike in the number of bicycle sharing schemes in Malaysia. The concept of public bicycle sharing schemes rose in Kuala Lumpur, Melaka, Penang and even small town like Taiping. The scheme not only operated because of tourism purposes but also to promote non-motorized transportation to reduce traffic congestions. Other benefits includes reduce carbon emission and fuel use. The other benefits of this schemes is as a support for transit connection, by acting as a ‘first mile’ and ‘last mile’ mode of connection. Various issues related to the development of this scheme encourage for a study to be conducted on bicycle sharing schemes that encompasses the end-user opinion that resulting in the lack of consideration in providing the schemes. Thus, this research study is conducted to assess and identify area of improvement of bicycle sharing schemes provision by exploring the current usage and quality of bicycle sharing schemes provided in University Malaya campus.

*Keywords:* Obike, Transport, Bicycle

### 1. INTRODUCTION

Public bicycle sharing schemes have been exist for almost 50 years. It was first launched in Europe in 1965. The occurrence and popularity of the bicycle sharing schemes have been increase for the last decade (S. Shaheen, Guzman, & Zhang, 2010). Public bicycle sharing schemes means the facility of bicycles to enable short-term rental from one docking station to another (Fishman, Washington, & Haworth, 2013). These bikes usually come with technologies that can track movement, from one docking station to another, and with integrated global positioning system (GPS), the bike’s movement through the network. Public bicycle sharing programmes can be categorizes into four generations based on their operational and logistical development based on review of the literature. The earliest generation of bicycle sharing scheme be found in Europe and known as “White Bikes” (or Free Bike Systems). These bicycles were unlocked, and public can use it for free. Then, the second generation known as “Coin Deposit Systems”. It required users to insert a refundable deposit to unlock and use a bicycle. Unfortunately, these two schemes failed because vandalized bicycles, stolen bicycles, and lack of time constraints on their use. The third generation known as “IT-Based Systems”, employ designated docking stations and smart technology. The third generation became widely recognized because it was designated docking stations and smart technology for bicycle check-in and check-out (S. A. Shaheen, Zhang, Martin, & Guzman, 2011). Since then, the number of bicycle sharing scheme increase globally with the awareness of traffic congestion, greenhouse gas emissions and others. The fourth generation is integrated with larger public transport systems via smart cards as a key

feature. The new generation may also introduce various types of bicycles for an example electric bikes and bicycle redistribution systems (Guo, Zhou, Wu, & Li, 2017).

Based on (Litman, 2011) “Mobility refers to physical movement, measured by trips, distance and speed, such as person-miles or –kilometers for personal travel, and ton-miles or tonne-kilometers for freight travel. All else being equal, increased mobility increases accessibility: the more and faster people can travel the more destinations they can reach”. The writer developed the “green transport hierarchy” in the context of multimodal transport planning. Walking and cycling are the top of the hierarchy following public transport, service and freight vehicles, taxis, multi-occupant vehicles and lastly single-occupant vehicles are to be considered. Sustainable transportation is the basic concept of bicycle sharing scheme (Midgley, 2009). He has differentiated the latest generation of bicycle sharing schemes with the traditional in the following ways:

- The bicycles can be rented at one location to another location or returned there;
- The bicycles provide fast and easy access of the bicycle;
- The bicycles have variety of business model;
- The bicycles make use of applied technology such as smart card or smart phones; and
- The bicycles are sometimes designed as part of the public transport system.

According to Midgely, bicycle sharing schemes have been operate 78 cities in 16 countries using around 70, 000 bicycles until 2009. There are many bicycles sharing schemes that have been introduced around the globe. Most of its are depend on its function as different area has different problem. Thus, they will tackle the problem in different way. Other than that, there are also various type of bicycle sharing scheme throughout the country. Table 1 below shows the distribution of bicycle sharing schemes by country.

Table 1: Distribution of bicycle sharing schemes by country.

Country	Systems	Bicycle Fleet	Bicycle Stations
Australia	1	n/a	n/a
Austria	1	1,540	58
Belgium	1	250	23
Canada	1	2,400	300
China	2	200	2
Denmark	2	2,400	167
France	2	39,798	2,643
Germany	6	5,800	n/a
Italy	19	2,563	246
Luxembourg	1	250	25
Norway	3	1,575	153
Portugal	1	350	33
Spain	6	9,689	720
Sweden	2	2,125	191
UK	5	198	59
USA	1	100	10
Total	78	69,238	4,630

(P. J. J. Midgley, 2009)

Generally, bicycle sharing schemes were familiarized to grow choices of mobility, improve air quality and to reduce traffic congestion in urban area. There are many reasons of

why these bicycle sharing has been introduced throughout the world. Most of the schemes were introduced to improve transportation in urban area and to promote sustainable transportation. The following table is lists of the objectives as expressed by some cities for their respective systems (Curran, 2008).

Table 2: Objectives of bicycle sharing schemes around the world.

(Curran, 2008)

System	Objectives
Barcelona, Spain	<ul style="list-style-type: none"> <li>• Improve interchange between different modes of transport and promote sustainable travel.</li> <li>• Create a new individual public transport system for citizen' habitual travel needs.</li> <li>• Implement a sustainable, health inducing service fully integrated with the city's public transport system.</li> <li>• Promote the buke as a common means of transport.</li> <li>• Improve quality of life, reduce air and noise pollution.</li> </ul>
Goteborg, Sweeden	<ul style="list-style-type: none"> <li>• Raise the status of cycling.</li> <li>• Promote using bicycles for short distance trips.</li> </ul>
Lyon, France	<ul style="list-style-type: none"> <li>• Help create a more sustainable transportation system in the region by launching a public bicycle system that provides a new mobility option for short trips.</li> <li>• Help achieve transport and land use planning objectives including pollution emission reductions, reduced traffic congestion, road and parking cost savings, consumer cost savings, energy conservation, reduced crash risk, improved public health, and support for smart growth land use development.</li> </ul>
Montreal, Canada	<ul style="list-style-type: none"> <li>• Encourage the use of public bicycles instead of cars for short, inner-city trips.</li> </ul>
Paris, France	<ul style="list-style-type: none"> <li>• Act on air quality and public health.</li> <li>• Improve mobility for all.</li> <li>• Render the city a more beautiful and agreeable place to live in.</li> <li>• Encourage economic vitality.</li> <li>• Reinforce regional solidarity.</li> </ul>
Washington, D.C.	<ul style="list-style-type: none"> <li>• Provide as many transportation options as possible and reduce the level of congestion, especially downtown.</li> </ul>

The NICHES (New and Innovative Concepts for Helping European Transport Sustainability) project (Bührmann, 2007) 2008 has developed checklist to help policy makers design and plan for a successful bicycle sharing programmes. Below is the following checklist:

Table 3: Checklist for bicycle sharing scheme.

Criteria	Checklist
City Size	<ul style="list-style-type: none"> <li>• Most suitable for medium to large cities (&gt; 200,000 populations).</li> </ul>
Implementation Time	<ul style="list-style-type: none"> <li>• Short term (&lt;2 years)</li> </ul>
Stakeholders' Involvement	<ul style="list-style-type: none"> <li>• For service implementation and operation: Rail or public transport operators, street furniture companies, advertising companies or local authorities;</li> <li>• For political and financial support: local authorities, user associates.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• For service implementation and operation: Rail or public transport operators, street furniture companies, advertising companies or local authorities;</li> <li>• For political and financial support: local authorities, user associates.</li> </ul>
Costs	<ul style="list-style-type: none"> <li>• Principal cost factors include staff needed for operation, service and maintenance; bicycle cost and parking and service terminals.</li> <li>• In most cases, financial backing is needed as most of the schemes are not financially self-supporting.</li> </ul>

(Bührmann, 2007)

There are six components of bicycle sharing schemes which are bicycles, docking stations, system access and user registration, system status information system, maintenance programmes, and bicycle redistribution mechanism (P. J. U. N. Midgley, Department of Economic & Affairs, 2011). For the first component is bicycle. The bicycles need to be easy to use, adaptable to users of different sizes, mechanically reliable, resistant to vandalism or theft, and distinctive in appearance. Next, docking stations. Based on Peter Midgely, there are three categories of docking stations that are fixed-permanent (bicycles are locked to designated racks when not in service), fixed-portable (the bicycles stands are mounted onto sets of rectangular platforms), and flexible (bicycles do not need to be locked to designated racks or stations). Obike bicycle scheme is fall under the third category for docking stations that is flexible. The bicycles need to have easy access and simple registration to encourage new user to use it. There are two kind of locking technologies for bicycles sharing schemes. First, the bicycles are checked out from automated bicycle rack using smartcard or magnetic strip card and the second technology is the bicycles are checked out using mobile phone. Bicycle sharing scheme systems also provide real time information for the bicycles availability. Other than that, maintenance programmes that are always become an issue for every public bicycle sharing schemes provided as all the bicycles provided need to be taken care of everyday. Lastly, bicycle redistribution mechanisms. The bicycles should be located at suitable places such as a place that have a demand for it or city centre.

## 2. EXISTING USAGE OF BICYCLE SHARING SCHEMES

The findings on the usage condition of bicycle sharing schemes are comprised of usage of bicycle sharing schemes that are focus on total sign-up user, total bikes deploy, total trips, total distance ride (km), total carbon emission saved (kg), and total trips per month. The analysis for this study will achieve the first objective of this study that is to identify bicycle sharing concept in University of Malaya.

As according to the site observation that have been made and primary data that have been collected, Obike was based from Singapore and it was a stationless bicycle sharing system and had operated in several countries such as Australia, Germany, Hong Kong and many other countries including Malaysia. Obike started operation in January 2017 while in University of Malaya, Obike started its operation in August 2017 and ended its operation in University of Malaya in August 2018. Obike bikes have a built in Bluetooth lock. These bikes can be left anywhere around in the campus at the end of the journey as it is a dockless bicycle sharing system. In University of Malaya, these bikes have been located in various places and there are stations for these bikes located around in the campus. Refer to figure three below for more details about the bicycles. These bicycles are single speed with a plastic chainguard, short mudguards on both wheel, front and rear rim brakes. To make use of this bikes, users must download the Obike application, then register and pay a deposit or just use it first. The app was used to rent these bikes and return it. Users are charged by 15 or 30 minutes, then the payment charged to their account.

To ride these bicycles, users must have an internet connection and Bluetooth enabled



Figure 1: (A) Obike parked in front of Science Faculty in University of Malaya, (B) Obike that have been vandalised.

*Source: Fieldwork, 2018*

on their mobile device to enable unlocking of their desired bicycles. It can be done by scanning the QR code or entering the corresponding bicycle number. If successful, the lock on the rear wheel opens automatically. Once users finish their ride, they need to manually lock and leave the bike in any parking spot to be ready for the next user. At the time of locking the bike the user must again ensure they have a Bluetooth and an internet connection, in order for the oBike system to record the end of the ride and correctly calculate the hire charge. There were many issues that have raised because of the dockless system as it become a public nuisance that users locked their bicycles anywhere such as on pedestrian walkway, car park, and other places that should not be placed. Other than that, these bikes also have been vandalised. Refer to Figure 4 below for more details.

Descriptive analysis is used in this study to summarize, organize and simplify data to be more manageable. It is one of statistical procedure that always been used for research analysis. Descriptive analysis helps to summarize large amounts of data in more functional way. For this study, there are four section that was asked to the respondents:

- I. Demographic profile of the respondent
- II. Purpose and frequency of respondents' bicycle travel
- III. Quality level of bicycle sharing scheme

#### IV. Respondents' overview of bicycle sharing schemes

S. Shaheen et al., (2010) has outline the benefits of bicycle sharing schemes, which can be summarized as:

- Flexible mobility,
- Emission reductions,
- Individual financial savings,
- Reduced congestion and fuel use,
- Health benefits; and
- Support for multimodal transport connections, by acting as a 'last mile' connection to public transport.

### 3. METHODOLOGY

A questionnaire survey was used to achieve research objective and to understand the perception on the quality level of bicycle sharing schemes among students in University of Malaya. It is focus on the user demographic profile as well as to get the perception towards these bicycles sharing scheme that provided in the campus. The survey will ask the respondents to rate it based on their experience and opinion towards the schemes. There are five variables in this study which are the purpose of the travel, the frequency of the travel, students' perception towards quality level of bicycle sharing scheme and students' overview of bicycle sharing schemes provided in the campus of University of Malaya.

Table 4: Methods of research study.

Research Question	Research Objective	Method	
		Data Collection	Data Analysis
What is the current usage of bicycle sharing schemes Malaysia and University of Malaya in particular?	To identify bicycle sharing schemes concept in University of Malaya in particular.	<ul style="list-style-type: none"> <li>• Site observation,</li> <li>• cycling experience</li> </ul>	<ul style="list-style-type: none"> <li>• Pictures of existing condition</li> </ul>
What is the satisfactory level of using bicycle sharing schemes in University of Malaya?	To examine the the quality level of bicycle sharing schemes in University of Malaya.	<ul style="list-style-type: none"> <li>• Cycling experience</li> <li>• Questionnaire survey</li> </ul>	<ul style="list-style-type: none"> <li>• Descriptive analysis</li> </ul>
What are the measures needed to improve the quality of bicycle sharing schemes in the University of Malaya?	To recommend measures of improvement based on identified issues and problems regarding the provision of quality bicycle sharing schemes in University of Malaya	Findings from; <ul style="list-style-type: none"> <li>• Site observation</li> <li>• Literature review</li> </ul>	<ul style="list-style-type: none"> <li>• Conclusion</li> <li>• Measures of improvement</li> </ul>

There are 50 respondents among students in the campus involves as respondents which were randomly picked from a group that experienced using Obike. The technique use in sampling is the stratified random sampling as to ensure selection of the respondents are made to students experienced using Obike at least once. The questionnaires contains general information of the respondents such as gender, main travel mode, travel frequency, travel purpose, distance of cycling and reasons of using the bicycle sharing scheme. Then, the questionnaire further ask on the level of quality provision of bicycle sharing schemes.

There are five parts of aspect to be assessed in measuring the quality of the scheme:

- I. Provision of bicycle sharing scheme,
- II. Docking stations,
- III. System access and user registration,
- IV. Safety of users, and
- V. Cycling experience and satisfactory level

**4. PURPOSE AND FREQUENCY OF RESPONDENT’S BICYCLE TRAVEL**

Based on the distributed survey answer, most of the respondents’ preference travel mode is by walking which is 32% and followed by riding the motorcycle, 28% of total respondents. Cycling were the second least of respondents’ preference mode with only 8% respondents cycling. Meanwhile, private car passenger was the least preferred travel mode which comprised only 2%. Figure 1 shows the reasons for the students choosing bicycle scheme as their travel mode.

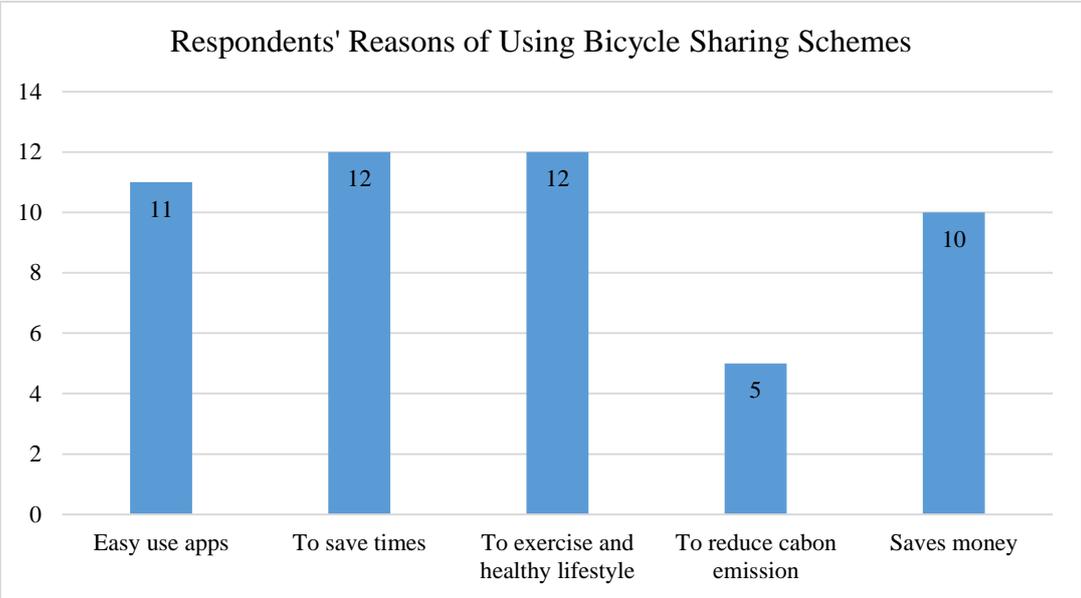


Figure 1: Reasons of using bicycle sharing schemes of respondents in University of Malaya

Figure 1 shows the highest reason for the students was not related to the awareness towards reducing traffic congestion and carbon emission but to save time and to create a

healthy lifestyle. The survey questionnaire also asked the respondents about the cycling distance when using bicycle sharing schemes provided in the university. Based on the answer, 30% of the total respondents use as far as 2km. Then, 26% of the total respondents use in average of 500 meters. About 11 respondents of the total respondents respectively pick 1km and 3km which covers 22% of the total respondents respectively. In measuring the quality of the bicycle schemes, there are five parts of aspect to be assessed which were provision of bicycle sharing scheme, docking stations, system access and user registration, safety of users, and cycling experience and satisfactory level.

Table 5: Result of respondents' perception towards provision of bicycle sharing schemes.

No.	Quality Statement	Mean	Data Result
1.	The bicycle is easy to use.	4.20	Very good
2.	The bicycle is adaptable to users of different sizes.	3.58	Good
3.	The bicycle is mechanically reliable.	3.70	Good
4.	The bicycle provided is adequate.	2.80	Unsatisfactory
5.	The fee of the bicycle is affordable and reasonable	3.54	Good

The first aspects to be assessed was provision of bicycle sharing schemes in University of Malaya. Based on the distributed survey, the results indicated that the bicycle was adaptable to users of different sizes, the bicycle is mechanically reliable, and the fee of the bicycle is affordable and reasonable with good perception from respondents as most of them agree with it. In terms of the bicycle is easy to use, the respondents rated as very good quality as they required for their satisfaction based on the mean of the survey answer. However, the lowest result was the bicycle provided is adequate. Based on calculated mean, the bicycles provided were not adequate from their perception.

Table 6: Result of respondents' perception towards docking stations.

No.	Quality Statement	Mean	Data Result
1.	The location of stations is relevant.	3.28	Satisfactory
2.	The location of station is easy to find.	3.36	Satisfactory
3.	The distance between bicycle stations is reachable	3.52	Good

The second aspect to be assessed was the docking station of bicycle sharing schemes as shown in table 6. The table shows the respondents' perception toward dockings station of bicycle sharing schemes provided in University of Malaya and data result of docking stations from the questionnaires that had been done. In terms of the quality of the location of the stations of bicycle sharing scheme provided in the campus, the respondents rated as satisfactory based on the mean of the survey.

Table 7: Result of respondents' perception towards system access and user registration

No.	Quality Statement	Mean	Data Result
1.	The registration and access process are easy.	3.44	Satisfactory
2.	The bicycle is easy to unlock and lock.	3.50	Good
3.	The application provides real time information about bicycle availability.	3.52	Good

The third aspect to be assessed was the system access and user registration of bicycle sharing schemes. There were three questions for this aspect which were shown Table 7. It shows the respondents' perception toward system access and user registration of bicycle sharing schemes provided in University of Malaya . The result shown that the majority of

respondents agreed and satisfied with the application of the bicycle sharing schemes. The schemes have easy registration process as it not required much details or information. Other than that, the bikes are easy to find as the application provides real time information about bicycle availability.

Table 5: Result of respondents' safety of using bicycle sharing scheme.

No.	Quality Statement	Mean	Data Result
1.	The bicycle is resistant to vandalism or theft.	2.86	Unsatisfactory
2.	The bicycle is safe from any accidents.	2.52	Unsatisfactory
3.	The bicycle provided is distinctive in appearance.	2.90	Unsatisfactory

The fourth aspect to be assessed was the safety of user when using the bicycle sharing schemes as shown in Table 8. In terms of safety aspects, most of the respondents were not satisfied with these statements. The lowest score was from the statement that the bicycle is safe from any accident. Currently, in the campus there were less provision of dedicated cycling lane and existing cycling lane is being shared with other road user which make them feel not safe and contributed to another issue. There are also cases which are not reported involving minor accidents among the users of Obike due to the lack of sharing space on the road between motorized and non-motorized vehicle. This has cause danger both to riders and also to the motor vehicles drivers.

Table 9: Result of respondents' cycling experience and satisfactory level.

No.	Quality Statement	Mean	Data Result
1.	Cycling using these schemes helped me experience the campus with safe and pleasant feelings.	3.54	Good
2.	These schemes encouraged me to cycle more.	3.78	Good
3.	I would recommend others to try cycling using these schemes based on my memorable experience.	3.82	Good
4.	These schemes save my pocket money.	3.44	Satisfactory
5.	These schemes are a good start to create cycle habit.	4.02	Very good

The survey assessed the respondents' perceptions on cycling experience and satisfactory level of the bicycle sharing schemes. Majority of them were very agreed with the statement of these schemes are a good start to create cycle habit among students in campus as there are many benefits from it. Besides that, many of them agreed with other statements too as it shown a good result. Only one of the statements got satisfactory that was these schemes save my pocket money which means that they were more concern about the experience and satisfactory level. Table 9 shows the respondents cycling experience and satisfactory level of bicycle sharing schemes and the mean score for each statement by respondents.

Table 10: Overall result of the quality level of provision of bicycle sharing schemes.

Rank	Quality Level of Bicycle Sharing Schemes	Mean	Data Result
1	Respondents' cycling experience and satisfactory level	3.72	Good
2	Respondents' perception towards provision of bicycle sharing schemes	3.56	Good
3	Respondents' perception towards system access and user registration	3.49	Satisfactory
4	Respondents' perception towards docking stations	3.39	Satisfactory
5	Respondents' safety of using bicycle sharing scheme	2.76	Unsatisfactory

Based on overall survey result as shown in Table 10 shows the students perception towards the quality level of provision of bicycle sharing schemes. The respondents voted on the cycling experience and satisfactory level the highest score. This was due to the statements of these schemes are a good start to create cycle habit as most of them agreed with this statement. The provision of bicycle sharing scheme was the second highest result and this was because majority of them were very agreed with the statements that the bicycles provided is easy to use. Meanwhile, the lowest score recorded was the respondents' safety of using bicycle sharing scheme which rated as unsatisfactory due to the mean result. This was because many of them were not agreed with the statement that the bicycle is safe from any accident.

There are some recommendations towards the usage and quality level of the provision of bicycle sharing scheme. These recommendations will help to improve the usage and quality level of the schemes in the future. Generally, the schemes were having issues such as vandalism, the bikes were not locked properly and locked at the dock station, users' safety issues (accidents), and the bikes provision were not adequate. Thus, these recommendations can help to solve the issues.

## **5. CONCLUSION**

Firstly, University Malaya and the bikes company can have a collaborations or cooperation in providing bicycle facilities such as cycling lane around the campus with high accessibility from colleges to others faculty and others. Through provision of cycling lane, this will help to solve the issues of safety that is accidents with other road users such as cars and motorist. Other than that, cyclist also can enjoy ride during peak hour as their lane are not shared with other road users. The provision of cycling lane should have barriers between other road users and pedestrians. This will improve the usage of the schemes and indirectly increase and create a new individual public transport system and mode of transportation. A study by Bachand-Marleu et al. (2012) reported that bicycle sharing schemes usage increased when there were more bicycle facilities near a bicycle sharing station. Then, provision of fixed mobile phone cradle for travel navigation also assist the scheme. This cradle will help user of the schemes to more focus on the road instead of holding their mobile phone. This will help user feel safe and one of the convenient ways so that the usage and quality level of bicycle sharing schemes are increase.

Next, provision of fixed-portable docking station. The stations have designated racks or service terminals. The bikes can be locked into the designated racks so that it will look neat. This will help to solve the issues of the bikes are not properly locked and not locked at the designated docking station. The docking station also should have a fixed service terminal that can show their map of distribution of docking station, the information of the schemes, the rules and regulation to use the schemes so that user can estimate travel in the campus and have a deep knowledge about the scheme. This terminal also will attract and encourage others to use the schemes as sometimes people cannot see the functions as they are not attracting to use it and only users know their bikes since they have the application. This also will create a convenient way to use the schemes

Lastly, guidelines or checklist of these bicycle sharing schemes should be existing. This guideline or checklist will help the provider of the schemes to implement successful bicycle sharing schemes and encourage cycling habit in the campus. For example, the guidelines should state that the provision of bicycle sharing schemes should have a fixed docking station which have service terminal and designated parking racks, or every bicycle

should have helmet. This will help provider of the schemes to provide a quality level of bicycle sharing schemes in the future. In conclusion, the level of quality in the bicycle sharing scheme are currently meeting the demand of the user thus provides a positive impact in promoting bicycle as one of the main transport mode. However, the the lack of facility such as dedicated path for bicycle has discourage user to use bicycle due to safety matters. The quality of the bicycle is also satisfactory and it looks like the bicycle sharing scheme can be the catalyst for non-motorized movement in reducing people dependability to motor vehicle in Malaysia.

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