

Encouraging Sustainable Environment Using Bicycle Sharing System in University Campus, Bangkok

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ABSTRACT

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Chulalongkorn University (CU) is the oldest university in Thailand. In the campus, it provides various environmentally friendly transportation modes such as shuttle buses, EV sharing vehicles, bicycles, and cover way for walking. Students today need convenient and fast commuting in the campus. As a new emerging way for students using, bike-sharing system (BSS) has been provided in the campus since 2014. However, the BSS in CU is still not so efficient and unpopular. This research aims to find out how to encourage the use of on-campus BSS in CU by using various research methods including interview, questionnaires and observation plans, and the researcher own experiences on using BSS in the campus. The survey results indicate that only 2% used bicycle for traveling from accommodation to the university; the most popular transportation mode was MRT/BTS, followed by public bus for graduate students, and by walking for undergraduate students. This implies that most of the respondents preferred public transportation rather than using their own cars or motorcycles. Upon questions about the preferring on-campus transportation modes, it was found that nearly half preferred using shuttle bus, followed by walking, while only 2.4% prefer using BSS. The university should raise awareness of the students to realize advantages of the BSS and providing more opportunities for students to know the bike-sharing system. Then, the university should improve the quality of the sharing bikes and motivate more students to use the system.

Keywords: *Bike-sharing system; University campus; Encouraging using*

INTRODUCTION

Bangkok is the capital of Thailand and with thousands of people living here and it is also the educational and cultural center of Thailand. It means that many universities would be in Bangkok. With the development of economy, more and more private cars are running in the Bangkok streets and roads. The traffic condition of Bangkok is getting worse and worse day by day. This terrible situation is also been spread to many universities' campuses. In many universities' campuses, there are also many cars running which teachers and students drive. Sometimes in rush hour, they cause traffic jam in campus. In addition, the drivers do not care the speed and it is extremely dangerous for passengers. Bangkokians' travel journey ranked the highest of the use of a private car with 46% from other transport mode share. Chulalongkorn University is the oldest university in Thailand and a comprehensive and research-intensive university with large campus about 3000mu in PathumWan. In this large campus, there are many cars running in the campus with high speed. It is too dangerous. The current traffic situation in Bangkok is awfully bad, especially in the rush hour whatever in the morning and night. When walking on the Phaya Tai Road, which is in the front of Chulalongkorn

University, many cars and motorcycles are running on the road. There are many evidences to support how bad about the traffic condition in Bangkok. Global Traffic Scorecard Report rated Thailand the world's most congested Feb (2017) Bangkok drivers spent an average 64.1 hours a year in traffic jams. Driving in Bangkok require average 57% extra travel times (61 minutes per day) when comparing to an uncongested condition Universities have various modes of transportation provided in campus, such as cars, motorcycles, and bicycles. Nevertheless, students today need convenience and speed in commuting on campus, so the number of motor vehicles, such as private cars and motorcycles, has increased. This situation especially emerged in universities that offer dormitories on and around campus Balsas (2003). The results lie in the following problems: noise and air pollution, increased budgets for road maintenance, shortage of parking space, and traffic jams during rush hour. Moreover, the number of students who commute by bicycle to and from campus has decreased in some universities where there used to be many cyclists. Even though this form of transportation provides many benefits to individuals and society, such as reduced fatal accidents, decreased amounts of automobile traffic, reduced environmental pollution, reduced travel cost, and enhance or improve physical health. When looking at universities' guidelines for promoting bicycling on campus, the researchers found that they have failed to study transportation modes on campus and students' opinions towards bicycle use. The ineffective guidelines lead students to continue using private cars or motor vehicles while the number of bicyclists remains limited. According to the above problems, studying the modes of transportation on university campuses and student attitudes towards bicycling will help analyse problems and difficulties related to bicycle use on campus. The results of this study are practical guidelines to encourage cycling on campus to meet student needs. In addition, Chulalongkorn University is in Pathum Wan the centre of Bangkok. It means the traffic jam is also serious issues in university campus. Today's campuses have become as complex as urban areas. The increased usage of private automobiles and the decline of public and non-motorized transport systems are the main causes of these outcomes. The exception is for the university located in city centers due to limited spaces and high land prices. The road is too narrow and that means it is quite easy to have traffic jam in Chula campus. Even in Chula campus, there are many shuttle buses; the traffic jam is still serious. The traffic condition seems that have never changed recently. The benefits of bike sharing schemes include transport flexibility, reductions to vehicle emissions, health benefits, reduced congestion and fuel consumption, and financial savings for individuals.

Problem Statement and Main Research Question

In addition, Chula also already has BSS (CU-bike), but it does not work very well. When passing the park station of sharing bike, all bikes just stand in there without any moving. So, why nobody wants to use the sharing bike? The CU-bike in the campus in the current stage would face many problems such as the road safety, no parking and inconvenience to join the membership. In recently there is a research about CU-bike parking. The area of parking is so limited, and the capacity is not enough for all the transports tools including vehicles, motorbike, and bikes. It means the capacity for the bike is very restricted. It would be an especially important factor affecting the using of CU-bike. As the statements saying, the Chula campus already has bike sharing system, but it does not work as we hope. Therefore, the main research question is "why the bike sharing system does not work effective in Chula campus? Through the study, it should find the reasons and give some practical suggestions for BSS using in the university campus. In this study, using Chulalongkorn University as the case study, the researcher makes a case study in the campus to find solutions.

Objectives

To survey the current situation of bicycle-sharing system using on the campus. 2 To study students' opinions about bicycle-sharing system use on the campus and to analyse problems and difficulties related to bicycle-sharing system using on the campus. 3 To give the practical guidelines to encourage bicycle-sharing system using in campus. In Chula university campus, there are models of transportation for students and staff. When people are walking on the streets and roads in the university campus, many cars and motorcycles are running around here. It is hugely different to find someone in the campus to use bicycle. In addition, when walking around the parking, there are many cars and vans here and many motorcycles stopping here. However, it is extremely hard to find a bike stopping in the parking. It seems like people may already forget the existing of bicycles. The bicycle is much healthier and more flexible than cars and motorcycles. However, in the campus the bicycle clearly forgets by students and staff. In our case study, the first objective is to figure out the existing conditions of transportation in the campus. The situations of every transportation models, the popularity of different transportations models then it is finding the reasons of these conditions. As following, the study would promote the cycling in the campus, the opinion about BSS of students and staff. The students and opinions about BSS in the campus are particularly important in the case study. When walking and seeing in the campus, the bicycle is not extremely popular clearly. The opinion is a key factor of this case study. Students and staff are the main body of this case. In the promoting, the students and staff are the important factors. If they are trying to use BSS in the campus, the study can make affect. Their attitudes are becoming important. The next objective is analysing the difficult and related issues about BSS in the campus. The BSS is clearly not extremely popular in the campus. What is difficult of the BSS in the campus, the study would analyse the difficult and reasons and related issues. Subjective reasons such as the students' and opinion objective reasons such as the conditions of road and streets the weather conditions and so on. The last objective is focusing on the solutions of promoting BSS in the campus. After the analysing the reasons, then getting the conclusion, the study would aim at the reasons to give guidelines to encourage students to use BSS in the campus. The university should provide the suitable conditions to meet students' needs

RESEARCH METHODOLOGY

It is not quite easy to figure out the reason why the bike-sharing system is not popular in the university campus. As mentioned in the above of the paper that it would need a case study to figure out the problem and find the conclusion. About the case study, the Chulalongkorn University is the oldest university in Thailand, established in 1917, has already 100 years history. In the long history, the university has already extended a lot in both floor space and students. Nowadays, Chulalongkorn University consists of 19 faculties, 3 colleges, 1 school and many institutes, which function as a teaching and researching unit and almost forty thousand students and a lot of stuff. As the trend, the university is still extending year by year. According to the condition of the university, the transportation in the university is a particularly important issue in campus. With the time passed, the transportation problems have given rise to challenges the university traffic networks. In addition, the university is the centre of Bangkok, which the traffic problems are awfully bad too, that would cause series of traffic problems. From theory study, there are many problems in promotion university bicycle and many limitations factor restricting the development of university bicycles. In addition, there are many relationships between promotion bicycles and students' attitudes and family conditions, road safety and weather conditions and so on. These would affect the bicycles using in Chula university campus. Via the case study, it will have and use many research methods to collect data. About the data, it will separate into to two parts. One type is primary data. Other is secondary data. The secondary data will be from many literatures and documents. The primary data should collect by the researcher. Data gathered by surveying the areas, studying relevant documents, interviewing experts, and using questionnaires to ask students using quota sampling with equal proportions.

Instrumentations and Scales

A set of questionnaires and semi-interview and observation plan would use for collecting data. The questionnaires are for Chulalongkorn University students to know their ideas about Bike-sharing System. The semi-interview would also use in the case study for collection data as a particularly important tool. The semi-interview would use for interview to the administrators of CU bike and about some students who is always using the CU-bike.

Sample Method

This study employed Quora sampling. The sample of questionnaire was only one group for Chula students. The group quota consisted of 400 samples. The method of sample selection as follows:

$$n = \frac{N}{(1 + Ne^2)}$$

n=corrected sample size

N=total population size

e=Margin of error (MoE) = 5%

In Chulalongkorn University, in 2017, there are 38941 registered students of all undergraduate and graduate database online (2017). Based on the number of registered students from the official statistical data, a systematic sampling method was used to select. The questionnaire sample is 400. Quota sampling is defined by the size or proportion of the population. A total of 35,277 people was sampled at least 401 samples. The sample size of each population is as follows.

Level	Population (N)	Sampling(n)
Bachelor's Degree	24,975	284
Master's degree	7,868	90
(PhD)	2,434	28
Total	35,277	402

In the table above, it can make a comparison between different education level groups then give practical guidelines with much more details.

RESULTS, AND RECOMMENDATIONS

Firstly, the researcher interviewed some people of administrations of CU-bike, who oversee CU-bike in Chula campus and the developer of CU-bike. In this interview, the researcher talked to them face to face, recording with mobile phone. Before, the interview, the researcher had already given the questions to the interviewee, based on the literature review. After the interview, the researcher analysed the data, which would combine with the questionnaires results. From their views and ideas, the researcher can understand the history and development of BSS system-CU-bike in Chula campus and the current traffic condition and CU -bike. Then, it can help the researcher to understand CU- bike much better and give much better practical guidelines. In addition, this research, the participants also called respondents of this research are all from Chulalongkorn University. There are almost 400 students including undergraduate students and graduates' students. Each of the respondents is from variety of every faculty and every education level. Most of them are freshman and amounts are 141, accounting for 27.81%. About their ages, most of them are age range of 18-19-year-old, just beginning their university lives. In addition, 98.25% of their nationality is Thai. In the research, there

are many factors about traffic conditions in Chula campus. Firstly, about the general condition, in the questionnaires, the researcher asked the respondents about their ideas about the conditions. In this study, it has already dived into variety groups to collect the questionnaires. In the same question, different groups would have various answers and then compare with different answers to get much more comprehensive conclusions. In the bachelor group, 54.5% students think the traffic condition in the campus is general. It has already covered half population of this group. It means it is acceptable for most of them. However, in the graduate school group, 41.12% respondents chose “good” about the traffic condition of Chula campus. In their mind, the traffic condition good. In their idea, there are not many spaces to improve for traffic condition in Chula campus. In graduate school group, there are 30.84% respondents think the traffic is particularly good. These two options have already accounted for over 70%. Most of them are satisfied with current traffic conditions whoever is from undergraduate or graduate school. Compared with undergraduate and graduate school, undergraduate’s students are not very satisfied with the traffic condition because over 15% respondents (17.75%) chose “bad” or “very bad” about the traffic conditions and about graduate school, only 3.8% respondents chose. In the following part, about opinions of violation behaviours and traffic management, most students do not think there are too many problems about the traffic. About violation behaviours, about undergraduate students, only 6.5% students think there too many violations behaviours in the university campus and 50% students in their opinions consider there are less even very less violation behaviours in the university campus. Compared with graduate school students, about 17.76% students think there are too many violation behaviours in the university campus and over 50% students think there are less violation behaviours in the university campus, especially about 36.44% student there are very less violation behaviours in the campus. About traffic management, undergraduate school students, 84% of them think the management meets the basic need and 5.25% students think it is messy and in graduate school, 63.55% of them think the management meets the basic need and 7.48% students think it is messy and 28.97% of them think it is efficient and rational. From the questionnaires data, at least, the current traffic condition in the university campus is acceptable for most students. With the further of the research, about the conditions of BSS system and students’ opinions about BSS system, the students have many ideas about the BSS system in the university campus. In the research, the BSS, as an important tool for students using, it can make students move much easier in the campus. In addition, it has many factors influencing using in the university campus. Firstly, Chulalongkorn University is comprehensive university with lots of faculties, departments and schools and many students living around the campus. The students need tools to go to the university campus and they also need tools moving in the campus form somewhere to some places. In the research, about undergraduate students, 31.44% students chose to use MRT/BTS to go to school and in graduate school, 34.48% students also chose MRT/BTS to go to school. In addition, about 29.89% students in graduate school go to school by public bus. About undergraduate students, 27.42% of them go to school by foot. Both of undergraduate students and graduate school students, around 10% of them using private car to go to school whoever is driving. These data would give researchers ideas to consider about the location of BSS bike stations. In the university campus, the shuttle bus provided by the university is the mainstream of all students moving. About BSS system using, both proportion of undergraduate students and graduate school students are low, 1.61% and 5.49, respectively. As for using BSS, in student’s minds, they many students like using the system. However, due to some limitation conditions, they seldom use or even give up the system. In the research, 70% of graduate school students and 90% of undergraduate students are not always using BSS, even some of them never using the system. Only seldom students always use the system. Firstly, about safety, there are too many vehicles and motorcycles on the roads, making the roads too crowded, and leaving limited space for bicycles. Then the bad driving behaviours and the fast speed, these deepened the unsafe feelings of students. Many students also complained that there is no special lane for bikes, over 50% students mentioned about it. Other factor is weather, hot weather and raining make many students give up using BSS. In addition, many students think it is inconvenient to use BSS. About the BSS system itself, many students over 30% said the amounts of BSS bike stations are not enough. The bike stations cannot cover every corner of the campus. It makes people must give up, especially for students whose faculties do have bike stations. Some of them want to use BSS system to move in the campus. However, because of the limited conditions, they must give up. Moreover, many students said the BSS system itself also has

many problems, such as the button on the bikes too hard to press, always finding broken bikes and the BSS bikes too hard to ride compared with some bikes. Over 50% students agreed with that BSS bikes are not easy to ride. Especially for female students, they wear skirts uniform every day, the BSS bikes are not very friendly for them to use, and many female respondents have mentioned about this problem. Although, there are a limited number of BSS users. Over 50% of them think riding bicycle is good for their health and the traffic condition would not affect them. The relationship between BSS system and traffic condition and quality, students also have expressed their ideas and opinions in Table 1, especially about the BSS system can improve the traffic quality or not. The undergraduate and graduate school students have difference in opinions. Over 50% undergraduate students (58%) think the BSS system can improve the traffic quality and most of them believe that more using bikes, the less vehicles using in the roads. Other 42% of them do not believe that it can improve the traffic and, in this group, about 31.54% of them think the roads have its own problems whatever using BSS or not. It does not have any direct relationship between traffic quality and BSS using. In graduate school students' group, only 32.71% students think the BSS can improve the traffic quality and the majority (67.29%) does not trust the BSS can make it. Meanwhile, the current in the campus. In undergraduate student group, about 54.5% believe that current condition is good for BSS and they think there enough space for BSS. However, still 45.5% students do not think it is good for BSS using in the campus. In graduate school group, over 70% (Mahmoudi, Shetab-Boushehri, Hejazi, & Emrouznejad, 2019)students do not believe the current situations is good for BSS system using and most of them think the narrow roads and too many vehicles would affect it.

Table 1. Opinions of BSS can improve the traffic in the campus

Response	Undergraduate students		Graduate students	
	Amounts	%	Amounts	%
YES	232	58	35	32.71
NO	168	42	72	67.29
Total	400	100	107	100
YES				
1 reduce traffic jam	74	31.89	30	60
2 good for environment	61	26.29	20	40
3 betters to have more choices	45	19.39	0	0
4 much faster and convenient than walk	52	22.41	0	0
Total	232	100	50	100
NO				
1 never saw bikes	18	10.71	0	0
2 the road not wide enough	53	31.54	40	31.50
3 don't like riding bicycles	27	16.07	20	15.75
4 many students have vehicles	15	8.93	15	11.8
5 no traffic jam in the campus	14	8.33	12	9.45
6 bad weather	19	11.3	15	11.8
7 complicated BSS system and broken bikes	22	13.1	25	19.7
Total	168	100	127	100

Table 2. Advices about Bike-sharing system in the university campus

Response	Undergraduate students		Graduate students	
	Amounts	%	Amounts	%
1 Low price/ even free for all students	35	8.75	14	13.08
2 education and promotion	69	17.25	13	12.15
3 more bike stations	55	13.75	15	14.02
4 bike lane/road safety	56	14	19	17.76
5 more parking area	35	8.75	15	14.02
6 more good quality BSS bikes	30	7.5	16	14.95
7 too complicated system	80	20	15	14.02
8 easy and comfortable for bikes	40	10	0	0
Total	400	100	107	100

Helped by the research findings-such as some advices from respondents in Table 2, the various and mature experiences, the researcher give several recommendations of BSS system development in Chulalongkorn University campus are the following.

- 1) Firstly, in the questionnaires, about 36.54% undergraduate students and 42.17% graduate students think the BSS system in the university campus is too hard to use. It means the complicated BSS system mentioned mostly and the provider and the university should work together to make the system much easier to use. In addition, in every bike station, it should build a repair station with many tools and repair guidebooks for users. This is particularly good experiences from other foreign universities. That means these activities, the provider, and the university work together to make the system much easier to use.
- 2) Secondly, respondents mention “education and promotion” many times, accounting for about 17.25%, among the undergraduate students. Because they said, they do not see many riders even no riders on the road and in the campus cannot see many boards related to BSS system. It needs the awareness for students to realize the advantages of bike-sharing system, giving more opportunities for students to know the Bike-sharing system. The university could do much more about this, such as publicity board in the university campus and free brochure about Bike-sharing system for students. Our Chula University students should take the initiative to learn and use bike-sharing system and related policies. Chulalongkorn University can give other universities a good example in the aspect of protection environment.
- 3) Thirdly, in the research, many respondents wrote about special bike land and road safety in the questionnaires. About 40.84% undergraduate students and 42.05% graduate students think the road is too crowded with vehicles and motorcycles. In addition, about 35.03% undergraduate students think there is no special bike lanes, making them give up using Bike-sharing system: also, about 51.28% graduate students have the same problem; the proportion even is higher than undergraduate students. The safety issue should be cared by the university, creating a safety environment for students using Bike. It makes people feel unsafety. People always cared about safety issues, without safety guarantee, nobody would like to use the BSS system in the campus. The university could provide the special bike lanes and more bike stations for students.

There are several measures to improve the road safety and comfort in the university campus.

- (1) Firstly, it can use much clearer signposts for warning that is an intersection is approaching. The signposts should be visible and clear view for every traffic participants, especially in the intersections.

- (2) Secondly, for vehicles and motorcycles, it must reduce the speed and it should have a speed limited for the motorized traffic in the university campus, giving a friendly environment for cyclists. At the intersection, it should be noticed that who has the priority of passing.
- (3) Thirdly, many respondents cared about the separated lanes between different modes of transport. The researcher strongly recommended that the roads should separate from vehicles and other models in the main roads and maybe in the small roads every transport model can share space together. About dedicated cycling space and road can be built in various ways. The bike lanes can be provided with hard or soft borders separated with other models. The borders can prevent other models use the lanes illegally and the cyclists should not need use other spaces. The borders can be made by concrete, creating height differences between different roads and lanes, or just using lines or colors. The borders should also be well visible from morning to the night.
- 4) Other issue is about the visible of the bicycle lane. The bicycle lanes should be very recognizable for all traffic participants, such as for motorcyclists and pedestrians. If it is possible, the bike lane should be good to have a surface color to indicate the bike space in the university campus with symbols showing the entrance of bike path. All the facilities should be obvious all day, especially in the night. If it needs, it should provide adequate lighting along the bike lane length, maybe like solar light. The bike lanes surface should be exceptionally smooth. Then, comprehensive considering with the opinions of weather of Bangkok including the rain and heat from the respondents, the bike lanes should provide adequate rainwater drainage. Protection from the sunshine, it can plant trees along the lanes, the campus already has many trees along the roads.

However, about the separated bike lane, in the current stage, it is not easy to rebuild and create the lanes but it can give the general and nice advices to the administration of the university and they should consider about this issue.

Then, many respondents wrote they need more BSS bike stations around the campus, accounting for 34.14% of undergraduate students and 32.53% of graduate students. There are also many advices like this advice, all related to the infrastructure issues. Now, there are only eight BSS bike stations in the university campus and many faculties do not have BSS bike stations. It should build more BSS stations with more parking spots. In addition, the BSS system should have more access to the public transportations (public bus, MRT and BTS) with the bike lanes. Because, about 34.48% undergraduate students use MRT/BTS, as main transportation modes from home to the university campus. From the MRT/ BTS stations, the students can use sharing bikes to move in the university campus.

The BSS system and bike lanes should improve the connectivity and the BSS system and bike lanes should create the networks instead of isolated routes. Then, it can have strong efforts in the campus.

- 5) Part of respondents, accounting for 8.75%, wrote about it needs more parking area for BSS bikes and many students mentioned that it should provide more good quality BSS. Therefore, it should create more parking area and bike stations and lanes in the functional areas, such as faculties' buildings, libraries, canteens, GYM, and dormitories. It can much easier reach the destinations and reduce the acceptable walking distances as much as possible. Like mentioned, the BSS system with lanes and parking areas become a network and influence students' behaviors, making the frequency of use higher.
- 6) Many respondents, accounting for 7.5% in the undergraduate students and 14.95% in the graduate students, want to improve the BSS bikes, making the bikes much friendlier to the users, attracting more students to use the system. The university should also create a good traffic environment for students, controlling the amounts and speed of vehicles and motorcycles, making students feel safe when they want to ride bikes.

- 7) Many students give advices about low price and even free charge for all students, just like Shuttle bus. For students, the economics issue is always important and concerned. If the BSS system can be free, the effort would be different. It could be free charge for all students, encouraging them to use.
- 8) In addition, if the university administrations also can attract investment from other companies, the new company could invest new brand BSS system in Chulalongkorn University campus, working together with CU-bike even the administrations can evaluate the value and influence of CU-bike, if the administrations can directly use other similar BSS system replacing CU-bike, cooperating with other developer or company.

CONCLUSIONS

Chulalongkorn University prefer to be a good example about environment protection, the university could do better in traffic management. The university would like to attempt and continue to use and improve the bike-sharing system and make it work effective. In addition, the system can contribute to the traffic and environment in the university campus. As an important policy of the university, the university could keep using the bike-sharing system and take responsibility of being a leader in environment protection, being a good example among Thailand universities. In the last, the university should pay much attention about BSS system and students should need to know about the BSS system and try to use it.

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