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Public Bicycle Sharing Service (BSS) in Bangladesh: An Overview on Operations and Services

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Abstract: A public bicycle sharing service (BSS) is a system where bicycles are strategically placed in a network of stations and offered for public use. The users of BSS can take advantages of biking without the responsibilities of purchase and maintenance of a bicycle. This paper provides a brief history and description of BSS operation in Bangladesh, current situation of the services and the users' opinions. An in-depth discussion with BSS providers was done and the responses of 871 users were collected through online questionnaire. The results show that BSS provides an alternative travel mode which is cheaper than rickshaws. Almost 90% of the users are satisfied with the service, however, there are several problems such as problems related to the App for unlocking, locking, and vandalism of the bike. The results will be helpful for researchers and professionals understanding the issues related to BSS in Bangladesh and in similar countries as well as formulating policy actions.

Keywords: access; bicycle sharing service (BSS); transport; trip; last-mile.

1. Introduction

The public bicycle sharing service (BSS) is a system where bicycles are strategically placed in a closely spaced network of stations and offered for public use (Rahman, 2020). The BSS is also known as bicycle hire scheme (BHS) or smart bike or bike hiring. It is a contemporary concept of public transport that offers a pollution free and flexible transport system for people in urban areas. The commuters can take the bicycle whenever they need and leave the bicycle after reaching their destinations (Lin et.al, 2013). Therefore, the BSS serves as an alternate mode of public transport in which people have access to cycles (Lin et al, 2013; ITDP, 2013). Thus, the BSS system provides point to point active travel for short distance without the need to own a bicycle.

A BSS can provide many benefits to the city and people. The benefits include access to a low-cost public transport option, improved health (through increased physical activity), improved connectivity and travel experience, flexible mobility and increased convenience, reduced travel cost and fuel use, emission reduction, support for multimodal connections and reduction of congestion on roadways (Ricci, 2015; Wilmingtonde, 2019; Woodcock et al, 2014). The BSS program can also help reducing traffic congestion and pressure on motor vehicle parking supply (Voeller and Elise, 2011); to solve the 'last-mile' problems (Ma et al, 2018; Qian and Niemeier, 2019); growing awareness for bicycle use as a daily mobility option, developing tourism and meeting targeted modal

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splits of the city (Shaheen et al, 2010; ITDP, 2013). The BSS program could play an important role for social inclusion of transport in the developing countries as the cycling is cheaper than any other public transport modes and the implementation cost as well as time for BSS scheme is very low compared with other transport projects.

To tap the benefits of cyclingand also for promoting bicycle use, many cities consider public BSS scheme as a strategy to facilitate short-term bicycle rental in urban areas (Woodcock et al, 2014; Hou and Haddad, 2020). Technology-driven BSS has been developed in many countries in recent years (Rahman, 2020), though the concept of BSS has been available in different countries for the last 50 years (Meddin, 2015). Several authors (e.g. Kou and Cai, 2019; Médard de Chardon et al, 2017; Shaheen et al, 2010; Qian and Niemeier, 2019) claim that BSS is getting popular because it provides many social, economic and environmental benefits to the city and the people. Therefore, BSS has been widely adopted in many cities around the world (Chen et al, 2020).

Bicycle is one of the cheapest forms of urban transport in Bangladesh; only a quarter of the cost of bus travel per passenger per km and one-tenth of the cost of rickshaw travel (Rahman, 2013). However, transport policies in Bangladesh are more concentrated with motorized traffic, whilst NMT is often ignored or considered as hindering motorized traffic flows (Rahman, 2007). Often the minimal infrastructure required for cycling is not provided (Rahman and Timms, 2020). Rahman (2009a, 2009b, 2011) argued that such approach is inconsistent with the realities of transport situation and the policy should be directed towards promoting walking and cycling along with low-cost public transport accessible for all. Research (e.g. Rahman 2020; Rahman and Shams 2020) showed that there are potentials of BSS in Bangladesh, particularly in major cities.

The paper provides a brief history and description of BSS operations in Bangladesh, the BSS services and associated problems or issues as well as the user's opinions about the BSS service. Section 2 discusses the review of relevant literature. The methodology of this paper is explained in Section 3. Section 4provides the major features of BSS operation and services in Bangladesh while Section 5 provides the opinions of BSS users. Section 6 and 7 provides the discussion of findings and conclusions respectively.

2. Relevant Literature

The BSS usually provides opportunity to the users to pick up a bicycle from anywhere within a service area and return it to any parking point or bike station located near their destination (Rahman, 2020). The BSS differs from traditional bicycle rental services in number of ways. The most common are (Burns, 2013; ITDP, 2018):

- BSS is a short-term and one-way use such as 30 to 60 minutes rather than daily or weekly rental period.
- Bicycle can be returned to any station or parking points of the BSS scheme.
- A single style and same design for all the bicycles of the scheme. A standardized specially designed (e.g. through distinctive color and frame style) bicycle built solely for the system so that anybody can be differentiate the BSS cycles from regular bicycles in the city and the parts cannot easily be stolen and resold, one size of bicycle to fit for all with low maintenance.

- In most BSS system, bike unlocking, and depositing is automated and the financial transaction for rental or use is fully automated therefore no need for on-site staff for most of the BSS schemes.
- After finishing the trip, bicycle is parked by the user at a special docking station and the user is no more responsible for the bicycle when the trip is complete, and bike is deposited. Thus, user's liability and the responsibility for the security of bicycle is minimized.

The BSS could be of different types with distinct characteristics. Rahman (2020) provides a summary on different types and characteristics of BSS. Broadly, there are two types of BSS schemes; docked and dock-less (Rahman, 2020). A docked scheme enables to pick the bicycle form any self-serve bicycle station and return to any other bicycle station - thus makes bicycle-sharing ideal for point-to-point trips. The main advantage of a docked scheme is: bicycles are docked in convenient locations and the user knows where (s)he can find a bicycle. As the bicycles are securely parked within a docking station, this system eliminates the likelihood of theft or vandalism of bicycles (MacDonald, 2018). However, this system requires additional spaces to install the stations and additional costs for installing the docking stations.

On the other hand, in a dock-less scheme the bicycles do not need to be physically locked with a conventional chain or returned to a designated station or rack. Users register, pay, unlock the bicycle and after completing the trip can lock and park the bicycle in a suitable place within the service area through a mobile phone App. The main advantage of dock-less schemes is: more convenience with using and parking the bicycle as there is no requirement to return the bicycle to a bicycle station (MacDonald, 2018). Therefore, there is no mechanism to prevent theft of the bicycles and abuse of privileges (e.g. for personal use locking the bicycle in inaccessible locations) in dock-less system.

3. Methodology

Relevant data were collected from both primary and secondary sources. Both published and unpublished documents related to the topic were reviewed. Unpublished documents of BSS provider, their website and server data were analyzed and reviewed. The primary data were collected during October 2019. An in-depth interview with the personnel engaged in management team of BSS service providers were conducted.

A questionnaire survey of BSS users was done to explore their opinions about BSS services. The questionnaire had two major sections: demographic and trip related (e.g. BSS usage and travel pattern)questions. The questionnaire survey was conducted using an online GoogleForm. The questionnaire/GoogleForm was shared in the verified BSS user's Facebook page of the community groupand retained for a week to collect their responses. The questionnaire survey was administered in five different locations, the then existing BSS service areas, in Bangladesh. Until September 2019, there were 20,000 total registered unique users from five different locations of service areas. Of the total 20,000 unique registered BSS users, about 871 respondents (4.5% of the total responses) were received and used for the analysis.

Data collected from the in-depth interviews were transcribed and translated. The BSS users' data received from the online survey were exported from GoogleForm and

analyzed using MS Excel. As the online survey was conducted only for the BSS users, opinions of people who do not use the system are not unknown and not included in this research.

For evaluating the performance of the existing BSS system, three different measures were taken into consideration. These measures are:

(i) trips per day per bicycle (TDB);

(ii) users' satisfaction rate; and

(iii) the rate of theft or vandalism.

4. BSS Operation and Services in Bangladesh

4.1. History of BSS and Service Areas in Bangladesh

The BSS in Bangladesh, known as 'Jobike', was first introduced in June 2018 by a private company named 'Jobike Limited'. Jobikebicycles were imported from China and the technology was developed with the help of Chinese developers (Ahmed, 2019). In order to adapt the Chinese technology in the context of Bangladesh, Jobilke authority hired some Bangladeshi developers and created a new technology. Initially, it was first planned by Jobike Limited to launch the BSS operation in Jahangirnagar University (JU)campus with 20 bikes for a test run in the early 2018; with this to assess the technology/services and to fix the problems (Ahmed, 2019). Jobike authority approached to the JU administration and requested for official permission to operate BSS within the campus. The then Chairman of the Department of Urban and Regional Planning at JU Professor Dr M Shafiq-Ur Rahman discussed about the innovative idea of BSS with JU administration and convinced to permit Jobike for operating BSS. After a period of about six months, Jobike received the official permission to operate BSS in JU campus (Ahmed, 2019).

In the meantime, during the delay due to administrative procedures of JU, Jobike authority worked to provide BSS in Cox's Bazar. Jobike launched its BSS operation in Cox's Bazar city – the first BSS in Bangladesh - on 18 June 2018 with 30 bicycles. The services were available only at Kolatoli, Sugandha, and Laboni point every day between 6am and 6pm. The BSS enabled the tourists exploring the city easily and helped the city to uphold the image by making greener and healthy initiatives (Jobike Authority, 2019). Later, JobikeBSS in JU was introduced on 11 July 2018.The BSS service in JU campus was initially with 20 bikes and 10 parking points and available every day from 8am to 6pm. Later, the number of bikes were increased to 100 and the duration of service was extended up to 10pm.

Jobikestarted operating BSS in Chittagong University (CU) campus in December 2018.The BSS in CU was initially provided with 50 bikes and later increased to 80 bikes.After receiving overwhelming responses from the users in Cox's Bazar and two university campus (e.g. JU and CU), BSS was introduced in Sylhet University of Science and Technology (SUST) campus at Sylhet and in Mirpor DOHS at Dhaka both in January 2019.Initially BSS in SUST was introduced on a pilot basis with 35 bicycles and later the number of bicycles were increased to 50. Mirpur DOHS is the first residential area to have a BSS in Bangladesh which was introduced with the help and support of Mirpur

DOHS Society and there were 70 bicycles.In October 2019, JobikeBSS was introduced in Dhaka University (DU) campus in association with DU Central Students' Union (DUCSU) with 50 bicycles. During COVID-19 pandemic, JobikeBSS has been introduced in Gulshan-Banani area of Dhaka in June 2020 with the support from Dhaka North City Corporation (DNCC).Now 120 bikes are available for service in Gulshan-Banani area.

As of now, Jobike BSS was introduced in seven different places in Bangladesh, shown in Figure 1. Ride sharing services such as Uber, Pathao in recent years seem to solve the first/last mile problem in Dhaka City, however, they are very expensive compared to Jobike BSS (Fahim, 2019).

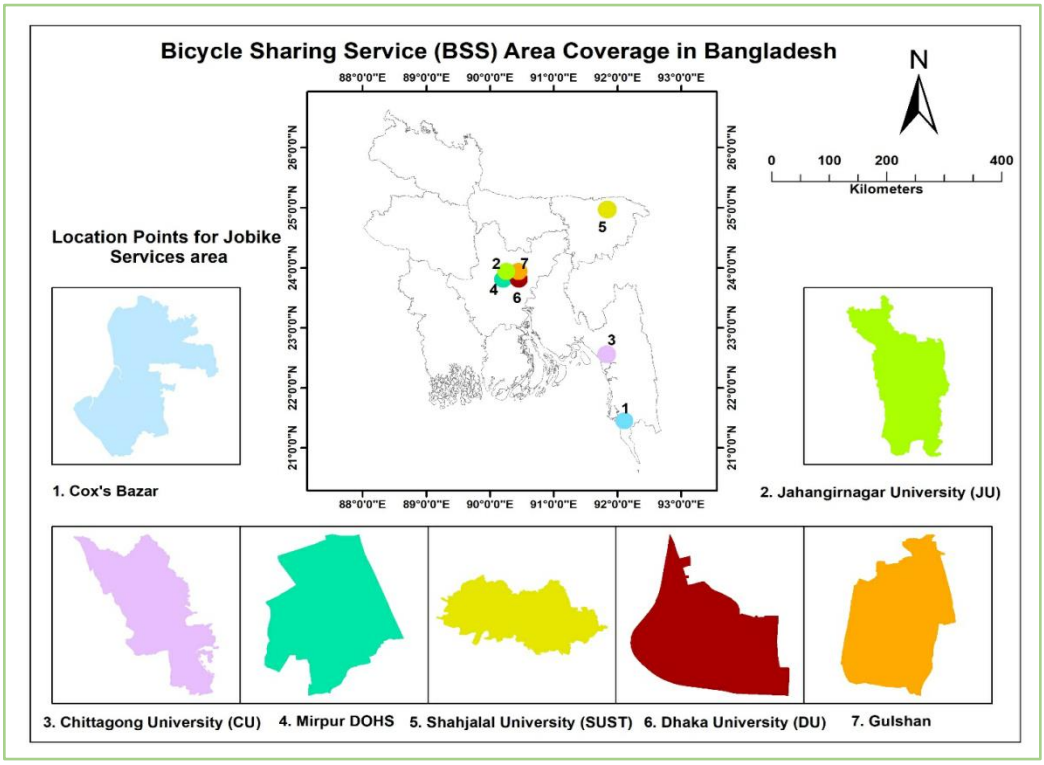

Figure 1. BSS service area locations in Bangladesh

Source: Jobike and prepared by Authors, July 2020.

The major features of Jobike BSS operations and services provided in different areas of Bangladesh are shown in Table 1. However, the service was discontinued in three locations (Cox's Bazar, JU campus, and CU campus) from June-July 2019. Moreover, due to COVID-19 pandemic, Jobike services are paused in two university campus (SUST and DU) in March 2020 as there is no student or users because of the vacation. Jobike operations in Mirpur DOHS also paused in June 2020. At present, as of July 2021, the BSS only in Gulshan-Banani area is functioning.

Table 1. Description of JobikeBSS schemes in different locations of Bangladesh

Features	Jobike BSS Locations						
	Cox's Bazar	**JU**	**CU**	**Mirpur DOHS**	**SUST**	**DU**	**Gulshan-Banani**
BSS started	11 June 2018	11 July 2018	10 Dec 2018	5 Jan 2019	27 Jan 2019	16 Oct 2019	24 June 2020
Area in BSS service	5,782 acre (23.5 sq.km)	698 acre (2.8 sq.km)	2110 acre (8.5 sq.km)	2 sq.km	320 acre (1.3 sq.km)	600 acre (2.5 sq.km)	3.5 sq.km
Population (or daily tourists)	85,000	15,000 (approx.)	20,000 (approx.)	N/A	15,000 (approx.)	N/A	N/A
Total Bikes*	50	100	80	70	50	50	120
Parking Points	3	12	6	10	8	7	14
Support staff	5	6	6	4	6	6	6
Monthly Avg. Trips	11,000	25,000	22,000	16,500	14,000	25,000	30,000
Trips per bike per day	7	12	9	10	9	10	10
Refill Point	3	6	4	6	4	2	8
Reported Vandalism	15	30	60	5	10	10	7
Theft	0	2	1	0	0	0	0
Service Status in July 2020	Stopped / discontinue July 2019	Stopped / discontinued June 2019	Stopped / discontinue June 2019	Paused June 2020 (Covid-19)	Paused March 2020 (due to Covid-19)	Paused March 2020 (Covid19)	Ongoing operation

* Total number of bikes in a particular location was increased or reduced time to time by Jobike.
Source: Jobike Authority, July 2020.

4.2. Main Features of Jobike BSS

Jobikeused the dock-less BSS system where anyone can pick up the bikes by using a smartphone App and after completing the ride (s)he can park to any designated areas for bicycle parking point or suitable place. Internet of Things (IoT) technology and smart solutions based on large data support is the main technology of this BSS system (Ahmed, 2019). The bicycle has unique design with red color, as seen in Figure 2, which is possible to recognize and distinguish very easily than the conventional bicycles. Tubeless tire, solar panel, seat adjustable systems, a small front basket, and a smart lock are the major features of the bicycle. It is flexible to use for both men and women. The smart lock includes a Global Positioning System (GPS) and telecommunication module as well as a new generation of IoT technology which keeps connecting with the central server of

Jobike. The lock is heavily built with a plastic-metal combination that cannot be broken easily.The geo-fencing technology is used to provide an alarm when the bicycle crosses the boundary (hypothetical) of the service area.

Figure 2. Jobike bicycles at parking point in JU (left), Smart lock (right)
Source: Authors, 2019

For using JobikeBSS, the user must download the mobile application from the related App store (android & iOS) and create an account using his/her valid mobile phone number. The user will be able unlocking the bicycle by scanning the QR code provided on the lock of each bike. However, to be able for unlocking the bicycle, should have sufficient credit (money) in his/her account to pay towards the cost will incur for the trip. Therefore, before taking a BSS ridethe user needs to refill the account (deposit money) from the specific recharge points for Jobike. The App shows the nearby available bikes at a given time in a map of the area. After finishing the trip, user need to leave the bicycle in one of the designated areas and lock the bicycle manually.

4.3. Costs and Fees of Jobike BSS

The average capital cost and operating cost for each bicycle of Jobike BSS is Tk 32,000 and Tk 18,000 per year respectively. Capital cost per bicycle of Jobike BSS is very low compared with the amount mentioned by Rahman and Shams (2020). Jobike BSS users are charged Tk 3 for every five minutes in the university areas (except in DU) and Tk 1 per minute in other areas. In DU campus, Tk 2.5 is charged for the initial 5 minutes and afterwards Tk 0.4 for additional each minute. Table 2 shows brief about different cost items for JobikeBSS in different locations.

Table 2. Costs and user charges of Jobike BSS

Cost items	**Cox's Bazar**	**JU**	**CU**	**Mirpur DOHS**	**SUST**	**DU**	**Gulshan-Banani**
Capital Cost (Tk/Bicycle)	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Operating Cost (Tk/Bicycle/Year)	18000	18000	18000	18000	18000	18000	18000
User charge (Tk*)	Tk 1 per minute	Tk 3 (for every 5 minute)	Tk 3 (for every 5 minute)	Tk 1 per minute	Tk 3 (for every 5 minute)	Tk 2.5 initial 5 minute, afterwards Tk 0.4 per min	Tk 1 per minute
Membership fee for users	No	No	No	No	No	No	No

Source: Jobike Authority, July 2020.

4.4. Operation of Jobike BSSand Customer Service

Jobike authority has hired people in their head office as per the requirements of different department to run the BSS effectively. There are a total 35 employees working in the head office and they monitor all the activities within the BSS service area. They developed a service centreor shop (called 'JoShop' or 'Jobike Outlet') in respective service area for managing the BSS. A Lead (or in-charge),one customer manager, two re-balancer, two technicians, and two security personnel were appointed for operation in each relevant service area. Jobike management team in head office cooperates the zonal (or area) Lead.The customer manager provides solution to the problems of BSS users or recharging credits and plays an important role in answering the queries of users. A website dashboard is used to track all the records of bicycle activities such as data on daily trips or daily sales for re-charging. A central customer relationship management team also works to create a close relation between operators and users. Moreover, the online community groups of BSS users (e.g. Jobike user group of JU) play a vital role in developing good relation between BSS users and service providing authority. Several operational characteristics are discussed below.

- **Service Hours:** Initially the Jobikebicycles were available to hire from 8 am to 6 pm. Gradually the duration of service hours or Jobike operation was increased depending on the demand of users in specific service area.
- **Bike Maintenance:** Jobike zonal operation team collects the bikes for regular maintenance and repair activities and charging the locks. In each service area, every day around 20 bikes are checked for regular maintenance. A smart dashboard system in each bike shows the charge status of the lock. The maintenance team have an App on their smartphone to detect the bikes with low charge and their locations to be collected.
- **Bikes Security at Night:** Every day after the operation hour, the Jobike field authority collects the bicycles and store them in the nearest parking point. All the bicycles are kept locked by a chain to prevent theft at night.
- **Parking Points:** A service area is divided into several parking points considering the density of people or demand of users. Each parking point has a parking stand sign.
- **Refill Credits**: BSS users need to refill credit before taking a ride. Small retailer shops such as recharge points, bKash shop, etc. are the partner for Jobike refill. The refill retailers get a 4% commission of the amount recharged for Jobike. However, Jobike technology team is working to develop and build an online system for recharging.
- **Re-Balancing:** A rebalancing team with a van is vigilant in the BSS area to collect the bikes and re-balancing in different stations to ensure proper utilization of the bicycles.

4.5. Operational Challenges of Jobike BSS

Until October 2019, Jobike App has been downloaded more than 50,000 times (Daily Sun, 2019). That time BSS was not introduced DU campus and Gulshan-Banani Area. Table 3 shows some basic statistics of JobikeBSS usages in five different locations of Bangladesh.

Table 3.JobikeBSS usage statistics in Bangladesh

Features	Statistics
Total bikes in operation	280
Total number of average daily trips (ADT)	2,700
Average trips per day per bicycle (TDB)	10
Total number of unique riders (UR)	20,000
Average trip duration	15 Minutes
Total reported vandalism or bikes crashes	130
Rate of complaints from the users	20%

Source:Jobike Authority, 2019.

Table 4. SWOT analysis of Jobike BSS

Strengths	**Weakness**
● Green transportation ● Popular concept and design ● Smart technology use ● Fashionable appearance of bike ● Durable & long-lasting product ● Interest from people & society ● Low-cost public transport	● Low financial strength of service provider ● Difficulty for regular maintenance ● High cost for product development ● Operating cost ● Poor user behavior e.g. vandalism ● Lack of bicycle infrastructure ● No support from the government or other institutions
Opportunity	**Threats**
● Expanding service areas ● Average 10 trips per bike per day ● Partnering with government ● Cooperation with telecom companies	● Misuses of bikes by the users ● Vandalism and damage of bike ● Theft of bike ● Reckless driving

Source: Authors.

Major strengths, weaknesses, opportunities, and threats (SWOT) of Jobike BSS are shown in Table 4. Many problems such as lack of finance, absent of public-private partnership, lack of political will to promote bicycling, absence of relevant bicycle infrastructures, misuses of bikes by some of the users, vandalism and theft of several bicycle are the major challenges of providing BSS that Jobike authority faced. However, financial difficulties and vandalism are the main two problems the Jobike authority faced while providing BSS (Ahmed, 2019). Nevertheless, Jobike authority also had poor and inefficient management within the company. The distribution and maintenance of the bikes in respective service area are also challenging. Moreover, not receiving any support from the respective authority of the service area (e.g. university administration) is another

important drawback of Jobike BSS. After one year of operation, Jobike discontinued the services in JU mainly due to financial constraints and several incidents of vandalism whilst at CU it was mainly due to high rates of vandalism.

5. Users' Opinions about BSS in Bangladesh

5.1. Demographic Profile and Socio-economic Conditions of the Respondents

The respondents are mostly the young adults, 77.5% are in age group 16-24 years. Only 4% of the respondents are from the residential areas while 96% are from different university campus. In terms of occupation, almost 93.5% are students. It is not unlikely that most of the respondents are students or young because three of the then five BSS service areas were the university campus. Moreover, anybody wanting to use Jobike bicycles would require a smartphone and many students have one. Furthermore, the students may have greater interest and time for using high-techbased services and filling out the online questionnaire.

Almost 80% of the respondents who used JobikeBSS have no personal vehicle or a bicycle. Therefore, they are interested and willing to use BSS. However, 20% of the respondents mentioned that despite owning a personal bicycle (s)he had Jobikeridesjust to have an experience about the BSS. The BSS users mostly used it because of money and time saving alternative mode of rickshaws. For instance, almost 68% of the respondents previously travelled by rickshawswhile 12% walked and the remaining 20% used other travel modes. Figure 3 shows that a large portion of the respondents consider 'travel cost' (62%) and 'travel time' (44%) as the main influencing factors for selecting a travel mode.

The usual travel frequency of the respondents per week are: 20-30 trips (28%), 15-20 trips (24%), 10-15 trips (25%), and below 10 trips (23%). Travel cost of a person usually depends on the number of trips (s)he makes and the travel mode being used. The average weekly travel cost for the respondents are: below Tk 50 for 16%, Tk 51-100 for 32%, Tk 101-150for 24.5%, andTk 151-200+ for 27.5%.

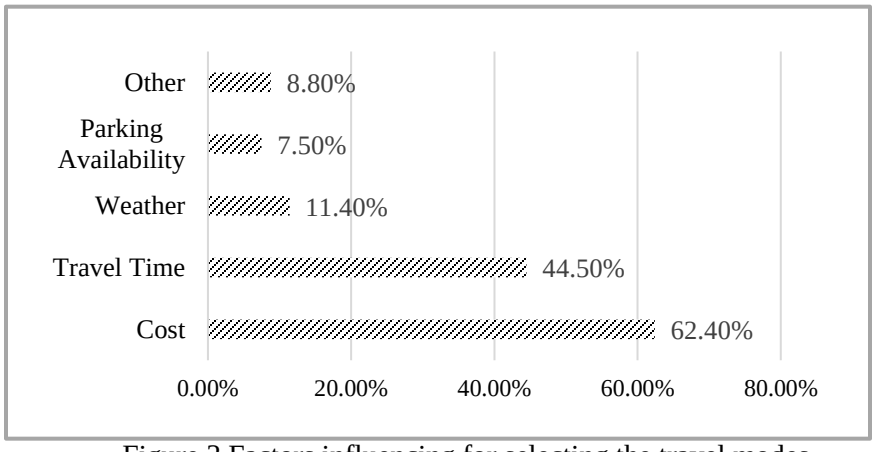

Figure 3.Factors influencing for selecting the travel modes

Source: Online Survey, 2019.

5.2. Respondents' Opinions about Jobike BSS Service

Almost half of the respondents (43.5%) are not the frequent user of BSS who use it 'sometimes' but not in a regular basis. The remaining are frequent users of Jobike BSS. Their weekly frequency of using BSS are: less than 6 trips for 15.5%, 6-10 trips for 21%, and more than 10 tripsfor 20% of the respondents. Availability of a bicycle in a desired station is the very important aspect for BSS users. Almost half of the respondents (50%) consider that finding a bicycle of JobikeBSS is often easy though 18% mentioned difficult.The design of Jobike bicycles is smartly made and both men and women can ride them comfortably. These bicycles require very low paddling pressure as the weight of bicycle is low. In terms of comfortof Jobike bicycles, more than 81% of the respondents feel 'very comfortable' or 'comfortable', as shown in Figure 4.

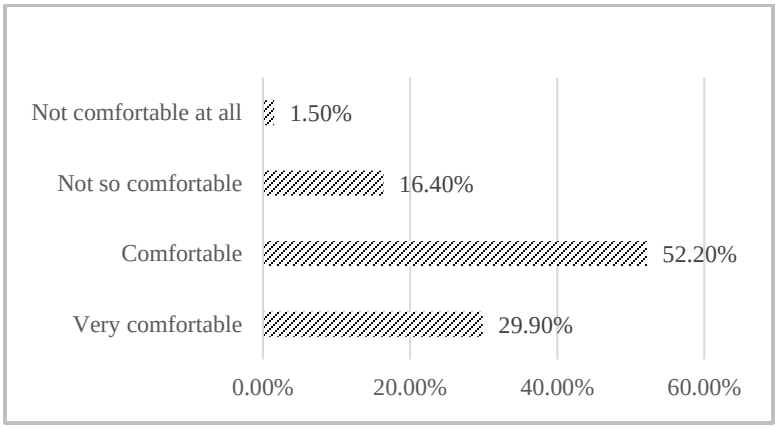

Figure 4.Users' opinions about comfort of Jobike bicycles

Source: Online Survey, 2019.

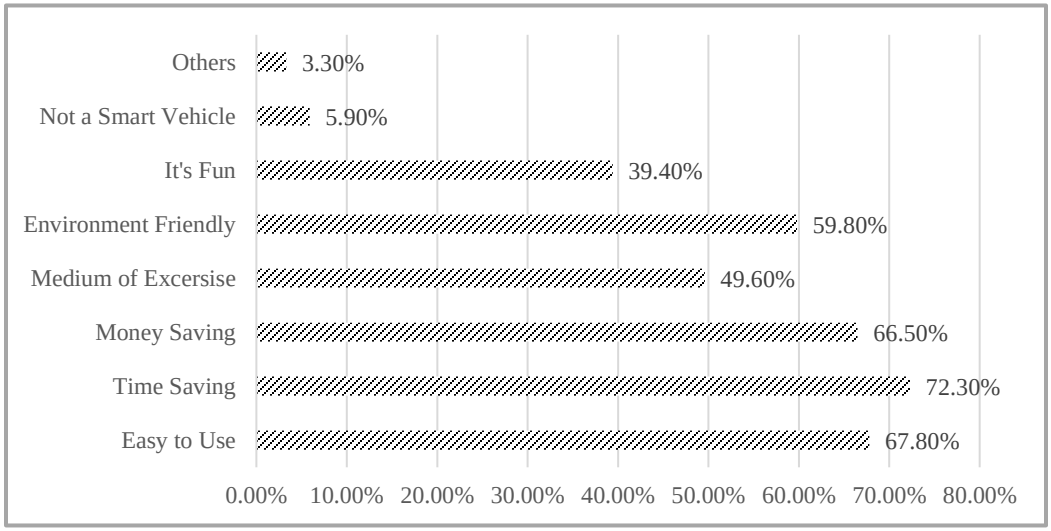

Figure 5.User's Perception about JobikeBSS service

Source: Online Survey, 2019.

About the existing pricing (cost for using BSS) of Jobike, almost 76% of the respondents are satisfied and the remaining 24% are not satisfied. The BSS users' have developed their own perception bout the different aspects of Jobike BSS after riding/using them. The results are shown in Figure 5. Almost three-quarter of the respondents consider that using Jobike is easy and saves their time to reach in destinations. Almost half of the respondents (49%) claimed that they are using BSS for physical exercise and usually do it in the morning or evening. More than half (59%) of the respondents consider that BSS is an environment friendly mode of transport. Surprisingly almost 40% of the respondents mentioned that they had BSS ride just for having fun.

Acceptability of Jobike BSSis good among the respondents. About the overall services, the proportion of the respondents mentioned 'satisfactory', 'good', and 'excellent' are 41%, 37%, and 13% respectively whilst 'poor' and 'very poor' are mentioned by 7.5% and 1.5% respectively as the services do not match with their expectations. More than half of the respondents consider the BSS as a 'low-cost' travel mode. Almost a-third of the respondents (29%) think that the availability of bicycles in BSS stations are scared though more than a third (39%) mentioned it is good or sufficient. Nevertheless, the problems with smartphone App and problems of bicycle lock are the major issueas almost 50% mentioned that there are problems with the smart lock system. Unlocking problem of the locks could be due to network issues and low charge in locks. Figure 6 shows some other problems are: bad quality of bicycles, overcharging, and refill problems.

Figure 6.Users' opinions about the problems of Jobike BSS

Source: Online Survey, 2019.

6. Discussion

The JobikeBSS is a very new concept of transport system and service in Bangladesh. After launching the JobikeBSS, it was widely accepted by people in all the service areas. People were curious and interested in using BSS. Within a few days of inauguration, it become a popular mode for short trips. Jobike bikes are equally popular to both male and female users for their unique design, light weight, and comfort. It was found that many

respondents use BSS as an alternative of rickshaw tripsbecause of reduced travel cost and time on BSS. Though a portion of BSS users in Bangladesh are occasional users, about 20% of the respondents have more than two rides per day. Many people consider BSS as environment friendly travel mode as well as a form of physical exercise. A few students also consider riding BSS for fun. However, almost 60% of the respondents reported that the bike was not available when it was in need. Several respondents also reported the problems in smart lock for unlocking the bicycle with the smartphone App or locking.

JobikeBSS in Bangladesh was widely accepted among the users of the service area. Only 11% of the respondents mentioned that the BSS do not match with their expectations though 89% are satisfied. However, despite their satisfaction, one-third suggested that the BSS service need to be improved in order to address the issues and problems of users such as hardware problems of the bike, technical improvement of the App, the system of rebalancing the bikes. Increasing the number of bikes may improve the availability of bikes. Developing an online system to refill money and introducing different pricing strategies are required to satisfy the users who are not satisfied with the existing service and fare rates. Preparing local transport plan will help to develop BSS considering the local contexts and culture or expectations of users.

The trips per day per bicycle (TDB) is one of the important factors or criteria to assess the performance of BSS system (Médard de Chardon, et al. 2017). The higher the TDB, the more effective the system is. This is the most common measure for performance of BSSsystem and widely used across the globe. The average TDB for Jobike BSS is 7 to 10 (as seen in Table 1), which is higher (better) than other BSS in other countries where TDB is usually 4 to 8.

Nevertheless, a total more than 130 incidents of vandalism were reported and 6 bikes were stolen in different JobikeBSS areas. Jobike service was discontinued in several locations due to financial crisis of the organization and thus difficulty in maintainingthe operating costs, and the vandalism. Raising awareness about green transport and introducing registration using valid National ID or Student Card may help reducing theft, vandalism and parking in wrong places.

The service area of JobikeBSS for all the locations is either a very small and confined area (e.g. university campus) or a small portion of the city (e.g. Mirpur DOHS or Gulshan-Banani in Dhaka). However, the small BSS systems do not work efficiently (Burden and Barth, 2009). The coverage area for a BSS system should be the whole city or 10 sq. km area with around 10-30 bikes for every 1,000 residents, as suggested by ITDP (2013) planning and design guidelines. Even though the capital cost and operating cost of Jobike is very less compared with other BSS in Europe or in other Asian countries, the cost could be further reduced if the bicycles are produced in mass scale and the BSS is in city wide. Moreover, the BSS may provide better services to more people if they are integrated with public transport system.

Support from the government agencies responsible for providing transport infrastructure and services, local governments, and private organizations would help to overcome financial constraints ofBSS operation. For example, partnering with the telecom companies may provide opportunity for BSS providers to use/receive free internet (for BSS App)as well as big data for their strategic planning or service provision. Moreover,

enhancing political will and collaboration with local government authority will facilitate to develop proper and safe infrastructure for cycling, such as integrated network of bicycle lanes and bicycle parking points.

7. Conclusions

The BSS is an alternative mode of transport which can help solving last-mile problems, reducing transport-induced pollution in built-up areas, and minimizing travel cost and time. Jobike is the first BSS provided in several areas in Bangladesh. This paper provides a brief background about Jobike BSS, their operations and services as well as the users' opinions about the BSS.

BSS operation in Bangladesh began in 2018 and since then, over the last several years,they have launched BSS in seven different locations. Most of the JobikeBSS users have a positive response towards the BSS scheme. However, there are some challenges for BSS operations. After about a year of operation, BSS services in Cox's Bazar, JU and CU campus were discontinued mainly due to financial difficulties and vandalism. To make BSS scheme successful it is very important to prevent vandalism and theft of bicycle. Public-private partnership may help to overcome the financial constraints. Thoughmostof the users are satisfied with the available BSS services, the system needs some improvements to overcome the problems. Generating awareness among the users and community participation could be helpful for the BSS system.

This paper will be helpful for researchers and transport professionals to know and understand about the overall BSS operations and services in Bangladesh. The service providers would be able to improve the BSS system by knowing users' opinions and addressing the issues. The results will be very helpful for the professionals or organizations who are planning to introduce/operate BSS in Bangladesh or in similar countries. This paper provides an avenue for further research on public-private partnership in BSS, detailed cost-benefit analysis of BSS, integration of BSS with mass transit, electric bicycle use in BSS, potentials and opportunities of BSS during COVID-19 pandemic in providing transport services.

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