Smart Bike Sharing System as Sustainable Transportation

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Abstract. The purpose of this study is to identify the bike-sharing system in Indonesia and its application for the prospect of sustainable transportation. This study used a descriptive method from secondary data as references for identifying and analyzing the system and application for sustainable transportation. The results of this study show that the bike-sharing system in two cities in Indonesia has different conditions. When comparing in the two cities, the bike-sharing in Yogyakarta seems to be more promising than in Bandung. The city government of Bandung needs to follow the success of Yogyakarta, in which the local government always improves the system and the facilities.

1. Introduction

Every city faces transportation problems such as traffic congestion, which has an impact on the community and the environment. One effort to deal with transportation problems is the use of bicycles as an alternative mode of transportation for the community. The city government in several cities provided bicycles with a bike-sharing system (BSS). BSS is a way that can increase bicycle use and public transportation as well as may decrease the use of motorized vehicles [1]. In other words, BSS is a form of sustainable transportation.

The bike-sharing system is an inclusive and sustainable alternative to urban transportation. This BSS serves short trips from one point to another without having to have a bicycle. Individuals can use bicycles from one station and can return the bike to the original station or another. The results of research in five cities in Asia (China, Korea, Taiwan, Japan, and India) show that bike-sharing can also produce benefits due to increased demand for transportation and maximizing the choice of transportation modes [2]. Bike-sharing is continually evolving, which is getting more sophisticated. The first and second generation is still trying to deal with vandalism and theft. The third generation of BSS improved user information, payment methods, and station distribution. The fourth generation is a dockless and foldable electric bicycle [3].

The characteristic of a smart bike-sharing system is that the system can connect public transportation and desired destinations by offering a new mobility system that complements existing public transport [4]. A smart bike-sharing system is a BSS equipped with sensors on a bicycle that can send real-time data and forward that data to the nearest station. Research conducted to assess the smart bike-sharing system has simulated data in the form of (a) prediction of bike availability, (b) busiest station, (c) average time to took between two stations, (d) the busyness of all route, (e) load factor, and (f) estimated time of availability of a bike [5].

This study aims to identify the Smart Bike Sharing system in two cities, Jogjakarta and Bandung. The study is to compare the bike system sharing in terms of application, its management, and the facilities.
2. **Method**

The method used in this study is the descriptive method using secondary data from the bike-sharing system located in two cities Indonesia, i.e., Yogyakarta and Bandung. The data is obtained from many resources, such as research papers, newspaper articles, and government regulations.

3. **Results and Discussion**

3.1. **The bike-sharing system in Yogyakarta**

Yogyakarta used to be a famous as a bike city because many people ride bicycles. Nowadays, because of the motor-cycle popularity is increasing, the local government introduce a bike-sharing system to promote bicycle riding in Yogyakarta. Bicycles, smart-lock devices, and applications for bike-sharing systems in the city of Jogjakarta are purely Indonesian local products. In the initial stage, the Yogyakarta City Government provided 20 bicycles. Whereas in 2019, there were 275 onthel bikes or traditional bikes [6].

To use bike-sharing is quite easy. Users only need to install the jogjabike application in the play store or google play (Figure 1). After downloading the jogjabike application, just register and login to the application. Then, tap the device on the bicycle handlebar until it lights up, wait for the information 'I'm ready to move QR' to appear. Then scan the QR Code to unlock.

The latest Jogja Bike application is equipped with GPS tracking, which will allow users to find out the bicycle routes. Besides, operators can also monitor the extent to which users use their bikes (Figure 2). Therefore, Yogyakarta implements a smart bike-sharing system.

![Figure 1. Bike sharing application in Jogjakarta or jogjabike application (InaBike)](image1)

![Figure 2. Bike sharing application in Jogjakarta or jogjabike application (InaBike) on Smartphone (GPS Tracking)](image2)
Besides providing traditional bicycles or onthel bicycle (Figure 3), Jogjabike also provided 50 units of mountain bikes in 2019 (Figure 4).

![Figure 3. Bike sharing system in Jogjakarta provide traditional bicycles or onthel bicycles.](image)

3.2. The bike-sharing system in Bandung

The local government of Bandung has applied for a bike-sharing program by providing bicycles for rent at affordable prices. The bike-sharing helps citizens to go other public transportation places. Therefore, this bike-sharing shelter is placed at mass transportation points such as bus terminals and train stations. The program began in 2012 with the provision of 150 bicycles that can be rented at 12 shelters [7]. Currently, the bike-sharing system in Bandung is called Boseh (Bike on Street Everybody Happy). Users can download the Boseh application at https://www.boseh.bike/ (Figure 5); the application under the Android platform is in Figure 6.

![Figure 4. Bike sharing system in Jogjakarta provide mountain bike (MTB).](image)

Head of Transportation Management Unit of DISHUB Bandung said that Boseh, which was launched of 350 units with the type of city bike multi-speed, is currently less attractive to the public (Figure 7) [8].
Bandung city government is more concerned with the safety of Boseh bikes rather than optimizing its use because bike-sharing with docking models such as bike-sharing in the city of Bandung will require subsidies for operational costs. Bicycle safety is essential. However, the supply of bicycles and facilities requires funds like in Kazakhstan and the bike-sharing system is also not going well. The absence of a proper legal arrangement and accounting system on the bike-sharing system in Kazakhstan complicates the transportation market (Figure 7) [9].
The results of the identification of the two bike-sharing system management show that Yogyakarta is better than Bandung. There are still many users, especially tourists because there is an increase in the number of bicycles. The availability of bicycles is critical because consumers who need are always served. The findings of the bike-sharing study in Brisbane is that with the addition of infrastructures such as helmets, the addition of operating hours, the addition of stations or substations increases the number of users [10].

Bike-sharing system applications in Bandung, which is not always updated, should be suspected to be the cause of the decline in users. Whereas in Yogyakarta, the city government updated the bike-sharing system application and added facilities. A bike-sharing system that is applied in a city so that it can be categorized as sustainable transportation needs an up to date smart system. Smart systems for bike-sharing applications that are used must be real-time and connected with other modes. Digital platforms in the form of virtual interfaces that facilitate access to information in real-time can be a solution in facilitating relations between different transportation systems [11].

4. Conclusion
Bike-sharing is an alternative for public transportation as a sustainable transportation. Yogyakarta has a bike-sharing system; InaBike and Bandung already has Boseh. This bike-sharing system requires funds for facility management and application maintenance. The city government needs to provide subsidies so that applications that run will be always in a good condition.

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