

COMPARATIVE ANALYSIS OF SERVICE PERFORMANCE BETWEEN PHNOM PENH'S AND TRANSJAKARTA CITY BUSES

Sri Setia Lestari^{1*}, Jovinda Raffael D.F², M. Farhan Ahmadani³, Amelia Dwi Alviani⁴, Roselina Rahmawati⁵, Nadila Mutiara Faeza⁶, Rachadyan Narotama⁷, Vannia Ardelia Amanda⁸

^{1,2,3,4,5,6,7,8}Civil Engineering Department, Politeknik Negeri Semarang, Jl. Prof. H. Soedarto, SH, Tembalang, Semarang City, 50275, Indonesia

e-mail: sriselstr0506@gmail.com

ABSTRACT

The cities of Jakarta and Phnom Penh face the same traffic problems, namely traffic congestion caused by the high number of private vehicle owners in both regions. To get around the problem, public transportation such as TransJakarta and Phnom Penh City Bus are used. The purpose of this study is to compare the performance of TransJakarta and Phnom Penh City Bus public transportation systems. The approach used in this research is a qualitative approach by comparing the same variables from both case studies. The comparison between TransJakarta and Phnom Penh City Bus public transportation services shows differences in several aspects. The results show that TransJakarta has lower fares, dedicated lanes that reduce congestion, as well as a cashless payment system that increases user convenience. In contrast, Phnom Penh City Bus faces challenges such as higher fares, lack of dedicated lanes, and reliance on cash payments, which hinder its operational efficiency. The contribution of this research emphasizes the importance of applying best practices from TransJakarta in global public transport management, such as the development of user-friendly infrastructure, improved accessibility, and the use of modern technology for payment systems. The findings will provide insights for policy and transport managers in various countries to design a more efficient public transportation system.

Keywords: Public Transportation; TransJakarta; Phnom Penh City Bus.

1. Introduction

Phnom Penh is the capital of Cambodia and the country's most populous city in terms of population. In 2023, the population of Phnom Penh City reached 2,281,000 people with a total population density of 3,359 people a square kilometer in the 679 square kilometers (262 square miles) urban area. This represents an increase of 3.17% from the population in 2022. The city's population is growing at about 3% annually. The growth in PDB according to capita poses a major challenge for urban transportation in Cambodia. Therefore, traffic congestion and accidents have become serious problems in the city. Previous studies have shown that the quality of public transport services affects user satisfaction and the use of mass transportation [1] and emphasized the importance of comparative analysis in understanding the differences in the performance of transport systems in different cities, which can provide insights for improving transport regulations [2].

This study attempts to identify the main factors that difference the performance of the two bus systems. In 2015, the volume of registered vehicles in Phnom Penh averaged about 20%, and the population has reached at least 1,500,000. Furthermore, the largest share of registered vehicles is due to the increase in motorcycle ownership (.84 % of registered vehicles) [3][4].

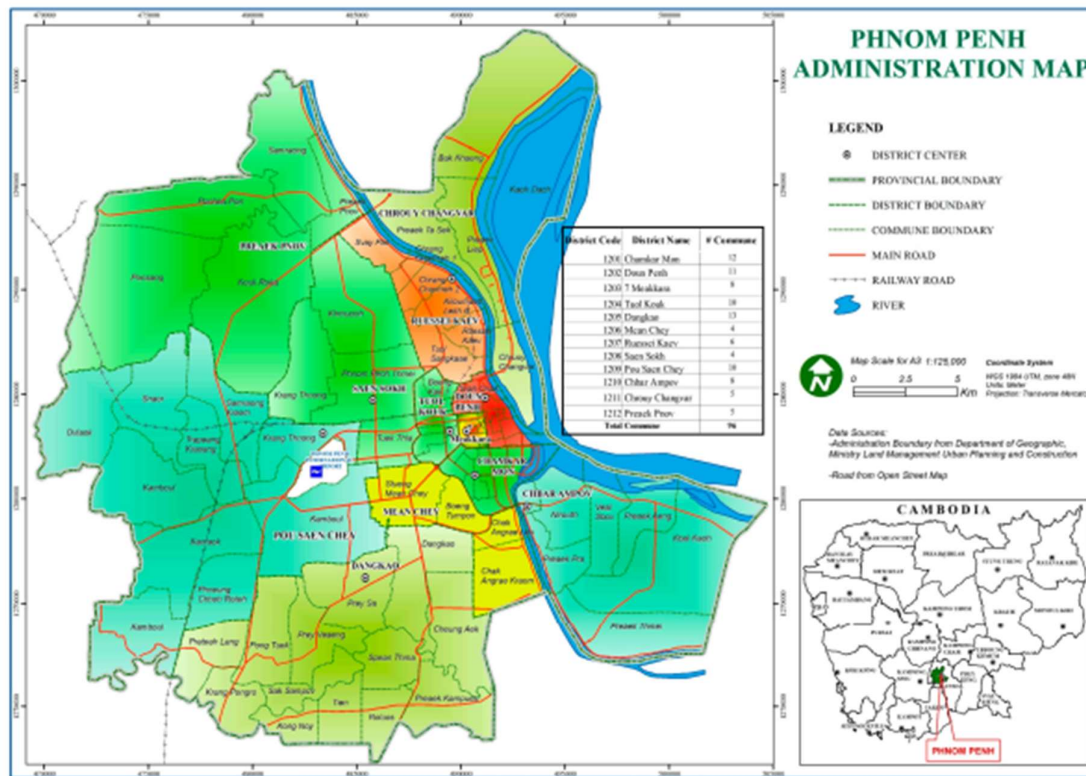


Figure 1. Phnom Penh City Map [5]

The city of Jakarta, the capital of Indonesia, also experiences more or less the same thing. As the center of business, politics, and culture, Jakarta is the location of the headquarters for State-Owned Enterprises (BUMN), private companies, and foreign companies. In addition, this city is also the headquarters of government institutions and the ASEAN secretariat office. Jakarta covers an area of approximately 664.01 km² (including ocean: 6,977.5 km²), with a population reaching 11,240,000 people in 2023 [6]. Based on the data, the population density of DKI Jakarta reached 16,125 people per km² and became the region with the highest population density in Indonesia. This population density certainly affects the increasing number of private vehicle ownership. Based on data from the Indonesian National Police, the number of vehicles in DKI Jakarta reached 23.03 million vehicles [7]. The number of vehicles is mostly contributed by motorbikes, which number 18.3 million.

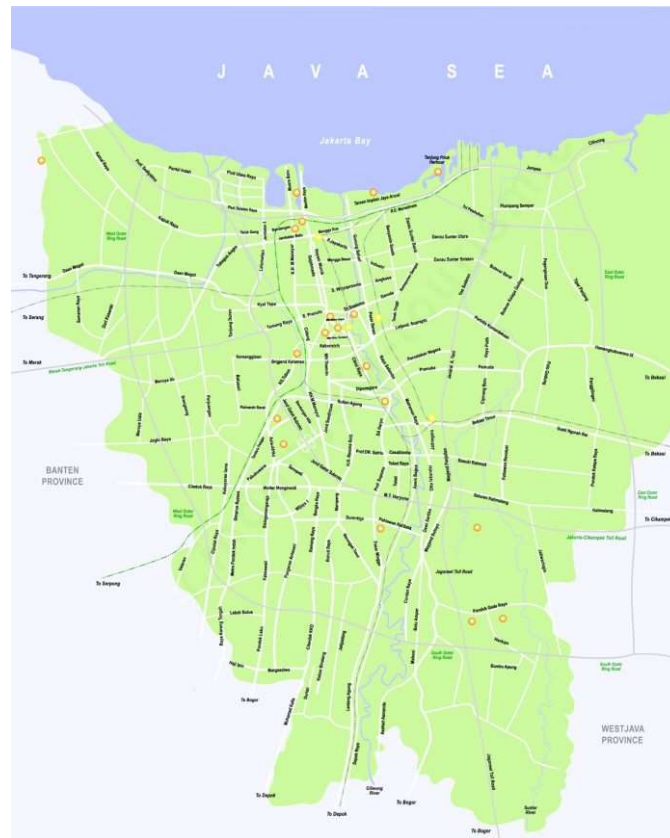


Figure 2. Map of DKI Jakarta [8]

Transportation facilities are a key element in the country's development process, where transportation is one of the basic factors for economic progress, social development, and industrial growth. However, various problems often exist that interfere with the efficiency and effectiveness of the system [9]. Traffic congestion is the most common problem faced by transportation network systems in large cities. Congestion is usually caused by an imbalance between the capacity of the road and the number of vehicles traveling on it. One way to overcome this is to switch to using public transportation. The current government has made efforts by issuing policies focused on the development of public transportation which aims to reduce the volume of traffic caused by the high use of private vehicles. The use of public transportation can significantly reduce the volume of vehicles on the road, so a sustainable public transportation system has a positive impact on the economic, socio-cultural and environmental sustainability of local communities. Poorly managed transportation network systems also cause environmental problems, such as increased carbon emissions, air pollution, and noise. Energy efficient public vehicles, such as buses are typically more efficient in energy use per passenger than private vehicles, thus reducing the carbon footprint. Increased mobility in transportation brings wider benefits by reducing negative impacts on the environmental sector [9].

One option for public transportation is the bus. Public transportation policy places the government as the owner and executor, but the government also allows private companies to participate in transportation management, especially land transportation [1]. Types of land transportation include city buses. City buses, also known as City bus or Transit buses in English, are a public transportation system that connects various locations within urban areas using public buses. These city buses operate on a scheduled and routine basis, following certain transportation routes. Generally, city buses are operated in cities with medium, large, or metropolitan population levels [2].

City buses themselves have the advantage of being able to accommodate many passengers at once so that they can reduce traffic volume. In this study, the author compares between city buses in Phnom Penh (Phnom Penh City Bus) and DKI Jakarta (TransJakarta).

Phnom Penh City Bus is a public transportation system serving the city of Phnom Penh, the capital of Cambodia. It was opened to the public in September 2014 with 3 routes, with the number of routes gradually increasing over the following years. As of 2018, the Phnom Penh City Bus has 11 routes that cover the entire city of Phnom Penh. The bus routes cover Prek Pnov (North), Ta Khmao (South), Chbar Ampov (East), and the Special Economic Zone (West), with plans to expand the network beyond [10]. The Phnom Penh City Bus operates from 5.30am to 8.30pm. About 7,000 people a day currently use the service. Tickets cost 1,500 riel per trip, although monks, the elderly, the disabled, garment workers, students and children under 1m tall are exempted from the ticket fee [11].

Meanwhile, in Jakarta, Indonesia, the city bus is named Transjakarta. Transjakarta is the first Bus Rapid Transit (BRT) transportation system in Southeast and South Asia, which has been operating since 2004 in Jakarta, Indonesia. This system is designed based on the TransMilenio system in Bogota, Colombia [12]. Transjakarta was built as a means of mass transportation to support the busy activities in the capital city. Transjakarta is a BRT system with the longest route in the world with a total of 230.9 km and has 243 stops on 13 main line corridors. Initially, Transjakarta had operating hours from 05.00 to 22.00 WIB, but on September 12, 2022, this Transjakarta bus began operating for 24 hours for all its corridors [13]. Transjakarta is operated by PT. Transportasi Jakarta. The number of workers involved in its operations includes drivers, flight attendants, terminal officers, and cleaners totaling around 6000 people. The average daily number of Transjakarta users is estimated at around 350,000 people, while in 2012, the number of TransJakarta users reached 109,983,609 people. In 2011, the system reached its maximum annual efficiency with buses carrying 114.7 million passengers, then in the following year the number decreased and in 2014 buses carried 111.6 million passengers [14], in 2015 buses served 102.95 million passengers, and the peak record was in 2016 with 123.73 million passengers [15]. The applicable fare since the beginning of the Transjakarta bus operation is IDR. 3,500 per passenger [16].

2. Materials and Method

This study uses a qualitative approach by comparing the same variables from two case studies [2]. In this writing, the author conducted a comparative study of the implementation of the TransJakarta and Phnom Penh City Bus systems. The initial stage carried out in the comparison was the collection of literature data to determine the characteristics of transportation and performance measures in the urban public transportation system. The performance was identified by the stages of describing and comparing the public transportation systems in the two capital cities. Based on data from the Transportation Agency, the service performance variables that will be used refer to the literature sources that have been obtained, so they can be formulated as in the table below:

Table 1. City Bus Service Performance Parameters

No	Parameter	Indicator
1	Rates	Passenger categories
2	Special Lane	Availability
3	Payment system	Proof of purchase of passenger ticket
4	Fuel	Fuel used
5	Route Network	Number of routes traveled
6	Bus Stop Facilities	Accessibility of bus stops
7	Bus Quality and Comfort	Facilities offered
8	Operating Hours	Bus operating hours
9	Number of Fleet	Number of buses in operation

Source: Department of Transportation

The variables listed in table 1 are the parameters to be identified, namely the differences between TransJakarta and Phnom Penh City Bus services. Furthermore, descriptive analysis is conducted to discuss how the performance conditions of the transportation are related to the characteristics of the capital city. The following are the steps during the research.

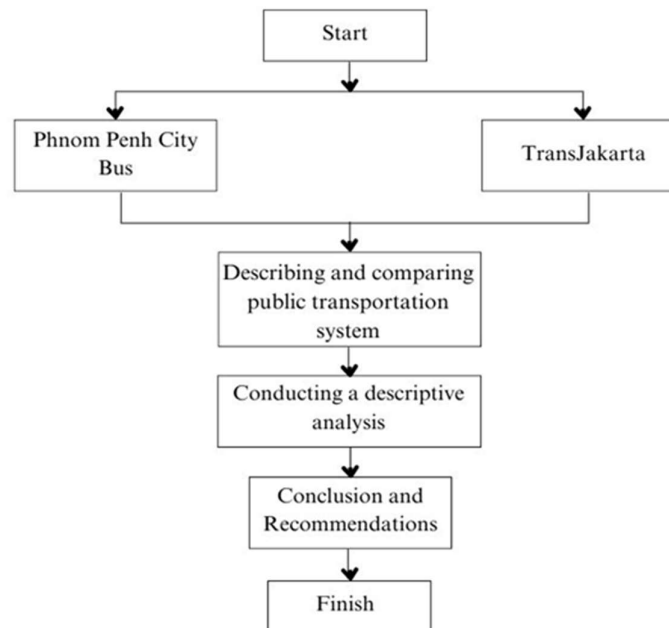


Figure 3. Research Flow Chart

3. Results and Discussion

To analyze the comparative performance of the two city bus systems, the parameters used are passenger fares, payment systems used, bus fuel, networks and routes passed, bus stop facilities, bus quality and comfort, operating hours, and the number of fleets of the two buses [2]. The results of the comparative analysis of the two city buses are then summarized in Table 2.

Table 2. City Bus Service Performance Indicators

No	Parameter	Indicator	Transjakarta	Phnom Penh City Bus	A Quick Comparison
1	Rates	Passenger Category	3500 per passenger	There are different rates for several categories	Fixed fares on Transjakarta can support use by all groups, while different fares in Phnom Penh may create inequality.
2	Special Lane	Availability	Available	Not available	TransJakarta allows buses to move faster and more efficiently, while Phnom Penh City Bus has to share the road with other vehicles, which can cause congestion.

No	Parameter	Indicator	Transjakarta	Phnom Penh City Bus	A Quick Comparison
3	Payment system	Proof of purchase of passenger ticket	e-money (cashless)	Cash (exact money put in the box) and e-money (cashless)	TransJakarta has adopted a more modern non-cash payment system, while Phnom Penh City Bus still relies on cash payments.
4	Fuel	Fuel used	CNG, Electricity, and Fossil Fuels	Fossil Fuels	The use of environmentally friendly fuel on TransJakarta while Phnom Penh City Bus still uses diesel fuel.
5	Route Network	Number of routes traveled	14 corridors	17 routes	Phnom Penh City Bus has more routes, but TransJakarta has a wider reach with more corridors,
6	Bus Stop Facilities	Accessibility of bus stops	- The height of the bus stop floor is the same as the bus floor - Some stops have a floor level with the ground. - Equipped with a comfortable waiting room - Disability friendly	- The height of the bus stop floor is the same as the sidewalk - Equipped with seating - Disability friendly	Better bus stop facilities on TransJakarta increase user comfort, while facilities on Phnom Penh City Bus still need to be improved.
7	Bus Quality and Comfort	Facilities offered	- Equipped with AC, - There are special buses for women available - Equipped with priority seats	Equipped with AC	TransJakarta facilities already support passenger comfort, while Phnom Penh City Bus interior quality can vary, which may affect user comfort.
8	Operating Hours	Bus operating hours	24 hours	05.30 - 20.30	TransJakarta has more flexible operating hours. In contrast, Phnom Penh

No	Parameter	Indicator	Transjakarta	Phnom Penh City Bus	A Quick Comparison
9	Number of Fleet	Number of buses in operation	4,079 buses	235 buses	City Bus has more limited operating hours. TransJakarta has a larger fleet, which allows for higher service frequency, whereas Phnom Penh City Bus has a smaller fleet, resulting in lower service frequency.

Based on Table 2 which compares the performance of TransJakarta and Phnom Penh City Bus services, it can be seen that there are several differences in each parameter used. In the tariff parameter, TransJakarta has a flat tariff of IDR. 3,500,- for one trip, both long and short [16]. In contrast, Phnom Penh City Bus has a fare of 1,500 riel.[11] or around IDR5,912, each trip. However, for the elderly (over 70 years old), small children under 1m tall, disabled, monks, and teachers are free by showing their ID card before boarding the bus.

In the lane sector, TransJakarta has a special lane located on the right side of the road, so that buses can run smoothly without getting stuck in traffic jams that often occur in Jakarta. For Phnom Penh City Bus itself, there is no special lane, where the bus passes together with other vehicles on the road. This is one of the weaknesses of Phnom Penh City Bus which causes this bus to get stuck in traffic jams if there is a traffic jam.

The payment system of TransJakarta has used a non-cash system that is easier and more modern, compared to Phnom Penh City Bus which still uses a cash system. The payment can use a prepaid card issued by a bank such as Bank Rakyat Indonesia (BRIZZI), Bank Central Asia (Flazz), Bank Negara Indonesia (Tapcash, Kartu Aku, and Rail Card), Bank Mandiri (e-money, e-Toll Card, Indomaret Card, and GazCard), Bank DKI (JakCard), and Bank Mega MegaCash. Payment of Phnom Penh City Bus fares is done by inserting money into the box next to the driver. At the time of payment, passengers are expected to pay money with a predetermined nominal according to the applicable category. This is because Phnom Penh City Bus does not provide change. In addition to using a cash payment system, currently Phnom Penh City Bus also provides payments using e-money or non-cash.

Several TransJakarta bus fleets have adopted environmentally friendly technology by using electric and gas power. The upgrade is part of an effort to reduce negative impacts on the environment and improve the quality of public transportation [17]. By utilizing electricity and gas, the fleet can reduce exhaust emissions and air pollution caused by the use of fossil fuels. Meanwhile, the entire Phnom Penh City Bus fleet still uses fossil fuels even though environmentally friendly technology has been increasingly developed. This adds a negative impact on air quality and contributes to climate change.

There are 14 corridors served by TransJakarta operating in the JABODETABEK area (Jakarta, Bogor, Depok, Tangerang, and Bekasi). With strategic route distribution, these corridors provide vital services for population mobilization as seen at Figure 4. Phnom Penh City Bus itself serves 17 routes spread throughout the region. Phnom Penh city. The route covers Prek Pnov (North), Ta Khmao (South), Chbar Ampov (East), and Special Economic Zone (West) areas. There are also plans to expand the network outside these areas as seen at Figure 5.

TransJakarta bus stops have the same floor height as the bus. The bus stops are buildings whose construction is dominated by aluminum, steel, glass, and concrete as the bus stop floor. TransJakarta bus stops are mostly located in the middle of the road, so to access the bus stops, there are pedestrian bridges that are made sloping and made of aluminum and steel (except for the existing pedestrian bridges) or there are crossings that are usually located near traffic lights or made zebra crossings. Bus stops located on the side of the road are equipped with public transportation stops next to the

Transjakarta bus stops. Inside the bus stops, there are seats, trash bins (certain buses), and information boards regarding Transjakarta routes or others. However, some TransJakarta routes are served by Low Entry buses where the bus stops for this type of fleet are level with the ground. This fleet is operated because some routes served by TransJakarta cannot be reached by High Deck buses. In addition, this fleet is also friendly for the disabled because they do not need to climb normal bus stops that are level with the bus deck, as seen at Figure 6.

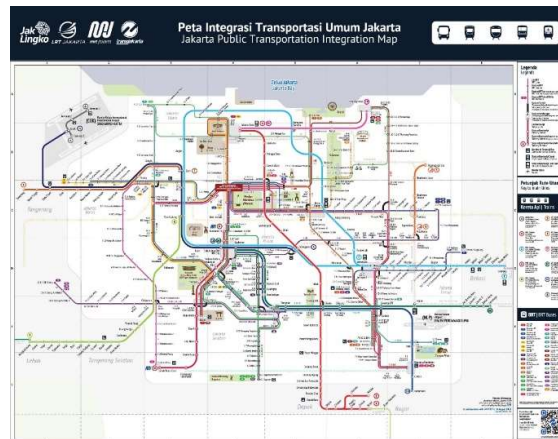


Figure 4. TransJakarta Route [18]



Figure 1. Phnom Penh City Bus Routes [19]



Figure 2. TransJakarta Bus Stop [20]

At Phnom Penh City Bus itself, all the stops are the type of stops that are parallel to the ground, so it can be said that the entire bus fleet used is the low entry type. The form of the stop itself is a simple building that provides chairs for waiting for the bus and information boards from the Phnom Penh City Bus route itself.



Figure 3. Phnom Penh City Bus Stop [10]

The buses used by TransJakarta consist of several types of buses, namely, articulated buses, double-decker buses, high deck buses, and low deck buses. TransJakarta also launched special buses for women in 2016. This fleet is expected to provide a sense of security and comfort for female users. All buses used by TransJakarta are air-conditioned and have a place to hold on for standing passengers. TransJakarta buses that are high deck have higher door heights than buses in general, so to board them you must pass through special TransJakarta stops. Conversely, TransJakarta buses that are low deck have a low floor height, so these buses can be boarded through regular bus stops located in several TransJakarta corridors.



Figure 4. TransJakarta Bus [21]

Phnom Penh City Bus itself has only one type of low entry bus. This is because the bus stop is a stop that has a floor height parallel to the ground. Just like TransJakarta, all buses used by Phnom Penh City Bus are also air-conditioned and equipped with a place to hold for standing passengers.



Figure 5. Phnom Penh City Bus [10]

TransJakarta operates 24 hours. The bus operating hours are divided into two, namely regular at 05.00 - 24.00 and Night Transportation (AMARI) at 24.00 - 05.00. TransJakarta's 24-hour operating hours are expected to help people who want to travel either in the morning, afternoon, evening, or night. While Phnom Penh City Bus operates from 05.30 - 20.00 Cambodian time.

The number of TransJakarta fleets until July 2020 reached 4,709 units consisting of 1,853 large buses, 361 medium buses, and 1,865 small buses. The large number of TransJakarta fleets is none other than because TransJakarta is a BRT system with the longest route in the world (230.9 km) and the number of daily passengers reaches 1.02 million users. The number of fleets owned by Phnom Penh City Bus is 235 buses. The smaller number of fleets used is because the number of daily passengers only reaches 30 thousand people. This number is only around 3% of the number of daily TransJakarta users.

The results of the study revealed that TransJakarta has several benefits compare to Phnom Penh City Bus, especially in terms of price, infrastructure, and payment system. TransJakarta offers lower fares and has dedicated lanes designed to reduce traffic congestion, as well as a cashless payment system that increases user experience. The Phnom Penh City Bus, on the other hand, faces serious challenges, such as higher fares, lack of dedicated lanes, and reliance on cash payments, which hinder operational efficiency and passenger convenience. The implications of these findings suggest that an efficient and sustainable transportation system relies a great deal on the integration of modern technology and the development of user-friendly infrastructure. The challenges faced by Phnom Penh City Bus, such as long lines and potential revenue loss due to cash processing, can be addressed by implementing a more widespread cashless payment system, such as prepaid cards or mobile apps. In addition, it is important to educate the public on the benefits of modern payment systems and provide incentives for users to switch from cash to cashless payments. With these measures, it is expected to increase public interest in using public transportation, reduce congestion, and ultimately support the sustainability of the transportation system in the two cities.

4. Conclusions

Based on the differences in several aspects that have been described, it can be concluded that TransJakarta has relatively affordable fares. By having a special lane that helps avoid congestion. TransJakarta has adopted environmentally friendly technology that reflects a commitment to sustainability. Good accessibility and a non-cash payment system provide convenience for users/passengers and add a modern impression. This is supported by a service network that involves corridors throughout the region, and sophisticated bus stop facilities. TransJakarta also provides a variety of fleets, such as special buses for women, and 24-hour operating hours. On the other hand, Phnom Penh City Bus, with higher fares compensated by free fares for some categories. However, the lack of dedicated lanes makes it vulnerable to traffic congestion. The cash payment system is still dominant, although now accepting non-cash payments, indicating an ongoing implementation stage. Although there have been efforts to renew the fleet with low-entry buses, they still use fossil fuels. Limited operating hours from 5:30 a.m. to 8:30 p.m. create time constraints for users of this service.

To upgrade transportation systems in Phnom Penh City Bus, it is recommended to implement cashless payment systems, such as prepaid cards and mobile apps, and develop dedicated lanes for buses to reduce congestion. Socializing the benefits of public transport is also necessary. Meanwhile, TransJakarta should expand its bus lane network and integrate technological innovations in its payment and bus tracking systems. Incentive programs for new users can also encourage more people to switch to public transport. The cities need to develop a comprehensive transportation strategy to integrate different modes of transportation and encourage investment in infrastructure. The implementation of an effective monitoring and evaluation system will help in making improvements based on user feedback.

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