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A Circumstantial Review on Ride-sharing Profile in Dhaka City

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ABSTRACT

The ride-sharing profile has gotten a decision to the horde of Dhaka City in the transportation field because of its broadened habits in transport offices. Before developing ride-sharing, broad issues like traffic blockage, misconduct of the conductors, and tolls' vexation were exceptionally regular in the city's common travel framework. The ride-sharing platform brings mollification in the city's transportation part through the possible relief of such basic practices. The paper aims to grant an itemized vision regarding the ride-offering plan in Dhaka City to how this vehicle framework executes various transportation issues, a couple of downsides, and some innovation-based achievements recommended by the researchers rising bothers of this new vehicle framework. The study also deals with the measures to make the ride-sharing scheme supportable in the future and includes the improvement of some application-based plans like ride-sharing. There is a gigantic extent of study for future researchers concerning the ride-sharing profile in Dhaka City.

1. Introduction

The ride-sharing profile is the parochial interpretation of the paratransit profile. The word "Para" means alongside, and "Transit" means transport. Thus, paratransit stands for any transportation facilities distinguished from the conventional transport system. The ride-sharing scheme is an

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identical version of the paratransit service system. The scheme generally consists of either a taxi, a car, a small bus, a human hauler, a motorcycle, or a bicycle. Ride-sharing is a demand-responsive transport service. The service effectiveness varies on the degree of flexibility it provides to the customers. The most effective service renders door-to-door service from any origin to on-demand destination in any service area. Community groups or for-profit private companies operate the services.

Carpooling: Carpooling is the sharing system to travel more than one person in a car with similar travel needs. It is also familiar to the customers as Car-sharing/Lift-sharing. Uber is the promoter of carpooling service in Bangladesh. The company started the service with UberX in Dhaka in 2016 [1] by the base fare of BDT 40, per minute fare of BDT 3, and per Km fare of BDT 18.

Vanpooling: Vanpooling is the ride-sharing system to travel together from home or more common locations to a common destination or work center. The system allows groups of people to share the ride like carpooling. Staff Bus and School Van are the two vanpooling services.

Transportation Network Company: A Transportation Network Company (TNC) is a Mobility Service Provider (MSP) that matches passengers with vehicle services and via websites or mobile apps. Transit companies for automobiles are the ride-hailing services. TNCs usually serve in less populated or more impoverished areas that taxicabs do not provide service regularly. The companies charge a lower rate than taxicabs.

Peer-to-peer ride-sharing: Peer-to-peer ride-sharing system allows the drivers to share a destination with passengers. It can be classified along the spectrum from commercial, for-free TNC to for-profit ride-sharing services to informal non-profit peer-to-peer carpooling arrangements. Modern peer-to-peer ride-sharing schemes rely on web applications and mobile app technology.

The ride-sharing scheme is a standard and reliable transport mode worldwide in the 21st Century. It is precisely due to relaxing traffic congestion and knocking off dependency on single-occupancy vehicles. In the USA, conventional taxi ridership had crashed from an average daily ridership of 967,000–954,000 within 2013–2017 [2]. The organized taxi sector accounts for 4 %–5 % of the industry and totals 800 million USD. Ride-sharing services, Uber and Grab, scored 8.1 opposite to 7.2 scored by the taxis regarding their ease of booking.

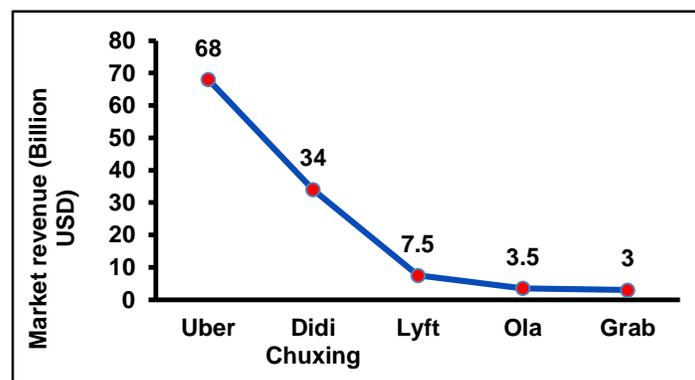


Fig. 1. Market revenue captured by the globally renowned ride-sharing companies.

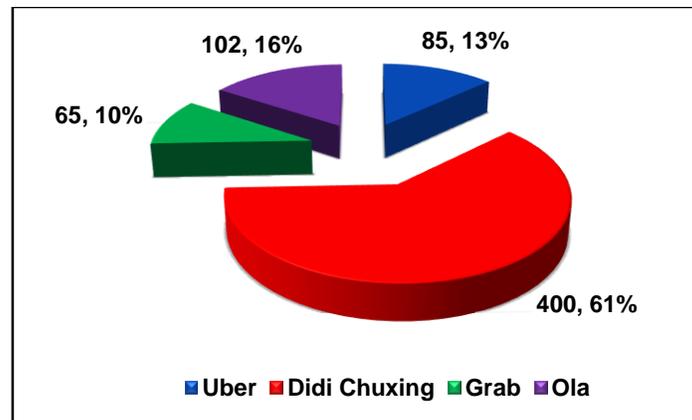


Fig. 2. Occupied regions by the globally renowned ride-sharing companies in Asia.

Dhaka is the 7th highest city globally in terms of its large-scale population of about 17 million within 1.528 square kilometers [3]. This condition makes the transportation demand at stake. According to Bangladesh Road Transport Authority (BRTA), an estimated 930,990 registered vehicles exist in Dhaka City up to October 2015. Almost 37,000 vehicles enter the city's pathways every year. Among those, about 80 % are private cars. The pioneer ride-sharing companies of Bangladesh, Pathao, Uber, and Amar Ride first introduced the ride-sharing services in Dhaka City in 2016 by kicking off their initiative services. Around 125,000 motorbikes and cars provide ride-sharing services throughout the city at present. Among those, 104,389 are motorbikes, and 18,253 are cars [4]. Therefore, the ride-sharing plan has significantly altered the inclusive transportation system of the city.

2. Ride-sharing in bangladesh

More than twenty ride-sharing companies provide the ride-sharing services in Bangladesh [5], including Uber, Pathao, Obhai, Shohoz, PiickMe, Share-A-Motorcycle (SAM), MUV, Chalo, Bahon, RideOX, BDcabs, Dako, Dhaka Moto, Amar Bike, Ezzyr, Garivara, Taxiwala, Amar Ride, Hellow Ride, and Shohozatri.

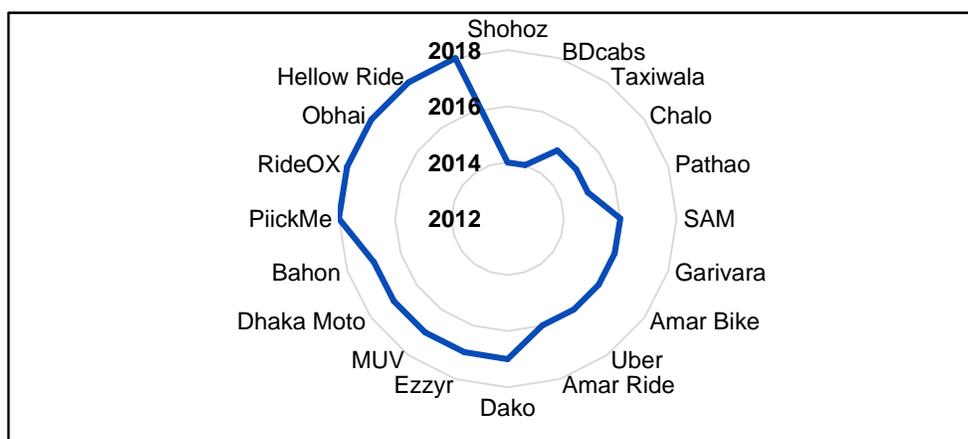


Fig. 3. Flowchart showing the launching years of the ride-sharing companies in Bangladesh.

The ride-sharing scheme's benefits have made it so popular in Dhaka City that the conventional transit system has a hard time to compete. Ride-sharing services have provided employment opportunities for more than 40,000 people, which solve the country's unemployment issue. Moreover, food delivery services of the ride-sharing companies (UberEATS, Pathao Food, and Shohoz Food) have originated more than 10,000 jobs in the country [6].

2.1. Top-rated ride-sharing companies in Dhaka City

Pathao Inc is one of the leading ride-sharing companies in Bangladesh, is a locally-based, private, for-profit, on-demand, and digital transportation service company in the country with a CB rank of 5,274 [7]. Fahim Saleh, Hussain M Elius, and Shifat Adnan are the Founder, CEO, and CTO of the company. Pathao started its journey on October 9, 2015, as a delivery service for several E-Commerce services, including Daraz of Alibaba Group (then Rocket Internet) [8]. Later, the company launched bike-sharing services in mid-2016. At present, Pathao provides ride-sharing services in Dhaka, Chittagong, Sylhet, Gazipur, and Narayanganj of Bangladesh and Kathmandu of Nepal. It successfully signed up more than 100,000 drivers and around 1 million users by March 2018 across Bangladesh. Pathao began its service in Nepal in September 2018. Pathao has eight partners and 1001–5000 employees at present. In an interview with TechCrunch, Pathao CEO Hussain M Elius included that Pathao has more than 50,000 bikes, and the company valued over US\$100 million as of April 2018. On December 3, 2019, Pathao turned into the significant ride-sharing company in Bangladesh, getting selection endorsement from the specialists. Currently, the company has eight investors. Battery Road Digital Holdings, Gojek, and Skycatcher are the three leading investors.

Uber Technologies, Inc. (founded in March 2009) is an American multi-national Transportation Network Company (TNC). The company offers peer-to-peer ride-sharing services in over 63 countries and 785 metropolitan areas worldwide [9]. In Bangladesh, Uber is another top-ranked ride-sharing company now. Uber Bangladesh officially kicked off its journey with UberX in Dhaka City in 2016. Initially, it had three members, including Quazi Zulquarnain, the Country Lead of Uber Bangladesh. The Uber branch has recruited 100,000 drivers since joining. As of December 2019, more than 10,000 active car drivers operate under the Uber network every month in the city [10]. Passengers mentioned Uber 1.5 multiple times in November 2017 alone. More than 200,000 individuals took Uber trips just around the same time of the year. At present, around 205 people use the Uber app every single minute in the city. Dhaka has become one of the rapid-growing Uber-using cities in the Asia-Pacific because of such overwhelming customer responses. Riders from 76 nations utilized Uber while visiting Bangladesh in 2019[11]. The branch also provides intercity ride-sharing services from Dhaka to Gazipur, Mymensingh, Narayanganj, Munshiganj, Narsingdi, Manikganj, and Comilla and vice-versa [12]. Additionally, Uber provides the intercity services from Dhaka to well-known tourist spots like Bhawal National Park, Moinat Ghat, Jora Moth, Idrakpur Fort, and Baliati Palace. Passengers can save Uber's top tier drivers and vehicles for as long as 10 hours with Uber Intercity. Thus, Uber gives them sufficient opportunity to finish any pending manufacturing plant visit or assemble their companions. Currently, Uber services are available in Dhaka, Chittagong, Sylhet, Cox's Bazar, Narayanganj, Gazipur, Narsingdi, Comilla, Manikganj, Munshiganj, and Mymensingh.

Obhai Solutions Limited is one of the emerging ride-sharing companies in Bangladesh with the tagline "Ride in a minute." Quazi Omar Ferdous is the Chief Operating Officer of the company [13]. The company has launched several transport facilities like Obhai Gari, Obhai Micro, Obhai Moto, and Obhai CNG to meet the passengers' daily transportation demands. Obhai provides a unique transport service, Obon, for female passengers with female riders [14]. It offers flexibility to the passengers to choose the intended rides from multiple ride options. Obhai is the first ride-sharing company in Rajshahi, Jessore, Cox's Bazar, and Khulna cities outside Dhaka, Chittagong, and Sylhet. The company has more than 500,000 customers and 150,000 enlisted riders since joining in 2018. Some Obhai services offer Wi-Fi, ACs, fans, comfortable seats, and back cameras to the passengers. Presently, Obhai has 10,000 CNG fleets in Dhaka City and 2,500 in Chittagong [15].

Shohoz Limited is another fastest-growing ride-sharing company in Bangladesh. It is a private, for-profit, on-demand, and digital transport service company in the country with a CB rank of 10,203 [16]. The multi-purpose company started its journey in 2014 [17] with the motive "To make life easy." Maliha Quadir is the Founder and CEO of the company. Initially, Shohoz focused on the bus ticket. The company now provides multiple services like Shohoz Ride, Shohoz Food, Shohoz Launch, Shohoz Bus, Shohoz Event, and Shohoz Movie. The company offers a clean application interface and an attentive customer care service to ensure rider and customer loyalty. Shohoz completes one million rides a month, and it has more than a million users [18]. In an interview on October 29, 2018, Maliha Quadir assured the future startup that the company has more than 50,000 drivers and served over 1.5 million rides in October 2018 [19]. Shohoz provides ride-sharing services in Dhaka, Gazipur, and Narayanganj. Shohoz has extended its service in the country with more than 40 bus operators and 20 ferries [20]. Presently, the company comprises of 51–100 employees. Financial experts supported the company with US\$15 million to pull it into the venture. Shohoz has ten financial specialists. Vostok New Ventures, Golden Gate, and Pegasus Tech Ventures are the lead financial supporters.

Table 1

Observations of each ride-sharing company in Bangladesh with their services, cover areas, users, drivers, and ride fare policy.

Ride-sharing company	Service provided	Cover areas	User (Estimated)	Driver (Estimated)	Ride fare policy (In BDT)*
Uber	Ride, Drive, Food, Business, Freight, Work	Dhaka, Chittagong, Sylhet, Narsingdi, Manikganj, Gazipur, Mymensingh, Comilla, Narayanganj, Munshiganj, Cox's Bazar	2 million	100,000	<p>Base fare: Uber Moto – 30 BDT UberX – 40 Uber Premier – 80</p> <p>Per-minute fare: Uber Moto – 0.5 UberX – 3 Uber Premier – 3 Uber Intercity – 3</p> <p>Per km fare: Uber Moto – 12 UberX – 18</p>

					<p>Uber Premier – 22 Uber Intercity – 22 (From Dhaka to out of Dhaka) Uber Intercity – 32 (From out of Dhaka to Dhaka) <u>For Uber Intercity:</u> Minimum fare – 499 Cancellation fee – 50 (After 5 minutes)</p>
Pathao	Ride, Drive, Food, Parcel, Courier, Mobile Recharge, Work	Dhaka, Chittagong, Sylhet, Gazipur, Narayanganj, Kathmandu of Nepal	1 million	100,000	<p><u>In Dhaka and Chittagong:</u></p> <p><u>For the bike ride:</u> Base fare – 25 Per km fare – 12 Waiting charge – 0.50/minute Minimum fare – 30</p> <p><u>In Sylhet:</u></p> <p><u>For the bike ride:</u> Base fare – 12 Per km fare – 8 Waiting charge – 0.40/minute Minimum fare – 25</p> <p><u>In Dhaka:</u></p> <p><u>For Car Plus ride:</u> Base fare – 50 Per km fare – 20 Waiting charge – 2.50/minute Minimum fare – 100</p> <p><u>For Car Lite ride:</u> Base fare – 40 Per km fare – 15 Waiting charge – 2/minute Minimum fare – 100</p> <p><u>In Chittagong:</u></p> <p><u>For Car Plus ride:</u> Base fare – 60 Per km fare – 24 Waiting charge – 2.50/minute Minimum fare – 80</p>

Obhai	Ride, Drive, Parcel, Work	Dhaka, Chittagong, Rajshahi, Sylhet, Khulna, Jessore, Cox's Bazar	500,000	150,000	Per km ride fare: Obhai Moto – 12.50 Obhai CNG – 20 Obhai Gari – 30.50
Shohoz	Ride, Food, Truck, Bus, Launch, Event, Movie, Drive, Work	Dhaka, Gazipur, Narayanganj	1 million	50,000	Ride fare: Base fare – 25 Per km fare – 12 Waiting charge – 0.50/minute
PiickMe	Ride, Drive, Work	Dhaka Metropolitan Area	250,000	45,000	For the bike ride: Base fare – 25 for the first 2 km, after the first 2 km – 12 BDT/km Premium ride + Waiting charge – 0.50 BDT/minute Minimum fare – 50 For the car ride: Base fare – 50 for the first 2 km, after the first 2 km – 20 BDT/km Premium ride + Waiting charge – 3 BDT/minute Minimum fare – 70

*The ride fares vary depending upon the demand, type of used transports, weather condition, route length, distance traveled, and waiting period, also the terms, conditions, and policy of the ride-sharing companies.

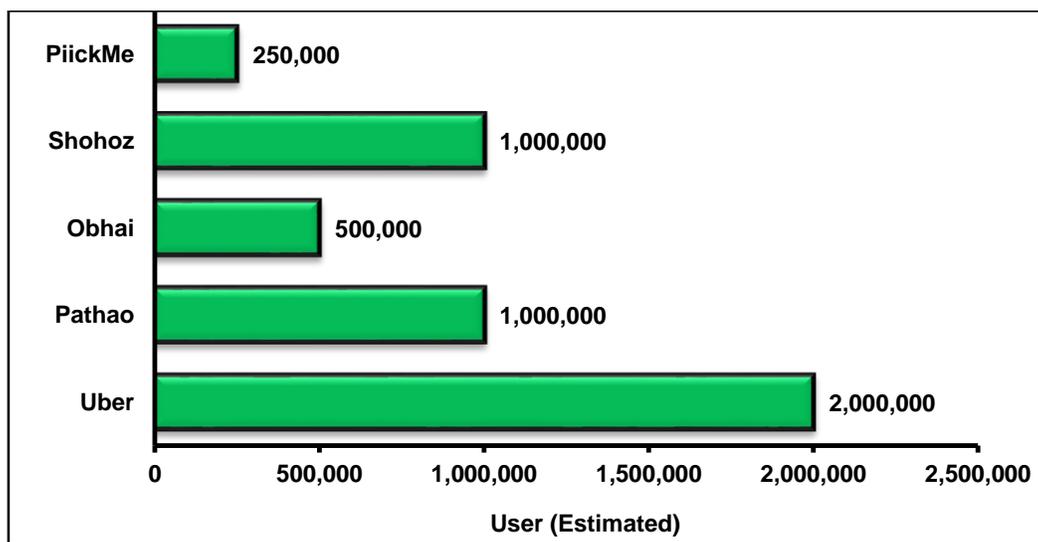


Fig. 4. User compliance in Bangladesh for each ride-sharing company.

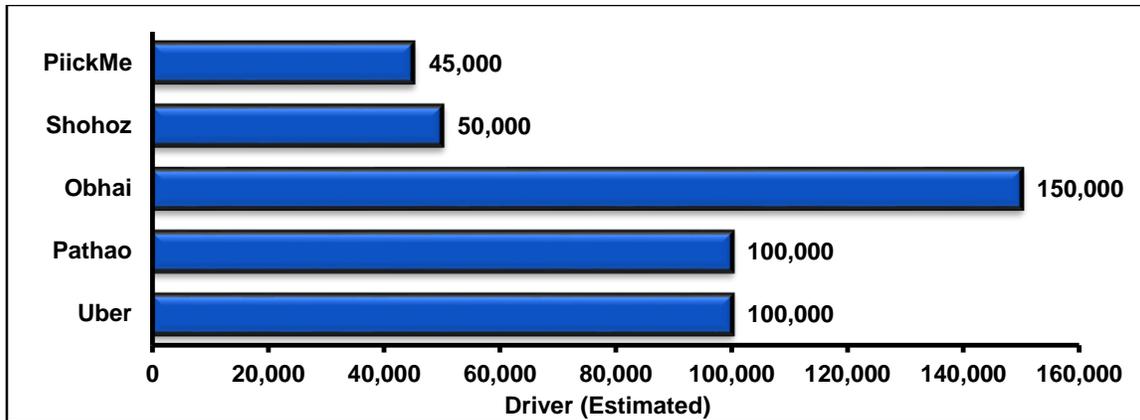


Fig. 5. Driver compliance in Bangladesh for each ride-sharing company.

3. Discussions

The ride-sharing scheme complements the other transport modes like trains, taxis, and buses; it does not eliminate them.

3.1. Benefits of the ride-sharing scheme

Offering all-time vehicle mobility: The ride-sharing platform provides accessibility and comfort to the customers. Customers can choose their intended rides any time from any place without any restriction or obligation. Timetable to get into any vehicle to travel is completely negligible in this vehicle framework. Therefore, passengers need not wait for either a bus, car, CNG, or others. As a result, they can easily choose their intended rides from home at any time through the ride-sharing apps. Thus, the ride-sharing system offers all-time vehicle mobility to the customers.

An alternative transport mode: Ride-sharing has become a substitute transport mode to the passengers of Dhaka city, which defines that the city people can go where they need to go. Passengers who do not have the funds to purchase a motorbike, car, or have their cars in the garage, have to travel by bus, train, or taxi to go shopping, school, work, or other places; ride-sharing is the smart option for them.

Acceptance to the passengers: Dhaka dwellers mostly use public buses and CNG to travel one place to another. Although the government transport authority has improved public bus service over time, there are still complaints such as frequently stopping in different places to take the passengers, not getting a seat even in a sitting service bus, and misbehavior of the conductors. The remaining choice is CNG, which already has earned dissatisfaction because of high asking fare, declining passenger requests, and the drivers' misbehavior. The ride-sharing service is free from such issues that make it more acceptable to the passengers.

User-friendly rather than the conventional transports: A passenger thinking to travel through a taxi or bus, he/she has to wait for his/her turn because there may be others waiting for their turns in that taxi or bus. It can be a serious matter when one is running late. The ride-sharing system allows the users to choose any ride close to them and indicate the locations where they are and

the destinations through the ride-sharing apps. Furthermore, the drivers will reach the destinations they provide as soon as possible.

Less time consumption by the ride-sharing motorbikes: 36 % of the country's urban population lives in Dhaka. As per a World Bank gauge, average traffic speed has dropped from 21 km/hour to 7 km/hour, slightly over the average walking speed within the last ten years. Traffic jam wastes 3.2 million working hours day-to-day in the city. As per urban transport specialists, the speed of cars is high (18.3 km/hour) during the AM period and low (10.7 km/hour) during the PM period, and an average speed of around 14 km/hour is the effluent. A ride-sharing motorbike can go up to 16 km/hour, sooner than the other transport modes. As a result, the ride-sharing motorbike is the quickest transport mode for the urban occupants.

Mutual connection between the drivers and passengers: Ride-sharing drivers are amicable. A passenger can rate his/her driver through the ride-sharing apps. The rating system keeps the drivers in check because nobody wants a negative review. The apps track vehicles. As a result, passengers feel safe. Thus, the platform builds a trustful relationship between the drivers and the passengers.

Affordable costing: Ride-sharing is cheaper than the conventional taxi service due to its sharing of more than two persons. A ride-sharing car user spends roughly BDT 300/trip without compromising comfort, and a hassle-free ride-sharing motorbike user spends less than BDT 150/trip. On the other hand, a CNG user spends roughly BDT 250/trip without door-to-door-pickup-drop-off service.

Scope of employment: Approximately 40,000 drivers provide ride-sharing services. It implies the job field potential of this transport sector. The ride-sharing scheme has facilitated the employment for the unemployed of the country.

Source of income: A survey by two Senior Research Associates of Policy Research Institute (PRI) uncovered that the gross salary of an individual Uber car proprietor is roughly BDT 60,000/month. The average earning of a Dhaka occupant is approximately BDT 30,000/month, half of the Uber car proprietor's salary. Moreover, Motorbike deals took off 3.60 lakh units in 2017 from 1.43 lakh units in 2015 because of the ride-sharing business. The ride-sharing system has become an income source for the city's young people choosing the ride-sharing profession.

Free from parking issues: The private vehicles need parking somewhere. The ride-sharing scheme is free from parking issues. As a result, Dhaka City commuters use the ride-sharing platform for their daily transportation needs rather than private vehicles.

Relaxing traffic congestion: According to the BRTA, about 37,000 vehicles enter the city streets every year, among them, 80 % are private cars. The ride-sharing platform allows its users to share the ride with more than two people with the same travel purpose, which proves economical. As a result, the city passengers use either a ride-sharing motorbike, a car, or other services instead of private vehicles to meet their travel needs. Therefore, traveling through private cars decreases in the city. The number of trips a vehicle makes per day reduces due to the ride-sharing services. Thus, the ride-sharing system reduces traffic congestion in Dhaka City.

Environment-friendly: WMO Greenhouse Gas Bulletin unlocked a 43 % rise in entire radiant coercion due to the nominal and perennial greenhouse gases since 1990, 80 % for Carbon-dioxide, and 17 % for Methane Gas [21]. In 2012, the maximum emission of Carbon-dioxide equivalent gases from Bangladesh's per capita was 0.98 metric tons [22]. Hence, the emission of greenhouse gases is undoubtedly a threat to the city inhabitants. However, the ride-sharing platform reduces the total greenhouse gas emissions from vehicles decreasing the number of trips a vehicle makes per day.

3.2. Disadvantages of the ride-sharing platform

Privacy and safety issue: The on-demand ride-sharing transport system has caused privacy and safety concerns to both customers and drivers. This transport service obliges customers to give up some privacy. If someone requests a ride from a ride-sharing company like Uber, Pathao, Obhai, Shohoz, or PiickMe, he/she has to request a ride from a stranger. Besides, most companies do not provide female drivers to ensure female passengers' privacy.

Lack of proper regulation and management system: In Dhaka City, customers have complained against the drivers for charging extra fares, taking circumbendibus, clocking for the ride before pick up, lack of experience in driving, the appearance of drug-addicted drivers, and refusing to take customers to their destination [23]. These phenomena create mistrust among the city's ride-sharing communities. Therefore, the lack of proper regulation and management system exists in the ride-sharing system.

Less suitable in some cases: The ride-sharing service is not fair enough for highways and narrow roads under users' perception. However, the service is fair enough for medium width (20–40ft) roads [24].

Risk of fraud: Drivers and commuters are not safe from fraud in ride-hailing services as there is an intent to misguide the online purchase process. Drivers can defraud passengers by requesting cash up-front or charging fees to the customer's Credit Card or PayPal Account. On the contrary, passengers can defraud the drivers with fake Credit Cards or canceling the trip mid-ride. Drivers spend several hours on the road due to false ride-booking by punk passengers.

Risk of vehicle damage: Ride-sharing companies do not provide the drivers any vehicle to use. As a result, it is required to have an operating vehicle of the drivers' own. In this platform, passengers share their rides with drivers despite having the risk of vehicle damage. Drivers in the rides can also cause vehicle damage. Moreover, passengers pay to prevent any loss during the agreement, though it is refundable if there detects no loss.

Unwillingness to stay loyal to a specific ride-sharing platform: Customer behavior is much unpredictable than it could imagine. They no longer feel the need to stay loyal to a specific brand. They bear a common tendency of shifting from one ride-hailing platform to another if they need to do so. Many of them do so for the cheapest rate. Additionally, many have an ill experience with one service. As a result, they switch to another ride-hailing platform to see how it serves. Likewise, the full-time employees do not stay loyal to a specific ride-sharing company due to insufficient opportunities.

A new capitalism model: Ride-sharing companies like Uber and Pathao profit the most from their business, contributing to form new capitalism. Therefore, there is a requirement of third parties in the ride-sharing services. Ride-sharing is an access economy for the sharing nature to access the services by both the passengers and drivers. The ride-sharing platforms do not offer any profit to the passengers who request the services through mobile apps. The new capitalism model is flopping the conventional transit system day-by-day.

Rising in travel costs sometimes: Renowned ride-sharing companies like Uber and Pathao have a challenging period of coping with unpredictable customer nature. The consumers tend to shift to another ride-sharing platform. It becomes frequent when the ride-sharing platforms increase the travel cost to achieve their revenue goals.

Lack of well-trained drivers: Ride-sharing drivers are not enough well-trained. As a result, Dhaka City passengers have noticed inappropriately driving the vehicle issues that cause troubles to the passengers.

Promoting ride-sharing rather than public transport: The ride-sharing platform has altered the traditional transportation ways in Dhaka City. Through which, a few years back, the city inhabitants met their daily transportation demand. The system has earned much popularity and acceptance from the city residents, which have caused the traditional transport system to suffer over the years. Passengers do not choose public transport rather than the ride-sharing service to meet their daily travel needs. Moreover, the ride-sharing companies have outstripped the conventional transport system by elevating their circumstances in the city's transportation sector.

Capturing of the roads' right side by ride-sharing motorbikes: Ride-sharing motorbikes undoubtedly minimize the daily time consumption due to traffic congestion throughout Dhaka City because of their speedy nature to travel from one place to another. However, ride-sharing motorbikes occupy the right side of the roads most of the time in the city. Due to this, passengers often feel trouble and discomfort to board into the public buses and alight from them.

Responsible for causing several motorbike accidents in Dhaka: Motorbike sales increased by 50 % within 2015–2017 due to the ride-sharing system's revolution. A report from BRTA showed that the number of registered motorbikes was 469,888 until April 2018, whereas, in 2010, it was 210,081 [25]. Another report revealed that BRTA registered about 75,251 motorbikes at the launching period of Uber and Pathao's motorbike ride-sharing services. Therefore, the number of ride-sharing motorbikes is increasing in the city day-by-day at an alarming rate. Accident Research Institute (ARI) of Bangladesh University of Engineering and Technology (BUET) disclosed that motorbike accidents in the city were 24.47 % in 2018, whereas the quantity was 18.25 % in 2017 and 9.75 % from March 2016–December 2016, by [26]. Moreover, ride-sharing motorbike drivers are not enough well-trained. As a result, the ride-sharing scheme causes several motorbike accidents in the city.

3.3. Technology-based solutions to fix the rising issues of the ride-sharing system

(a) The Prize Collect Traveling Salesman Problem (PCTSP) with the ride-sharing platform is a modern problem. The distribution of expenses reduces the costs of the driver journey due to

vehicle sharing travel. The drivers must fulfill a minimum riding task and take into account the penalties for the absence tasks. The cost distributions should be less than or equal to the service consumers' tariff limits set up. Formulating a mathematical model in an exact solution process with the aid of two algorithms and accurately, step-by-step with heuristic decisions, can solve the issue [27].

(b) The pricing system used by the ride-sharing companies for passengers affects social connectivity and revenue. Therefore, social connectivity and revenue optimization are essential for the commercial ride-sharing platform's sustainable development. A new price blueprint can encouragingly bring out a revolution in the participation of both drivers and riders. It can be implemented by designing an efficient algorithm with powerful pruning techniques and proposing a new-fashioned type of Price-aware Top-k Matching (PTkM) to retrieve the top-k vehicles on rider's demand [28].

(c) Taxi ride-sharing is a feasible transport service in the ride-sharing system for passengers of similar travel destinations. The issues in taxi ride-sharing are usually assessed on the distance traveled by the taxis. This problem is formulated as a Mixed Integer Linear Programming (MILP) problem. An exact algorithm can unravel it under ride capacity restrictions and a heuristic algorithm that evolves usual cases. The proposed model has been performed with numerical experiments, without lengthening the taxis' minimum travel distance and shortening the total trip distance [29].

(d) The Vehicle Routing Problem (VRP) plan's prevalence depends mostly on driver's contentment, customers' perceived quality, company's financial motives, and supply chain strategic fit (Strategic, tactical, and operational level). VRP plan is one of the most vital parameters to evaluate the service quality of the ride-hailing companies. The factor modifications of the advanced VRP plan are sufficient to improve service quality. It can be implemented through two heuristic methods, the Greedy and the Intra-route neighborhood heuristic models. The outcomes from both models are nearly the same [30].

(e) An extensive figure of circulating vehicles is responsible for pollution and traffic congestion that increasingly frustrates the day-to-day life of people living in densely populated cities. This life-hacking problem can be fixed by improving the existing ride-sharing facilities and barely lessening the circulating vehicle figure [31].

(f) Home-work carpooling is a tool for social mixing in the ride-sharing system. The specific carpooling system minimizes the prime bases of traffic in cities. Moreover, it lessens the digit of cars and kilometers traveled. Carpooling from this new spectacle maximizes the number of rides shared and the volume of time passengers spend simultaneously [32].

3.4. Measures to adopt in the future to ensure the ride-sharing scheme a supportable one

Implementation of government policy: The government of Bangladesh has made this illegal ride-sharing service legal since 2017 by setting up the transport system [33]. The government published a gazette on February 28, 2018, for the ride-sharing service policies. Many ride-sharing companies have already implemented the policies since March 8, 2018. However, several

ride-sharing companies have not implemented the policies still. The ride-sharing policies include all the rules and regulations required to maintain the ride-sharing service properly with operational transparency-cum-accountability, which will work as a result-oriented one for the ride-sharing model. After that, customers and drivers will receive the ride-sharing platform with privacy, safety, and free from complaints.

The government imposed ride fare policy: The ride-sharing enterprises have already counted much response from the crowd of Dhaka City. Recently, the transport system has tasted a little bit of trouble within the city due to the absence of proper rules and regulations in the ride fare policy. The issues like charging extra fares and clocking for the ride before pick up have already taken place within the city. Therefore, the ride-sharing companies should consider the government imposed ride fare policy to overcome such inconveniences.

Offering complaint centers: The ride-sharing companies do not offer any complaint centers for both the drivers and passengers to execute. As a result, city people have noticed harassment of female passengers by the male drivers, including rape attempts, taking circumbendibus by the drivers, lack of enough experience in driving, charging extra fares, and clocking for the ride before pick up. Moreover, issues such as drug-addicted drivers' appearance, defrauding of passengers by the drivers, drivers deceived by the punk passengers, canceling the trips at mid-ride, driving the vehicles recklessly, and refusing to take customers to their destination have become prevalent in the city. Therefore, the ride-sharing companies should introduce the complaint centers to cope with the rising bothers and ensure an effective ride-sharing system.

Possible congestion in Dhaka city due to ride-sharing motorbikes soon: In Dhaka City, the number of ride-sharing motorbikes increases day by day at a significant rate since the introduction to the ride-sharing business. BRTA registered approximately 75,251 motorbikes when Uber and Pathao launched a motorbike ride-sharing service in 2017. Market insiders approximated the number of motorbikes purchased daily as 1,500 [34]. Therefore, there is a huge chance to get the city influenced by motorbikes in the future unless the concerned authority controls the total number of ride-sharing motorbikes. In the context, it is essential to restrict the total number of ride-sharing motorbikes in the city to avoid any possible traffic congestion soon.

3.5. Comparing the ride fare policy of each ride-sharing company in Dhaka City

- Car (Category-1): UberX, Pathao Car Lite, PiickMe Car
- Car (Category-2): Uber Premier, Pathao Car Plus, Obhai Gari

3.5.1. Comparison based on base ride fare

The base ride fare for a motorbike ride service of Pathao, Shohoz, and PiickMe is BDT 25 (For PiickMe, the ride charge is valid up to 1st 2 km; after the 2 km, it is BDT 12/km), whereas the fare for Uber's motorcycle ride service is BDT 30. For car (Category-1) ride, Uber and Pathao charge BDT 40 for UberX and Pathao Car Lite service, respectively, whereas, PiickMe charges BDT 50 for its PiickMe Car service (It is valid up to 1st 2 km; after that, the fare is BDT 20/km).

For car (Category–2) ride fare, Uber assigns the base ride fare as BDT 80 for Uber Premier ride and Pathao as BDT 50 for Pathao Car Plus ride.

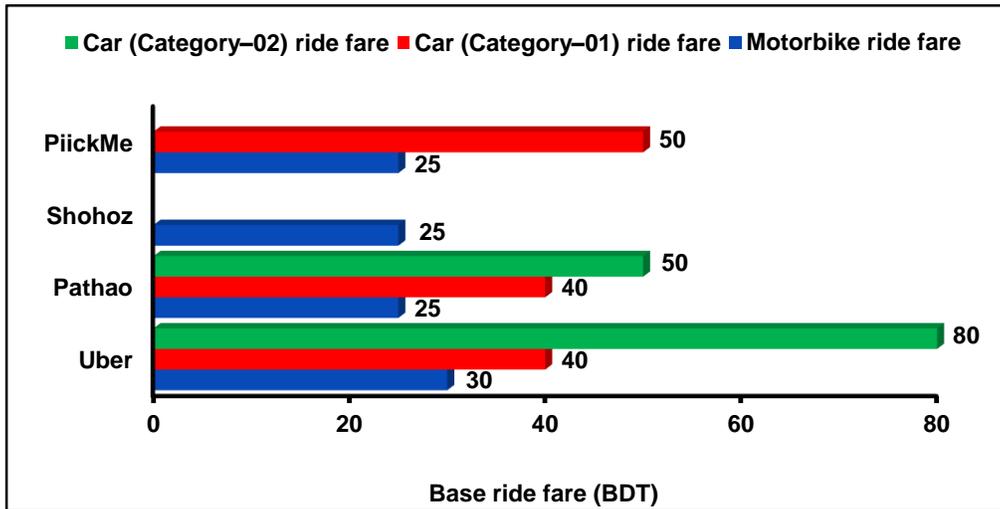


Fig. 6. Comparison based on base ride fare.

3.5.2. Comparison based on per km ride fare

The per km ride fare of Uber, Pathao, and Shohoz's motorbike ride service is BDT 12, whereas the ride fare is BDT 12.5 for the Obhai motorbike service. For car (Category–1) ride, Pathao charges BDT 15 for the Pathao Car Lite service, and Uber charges BDT 18 for the UberX service. Now, for car (Category–2) ride, Uber and Pathao charge BDT 22 and BDT 20 for Uber Premier and Pathao Car Plus ride, respectively, whereas Obhai charges BDT 30.5 for its Obhai Gari service. The ride fare for Uber's intercity service is BDT 22 from Dhaka to out of Dhaka and BDT 32 from out of Dhaka to Dhaka. Obhai appreciates BDT 20 for its CNG ride service.

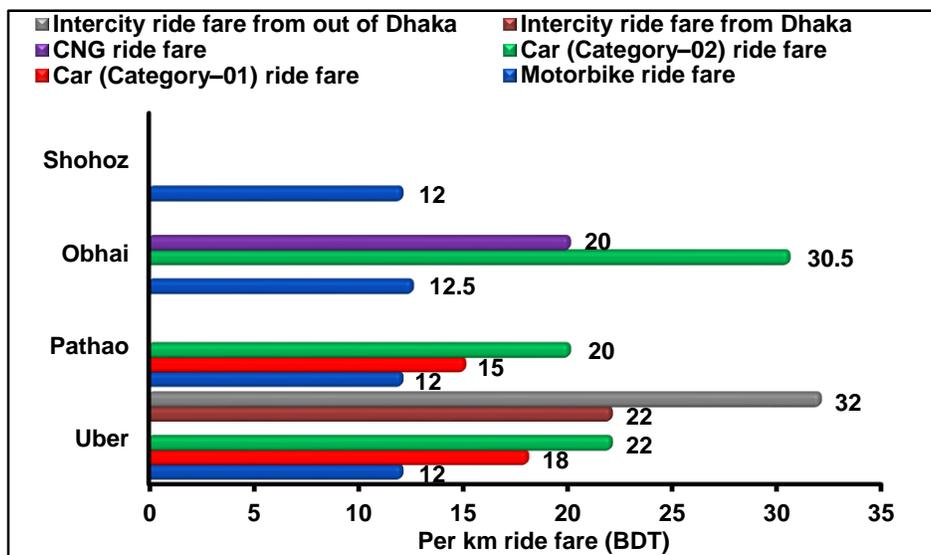


Fig. 7. Comparison based on per km ride fare.

3.5.3. Comparison based on waiting charge/minute for a ride

The waiting charge for a motorbike ride of Uber, Pathao, Shohoz, and PiickMe is BDT 0.5/minute (For PiickMe, Ride Premium + Waiting Charge is BDT 0.5/minute). For car (Category-1) ride, Uber and PiickMe design the waiting charge as BDT 3/minute for UberX and PiickMe Car service (For PiickMe, Ride Premium + Waiting Charge is BDT 3/minute), whereas Pathao sets the waiting fare as BDT 2/minute for the Pathao Car Lite service. For car (Category-2) ride, the waiting charge for Uber Premier service is BDT 3/minute and for Pathao Car Plus service BDT 2.5/minute. In the case of Uber's intercity service, the waiting cost is BDT 3/minute.

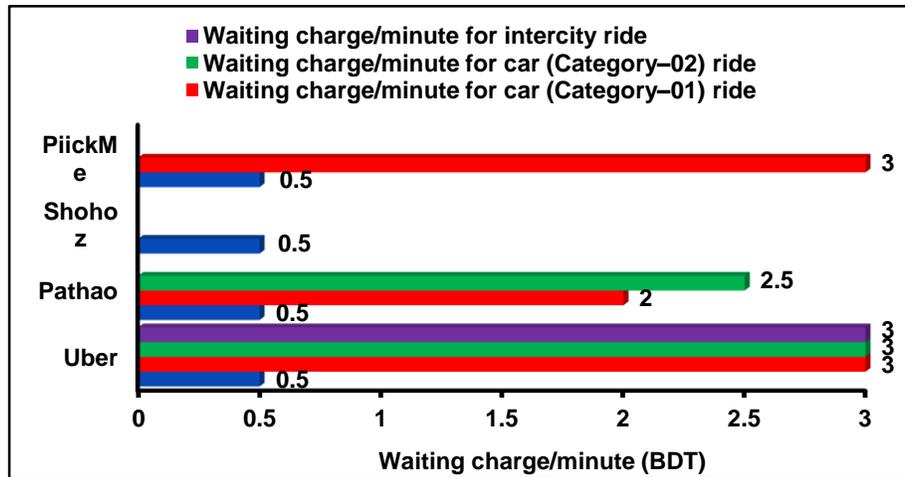


Fig. 8. Comparison based on waiting charge/minute for a ride.

3.5.4. Comparison based on minimum ride fare

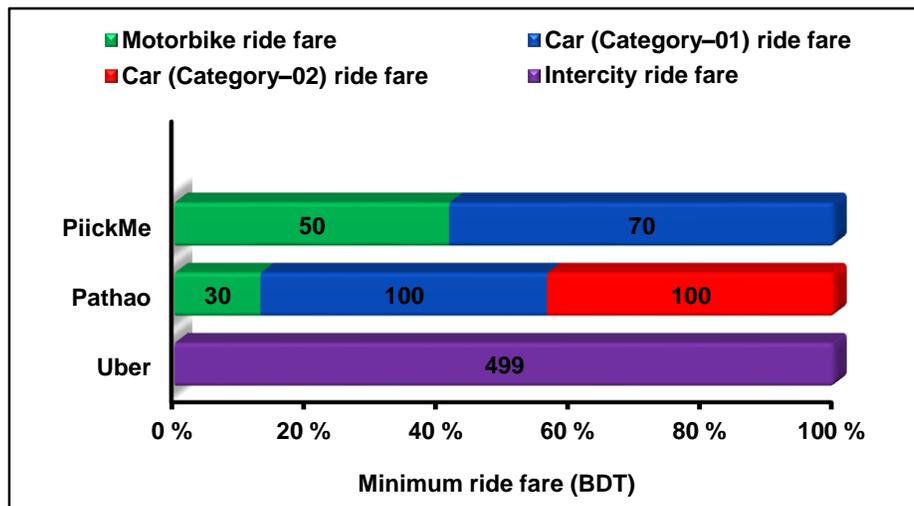


Fig. 9. Comparison based on minimum ride fare.

The minimum ride fare for motorbike ride service of Pathao is BDT 30, whereas PiickMe designs the cost as BDT 50. For car (Category-1) ride, PiickMe charges BDT 70 for its PiickMe Car service, and Pathao sets BDT 100 for its Pathao Car Lite service. The minimum ride fare for

Pathao Car Plus ride (Pathao's category-2 car service) is BDT 100. The charge for Uber intercity service is BDT 499.

3.6. Ride-sharing companies providing food delivery service

UberEATS: UberEATS is an online-based food delivery service of Uber Technologies, Inc. The food delivery service is based in San Francisco, California, the US. UberEATS started its journey with a lunch delivery service, UberFRESH, in Santa Monica, California, the US in August 2014 [35]. It was renamed UberEATS in 2015 [36]. In Bangladesh, UberEATS officially launched in Dhaka City in April 2019 [37] with more than 150 restaurants, including Sushi Samurai, Pizza Guy, Cheez, Tehari Avenue, Salam's Kitchen, Sultan's Dine, Madchef, and Chillox [38]. Bhavik Rathod is the Head of UberEATS in India and South Asia. Misha Ali is the Country Lead in Bangladesh. Currently, UberEATS is available in over 36 countries and 350 cities throughout the world.

Shohoz Food: Shohoz Food is a well-known online-based food delivery service of Shohoz. The company launched a connection with more than 1,000 restaurants within Dhaka City for the food delivery service to catch up with the milestone of 2,000 up to May 2019 [39]. Shohoz Food arranged a food campaign, Matha Noshto Food Fest, from March 12 to March 19 of 2019. The minimum food delivery charge of Shohoz Food is BDT 50.

Pathao Food: It is an on-demand digital food delivery service of Pathao. The service began its flight in Dhaka City in October 2015 [40]. Currently, Pathao provides its food delivery service in the Dhaka Metropolitan Areas and Chittagong Metro Regions. Pathao Food apprehends almost 80 % of participation in the online food delivery business.

3.7. Development of app-based models like ride-sharing

JoBike: JoBike is a bicycle-sharing platform in Bangladesh. Mehedi Reza is the Founder and CEO of the company [41]. The company started its journey on June 18, 2018. At startup, the company exposed bicycle stations in Calatoli, Sugandha, and Labani Point of the tourism city, Cox's Bazar. Now, JoBike serves bicycle-sharing systems in Dhaka, Chittagong, and Cox's Bazar and some universities, including the University of Dhaka, Jahangirnagar University, University of Chittagong, and Shahjalal University of Science and Technology. The company has five bicycle stations and 300 bicycles. Among those, 100 bicycles are operational in the Jahangirnagar University, 100 in the University of Chittagong, and 50 in Cox's Bazar [42]. JoBike launched the bicycle-sharing service at the University of Dhaka with 100 bicycles on October 7, 2019 [43] and in Mirpur DOHS (Defense Officers Housing Society) of Dhaka with 50 bicycles in January 2019. Ride fare of JoBike is BDT 1/minute in Dhaka and Cox's Bazar and BDT 3 for every 5 minutes in the Jahangirnagar University and University of Chittagong. At the University of Dhaka, the fare is BDT 2.5 for the first 5 minutes of the ride; after that, BDT 0.4/minute. Customers can avail the JoBike's bicycle-sharing service within the country's reachable areas through JoBike Mobile Application. Customers have downloaded the application more than 35,000 times, and they utilize the JoBike bicycles around 3,000 times every day.

Truck Lagbe: Truck Lagbe, Inc. is a private, for-profit, and digital platform in Bangladesh to hire a pickup, truck, covered van, or trailer truck. Anayet Rashid is the Founder and CEO of the

company. The platform started to freight pickups or trucks for the business and personal needs on June 1, 2016 [44]. Truck Lagbe is the leading truck hiring company in the country, and the company has 11–50 employees. The company connects the truck owners or agencies with the shippers or people seeking the trucks to hiring. The platform offers online truck booking or hiring services for the truck proprietors, agencies, drivers, and shippers through the Truck Lagbe App or Website (www.trucklagbe.com). The app has two versions—one is for the truck proprietors, and the other is for the shippers [45]. The company has managed two local partners, Robi as the tracking service associate and bKash as the financial shareholder. Truck Lagbe promoted 1 million USD in a pre-series A investment in April 2019 [46].

Parking Koi: Parking Koi INC Ltd. is an online-based and on-demand parking space provider in Bangladesh. The platform connects the parking space owners with parking space seekers. Rafat Rahman is the Founder [47] and CEO of the company [48]. The company officially launched in April 2018. Parking Koi makes the effective use of underutilized places in Dhaka City through parking and bans the illegal roadside parking practice from the city. Currently, Parking Koi provides parking facilities in Dhaka, Chittagong, and Sylhet [49]. The company has enrolled six divisions for the service operations in Dhaka City. The enterprise offers hourly and monthly parking solutions to the customers. Parking charge/hour varies from BDT 5 to BDT 30 and parking charge/month from BDT 1500 to BDT 4500 following the location. The company consists of 31 members, including three founding members and 24 members from the two operational teams, and is a parking solution platform for 52,000 customers and serves an average of 800–900 customers. The enterprise daily counts 100 transactions/hour. Parking place owners pay 20 % of the total service charge, and customers pay 10 % of that to the company. The percentage of service commission with a maximum of 20 % depends on time. The company has already parked 30,000 vehicles conveniently. Parking Koi got financial support of 1.25 crore BDT from an aggregate of 15 crore BDT. The company achieved the first position in the local seed-stage startup competition, Bangladesh Round of Seedstars World [50] before it secured the first position among the top ten teams of the Seedstar Growth Program. Parking Koi Mobile App is available on Google Play Store since April 1, 2018. The app has 12,000 active users, and they have already downloaded it 25,000 times.

Zantrik: Zantrik Pty Ltd is a private, for-profit, Dhaka based, and on-demand vehicle maintenance service provider in Bangladesh with a CB rank of 43,373 [51]. Muhtasim Mahdi Al Farooque is the Founder and CEO of the company. The company introduced its official journey in 2018 [52]. The company consists of two key persons—Muhtasim Mahdi Al Farooque and Biplob Biswas (Co-founder and COO of the company) and 11–50 employees. The platform offers its automotive maintenance services throughout the country, including the remotest places like Teknaf, Tetulia, and Sajek Valley. The company provides emergency roadside vehicle assistance service, vehicle maintenance service at home in Dhaka City, subscription authorizations and insurance service, and B2B. At present, Zantrik has three moneylenders, including the lead, Bangladesh Angels. The company has captured 1,600 workshops as the servicing partners. Among those, 400 workshops are serving within Dhaka City and 1100 in the rest areas. The platform counts 50 service requests daily from the customers. BD Ventures funded Zantrik USD 120,000 in a pre-seed investment on February 15, 2018, Accelerating Asia and Bangladesh Angels USD 100,000 on May 15, 2019, and Bangladesh Angels a secret amount

on January 3, 2020. Moreover, the company secured the second position in the local seed-stage startup competition, Bangladesh Round of Seedstars World.

Toolbox: Toolbox is an automotive service provider in Bangladesh. It is a supplementary company of the parking solutions platform, Parking Koi [53]. The Toolbox provides car washing, car repair, and driving training service to the customers. Car washing service includes foam washing and oil and filter change, and car repair service includes foam washing, exterior polish, interior polish, anti-bacterial steam cleaning, and oil and filter change. The platform ceases car washing service within 45 minutes in BDT 500 plus and car repair service within 2 hours in BDT 2500. Moreover, the company offers flexibility to its customers to choose the location and time as per their preferences.

4. Conclusion

The ride-sharing scheme has changed the conventional method of transportation in Dhaka City. Significantly, this spear economy has drawn out a progressive variation by moving how the city occupants receive transport benefits, despite having not so many confinements. Moreover, the new vehicle framework brings straightforwardness, accommodation, and reassurance of the city occupants through solving numerous transportation issues.

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