A CRITICAL ANALYSIS AND INVESTIGATIVE ASSESSMENT OF THE INFLUENCE OF RIDE-SHARING SERVICES ON THE TRANSPORTATION SYSTEM IN DHAKA

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ABSTRACT

The emergence of ride-sharing applications has significantly transformed the global transportation industry. The objective of this study is to conduct a comprehensive examination and evaluation of the influence exerted by ride-sharing applications on the transportation infrastructure of Dhaka. The present evaluation and analysis are predicated upon an exhaustive examination of extant scholarly literature and empirical statistics data. Moreover, a questionnaire study was undertaken to assess users' perceptions of the socioeconomic implications and accessibility of transportation services provided by ride-sharing applications, to investigate the effects of such apps on various aspects of transportation in Bangladesh. This study examines various key factors about the impact of ride-sharing applications on conventional transportation systems, traffic congestion, accessibility, affordability, comfort, efficiency, environmental sustainability, socio-economic consequences, and the introduction of a newly implemented mass rapid transit system in the city of Dhaka. According to the perspective of the participants, it was determined that approximately 28% of individuals who previously used public transportation have switched to ride-sharing services (RSS) due to its convenience and popularity which results in the decline of public transport usage. However, the substantial growth in private car and motorcycle registrations not only makes up for the decrease in public transport usage but also adds to the overall traffic congestion besides that 87% of respondents still believe that owning a private vehicle is essential compared to using ride-sharing services. Consequently, the combined traffic volume comprising private vehicles, ride-sharing services, and public transport is likely to increase. To mitigate carbon emissions resulting from these traffic activities, the promotion of electric vehicles for ride-sharing services (RSS) is encouraged. Another survey revealed that accessing ride-sharing apps to secure transportation services is convenient, with approximately 52.2% of respondents finding it user-friendly. However, there are certain limitations, such as difficulties in obtaining service in areas with heavy traffic, remote locations, or narrow roads. These challenges could be addressed by incorporating some aspects of public transportation into the RSS process. Moreover, the introduction of a call-based ride-sharing service could also extend the accessibility of RSS to illiterate individuals and those without smartphones, thereby playing a significant role in enhancing the transportation system. This study aims to assess the relevance of the ride-sharing services following the implementation of the Mass Rapid Transit (MRT) system in the urban area of Dhaka. The findings of this study aim to contribute to the development of a more sustainable and modernized transport system in the country.

Keywords: *Ride-sharing service (RSS), traffic congestion, socioeconomic impact, affordability and accessibility.*

1. INTRODUCTION

In developing countries such as Bangladesh, the progress of transportation and communication systems is a crucial factor in measuring economic development. Ride-sharing has emerged as a significant component of this advancement. Due to the availability of smartphones and wide access to the internet, different app-based services have increased drastically as it is helpful to identify the nearest vehicles within the shortest possible time. Apart from this, it facilitates easy tracking of the driver's location, expected destination, and computerized fixation of fares virtually on screen by mobile app (Chen et al., 2011). Consequently, the introduction of ride-sharing apps has brought about a transformative change in the transportation system on a global scale, including in developing nations such as Bangladesh.

One of the prime focuses of this study is to reflect on the contribution and development of a sustainable and modernized transport system in the country. Sustainable and modernized transportation structure encompasses a comprehensive strategy for organizing transportation systems, taking into account their economic, social, and environmental effects. Its objective is to establish a transportation infrastructure that is both accessible and efficient while also promoting safety and environmental responsibility. This approach seeks to bolster economic development and improve the overall quality of life Besides that it a close eye should be kept to highlight the promotion of sustainable transportation methods that minimize greenhouse gas emissions and air pollution, thereby mitigating significant health issues and environmental deterioration (Priyadarshan Patil, 2022).

The primary objective of this research is to examine how Ridesharing Services (RSS) and Mass Rapid Transit (MRT) influence the transportation system of Bangladesh and also intends to investigate the opinions of RSS and MRT users regarding various aspects and provide a comprehensive analysis and perspectives on its influence on the transportation industry and its users. In essence, this study's main aim is to assess the impact of RSS on the transportation system, while it also evaluates the impact on RSS after the introduction of MRT. The advantages and obstacles faced by users in terms of traffic congestion, accessibility, socio-economic consequences, and its future outlook. Additionally, it seeks to identify potential solutions for addressing these challenges.

2. LITTERATURE REVIEW

Shared transportation is assuming a growing significance in the realm of sustainable urban transportation strategy and management. This is due to its substantial impact on the daily lives of individuals, socioeconomic progress, and the overall environment (Sun et al., 2019). Ride-sourcing services present secure transportation options that offer convenient mobility solutions, enhance transit accessibility in underserved and remote regions, and cater to fluctuations in taxi demand. They can generate fresh employment prospects by enlisting untapped labor resources, offer drivers flexible work hours, and exhibit greater efficiency compared to traditional taxi services. These offerings open doors for expanding or supplementing public transportation, reducing private car ownership and traffic congestion, and curtailing the need for extensive parking facilities. Nevertheless, they face criticism for engaging in unfair competition with conventional taxi services, limited adherence to social regulations, and affordability concerns. Notably, they remain unavailable in certain locations and may inadvertently exclude certain vulnerable and socially disadvantaged demographics (Garmsir ET AL., 2021).

Heme et al. (2020) focused on assessing how the introduction of ride-sharing services affects Dhaka's current transportation system, specifically by estimating the changes in travel mode choices resulting from this new transport option through a well-organized survey questionnaire and the study also collected fundamental demographic information from the participants, as well as details about the purpose of their trips and the starting and ending points of these journeys, all of which were recorded to facilitate a thorough analysis. The investigation delved into how various factors related to travel habits influenced changes in transportation modes and stimulated additional travel. A separate study suggests that ridesharing services provide a high level of satisfaction, addressing both assurance and empathy factors. The study utilized elements derived from the SERVQUAL dimensions, including reliability, responsiveness, assurance, tangibility, and empathy. A structured questionnaire was

employed to gather data from users of ridesharing services in Dhaka city. The study's hypotheses were subjected to testing using the regression analysis technique in the SPSS software. (Dey, Salam & Saha, 2021) A study is performed on the app-based ride-sharing service "Uber" to demonstrate that user satisfaction is primarily linked to the aspects of riding safety and security, while the efficiency of the system is mostly influenced by factors such as the destination display system, customer service quality, and the pricing of the rides (Mohammad et al., 2022).

Certain research endeavors involve a comparative analysis between ridesharing services and established transportation systems, such as public transit (Sun & Edara, 2015). A comparative assessment of regulations about ride-hailing services across 15 distinct cities in the United States was done (Beer et al., 2017). Labib et al. (2018) identified ten studied nodes in Dhaka City that had very high CO_2 emissions and low biocapacity due to high emissions from urban traffic. A multitude of elements play a role in a user's choice to utilize a ride-sharing service, encompassing aspects like commuting, personal privacy, convenience, social engagement, and environmental preservation (Olsson et al.,2019).

Ridesharing has become a significant presence in the transportation landscape of Bangladesh. Kumar, Jafarinaimi & Morshed (2018) investigated how the introduction of Uber influenced the transportation system in Dhaka, assessing both practices and the city's mobility infrastructure. However, there is still a notable absence of a comprehensive study examining how ridesharing affects public transportation in Dhaka city and how riders perceive these changes.

The present study has the objective to conduct a thorough analysis and evaluation of how ride-sharing apps impact Dhaka's transportation infrastructure and their effects on the environment and the socio-economic well-being of its residents. Additionally, the paper seeks to examine the relevance of ride-sharing services after the introduction of the Mass Rapid Transit (MRT) system in Dhaka's urban area, as the MRT system is expected to play a significant role in influencing passengers' mode choices due to its convenience and time-saving benefits on congested city roads. This research aims to bridge the existing gap in understanding users' perceptions regarding their choice between ride-sharing services and the MRT system.

3. METHODOLOGY

To analyze users' perceptions regarding ride-sharing services, a meticulously structured questionnaire survey was administered in Dhaka city. The questionnaire design was initially inspired by the work of Heme et al (2020) and was subsequently adapted to align with the specific context of this study. It aimed to delve into users' viewpoints regarding the socio-economic implications and accessibility of transportation services offered by ride-sharing apps, as well as the impact of the Mass Rapid Transit (MRT) system on these services. The survey was executed in strategic locations anticipated to have a high concentration of ride-sharing users, predominantly from Dhaka. To streamline data collection, an online survey via Google Forms was employed for easy accessibility.

The survey consisted of a set of 20 questions that covered a range of topics, including basic demographic information, challenges in using ride-sharing apps, frequency of ride-sharing app usage, the economic and social impact of these apps, factors influencing the choice of ride-sharing over public transportation, and the impact of the Mass Rapid Transit (MRT) system on ride-sharing services. On average, it took participants about four minutes to complete this questionnaire. A total of 504 questionnaires were distributed. Sample size is specified using simple random sampling due to time and resource constraints. A little more than 600 questionnaires were organized and among them, 504 were received well. The analysis of the data sought to investigate the connection between the demographic features of the respondents and the changes in traffic patterns they might induce, as well as their mode choice shifts and playing a revolutionary role in changing the socio-economic condition of the country.

4. DATA ANALYSIS

In this section, we have divided the data into distinct segments to facilitate a comprehensive analysis from various perspectives The primary results of the survey are deliberated upon, taking into account demographic attributes, the influence of ride-sharing apps on traditional transportation systems, traffic congestion, accessibility challenge and navigation of ride-sharing application, cost-effectiveness, convenience, effectiveness, environmental sustainability, socio-economic implications, and the integration of a recently introduced mass rapid transit system in Dhaka city.

4.1 Demographic Attributes
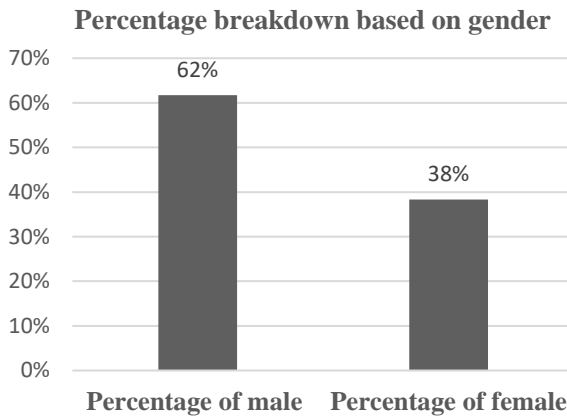
Figure 1: Percentage of male and female respondents
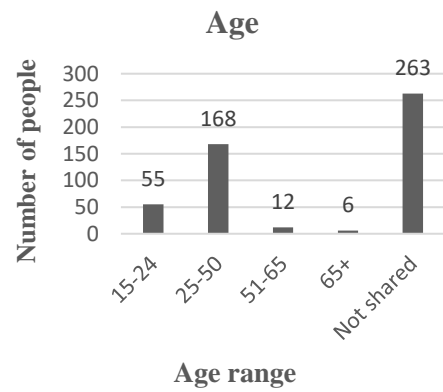
Figure 2: Age range of the respondents

From the demographics of gender and range of age, it is observed that male and youth participants dominate in number and it is about 62% of males recorded their opinion. On the other hand, the number of female participants is 38%. If the age variation of the participant is observed it is seen that the participants ranging from the age of 25 to 50 are high compared to those of other age range as the young generation always prefer to use technology to save time and also to ensure safety and security during traveling from one place to another in collaboration with convenience of using RSS but a major portion of people had not shared their age and number of opinions recorded by senior citizens are less in number. The reason might be a conservative mindset of people prevailing in our country regarding sharing the age and senior citizens sometimes find it difficult to operate and communicate with the driver through RSS so they deviate from taking the RSS service.
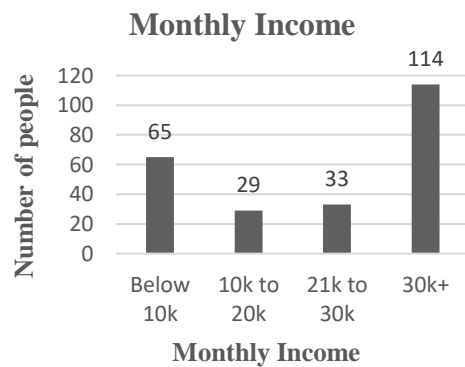
Figure 3: Occupation of the respondents

Figure 4: Monthly income of the respondents

The demographics of occupation and monthly income indicate that the maximum number of people are private employees and the respondents whose monthly income exceeds more than 30,000 takas had recorded their opinion compared to other income ranges.

4.2 Accessibility challenge and navigation of ride-sharing application

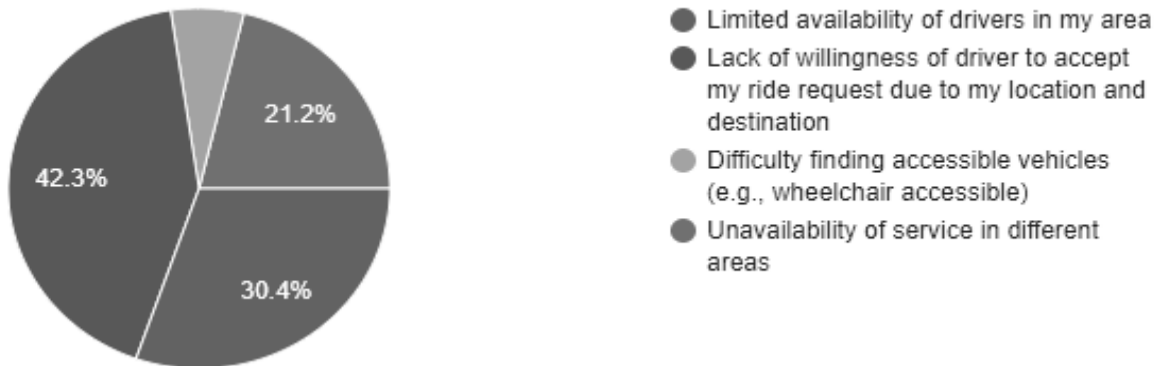**Specific accessibility challenges encountered**

Figure 5: Specific accessibility challenges encountered by riders while using ride sharing service

Respondents were asked about specific accessibility challenges they encountered while using ridesharing apps. From Figure-5 it is seen that 42.3% of the total respondents encountered a lack of willingness of the driver to accept any ride request due to the location and destination of the trip 30.4% of respondents thought that there was limited availability of drivers in his/her area and 21.2% respondents felt that there is the unavailability of service in a different area. From the respondent's feedback, it is clear that the ride-sharing app has some limitations when it comes to availing service in different areas due to traffic jams, distant locations, and narrow carriageways. In this case, conventional transport will take precedence. Besides that, a very minimum percentage of people (6.2%) find it difficult to access wheelchair-type equipment in RSS.

Ease of navigation and use of ride-sharing apps interface

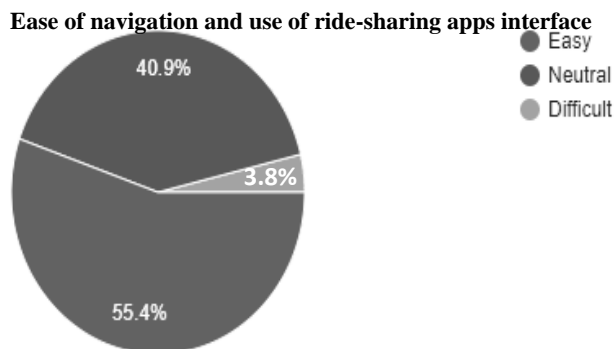**Accessibility challenges while using ride-sharing apps**
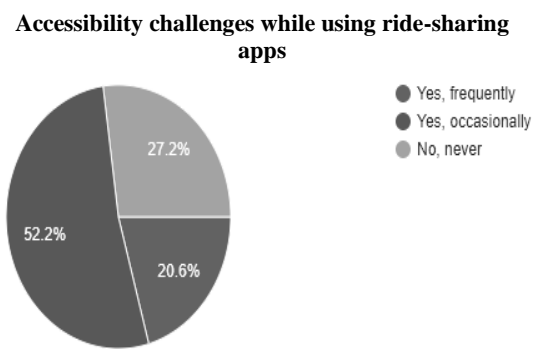

Figure 6: Occupation of the respondents

Figure 7: Accessibility challenges rider experience while using ride-sharing apps

While conducting the questionnaire survey respondents were asked if they face any accessibility challenges while using ride-sharing apps. From Figure 6 and Figure 7, it is seen that more than half of the respondents (52.2%) occasionally face accessibility challenges while using ride-sharing apps. This indicates ride-sharing app is easily accessible to avail transportation service and almost 55.4% of respondents find it easy to navigate and use the ride-sharing app. So, these positive user experience may influence the respondents to prefer ride-sharing service as it seems to be user-friendly to the rider.

4.3 Influencing factors and frequency of using ride-sharing service
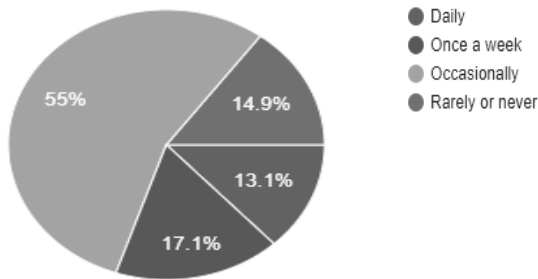
Frequency of using ride-sharing apps

Figure 8 :Frequency of using ride-sharing apps for transportation

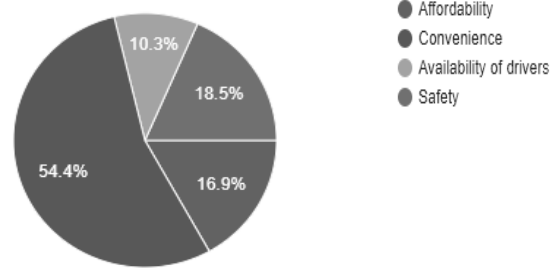**Decision making factors to use ride-sharing apps**

Figure 9 :Factors influencing to choose ride-sharing services

From figure-8 it is seen that in the questionnaire survey conducted among the participants, 55% of the respondents take the RSS occasionally and 14.9% use it rarely or never take the service. On the other hand, from figure-9 it is found that 54.4% of the respondents preferred the service for convenience and only 16.9% found it affordable. So, in terms of affordability ride ride-sharing services are comparatively expensive than public transport so people are taking the service occasionally according to their convenience and safety.

4.4 Affordability
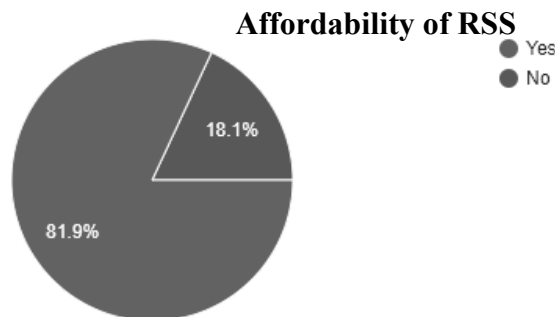
Affordability of RSS

Figure 10 : Affordability of RSS on special situation

About 81.9% of the respondents feel that RSS becomes expensive at peak hours and long-distance traveling so sometimes it becomes unaffordable to take RSS and the user has to find alternatives to reduce the travel cost.
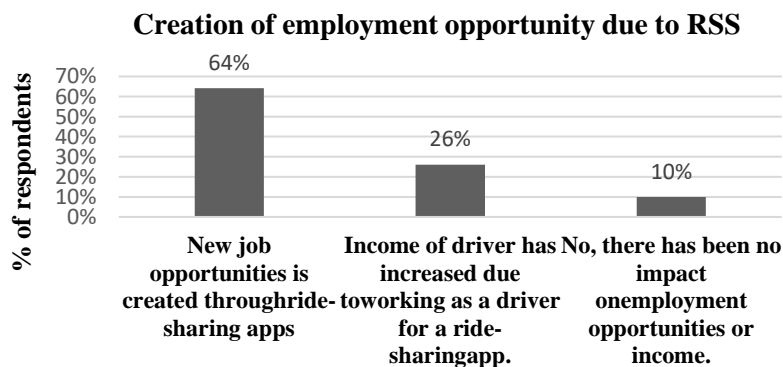
4.5 Socio-economic impact of ride-sharing service

Creation of employment opportunity due to RSS

Figure 11 : Changes in employment opportunities due to ride-sharing apps
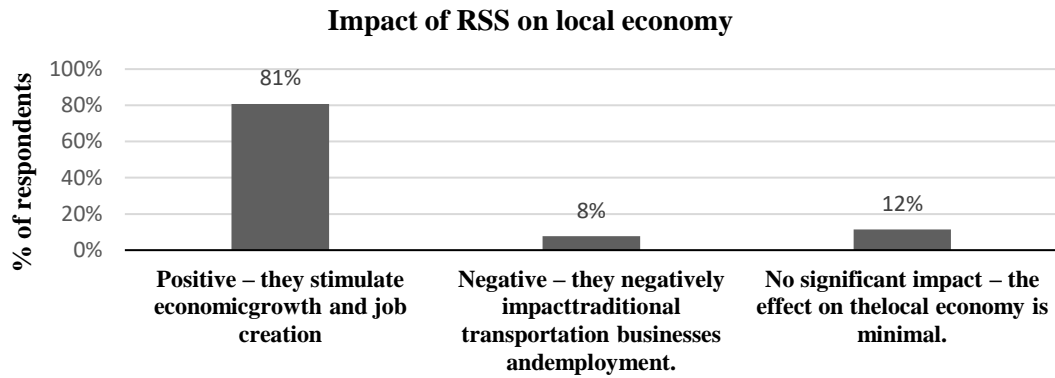
Impact of RSS on local economy

Figure 12 : Overall impact of ride-sharing apps on the local economy

To analyze the socioeconomic effect, it is seen from figure-11 that 64% believe that new job opportunities are created through ride-sharing apps and 26% thinks that the Income of driver has increased due to working as a driver for a ride-sharing app. On the other hand, from figure-12 it is found that 81% of the respondents think that ride-sharing app has stimulated economic growth by creating job opportunities. So, the introduction of ride ride-sharing apps may work in eradicating unemployment and upgrading the living standards of people by promoting economic growth.

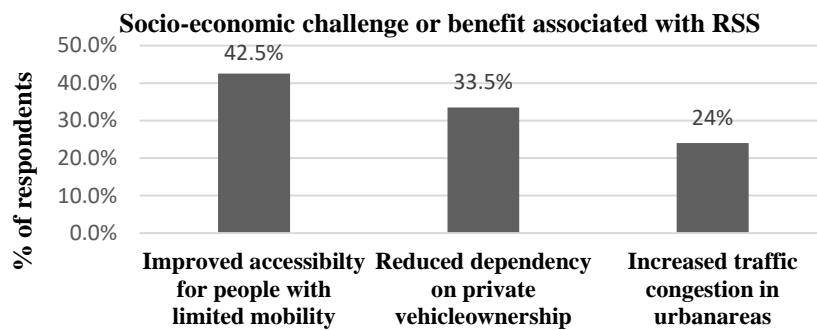**Socio-economic challenge or benefit associated with RSS**

Figure 13 : Changes in employment opportunities due to ride-sharing apps

The above survey indicates that 42.5% of respondents think RSS can provide improved accessibility for people who have limited mobility and 33.5% think that the introduction of RSS can help to reduce the dependency on private vehicles as RSS can provide a similar kind of vehicle to complete the trip and 24% think that it can increase traffic congestion in urban areas by increasing the traffic volume.

4.6 Effect of Ride-sharing apps on Public Transport Usage

Mode of transportation Preference before and after the introduction of Ride-sharing
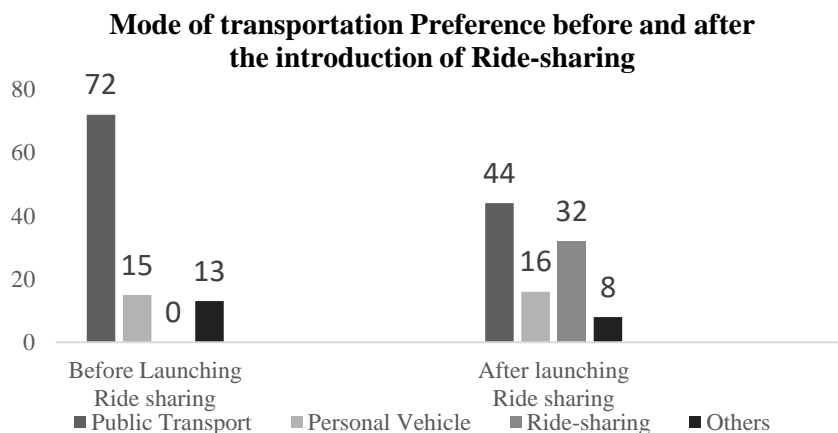

Figure 14: Mode of transportation preference before and after the introduction of ridesharing (Heme et al.,2020)

According to Figure 14, within the same group of respondents, only 44% currently opt for public transport for their daily journeys following the introduction of ridesharing. Consequently, there has been a significant shift, with 28% of former public transport users now using ridesharing services. Likewise, the percentage of individuals utilizing other modes of transportation, such as CNG/Auto rickshaws, has decreased from 13% to 8%. This substantial transition away from public transport underscores the government's shortcomings in attracting people by offering modern facilities. The likely consequence is an increase in the number of vehicles on the roads (Heme et al.,2020).

4.7 Impact on Traffic Congestion

The trend analysis reveals a decline in the registration of public transport vehicles like buses and microbuses from 2016 to 2019. In contrast, private car registrations saw an increase in 2017 compared to 2016, while the number of registered motorcycles experienced a substantial surge in 2018 and 2019 compared to 2017. The initiation of Ride Sharing Services in 2018 contributed to the rising trend in motorcycle registrations (Mollah, M.L.H., 2020), potentially leading to an escalation in traffic volume on urban roads.
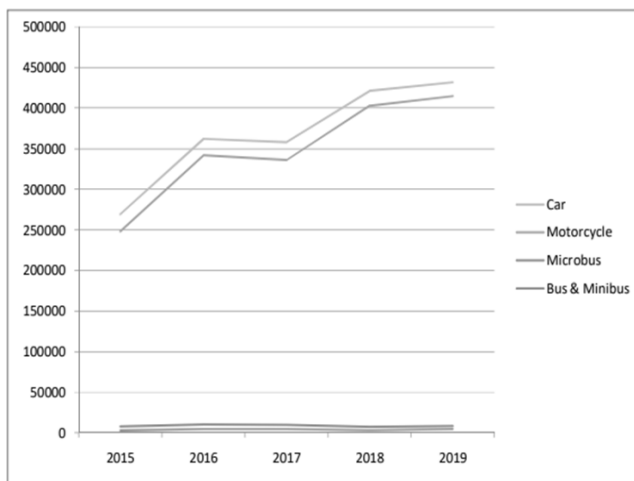

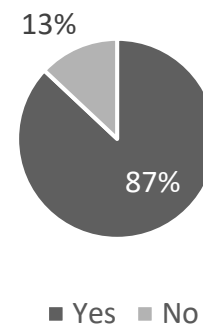Figure 15: Trends of vehicle Registration Due to RSS (Mollah, M.L.H., 2020)

Figure 16: Necessity of personal vehicle (Heme et al.,2020)

In a conducted survey, participants were queried about their need for a personal car in the presence of ridesharing options. Out of 1007 respondents, 189 individuals owned at least one vehicle. Within this group, 22 individuals expressed that they no longer find it necessary to own a vehicle. Figure 16 illustrates that 13% of car owners now perceive no need for a personal vehicle. This suggests a shift in transportation preferences from owning a personal vehicle to relying on ridesharing services (Heme et al.,2020).

Comparing both the studies which were conducted based on a survey in 2020 it is observed that in figure-15 the registration of public transport was decreasing but on the other hand registration of private cars and motorcycles has increased rapidly and is found that 14,418 private cars and 102,102 motorcycles have registered to offer ride-sharing service(RSS) till 2019 (Mollah, M.L.H., 2020) which not only compensate the decreased amount of public transport but it may contribute to the increasing volume of traffic. In addition, it is observed in figure-16 that only 13% feel that they don't require a personal vehicle after the introduction of RSS so a major group of people prefer personal vehicles rather than taking RSS.

So a traffic volume composed of personal vehicles, Ridesharing vehicles, and public transport may increase the amount of traffic which may create severe traffic congestion on city roads.

4.8 Integration of MRT and its impact on RSS

Availability of MRT in individual areas
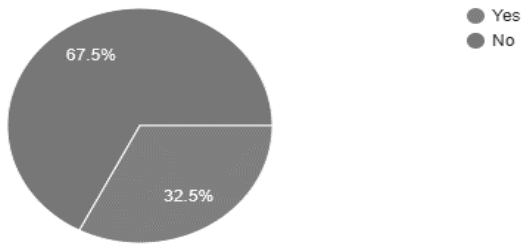

Figure 17: Availability of MRT in individual areas
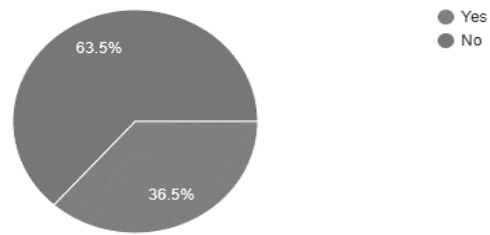
Preference of MRT over RSS

Figure 18: Preference of MRT over RSS

To observe the impact of MRT after its integration into the transportation system of Dhaka it is observed that 67.5% of the respondents doesn't have MRT service in their area and 63.5% of respondents prefer to use MRT over RSS. So, it indicates that a large number of people prefer MRT but they are unable to get the service due to its unavailability.
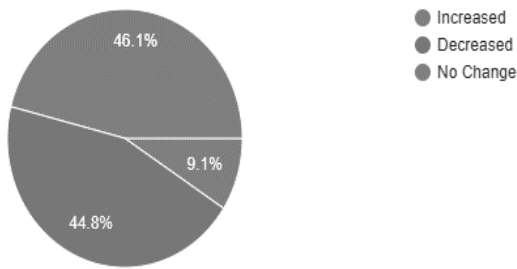
Shifting of transport mode from RSS to MRT

Figure 19: Shifting of transport mode from RSS to MRT

Tendency to use MRT after its expansion or improvements
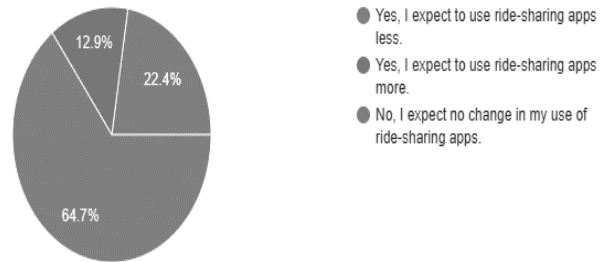

Figure 20: Tendency to use MRT after its expansion or improvements

It is observed from the above survey that 44.8% of respondents had opined that the use of RSS has decreased after they started to use MRT and 46.1% feel that there is no change in their transport mode after the introduction of RSS because in Figure 16 it is seen that 67.5% of the respondent doesn't have MRT service in their area so despite having the willingness to use MRT they are unable to take the service that's why in Figure-20, 64.7% had opined that after the expansion or improvement of MRT they are expecting to use RSS less.
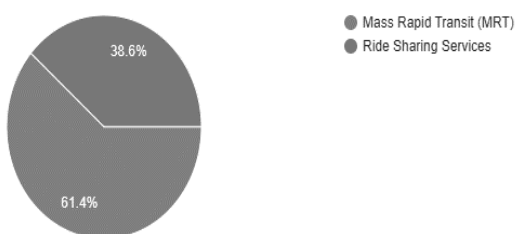
Choice of mode between RSS and MRT

Figure 21: Choice of mode between RSS and MRT

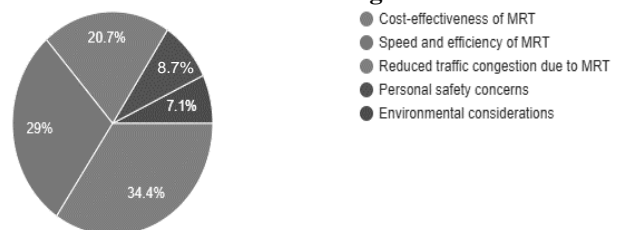**Factors influencing to use RSS apps more or less after using MRT**

Figure 22: Factors influencing to use RSS apps more or less after using MRT

From Figure-21 it is concluded that 61.4% of respondents feel that MRT is more convenient than RSS and the reason behind this thinking can be co-related with the outcomes of Figure-22 where 34.4% of respondents think that MRT is more cost-effective as we can travel a longer distance with the low trip fare,29% think that MRT is efficient and maintains a uniform speed which reduces the travel

time,20.7% feel that MRT can reduce traffic congestion as it will divert people to use public transport as well as personal vehicle and ride-sharing vehicle as personal safety(7.1%) and convenience of trip is ensured through air-conditioned compartment, automated ticket system and presence of law enforcement authority to avoid any unwanted situations and 8.7% think that MRT is environment friendly so it will help to reduce environment pollution.
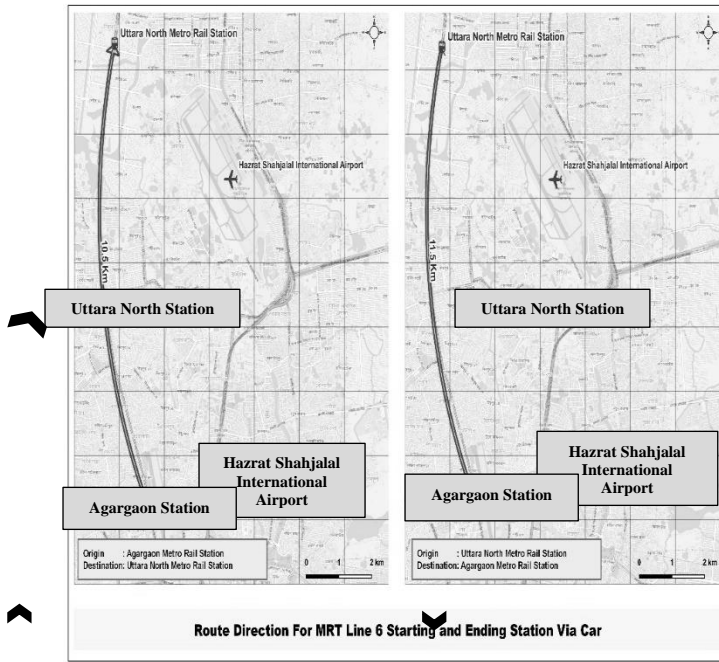

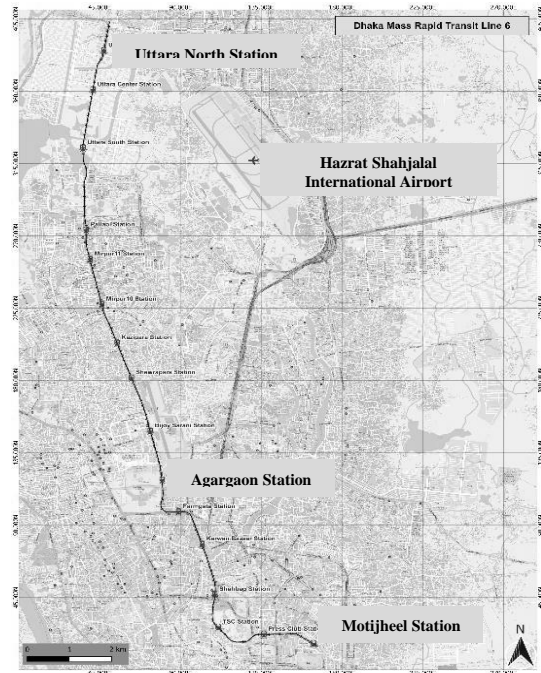Figure 23: Route direction for the car (Uttara North to Agargaon Metro Rail Station and vice-versa)

Figure 24: Route alignment of MRT Line 6

Agargaon to Uttara North & Uttara North to Agargaon

	MRT (A to U.N)	RSS (A to U.N)	MRT (U.N. to A)	RSS (U.N. to A)
Travel Time(minutes)	17	27	17	37
Travel Distance(Km)	11.73	10.5	11.73	11.5

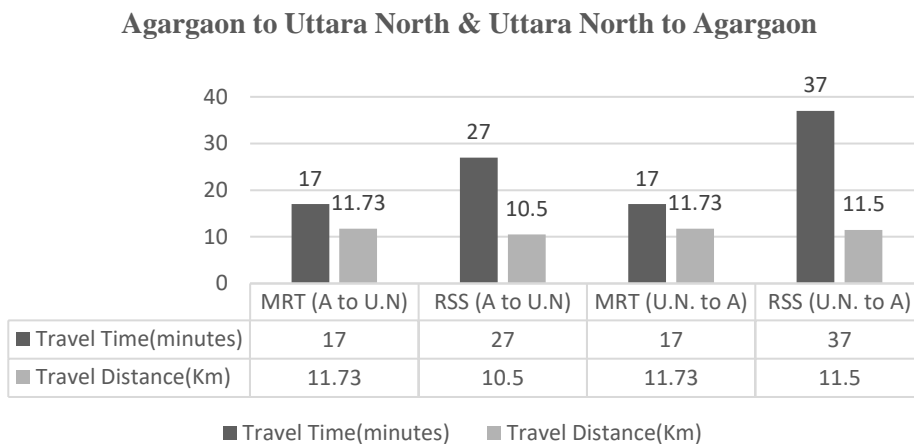■ Travel Time(minutes) ■ Travel Distance(Km)

Figure 25: Comparative analysis of travel time between MRT and RSS

In figure-25 a peak hour (1.00 PM) is considered to observe the travel time and travel distance through MRT and RSS and it is observed that only 17 minutes is required for Uttara North to Agargaon Metro Rail Station and vice-versa while traveling through MRT and 27 minutes is required from Agargaon to Uttara North and 37 minutes for Uttara North to Agargaon through RSS and the time may increase with the increased volume of traffic on the roadway.

5. IDENTIFYING CHALLENGES AND POTENTIAL SOLUTIONS

- As ride-sharing services may influence the growth of traffic volume steps can be taken for potential reduction in carbon emissions resulting from the use of more fuel-efficient vehicles such as encouraging the use of electric vehicles as ride-sharing vehicles. These vehicles are powered by electricity, produce zero emissions, and are more eco-friendly alternatives to traditional gasoline-powered vehicles. Gasoline-powered cars emit carbon dioxide and other pollutants that contribute to air pollution. Therefore, the use of electric vehicles will help to maintain air quality and reduce noise pollution.
- Not all segments of society have equal access to smartphones or the internet, limiting the reach of ride-sharing apps to certain populations so modification of ride-sharing apps service for those not having any smartphone. So, a call-based ride-sharing service may be provided by dialling in any particular number and the caller will be directed accordingly to get a trip and it will help the illiterate people also to get the required service.
- Making it affordable to the low-income group by including some public transportation services in the process.
- Often some riders are seen to provide ride-sharing services without using any app service so these should be brought under proper regulation and monitoring to ensure the safety of the rider.

6. FUTURE PROSPECT

- Ride-sharing apps have primarily focused on urban areas, but there is potential for expansion to rural regions, providing improved transportation options including proper infrastructure, road conditions, and mapping accuracy. The ride-sharing service may be provided utilizing the available transportation of a particular area which may help to get a trip in a remote rural area where the movement of vehicles is limited.
- The introduction of ride-sharing apps has influenced traffic patterns in major cities of Bangladesh so a detailed investigation may be done in the following years to ascertain the influence of RSS on traffic volume, travel times, and congestion levels before and after the apps' introduction by traffic count and questionnaire survey on major city roads to evaluate their effect on overall traffic congestion.

7. CONCLUSIONS

This study focuses on the transformative impact of ridesharing apps and MRT on Bangladesh's transportation system. The affordability, convenience, efficiency, and socio-economic benefits of both services have made them a popular choice among commuters. However, more research and concerted efforts between government agencies, ridesharing companies, DMTCL, and stakeholders are needed to address the challenges and maximize the benefits of this evolving transportation paradigm in Bangladesh.

ACKNOWLEDGMENTS

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