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An Investigation of Transportation Availability for Socially Sustainable Dhaka, Bangladesh

Sultana Razia[1,2], Marufa Akter[1], Md. Azizur Rahman[3*]

[1] Department of Global Studies & Governance, Independent University, Dhaka 1229, Bangladesh
[2] Department of Social Sciences and Humanities, Independent University, Dhaka 1229, Bangladesh
[3] Department of Business Administration, Daffodil International University, Dhaka 1216, Bangladesh

Corresponding Author Email: azizur.bba@diu.edu.bd

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ABSTRACT

Sustainable urban development stands as a pivotal imperative in contemporary discourse. One of the world's largest megacities, Dhaka, faces immense social sustainability challenges due to rapid urbanization for both present and future generations. As Dhaka's urbanization accelerates, transportation availability has become a pressing concern for socially sustainable urban areas. This study aims to investigate the current conditions of transportation availability and its impact on socially sustainable urban development, particularly in developing cities. This study used a quantitative research approach, and Dhaka is considered a representative city in a developing region. A multistage sampling method was used to collect 564 responses from residents of Dhaka through a structured questionnaire survey. The results indicated that four indicators of transport availability in Dhaka city exhibit low satisfaction levels among residents. Additionally, transportation availability statistically impacts Dhaka's socially sustainable urban development, as determined using four indicators cross-section OLS and Poisson regression analysis. The results guide governmental bodies, legislators, and urban planners in pursuing socially sustainable cities. Moreover, transportation availability indicators offer actionable policy insights for urban sector strategies in developing nations, bridging urbanization and sustainability to advance SDG-11 (Sustainable Cities and Communities) in the 2030 Agenda.

1. INTRODUCTION

In pursuing socially sustainable urban conditions, social sustainability has assumed a prominent position on the global stage. Notably, transportation availability emerges as a pivotal facet within the domain of social sustainability [1]. The accessibility of fundamental amenities such as transportation plays an instrumental role in cultivating an affordable living environment [2, 3]. Sustainable urban transportation planning not only enhances the quality of life but also fosters liveable cities [4]. Similarly, the availability of transport increases connectivity which increases the accessibility of local services [5]. Furthermore, the provision of sound transportation facilities within communities has been shown to ameliorate the overall living conditions of residents [6]. Considering these observations, it becomes increasingly apparent that the significance of transportation availability has engendered a heightened imperative for the creation of a sustainable future. Nonetheless, it is crucial to acknowledge that developing countries encounter substantial challenges in ensuring equitable transportation access for their citizens.

Dhaka, located within a developing country, is an example of the remarkable urban growth witnessed in recent decades. Over four decades, Dhaka has become one of the world's megacities due to rapid urbanization and significant population growth [7]. There is a major struggle in Dhaka's urban community against social issues, with public transportation being a prominent concern due to the city's rapid urbanization [8-10]. It is important to note that urbanization generally contributes to the development of social amenities and services such as transportation [11], but rapid urbanization also affects the provision of transportation facilities. As a result, Dhaka's rapid urbanization affects its ability to provide essential services, such as the availability of transportation, as government revenues for the maintenance and provision of city amenities are minimal [12]. In Dhaka, traffic congestion is the most pressing livability issue, affecting middle and lower-income groups [8]. It is crucial to consider transportation availability as a vital aspect of social sustainability in urban areas, particularly in developing cities. This aspect should not be overlooked to achieve socially sustainable urban spaces.

Likewise, numerous researchers have dedicated their efforts to the study of transportation within urban areas. They highlighted certain issues, such as 'A bibliometric analysis of sustainable urban transportation [13]', 'Linkage between transportation, urbanization, economic growth and GHG emissions in Southeast Asian Nations [14]', 'Strengthening

green transportation [15]', 'Exploration of sustainable urban transportation development [16]', 'Sustainable development of urban transportation and ecological environment [17]', 'Strategic planning of urban transportation system [18]', 'Large urban transportation infrastructure networks [19]'. None of the studies focuses on assessing the current state of transportation availability which is crucial for ensuring social sustainability in developing country cities. Thus, this study effectively addresses the current gap in research by assessing the current state of transport availability in socially sustainable urban areas of Dhaka city. Also, comprehending the intricate interplay between transport availability and socially sustainable urban development assumes paramount significance for all stakeholders vested in the progress and well-being of Dhaka city. As a result, the primary research objectives (RO) in the present study are:

RO1: To investigate the current status of transportation availability as a significant aspect of social sustainability in Dhaka.

RO2: To examine the impact of transportation availability on socially sustainable Dhaka.

The implication of this study lies in its empirical approach, which contributes fresh insights to scholarly work. First, this research endeavors to quantify the present situation of transportation availability as a means to foster social sustainability within the city of Dhaka. While prior studies have extensively examined various issues of transportation, none have comprehensively unveiled the contemporary situations of transportation availability which is very essential for the policy and practice of city planners and authorities. Consequently, this study augments the existing knowledge base by furnishing precise empirical evidence. This empirical evidence is a crucial resource that can greatly benefit governmental bodies, policymakers, urban planners, and implementing agencies. It equips them with the necessary data to develop effective strategies, formulate policies, and execute plans aimed at realizing a socially sustainable Dhaka city. Second, this study elucidates the impact of transportation availability on the trajectory of socially sustainable urban development. The research findings provide valuable insights to city authorities and stakeholders, facilitating informed decision-making activities to enhance the livability and overall quality of life in the city. This study's findings are needed for cities in developing nations dealing with the same problems arising from rapid urbanization, such as Kolkata, Delhi, Shanghai, Beijing, Mumbai, and others. Third, this study also facilitates achieving target 11.2 under the Sustainable Development Goals (SDG-11) titled "Sustainable Cities and Communities". Target 11.2 of the UN SDGs aims to ensure safe, affordable, accessible, and sustainable transportation systems for everyone. This includes expanding public transportation to improve road safety, with a focus on meeting the needs of vulnerable communities such as women, children, people with disabilities, and the elderly.

2. LITERATURE REVIEW

2.1 Transportation availability and socially sustainable urban development (SSUD)

Transportation availability plays an important role in creating a sustainable future. A sustainable transport system is essential for a sustainable city where access to public transport is necessary for citizens [20, 21]. The availability of transportation refers to the ease of access and quality of services that are provided to reach different destinations [22]. Additionally, urbanization contributes to the development of transportation facilities for a city [11]. Public transportation is very important in big cities and metropolitan areas; access to transportation facilities is a significant concern for those cities [23, 24]. However, rapid urbanization has accelerated the demand for transportation availability, which affects socially sustainable urban development, highlighting the need for effective management strategies in fast-growing cities.

Currently, there is growing attention on socially sustainable urban development in the literature, especially its social aspects [25-28]. Socially sustainable urban expansion distinguishes itself from general sustainable urban development by placing a particular highlight on the social aspects [29]. To achieve socially sustainable urban development, urban areas need to ensure various social dimensions including community involvement, social cohesion, cohesion, fairness, equity, participation, empowerment, and access [30]. As a result, governmental agencies, policymakers, and non-governmental organizations are increasingly prioritizing the establishment of socially sustainable cities. The discussion leads this study to formulate the subsequent main hypothesis:

Hypothesis 1 (H1): Transportation availability has a positive effect on socially sustainable urban development.

2.2 Theoretical perspective

Securing social sustainability plays a pivotal part in the attainment of urban sustainability. The worldwide landscape grapples with formidable challenges in upholding urban sustainability in the face of relentless urbanization. This investigation elucidates the intricate connection between rapid urbanization and the emergence of social issues that bear a substantial impact on the fabric of social sustainability. Significantly, as far back as 1938, the Theory of Urbanism posited that rapid urbanization was a primary catalyst for the genesis of urban social predicaments. It is worth noting that these social predicaments stemming from urbanization exert a discernible influence on the overarching goal of social sustainability [31]. Likewise, the Theory of Sustainable Development posits that in the pursuit of sustainability, due regard must be given to the economic, environmental, and social dimensions, with parity among these facets being imperative [32-38]. Contemporary literature reveals a significant imbalance in the focus on social sustainability compared to economic and environmental dimensions, especially in developing nations. Social sustainability often receives less attention in efforts to promote sustainable urban development. Like other megacities, Dhaka struggles with this disparity, hindering its progress toward SSUD.

In response, the current study concentrates on the "Theory of Sustainable Development", emphasizing transportation availability as a critical component of social sustainability in promoting socially sustainable growth of Dhaka. The existing body of literature has already highlighted transportation availability as a central theme within social sustainability, gaining particular significance in the context of Dhaka. Therefore, the need to substantiate social sustainability through empirical evidence is of paramount importance within the scope of Dhaka city.

2.3 Transportation availability in Dhaka, Bangladesh

Urbanization represents a potent catalyst for global economic expansion. Undoubtedly, urbanization yields substantial economic advantages for a nation. Nevertheless, it is imperative to acknowledge that the rapid urbanization prevalent in developing countries, such as Bangladesh, engenders adverse consequences. Dhaka, the capital city of Bangladesh, exemplifies the profound transformation wrought by the urbanization process, having burgeoned into a sprawling megacity, beset by the substantial growth of its populace in recent decades [39]. Urbanization in Dhaka has caused a surge in demand for amenities like electricity, gas, water, sanitation, waste management, transportation, telecommunications, infrastructure, and social services [7, 40]. Notably, the availability of transportation assumes a particularly salient role among these concerns, commanding the attention of city authorities in Dhaka.

Moreover, the fast-growing city of Dhaka faces extreme challenges that affect accessibility, poor quality of services, compromised safety and comfort, and operational efficiency [41, 42]. Extreme traffic congestion in Dhaka inflicts severe damage, with significant economic, social, and environmental consequences, as well as disruptions to daily life [43]. Due to inadequate public transport options, Dhaka has the most chaotic transport system and relies heavily on private vehicles for residential movement [44]. Mainly, the existing urban transport system in Dhaka city is not sufficient compared to the requirement [45]. The authors also stated that extensive indiscipline and corruption have made the transport system extremely vulnerable, causing untold suffering to the public. Given Dhaka's role as the administrative, commercial, and cultural capital of Bangladesh, the challenges it faces reverberate throughout the country [41]. As a megacity, Dhaka's viability hinges on developing a robust transportation system capable of supporting its current population and sustaining future growth [46]. Therefore, measuring the current status of transport availability and its impact on the socially sustainable urban development of Dhaka city is a key issue.

3. METHODOLOGY

3.1 Study area, sample selection, and data collection

The study unequivocally examined Dhaka city as a prime example of a developing country. This city is placed at 23°42′ to 23°52′ latitude in the north and 90°22′ to 90°32’ longitude in the east [7] with a total coverage area of 302.92 sq. Km [47]. Dhaka's urbanization has rapidly elevated it to megacity status, bringing with it the burdens of extensive population density in recent decades. Also, 63% of Dhaka's population growth was due to migration, while only 37% resulted from natural increase [40]. In 2018, Dhaka ranked 9th among the top 10 cities by urban population and is projected to rank 4th by 2030 [39]. With a population density of 41,000 per square kilometer, Dhaka ranks 1st worldwide in urban area density [48]. For this reason, the researchers chose Dhaka as a case study city which is representative of other urbanizing cities suffering from similar problems.

This study intends to choose a sample from the population of people in Dhaka, specifically focusing on voters who have participated in the survey. Voters can provide insights into Dhaka's social sustainability status due to their prior residency in the area. The study only analyzes voters to maintain a fair sample size, while considering the overall population of Dhaka city. This decision is due to the challenges of gathering information from all voters, considering the constraints of time and resources the researcher faces. Using G*Power 3.1.9.7, we estimated that 164 participants would be an adequate sample size for this investigation, with a true power greater than 0.80 [49]. Accordingly, this investigation required a minimum of 164 participants (see Figure 1).

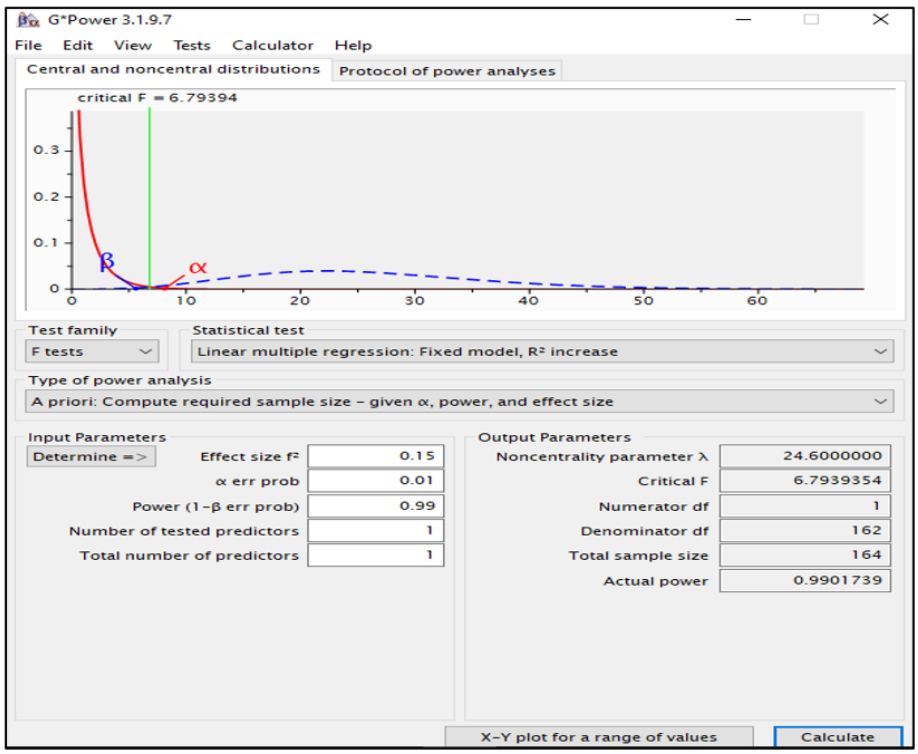


Figure 1. Sample size calculation

Table 1. Profile of survey participants

Attributes	Classes	Proportion
Gender	Male	67.38
	Female	32.62
Age (Year)	19-28	47.52
	29-38	26.06
	39-48	16.13
	49-58	5.14
	59+	5.14
Marital status	Married	40.61
	Single	58.68
	Opted not to specify	0.72
Religion	Muslim	93.61
	Hindu	6.03
	Opted not to specify	0.36
Education	Under Secondary	2.00
	Secondary	1.00
	Higher Secondary	13.00
	Graduate	48.00
	Post-Graduate	33.00
	Opted not to specify	3.00
Occupation	Student	49.00
	Service-Private Sector	16.00
	Service-Public Sector	13.00
	Business	9.00
	Academician	7.00
	Opted not to specify	6.00

Note: The total respondents are 564.

Participants were selected using a multistage sampling process. In the first phase, the purposive sampling method is mainly used to find the voters of Dhaka city. In the second phase, a systematic selection method was used to select 23 wards from the municipal corporation. During the third phase, we used a systematic sampling method to choose the target respondents, who were the residents of the voters, by gathering voter information from the "Ward Commissioner's Office and the Election Commission of Bangladesh". At the outset, 590 respondents filled out the survey. However, another nine answers and seventeen responses were excluded from the voter status process validation because they were incomplete. The study's structured questionnaire survey yielded 564 answers from people living in Dhaka city. The details of the demographic profile of the respondents are presented in Table 1.

Furthermore, this study embraced a quantitative research approach, employing a survey technique to gather data from the residents of Dhaka. This approach enabled the researcher to assess the actual availability of transportation for the social sustainability of Dhaka. From May to November 2021, the questionnaires were distributed to gather responses, spanning six months to amass a comprehensive dataset for the study. In addition to primary data collection, this study also relied on secondary sources. The secondary sources included an exhaustive examination of relevant published material, including scholarly publications, documents from international or UN agencies, NGOs, Bangladesh government gazettes, news releases, and official documents.

In the pre-testing phase, this study focused on assessing the content validity of the survey questionnaire. To measure the content validity of "individual items (I-CVI)" and the "overall scale (S-CVI)", a structured questionnaire was administered to six distinguished experts, comprising "Directors of Urban Planning and Development", "City Planners", Consultants, and "Program Analysts" from national and international arenas. To assess relevance, the questionnaire utilized a four-point scale, evaluating dimensions such as consistency, conceptual representativeness, relevancy, and clarity (see Table A). As per experts' recommendations, it was determined that four items related to transportation availability are essential for Dhaka city, with only minor suggestions for rephrasing some of the language for better clarity. Based on the relevance ratings and input from experts, these four items were subsequently selected for the pilot study. A sample size of 30 participants from the target population was deemed appropriate for pilot testing [50]. The researchers conducted a pilot study before the main questionnaire survey, but no significant differences were observed between the pilot and final results.

3.2 Variables measurement

This section discusses the measurements of all variables including the responding variable, explanatory variable, and covariates. Some widely used techniques such as PCR and factor analysis are used to measure the concurrent relationship or causality between the variables. However, these techniques are mostly used to reduce the data. Therefore, the objective of this study is to use only the weighted average score method to reveal Dhaka's current status of transportation availability.

3.2.1 Measurement of socially sustainable urban development

The "New Urban Agenda" was the primary focus of the 2016 UN "Conference on Housing and Sustainable Urban Development". One of the most critical dimensions of this agenda is socially sustainable urban development [51]. The New Urban Agenda intends to accomplish SDG 11 by creating human settlements that are inclusive, safe, resilient, and sustainable. The literature increasingly highlights the importance of social dimensions in sustainable urban development [25-29]. A 5-point Likert scale was used to measure socially sustainable urban development across five items. Table B provides a detailed illustration of the measurement items. Followed by this study measured the weighted average score of five items for each response which was used as a responding or dependent variable.

3.2.2 Measurement of transportation availability

This study used transportation availability to measure social sustainability in Dhaka, as per the "National Urban Sector Policy". We used survey questionnaires with a 5-point Likert scale and four items were employed to assess the availability of transportation. Respondents were required to provide their responses to the items. All items were embraced by Ali et al. [1]. The reason for adopting the transport availability items is that Bangladesh has no specific indicators to measure it. Details of measuring items of each explanatory variable are presented in Table C.

3.2.3 Measurement of covariates

Ensuring sustainable urban development for society varies based on the citizen's age. Also, equitable facilities for confirming sustainable urban progress depend on the gender of city dwellers. These issues also remain considerable in the case of socially sustainable urban growth in Dhaka. Moreover, citizens' age and gender are also vital issues for ensuring transportation availability [1]. Thus, this study controls the citizens' age (count data for each respondent) and gender (categorical data 1 for male and 2 for female).

3.3 Data overview

In Table 2, the descriptive analysis of variables such as socially sustainable urban development (SSUD), transport availability (TA), age, and gender has been reported. A total number of 564 responses are considered. In the case of SSUD, this study found the respondents' opinion lies between 1 to 4, indicating that none of the respondents showed they strongly agree with the current status. Likewise, identical responses were found in the case of TA2 to TA4. However, the maximum value was found 5 (strongly agree) for TA1. This study found a Skewness value less than ±1 which indicates the normality of the responding and explanatory variables. However, the Kurtosis value was found higher than ±2. Although, according to Hair et al. [52] and Byrne [53], data is deemed normal if the Skewness value is between ±2 and Kurtosis is ±7, this study also ran separate normality tests (i.e., joint test, Shapiro-wilk W test) further to investigate the normality status of responding and explanatory variables (see in Table D). Thus, this study can reject the null hypothesis (variable is normally distributed) and conclude that there is sufficient evidence to state that the variable is not normally distributed.

Furthermore, Cronbach's Alpha was used to assess the research instruments' quality and measure the adopted items' reliability where the Alpha value must be higher than 0.70 [54]. According to the reliability analysis conducted in this study, the overall Cronbach's Alpha value was found to be 0.899. The analysis also revealed that the 04 items had significantly higher reliability, as shown in Table 3. Therefore, the measuring variable used in this study meets the required threshold value of Cronbach's Alpha, making it valid, reliable, and acceptable for the study.

According to the correlation matrix shown in Table 4, none of the variables are highly correlated with each other, indicating that there are no considerable multicollinearity issues. Moreover, this study also diagnoses multicollinearity issues, results reported in Table E. Finally, this study concludes that there is no multicollinearity issue in the dataset.

Table 2. Data overview (Descriptive analysis)

Stats	SSUD	TA1	TA2	TA3	TA4	Age	Gender
N	564	564	564	564	564	564	564
Mean	2.45	2.50	2.42	2.23	2.09	33.48	1.33
P50	2.40	2.00	2.00	2.00	2.00	31.00	1.00
Variance	0.34	1.05	0.70	0.71	0.42	119.75	0.22
SD	0.58	1.03	0.84	0.84	0.64	10.94	0.47
P25	2.20	2.00	2.00	2.00	2.00	25.00	1.00
P75	2.80	3.00	3.00	3.00	2.00	39.00	2.00
Min	1.00	1.00	1.00	1.00	1.00	19.00	1.00
Max	4.00	5.00	4.00	4.00	4.00	69.00	2.00
Skewness	0.15	0.53	0.27	0.36	0.08	1.25	0.74
Kurtosis	2.68	2.36	2.51	2.61	2.80	4.25	1.55

Note: SSUD: Socially Sustainable Urban Development, TA1: "Reach to bus stop easily from home", TA2: "Availability of public transport in Dhaka", TA3: "Satisfaction level of public transportation", and "TA4: Public Transport accessibility (i.e., disabled/special need)".

Table 3. Reliability analysis

Name of Variable	Cronbach's Alpha	Number of Items
Transportation Availability	0.899	04

Table 4. Correlation matrix

	SSUD	TA1	TA2	TA3	TA4
SSUD	1				
TA1	0.4830	1			
TA2	0.4798	0.6524	1		
TA3	0.4764	0.6304	0.6133	1	
TA4	0.3995	0.4775	0.4803	0.5248	1

Note: Refer to Table 2 for the elaboration of SSUD, TA1, TA2, TA3, and TA4.

3.4 Model specification

Cross-sectional regression can be used in many aspects, especially, to explore and establish correlations or associations between variables and examine how demographic factors (age, income, education) relate to an outcome variable [55]. Despite, the causality limitation (it identifies correlations but not causal relationships) and weaker evidence of causality compared to longitudinal or experimental designs, this study used cross-section OLS to make causal inferences, particularly to control for confounding variables [56]. Moreover, it helps us to provide valuable insights for policymakers by identifying current correlations or disparities that may require intervention [57]. For example, understanding the current relationship between education and income can help in designing targeted policies [58]. In this context, this study considers cross-sectional ordinary Least Squire (OLS) as a benchmark regression to measure the impact of transportation availability on SSUD. Also, we cross-validated the results of benchmark regression through Poisson regression concerning the Poisson distribution of the dataset.

3.4.1 Benchmark regression

To measure the relationship between the SSUD and the transportation availability of Dhaka, this study considers the cross-section OLS as a benchmark model without any covariates. Hence, the regression equation is:

$$Y = \int X, Z \tag{1}$$

where, Y is measured with the weighted average of all individual items of socially sustainable urban development (SSUD). Also, X is the categorical variable consisting of four different questions measured by a 5-point Likert scale, whereas Z represents the covariates namely AGE and GENDER of each respondent 'n', ε is the error term. Hence, the actual regression function is:

$$SSUD_{WAS} = \alpha + \beta_1 TA_1 + \beta_2 TA_2 + \beta_3 TA_3 + \beta_4 TA_4 + z_n + \varepsilon \tag{2}$$

3.4.2 Poisson regression

The Poisson model posits that the event count in research denoted as Y, conforms to a Poisson distribution with parameter μ: Y Poisson (μ). The logarithm of μ is represented by a linear combination of variables as follows.

$$\log(\mu) = C\beta + D \tag{3}$$

Here, C represents a matrix of covariates with dimensions n × (k + 1), where n is the number of observations and k is the number of covariates. X_0, the 1st column of X, is often composed entirely of 1st to facilitate the calculation of an

intercept. D represents an offset variable, the log of supplement time, or the total count of respondents. The 'log-likelihood function' for the 'Poisson model' can be written as:

$$\ell(\beta) = \sum_{i=1}^{n} [-\exp(x_i\beta + z_i) + (x_i\beta + z_i)y_i - \log(y_i!)]$$

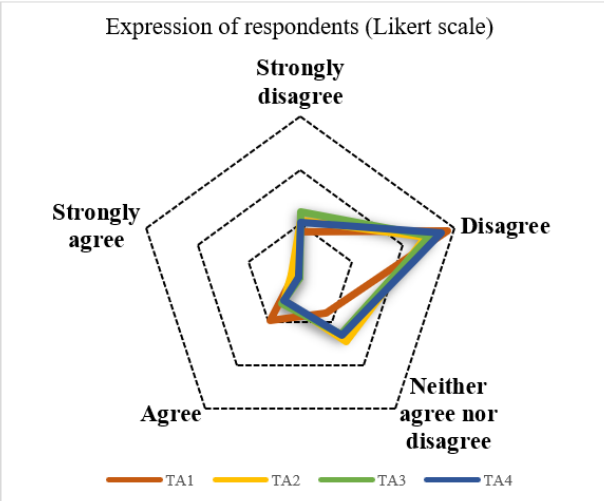
The parameters $\beta_j, j = 0, \ldots, k$, are estimated via 'maximum likelihood (ML)' by solving the following score equations:

$$U_j(\beta) = \sum_{i=1}^{n} x_{ij}\,[y_i - \exp(x_i\beta + z_i)] = 0$$

where, $j = 0, \ldots, k, x_{ij}$ denotes the observed value of the '*j-th'* covariate for the '*i-th'* subject, x_i is the row vector containing covariate values for the *'i-th'* subject, and z_i corresponds to the counterbalance value for the subject.

4. FINDINGS

4.1 Current status of transportation availability



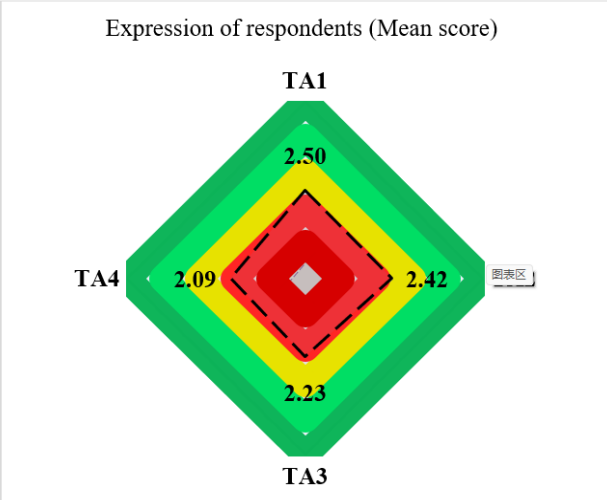


Figure 2. Expression of respondents about transportation availability in Dhaka city
Note: Refer to Table 2 for the elaboration of TA1, TA2, TA3, and TA4.

To assess the availability of transportation in Dhaka, we utilized descriptive statistics including frequency, weighted average score, and standard deviation. The mean score of the four transportation availability items in Dhaka city was 2.31 (see Table F). Figure 2 illustrates the expression of respondents about transportation availability in Dhaka city.

Based on the results shown in Figure 2, it can be inferred that respondents in Dhaka have a negative stance towards the availability of transportation in the city, as indicated by their responses on the Likert scale. Survey results indicated that the average ratings for various factors—such as the convenience of reaching the bus stop from home, the availability and accessibility of public transportation in Dhaka, and overall satisfaction with public transit—fell between 2.09 and 2.50. Dhaka inhabitants have lower satisfaction levels with transportation availability based on these data. Hence, it is advised to prioritize all transportation alternatives to enhance Dhaka's social sustainability.

4.2 Impact of transport availability on socially sustainable Dhaka city

This study runs different OLS models to examine the impact of transportation availability on SSUD. In Table 5, model 1 represents the impact of transportation availability on SSUD which is considered a benchmark model. According to model 1, all the coefficients are positive and statistically significant. For example, reaching to bus stop easily from home (TA1) positively influences the SSUD by 0.142 and it is significant at a 1% significance level. Similarly, other transportation availability variables (i.e., TA2, TA3, and TA4) have a statistically significant positive relation. Moreover, this study also cross-validated the effects of age and gender variations in the relationship between TA and SSUD, the results presented in model 2 of Table 5. Nonetheless, this study found almost identical results of benchmark OLS regression (model 1), which indicates that age and gender variation do not have any considerable influence on the relationship between TA and SSUD. Based on OLS regression (reported in models 1 and 2), we found that transportation availability has a significant impact on SSUD, and this issue remains the same for every citizen in Dhaka city.

Table 5. Impact of transportation availability on socially sustainable urban development

Variables	OLS		Poisson	
	Model 1	Model 2	Model 3	Model 4
	SSUD	SSUD	SSUD	SSUD
TA1	0.142***	0.143***	0.054***	0.055***
	(-0.0285)	(-0.0285)	(-0.0113)	(-0.0113)
TA2	0.138***	0.137***	0.055***	0.055***
	(-0.033)	(-0.0334)	(-0.0134)	(-0.0135)
TA3	0.114***	0.114***	0.044***	0.044***
	(-0.0332)	(-0.0331)	(-0.0132)	(-0.0132)
TA4	0.0846**	0.0831**	0.0361**	0.0353**
	(-0.0377)	(-0.0377)	(-0.015)	(-0.015)
Control Variable	No	Yes	No	yes
Constant	1.343***	1.358***	0.448***	0.456***
	(-0.0704)	(-0.118)	(-0.0294)	(-0.0479)
Observations	548	548	548	548
R-squared/Pseudo R^{2*}	0.374	0.374	0.0162*	0.0162*

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Control variable "Age" and "Gender".

4.3 Robustness test

The Poisson distribution is the primary distribution used for counting data [59]. The Poisson distribution presupposes equidispersion, where the mean and variance are equal. Over-dispersion is the term used to describe a substantial deviation from the mean [60]. If the dependent variable is Poisson distributed, then the parameters of the Poisson regression model may be estimated using maximum likelihood [61]. However, this cross-checks the Poisson distribution issues and whether an over-dispersion of the dependent variable (i.e., SSUD) influences the regression estimation [60, 62, 63]. To confirm the application of Poisson regression and over-dispersion issues in this count data, we validate it through post-estimation (results shown in Table G), where the high p-values indicate no evidence of lack-of-fit in both Deviance and Pearson goodness-of-fit.

In the case of the output of Poison regression reported in Table 5 (model 3 and model 4), this study also found a positive relation between SSUD and TA1, TA2, TA3, and TA4 separately. Also, the results are identically statistically significant to the results of benchmark models (OLS-based model 1 model 2) reported in Table 5, which indicates the cross-validation of the output of benchmark regression. Thus, this study concluded that according to the respondents' opinions, the availability and accessibility of transport in Dhaka city have a strong positive relation to the sustainable social development of Dhaka.

5. DISCUSSION

Transportation availability is one of the significant features of social sustainability. The study revealed that the residents of Dhaka city are dissatisfied with the availability of transportation. A case study in Irbid, Jordan found moderate to relatively low satisfaction with transportation availability among respondents [1]. In addition, there was widespread dissatisfaction with Dhaka's existing transport system, with poor use of public transport among Dhaka city residents due to poor sustainability and the city's narrow and congested roads [20]. Additionally, it was observed that the combination of high population density and limited access to public transportation compels residents to rely on non-transit modes of travel, such as auto-rickshaws and taxicabs, despite their comparatively higher costs.

Moreover, the statistical examination conducted in this study unveiled a notable positive correlation between transportation availability and socially sustainable urban development within Dhaka city. The profound impact of urban form on transportation availability is a pivotal indicator of social sustainability in Irbid, Jordan [1]. Transportation availability emerges as a crucial variable closely linked to the advancement of socially sustainable urban growth in the City of Dunedin, New Zealand [3]. The rapid urbanization witnessed in Baghdad, the capital of Iraq, poses a formidable challenge to meet the growing demand for transport availability, which is critical to ensuring sustainable urban development [64].

Smart cities are instrumental in fostering the intellectual growth of urban transportation systems while addressing the imperative of sustainable urban development [65]. Transport holds a pivotal position in the planning for urban sustainability, where cities institute programs and policies geared toward enhancing public transport, cycling, and walking options [66]. The provision of transportation amenities underscores the significance of elevating residents' quality of life to establish a socially sustainable community [5]. In the pursuit of social sustainability, the role of public transport remains essential for urban and metropolitan settings [67]. Transportation facilities are essential components of urban systems aimed at fostering a sustainable city [68].

Dhaka city's transportation landscape is marked by persistent traffic congestion, discomfort, safety concerns, and subpar air quality [69]. Despite the overwhelming need, the metropolis of Dhaka continues to grapple with a substantial deficit in adequate and quality public transport options and pedestrian pathways [70]. The unchecked expansion of urban areas further strains the capacity to deliver essential municipal services, including transportation infrastructure, particularly evident in Dhaka [12]. Widespread dissatisfaction among users of public transport pervades the neighborhoods of Dhaka city, underscoring a notable absence in the performance of transport sustainability [8, 20]. The city of Dhaka has experienced a chaotic and intense spread of horizontal densification, emphasizing the imperative of an integrated approach to residential planning that prioritizes the provision of public transport facilities and associated amenities [8].

Sufficient transportation infrastructure cannot be overstated in developing sustainable urban systems, crucial for fostering a sustainable city [68]. Dhaka city's developmental strategy strongly emphasizes enhancing public transport services while promoting walking and cycling alternatives [40]. The Dhaka city plan highlights the lack of coordination between different transport modes [71]. Additionally, the government has initiated the "Bus Rapid Transit System (BRT System)" as a sustainable urban transport initiative to provide Dhaka with safe, affordable, comfortable, and environmentally friendly transportation solutions [69]. However, existing literature suggests that the issue of transportation availability within Dhaka city demands heightened attention to improve services for its residents, thereby contributing to the city's sustainability. Moreover, this study reinforces the notion that the availability of transportation significantly and positively impacts socially sustainable urban growth within the context of Dhaka city.

Hence, based on residents' opinions and statistical analysis, it is evident that all indicators of transportation availability need to be considered by the relevant authorities in Bangladesh to ensure a sustainable city. Furthermore, these findings are similarly significant for Dhaka and other cities of developing regions such as Kolkata, Delhi, Shanghai, Beijing, Mumbai, and Cairo, and future researchers are advised to adopt the same approach to explore other cities in Bangladesh facing similar challenges. Therefore, authorities can leverage these findings to assess their transportation infrastructure, and availability, facilitating progress toward sustainability.

6. PRACTICAL RECOMMENDATIONS

Following the acquisition of statistical findings from the study and thorough analysis of survey responses, this paper outlines the subsequent recommendations:

1) Due to the lack of specific indicators of transport availability in Dhaka, this study provides clear insights into current conditions for legislators, city planners, municipal authorities, and executing groups by addressing four key indicators. These findings can inform policy decisions, and

implementing agencies can use them to ensure socially sustainable urban development in Dhaka.

2) Similarly, this study's findings demonstrate that each indicator of transportation availability positively influences the social sustainability of Dhaka city. To facilitate the implementation of transportation availability measures, it is crucial to conduct a comprehensive review of key planning documents such as the "Structure Plan," "Urban Area Plan," "Detailed Area Plan," and "Urban Sector Policy-2011." This review should explicitly prioritize the examination of each identified indicator of transportation availability outlined in this study.

3) This study recommends active community involvement alongside government initiatives as crucial for ensuring transport service availability, thereby contributing to a socially sustainable Dhaka. Collaboration between residents and government agencies is vital for shaping the city's transportation landscape in line with social sustainability principles, helping to achieve target 11.2 under SDG-11, "Sustainable Cities and Communities."

7. CONCLUSIONS

Transportation availability plays a crucial role in fostering social sustainability, which is paramount for the overall sustainability of urban environments. Regrettably, this critical aspect often goes unnoticed in the development plans of many cities in developing regions including Dhaka. Hence, it is imperative for all stakeholders, including city authorities, to recognize the present state of transportation availability and its profound influence on the advancement of socially sustainable urban development. Through gaining a deeper understanding of these dynamics, we are empowered to create a socially sustainable urban landscape that benefits both current inhabitants and future generations. This endeavor is crucial to building a better, more equitable urban environment for all.

The findings of this study underscore a concerning trend: all aspects related to transportation availability have contributed to a notable dissatisfaction among Dhaka city dwellers. The current transport availability does not align with socially sustainable urban development requirements. Furthermore, the statistical analysis elucidated that each indicator of transportation availability positively influences the advancement of SSUD within Dhaka city. It underscores the pivotal role of transportation availability as a cornerstone of social sustainability, crucial for progressing in socially sustainable urban environments. Therefore, the findings of this study contribute to Dhaka City Corporation, policymakers, urban planners, and implementing agencies to find out the gap between the current transport availability and its impact on socially sustainable urban development. Also, it contributes to the Urban Sector Policy 2011 in Bangladesh by including all indicators of transport availability. Only through their collaborative efforts can a socially sustainable Dhaka be realized, paving the path for a brighter, more equitable future for all its inhabitants.

Notably, this research had limitations. Our study is limited to a small sample size of 564 replies, which suggests that future studies might benefit from a more extensive dataset to get more depth and robustness. Second, quantitative methods were used in the study. Future studies could integrate qualitative research methods to enrich the exploration of urban social sustainability, offering more profound insights into the multifaceted dimensions at play. Thirdly, it is essential to highlight the geographical focus of this study on Dhaka city. Recognizing the broader relevance of data insights to Dhaka and other rapidly urbanizing cities, future researchers are encouraged to adopt a similar approach in exploring other similar cities. Fourthly, this study utilized four items from existing literature to gauge transportation availability. Future researchers may find value in constructing a dedicated index tailored to the specific context of the city, potentially yielding fresh perspectives and insights within this field of study.

REFERENCES

[1] Ali, H.H., Al-Betawi, Y.N., Al-Qudah, H.S. (2019). Effects of urban form on social sustainability–A case study of Irbid, Jordan. International Journal of Urban Sustainable Development, 11(2): 203-222. https://doi.org/10.1080/19463138.2019.1590367

[2] Vijayakumar, A., Mahmood, M.N., Gurmu, A., Kamardeen, I., Alam, S. (2022). Social sustainability indicators for road infrastructure projects: A systematic literature review. IOP Conference Series: Earth and Environmental Science, 1101(2): 022039. https://doi.org/10.1088/1755-1315/1101/2/022039

[3] Larimian, T., Sadeghi, A. (2021). Measuring urban social sustainability: Scale development and validation. Environment and Planning B: Urban Analytics and City Science, 48(4): 621-637. https://doi.org/10.1177/2399808319882950

[4] Huang, J.Y., Wey, W.M. (2019). Application of big data and analytic network process for the adaptive reuse strategies of school land. Social Indicators Research, 142: 1075-1102. https://doi.org/10.1007/s11205-018-1951-y

[5] Chan, H.H., Hu, T.S., Fan, P. (2019). Social sustainability of urban regeneration led by industrial land redevelopment in Taiwan. European Planning Studies, 27(7): 1245-1269. https://doi.org/10.1080/09654313.2019.1577803

[6] Zou, T., Su, Y.K., Wang, Y.W. (2018). Research on the hybrid ANP-FCE approach of urban community sustainable construction problem. Mathematical Problems in Engineering, 2018(1): 8572498. https://doi.org/10.1155/2018/8572498

[7] Roy, S., Sowgat, T., Ahmed, M.U., Islam, S.T., Anjum, N., Mondal, J., Rahman, M.M. (2018). Bangladesh: National urban policies and city profiles for Dhaka and Khulna. GCRF Centre for Sustainable, Healthy and Learning Cities and Neighborhood (SHLC).

[8] Satu, S.A., Chiu, R.L. (2019). Livability in dense residential neighbourhoods of Dhaka. Housing Studies, 34(3): 538-559. https://doi.org/10.1080/02673037.2017.1364711

[9] Barai, M.K. (2020). Conclusion: Bangladesh's development—challenges to sustainability and the way forward. In: Bangladesh's Economic and Social Progress: From a Basket Case to a Development Model, pp. 383-409. https://doi.org/10.1007/978-981-15-1683-2_13

[10] Yasmin, F. (2019). Identification of the existing social problems and proposing a sustainable social business model: Bangladesh perspective. International Journal of Economics and Finance, 11(9): 1-81.

https://doi.org/10.5539/ijef.v11n9p81
[11] Pradhanang, S.M., Jahan, K. (2021). Urban water security for sustainable cities in the context of climate change. In: Water, Climate Change, and Sustainability, pp. 213-224. https://doi.org/10.1002/9781119564522.ch14
[12] Sarker, P., Wang, L. (2020). Analyzing urban sprawl and sustainable development in Dhaka, Bangladesh. Journal of Economics and Sustainable Development, 11(6): 9-20. https://doi.org/10.7176/JESD/11-6-02
[13] Kenger, Z.D., Kenger, Ö.N., Özceylan, E. (2023). Analytic hierarchy process for urban transportation: A bibliometric and social network analysis. Central European Journal of Operations Research, 1-20. https://doi.org/10.1007/s10100-023-00869-x
[14] Huang, S.Z., Sadiq, M., Chien, F. (2021). Dynamic nexus between transportation, urbanization, economic growth and environmental pollution in ASEAN countries: Does environmental regulations matter? Environmental Science and Pollution Research, 30: 42813-42828. https://doi.org/10.1007/s11356-021-17533-z
[15] Fang, X., Mu, B., Yu, C.L. (2020). Strengthening green transportation and implementing sustainable urban environmental development in the new period. International Journal of Environmental Technology and Management, 23(2-4): 149-161. https://doi.org/10.1504/ijetm.2020.112963
[16] Li, Y., Miao, L., Chen, Y., Hu, Y.K. (2019). Exploration of sustainable urban transportation development in China through the forecast of private vehicle ownership. Sustainability, 11(16): 4259. https://doi.org/10.3390/su11164259
[17] Lu, S.R., Liu, Y. (2018). Evaluation system for the sustainable development of urban transportation and ecological environment based on SVM. Journal of Intelligent & Fuzzy Systems, 34(2): 831-838. https://doi.org/10.3233/jifs-169376
[18] Hatefi, S.M. (2018). Strategic planning of urban transportation system based on sustainable development dimensions using an integrated SWOT and fuzzy COPRAS approach. Global Journal of Environmental Science and Management, 4(1): 99-112. https://doi.org/10.22034/gjesm.2018.04.01.010
[19] Shen, B. (2017). Sustainable development of large urban transportation infrastructure networks: Management optimization and incorporation of autonomous vehicles. Doctoral dissertation, Stanford University.
[20] Munira, S., San Santoso, D. (2017). Examining public perception over outcome indicators of sustainable urban transport in Dhaka city. Case Studies on Transport Policy, 5(2): 169-178. https://doi.org/10.1016/j.cstp.2017.03.011
[21] Baloian, N., Frez, J., Pino, J.A., Zurita, G. (2015). Efficient planning of urban public transportation networks. In Ubiquitous Computing and Ambient Intelligence. Sensing, Processing, and Using Environmental Information: 9th International Conference, UCAmI 2015, Puerto Varas, Chile, pp. 439-448. https://doi.org/10.1007/978-3-319-26401-1_41
[22] Gidebo, F.A., Szpytko, J. (2019). How to implement telematics into the urban public transportation system in Addis Ababa, concept study. In Development of Transport by Telematics: 19th International Conference on Transport System Telematics, TST 2019, Jaworze, Poland, pp. 302-318. https://doi.org/10.1007/978-3-030-27547-1_22
[23] Xie, H.L., Zhang, Y.W., Duan, K.F. (2020). Evolutionary overview of urban expansion based on bibliometric analysis in Web of Science from 1990 to 2019. Habitat International, 95: 102100. https://doi.org/10.1016/j.habitatint.2019.102100
[24] Yazdanifard, Y., Talebian, M., Joshaghani, H. (2021). Metro station inauguration, housing prices, and transportation accessibility. Journal of Transport and Land Use, 14(1): 537-561. https://doi.org/10.5198/jtlu.2021.1622
[25] Cho, I.S., Heng, C.K., Trivic, Z. (2015). Re-Framing Urban Space: Urban Design for Emerging Hybrid and High-Density Conditions. Routledge.
[26] Shirazi, M., Keivani, R. (Eds.). (2019). Urban Social Sustainability: Theory, Policy and Practice. Routledge.
[27] Ring, Z., Damyanovic, D., Reinwald, F. (2021). Green and open space factor Vienna: A steering and evaluation tool for urban green infrastructure. Urban Forestry & Urban Greening, 62: 127131. https://doi.org/10.1016/j.ufug.2021.127131
[28] Wrangsten, C., Ferlander, S., Borgström, S. (2022). Feminist urban living labs and social sustainability: Lessons from Sweden. Urban Transformations, 4: 5. https://doi.org/10.1186/s42854-022-00034-8
[29] Enyedi, G., Kovács, Z. (Eds.). (2006). Social Changes and Social Sustainability in Historical Urban Centres: The Case of Central Europe. Pécs: Centre for Regional Studies of Hungarian Academy of Sciences.
[30] Ogunsola, S.A. (2016). Social Sustainability: Guidelines for Urban Development and Practice in Abuja City, Nigeria. Nottingham Trent University (United Kingdom).
[31] Talan, A., Tyagi, R.D., Surampalli, R.Y. (2020). Social dimensions of sustainability. In: Sustainability: Fundamentals and Applications, pp. 183-206. https://doi.org/10.1002/9781119434016.ch9
[32] Zhang, Z.G. (2022). Evolution paths of green economy modes and their trend of hypercycle economy. Chinese Journal of Population, Resources and Environment, 20(1): 1-11. https://doi.org/10.1016/j.cjpre.2022.03.001
[33] Zhang, Y., Wang, Y., Wei, J.H. (2022). Evaluation of sustainable development of an agricultural economy based on the DPSIR model. Journal of Sensors, 2022(1): 2591275. https://doi.org/10.1155/2022/2591275
[34] Zhang, X.Y., Cao, Y.H., Tang, M.F., Yu, E.Y., Zhang, Y.Q., Wu, G. (2022). Evaluation of a Chongqing industrial zone transformation based on sustainable development. Sustainability, 14(9): 5122. https://doi.org/10.3390/su14095122
[35] Yankovskaya, V.V., Mustafin, T.A., Endovitsky, D.A., Krivosheev, A.V. (2022). Corporate social responsibility as an alternative approach to financial risk management: Advantages for sustainable development. Risks, 10(5): 106. https://doi.org/10.3390/risks10050106
[36] Jia, J.R., Khalid Anser, M., Peng, M.Y.P., Yousaf, S.U., Hyder, S., Zaman, K., Bin Nordin, M.S. (2023). Economic determinants of national carbon emissions: Perspectives from 119 countries. Economic Research-Ekonomska Istraživanja, 36(1): 1099-1119. https://doi.org/10.1080/1331677x.2022.2081589
[37] Li, Y.L., Zhao, X.K., Shi, D., Li, X. (2014). Governance

of sustainable supply chains in the fast fashion industry. European Management Journal, 32(5): 823-836. https://doi.org/10.1016/j.emj.2014.03.001
[38] Ma, S.Q., Dai, J., Wen, H.D. (2019). The influence of trade openness on the level of human capital in China: On the basis of environmental regulation. Journal of Cleaner Production, 225: 340-349. https://doi.org/10.1016/j.jclepro.2019.03.238
[39] United Nations. (2018). The World's Cities in 2018. https://www.un.org/en/development/desa/population/publications/pdf/urbanization/the_worlds_cities_in_2018_data_booklet.pdf.
[40] Dhaka Structure Plan (2016-2035). http://www.rajukdhaka.gov.bd/rajuk/image/slideshow/1.%20Draft%20Dhaka%20Structure%20Plan%20Report%202016-2035(Full%20%20Volume).pdf.
[41] Ahasan, R., Hoda, M.N., Alam, M.S., Nirzhar, Y.R., Kabir, A. (2023). Changing institutional landscape and transportation development in Dhaka, Bangladesh. Heliyon, 9(7): e17887. https://doi.org/10.1016/j.heliyon.2023.e17887
[42] Ahasan, R., Kabir, A. (2019). Performance evaluation of public transportation system: Analyzing the case of Dhaka, Bangladesh. Planning Forum, 18: 79-99. http://doi.org/10.2139/ssrn.3560667
[43] Yeasmin, R. (2019). Road transportation challenges in Bangladesh: The case of traffic jam in Dhaka city.
[44] Asian Development Bank. (2012). Bangladesh: Strengthening regional planning and governance. https://www.adb.org/sites/default/files/project-documents/39298-013-ban-tacr-02.pdf.
[45] Kamal, M., Alam, M.S. (2007). Sustainable urban development: The case of Dhaka Mega city. Society & Change, 1(1): 35-50.
[46] Chowdhury, M.S. (2014). Sustainable transportation systems for Dhaka Metropolitan City: Issues and opportunities. In: ICSI 2014: Creating Infrastructure for a Sustainable World, pp. 448-459. https://doi.org/10.1061/9780784478745.040
[47] Bangladesh Bureau of Statistics. (2018). Labour force survey (LFS) 2016-17. http://nsds.bbs.gov.bd/storage/files/1/Publications/LFS/LFS_2016-17.pdf.
[48] Demographia. (2019). Demographia world urban areas. http://www.demographia.com/db-worldua.pdf.
[49] Chin, W.W. (2001). PLS-graph user's guide. https://www.spss-pasw.ir/upload/images/ei8gx66re11tenmq0sm.pdf.
[50] Johanson, G.A., Brooks, G.P. (2010). Initial scale development: Sample size for pilot studies. Educational and Psychological Measurement, 70(3): 394-400. https://doi.org/10.1177/0013164409355692
[51] UN-Habitat. (2020). The new urban agenda. UN-Habitat, HS/035/20E. https://unhabitat.org/the-new-urban-agenda-illustrated, accessed on Aug. 3, 2022.
[52] Hair, J.F., Black, W.C., Babin, B.J. (2010). Multivariate Data Analysis: A Global Perspective. Pearson Education.
[53] Byrne, B.M. (2013). Structural Equation Modeling with Mplus: Basic Concepts, Applications, and Programming. Routledge.
[54] Hair, J.F., Babin, B.J., Anderson, R.E., Black, W.C. (2022). Multivariate Data Analysis. Cengage Learning,
[55] Wang, X.F., Cheng, Z.S. (2020). Cross-sectional studies: Strengths, weaknesses, and recommendations. Chest, 158(1): S65-S71. https://doi.org/10.1016/j.chest.2020.03.012
[56] Angrist, J.D., Pischke, J.S. (2009). Mostly Harmless Econometrics: An Empiricist's Companion. Princeton University Press.
[57] Finkelstein, A., Poterba, J. (2002). Selection effects in the United Kingdom individual annuities market. The Economic Journal, 112(476): 28-50. https://doi.org/10.1111/1468-0297.0j672
[58] Verbeek, M. (2017). A Guide to Modern Econometrics. John Wiley & Sons.
[59] Harris, T., Yang, Z., Hardin, J.W. (2012). Modeling underdispersed count data with generalized Poisson regression. The Stata Journal, 12(4): 736-747. https://doi.org/10.1177/1536867x1201200412
[60] Farhadian, M., Mohammadi, Y., Mirzaei, M., Shirmohammadi-Khorram, N. (2021). Factors related to baseline CD4 cell counts in HIV/AIDS patients: Comparison of poisson, generalized poisson and negative binomial regression models. BMC Research Notes, 14: 114. https://doi.org/10.1186/s13104-021-05523-w
[61] Fávero, L.P.L., dos Santos, M.A., Serra, R.G. (2018). Cross-border branching in the Latin American banking sector. International Journal of Bank Marketing, 36(3): 496-528. https://doi.org/10.1108/IJBM-01-2017-0003
[62] Fávero, L.P.L., Belfiore, P., dos Santos, M.A., Souza, R.F. (2020). Overdisp: A stata (and Mata) package for direct detection of overdispersion in poisson and negative binomial regression models. Statistics, Optimization & Information Computing, 8(3): 773-789.
[63] Green, J.A. (2021). Too many zeros and/or highly skewed? A tutorial on modelling health behaviour as count data with Poisson and negative binomial regression. Health Psychology and Behavioral Medicine, 9(1): 436-455. https://doi.org/10.1080/21642850.2021.1920416
[64] Mohsin, M.M., Beach, T., Kwan, A. (2017). Public perceptions of urban sustainable challenges in developing countries. WIT Transactions on Ecology and the Environment, 226: 131-140. https://doi.org/10.2495/SDP170121
[65] Bouzguenda, I., Alalouch, C., Fava, N. (2019). Towards smart sustainable cities: A review of the role digital citizen participation could play in advancing social sustainability. Sustainable Cities and Society, 50: 101627. https://doi.org/10.1016/j.scs.2019.101627
[66] Karjalainen, L.E., Juhola, S. (2019). Framework for assessing public transportation sustainability in planning and policy-making. Sustainability, 11(4): 1028. https://doi.org/10.3390/su11041028
[67] Pitarch-Garrido, M.D. (2018). Social sustainability in metropolitan areas: Accessibility and equity in the case of the metropolitan area of Valencia (Spain). Sustainability, 10(2): 371. https://doi.org/10.3390/su10020371
[68] Ben-Zadok, E. (2018). The sustainable city, by Steven Cohen: New York, Columbia University Press, 2018. Journal of Urban Affairs, 41(3): 419-421. https://doi.org/10.1080/07352166.2018.1507209
[69] Ahmed, I., Alam, N., Warda, F. (2017). A sustainable urban transport initiative in Dhaka: Introducing BUS rapid transit system. UNESCAP: Transport and

Communications Bulletin for Asia and the Pacific, 87: 67-87.
[70] Gallagher, R. (2016). Prioritising Dhaka s urban transport system. Journal of Business and Technology (Dhaka), 141-144.
[71] Hasnat, M.M., Hoque, M.S. (2016). Developing satellite towns: A solution to housing problem or creation of new problems. International Journal of Engineering and Technology, 8(1): 50-56. https://doi.org/10.7763/IJET.2016.V8.857
[72] Bramley, G., Dempsey, N., Power, S., Brown, C. (2006). What is 'social sustainability', and how do our existing urban forms perform in nurturing it. In Sustainable Communities and Green Futures' Conference, Bartlett School of Planning, University College London, London, pp. 1-40.
[73] Chan, E., Lee, G.K. (2008). Critical factors for improving social sustainability of urban renewal projects. Social Indicators Research, 85: 243-256. https://doi.org/10.1007/s11205-007-9089-3
[74] Bramley, G., Dempsey, N., Power, S., Brown, C., Watkins, D. (2009). Social sustainability and urban form: Evidence from five British cities. Environment and Planning A, 41(9): 2125-2142. https://doi.org/10.1068/a4184
[75] Dempsey, N., Bramley, G., Power, S., Brown, C. (2011). The social dimension of sustainable development: Defining urban social sustainability. Sustainable Development, 19(5): 289-300. https://doi.org/10.1002/sd.417
[76] Abdullah, M., Das, S.K., Tatsuo, O. (2014). Urbanization and sustainability challenges in Dhaka city, Bangladesh. In Proceedings of the 2nd International Conference on Civil Engineering for Sustainable Development (ICCESD-2014), KUET, Khulna, Bangladesh, pp. 53-62.

APPENDIX

Table A. Experts' relevance ratings on the "item scale"

Items (Transportation Availability)	Expert						Experts' Agreement	I-CVI UA	UA
	1	2	3	4	5	6			
TA1= 'Public transportation availability'	1	1	1	1	1	1	6	1.00	1
TA2= 'Time to reach the bus stop'	1	1	1	1	1	1	6	1.00	1
TA3='Satisfaction level of public transportation'	1	1	1	1	1	1	6	1.00	1
TA4= 'Public Transport accessibility (for example, disabled/special needs)'	1	1	1	1	1	1	6	1.00	1
Item Wise Individual Expert Relevance Agreement	4	4	4	4	4	4	Mean I-CVI	1.00	4
							S-CVI/UA	1.00	
Proportion Relevance	1	1	1	1	1	1	Mean Expert Proportion	1.00	

Note: I-CVI= 'content validity of individual items', S-CVI= 'content validity of the overall scale', UA= 'Universal agreement, score '1' means all the items achieved 100% experts in agreement, score '0' means not all the experts provided relevance rating of 1'.

Table B. Items for SSUD

Items	References
To achieve SSUD in Dhaka, it is essential to guarantee that all residents have access to fundamental needs like housing, education, and healthcare. Ensuring satisfaction with welfare needs, such as community participation in public decision-making, is crucial for achieving SSUD in Dhaka. Equitable access to opportunities and services (i.e., open space, transport facilities, and facilities) for marginalized groups. The sustainability of the community (i.e., social capital, social justice, safety, and poverty reduction) is ensured for all to make an SSUD in Dhaka. Ensuring equal rights and privileges for each gender is crucial for achieving SSUD in Dhaka.	Ali et al. [1]; Chan et al. [5]; Bramley et al. [72]; Chan and Lee [73]; Bramley et al. [74]; Dempsey et al. [75]; Abdullah et al. [76];

Table C. Items for TA

No	Items	Reference
1	Public transportation availability.	Ali et al. [1]
2	Time to reach the bus stop.	
3	Satisfaction level of public transportation.	
4	Public Transport accessibility (for example, disabled/special needs).	

Table D. Skewness and kurtosis tests for normality

		Joint Test				Shapiro-Wilk W Test			
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	Adj chi2(2)	Prob>chi2	W	V	z	Prob>z
SSUD	564	0.145	0.082	7.15	0.036	0.993	2.542	2.254	0.012
TA1	564	0.000	0.000	36.28	0.000	0.971	10.895	5.772	0.000
TA2	564	0.010	0.002	14.31	0.001	0.996	1.495	2.973	0.065
TA3	564	0.001	0.026	14.69	0.001	0.995	1.711	1.298	0.097
TA4	564	0.137	0.049	6.48	0.055	0.989	3.954	3.322	0.000

Table E. Multicollinearity diagnostic tests

Correlation Matrix, (obs=564)				
	TA1	**TA2**	**TA3**	**TA4**
TA1	1.0000			
TA2	0.6524	1		
TA3	0.6304	0.6133	1	
TA4	0.4775	0.4803	0.5248	1

Multicollinearity Diagnostic Criteria						
Var	**Eigenval**	**C_Number**	**C_Index**	**VIF**	**1/VIF**	**R2_xi,X**
TA1	2.696	1.0000	1.0000	2.0022	0.4803	0.5197
TA2	0.5765	4.6766	2.1625	2.0017	0.4939	0.5061
TA3	0.3831	7.0376	2.6528	2.0036	0.4942	0.5058
TA4	0.3444	7.8287	2.798	1.4891	0.6715	0.3285

* (1) Farrar-Glauber Multicollinearity Chi2-Test:	
Chi2 Test = 888.6415	P-Value > Chi2(6) 0.0928

Table F. Current status of transportation availability

Variable and Items	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	**σ**	**x̄**
TA1	86	287	81	96	14	1.03	2.50
TA2	107	244	146	50	17	0.84	2.42
TA3	124	253	128	57	2	0.84	2.23
TA4	103	274	132	52	3	0.64	2.09
Mean value: 2.31							

Note: Refer to Table 2 for the elaboration of TA1, TA2, TA3, and TA4.

Table G. Post estimation of poisson test

Post Estimation of Poisson Test	
Deviance goodness-of-fit = 55.05154	Pearson goodness-of-fit = 53.39998
Prob > chi2(559) = 0.9200	Prob > chi2(559) = 0.9120