

ORIGINAL ARTICLE

Urban livability and contextual uncertainties: An assessment of livability through the lens of urban dwellers in Guwahati, India

Anwasha Mahanta and Parijat Borgohain*

Department of Geography, Cotton University, Guwahati, India

ABSTRACT

The frenetic pace of urban growth in India has caused major concerns regarding the quality of urban livability. Thus, constructing livable cities has become a major goal for new urbanization in India. But urban livability as a behavioral function of the interaction between urban environment and individual characteristics is still understudied. Therefore, to enhance urban livability and construct people-oriented livable cities, this research study aimed to understand the perception of the residents of Guwahati, India, on urban livability and its determinants. Following the notion of uncertain geographic context problem (UGCoP), the current study developed an appropriate conceptual and methodological framework that evaluated the residents' satisfaction with urban livability and the effect of its dimensions using statistical methods, which were exploratory factor analysis, structural equation modeling and Spearman's rank correlation. The empirical results of the study indicate that residents' mean satisfaction with the city's livable condition is above dissatisfaction level (2.735) and the four examined dimensions have a positive influence upon residents' satisfaction with urban livability. Additionally, different socio-economic attributes also exert significant effects on the overall satisfaction with urban livability. Therefore, this study is a practical example and model reference for enhancing urban livability in India, particularly for fast-growing cities.

Keywords: *urban livability; residents' satisfaction; uncertain geographic context problem (UGCoP); structural equation modeling*

1. Introduction

The global share of the population living in urban areas has reached 55.7 percent in 2019, which is projected to rise to 68 percent by 2050 (United Nations, 2018). The rapid process of urbanization has been most pronounced in developing countries of Asia, which are going through the process of messy and hidden urbanization without effective urban planning and sufficient infrastructural investment (Kundu et al., 2020). Thus, multiple initiatives have been made to enhance the urban infrastructure but many developing countries have failed to keep pace with the growing urban population and are facing various issues, such as underinvestment in infrastructure, poor spatial and economic planning, and suboptimal land use (African Development Bank, Asian Development Bank, European Bank for Reconstruction and Inter-

ARTICLE INFO

Received: December 16, 2021

Accepted: March 16, 2022

Available online: May 24, 2022

*CORRESPONDING AUTHOR

Anwasha Mahanta, Department of Geography, Cotton University, Panbazar, Guwahati, Assam 781001, India;
gph1991002_anwasha@cottonuniversity.ac.in

CITATION

Mahanta A and Borgohain P (2022). "Urban livability and contextual uncertainties: An assessment of livability through the lens of urban dwellers in Guwahati, India". *Journal of Infrastructure, Policy and Development*, 6(1): 1395. doi: 10.24294/jipd.v6i1.1395

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American Development Bank Development, 2019). Moreover, the twentieth-century short-term planning policies proposed for single-purpose solutions are struggling to tackle twenty-first-century livability challenges (Fairchild and Revord, 2017). Global issues such as climate change, widening inequities, globalization and the rising burden of the population also lead to additional and substantial pressure on cities, with these challenges disproportionately affecting the developing nations (Alderton et al., 2019). Therefore, there is now a pressing need for cities to be resilient and to mitigate the adverse consequences of these challenges. International agendas, such as the Sustainable Development Goals (SDGs) and the New Urban Agenda, have also provided road maps to build livable cities that are resilient, sustainable, inclusive and equitable and support a higher quality of life (United Nations, 2015; 2017).

As far as India is concerned, the population residing in urban areas was 34.47% in 2019 and is projected to increase to 38.2% by 2036 (National Commission on Population, 2020). The country has witnessed an increase of 8 crore houses during 2001–2011 but 32.1% of urban households have only one dwelling room (Office of the Registrar General & Census Commissioner, 2011). Additionally, 7% of urban households are still deprived of electricity and one in every ten households has no latrine facility, which depicts that government policies have failed to provide basic amenities and a livable environment to all citizens (Office of the Registrar General & Census Commissioner, 2011). Therefore, the Indian government has adopted different urban renewal programs, such as National Smart Cities Mission and Atal Mission for Rejuvenation and Urban Transformation in 2015, to improve the quality of life in cities (Ministry of Urban Development, 2015). But, urban livability is more than the absolute concept of quality of urban space; it is a behavioral function of the interaction between the urban environment and individual characteristics (Pacione, 1990). Furthermore, previous research studies indicate a strong association between urban environment and individual well-being (Mouratidis, 2021; Shekhar et al., 2019). Thus, it is crucial to conduct a subjective evaluation of residents' satisfaction with urban livability and its indicators to explore their perception of the quality of the city environment and develop new insights on the construction of a livable city.

Numerous research studies have been carried out on urban livability but works emphasizing residents' satisfaction with urban livability have been limited. Most of the studies have exaggerated the influence of city services on constructing livable cities, neglecting the residents' point of view. These studies often lead to counterintuitive findings

that contradict with residents' outlook on the city's ability to provide a desired livable environment. Additionally, previous literature has failed to address the subjective dimension of livability at the neighborhood level and the association of individuals' socio-economic attributes with urban livability due to the lack of data, especially in India. Therefore, a systematic framework is required to determine the ability of city amenities to fulfill the needs and expectations of urban residents. Moreover, a methodological approach that measures the influence of the dimensions of livability on people's overall satisfaction with their urban environment has been rarely adopted for Indian cities.

To fill these research gaps, the present study aimed to formulate a conceptual and methodological framework that evaluates the residents' satisfaction with urban livability and its dimensions. The paper mainly focused on the following:

1. To measure residents' mean satisfaction with urban livability and its dimensions across the study area.
2. To examine whether all critical observed variables related to residents' satisfaction could be grouped into a smaller number of dimensions (factors).
3. To evaluate the effect of satisfaction attained from the dimensions on the overall satisfaction with urban livability.
4. To identify the correlation between individuals' socio-economic attributes and the overall satisfaction with urban livability.

2. Review of literature

2.1. Concept of urban livability

In recent years, strenuous efforts have been carried out to build livable spaces across cities on a global scale to alleviate the growing issues of urbanization, but the term "livability" has no universally accepted definition. It is an ambiguous term that has been used in various academic publications and professional writings in different circumstances with various interpretations. The concept of livability incorporates extensive human needs ranging from physical and socio-economic well-being, basic security to cultural expression and a sense of belonging to a community or place, as well as the ability of cities to fulfill the expectations of inhabitants for their well-being and quality of life (National Research Council, 2002; Martino et al., 2021). Thus, the assessment of the subjective satisfaction of a person living in a particular place has a major role to play in identifying the key attributes of livability. The term livability is much more than the good quality of life, since it integrates social, economic, physical and psychological health of residents and services such as parks or green spaces, besides cultural offering, job prospects, economic dynamism and feeling of safety, and it has been continuously expanded to address different issues, such as accessibility, equity, urban safety, comfort, walkability transit and urban transportation, which are influenced by a common set of underlying principles (Shabanzadeh Namini et al., 2019; Yu et al., 2014).

Urban livability is a distinctive case of livability that has a close relationship with urban life. According to urban scientists, livability is referred to the well-balanced and stable mode of economic, social, cultural, land use and environmental development in cities (Liu et al., 2014; Kazemi et al., 2018). Thus, concerning urban planning and land use policies, a livable city provides

acceptable living conditions with optimum land use allocation patterns that satisfy the materialistic as well spiritual needs of the residents and seek to achieve long-term sustainable goals (Chen et al., 2016; Mesimäki et al., 2017).

2.2. Dimensions of residents' satisfaction with urban livability

Previous studies have recognized both objectives as well as subjective indicators to measure livable conditions of cities. Notably, the majority of the works emphasized objective indicators or city services/amenities of urban livability. Therefore, the current study is an attempt to carry out a subjective evaluation of people's satisfaction attained from 15 observed variables, which can be clustered under four dimensions.

2.2.1 Physical environment and city amenities

The physical environment shapes a particular form of human behavior that contributes to the well-being of people and influences perceived livability as well. Generally, satisfaction with the physical environment includes residents' satisfaction attained from both the quality of the natural environment, which include favorable climate, access to parks, urban green spaces and water areas, a green clean urban environment, and environmental health concerning solid waste management, air quality and noise pollution in the urban area (De Vos et al., 2016; Weziak-Białowolska, 2016; Cinderby et al., 2021). Studies carried out in the United Kingdom and Australia have reported a positive association of urban green spaces with well-being and residents' self-reported life satisfaction (White et al., 2013; Ambrey and Fleming, 2014).

Moreover, city amenities, such as economic facilities, health facilities, educational facilities and basic infrastructural services, are strong variables of measuring city livability. The economic facilities of a city imply various services, such as housing costs, cost of living, industrial and functional dimensions of economic specialization, local taxes and labor market opportunities, whereas, from residents' perspective, they are more concerned about the availability of work. Blom, Kraaykamp and Verbakel (2019), using a sample from the European Quality of Life Survey 2012 and applying multilevel analyses, concluded that people who experienced or expected economic hardship were less satisfied with their life.

Additionally, a positive association of life satisfaction with health behaviors, such as not smoking, physical exercise, eating fruit, limiting fat intake among young adults (Grant et al., 2009), has been identified. But, Goel et al. (2018) reported an increasing life dissatisfaction was associated with higher healthcare utilization and costs in Ontario, Canada. Thus, providing cost-effective health facilities has become an essential service for livable cities. The impact of educational attainment on the quality of life is multifaceted and its impact can be observed in several life domains. Thus, the educational facilities of cities are reviewed by different indices, such as Mercer's Quality of Living and Ease of Living Index, while the cities are ranked based on livability (Ministry of Housing and Urban Affairs, 2021; Okulicz-Kozaryn and Valente, 2019).

Furthermore, cities need to provide certain basic infrastructure, such as clean water, roads, electricity, telecommunications, IT services and city administration, to create a better livelihood space for their citizens. The development of the infrastructure must meet societal expectations, such as social well-being, balanced utilization of public space and environmental sustainability (Mouratidis, 2021). Despite so much progress has been made in defining and characterizing the

infrastructure, it has been more difficult to unpack the association between physical infrastructure and the broader concept of livability. A study conducted in Europe to unpack the relationship between green infrastructures and personal well-being ranging from psychological measures to more global measures of life satisfaction reported a positive relationship between the variables (Bertram and Rehdanz, 2015).

2.2.2 Social interactions and mental well-being

A community, in this study, refers to the geographic community where people are attached to a particular geographical area (neighborhood). A livable city must facilitate community activities within the neighborhood (Guzmán et al., 2019). It is evident from studies that a sense of community is significantly associated with life satisfaction (Benita et al., 2020). Studies also reveal friendship, in terms of intensity and quality, is positively associated with life satisfaction (Amati et al., 2018). Moreover, the association between neighborhood-based social contacts and individual life satisfaction is likely to differ among people. Oshio (2017) concluded that trust in neighbors, social contacts in the neighborhood and participation in neighborhood activities are positively associated with happiness. Research studies have also found both social contacts and social cohesion in the neighborhood are positively associated with life satisfaction (Hoogerbrugge and Burger, 2018).

Mental well-being has not always been an obvious priority for city planners but as they begin to focus on physical health, some of the greatest potentials for impact lies with mental health. In previous studies, life satisfaction was strongly associated with self-reported mental health (Lombardo et al., 2018) and negatively correlated with depression, anxiety and hopelessness (Guney et al., 2010). Furthermore, the notion of social inclusion and a livable city is closely interconnected to one another. Studies have concluded that livable streets in urban neighborhoods can be great places for public life and social inclusion (Sauter and Huettenmoser, 2008).

2.2.3 Security and management services

A dominant subdomain under the urban living condition domain is to assure public security and safety during emergencies. Community resilience is the main factor that shapes livability (Lombardo et al., 2018). According to the IBM Global Business Services executive report, public safety and emergency response capacity have a huge impact on the growth process of a smart livable city (Dirks, 2010). A well-maintained disaster management system has also become an essential component of a livable city, since a disaster has a huge impact on city sustainability. Recent studies have aimed to build an integrated smart disaster management system to increase the disaster resilience of cities (Sukmaningsih et al., 2020). Moreover, urban security is a basic requirement in building livable urban spaces. But many cities have failed to provide a sense of safety to citizens' life and property. Past studies have explored different dimensions of urban security, such as crime rate (Ibem and Amole, 2013), traffic safety (De Vos et al., 2016), emergency shelters (Yu and Wen, 2016) and public security (Pan et al., 2021), and their relation to urban environment and livability.

2.2.4 Cultural and recreational services

Recreation and leisure sports activities in urban parks have become a part of a healthier lifestyle due to higher standards of living in recent years. Previous studies have consistently recorded the positive impact of physical activity on happiness and satisfaction with life (Bertelli-Costa and Neri, 2019; Hartman et al., 2019). For instance, a study using ordered logit analysis revealed that

increasing leisure activities among elderly people in Sweden improves their quality of life (Silverstein and Parker, 2002). Additionally, cultural services in a city imply art events, museums and historical and archaeological sites, but measuring the cultural value associated with them is a matter of concern (Wheatley and Bickerton, 2017). Life satisfaction from increased engagement in arts events, historical sites and museums was obtained using ordinary least squares (OLS) regression in the United Kingdom (Wheatley and Bickerton, 2019).

2.3. Individuals' socio-economic attributes

Besides the objective and subjective indicators of urban livability stated above, individuals' socio-economic attributes such as gender, age, education, income, homeownership, occupation are equally important factors influencing residents' satisfaction with the urban environment. A study based on the American Housing Survey's national sample indicated that being older and white, having a higher income and living in more expensive homes are associated with higher residential satisfaction (Lu, 1999). In the context of India, an empirical study using ethnographic observation and in-depth interviews over four years in Mysore found that occupation, education and family income correlated positively with life satisfaction (Darai and Mohajery, 2013). Income growth propels income inequality and also inequality in well-being. Thus, studies on people's satisfaction with urban spaces may produce varying results due to variations in the socio-economic attributes of each individual (Mohit et al., 2010).

It is evident from the literature review presented above that residents' satisfaction with urban livability is a complex notion determined by a series of interrelated variables. Therefore, the present research formulated a conceptual framework to measure residents' satisfaction with city livability to address its connection with the uncertain geographic context problem (UGCoP).

3. Conceptual framework

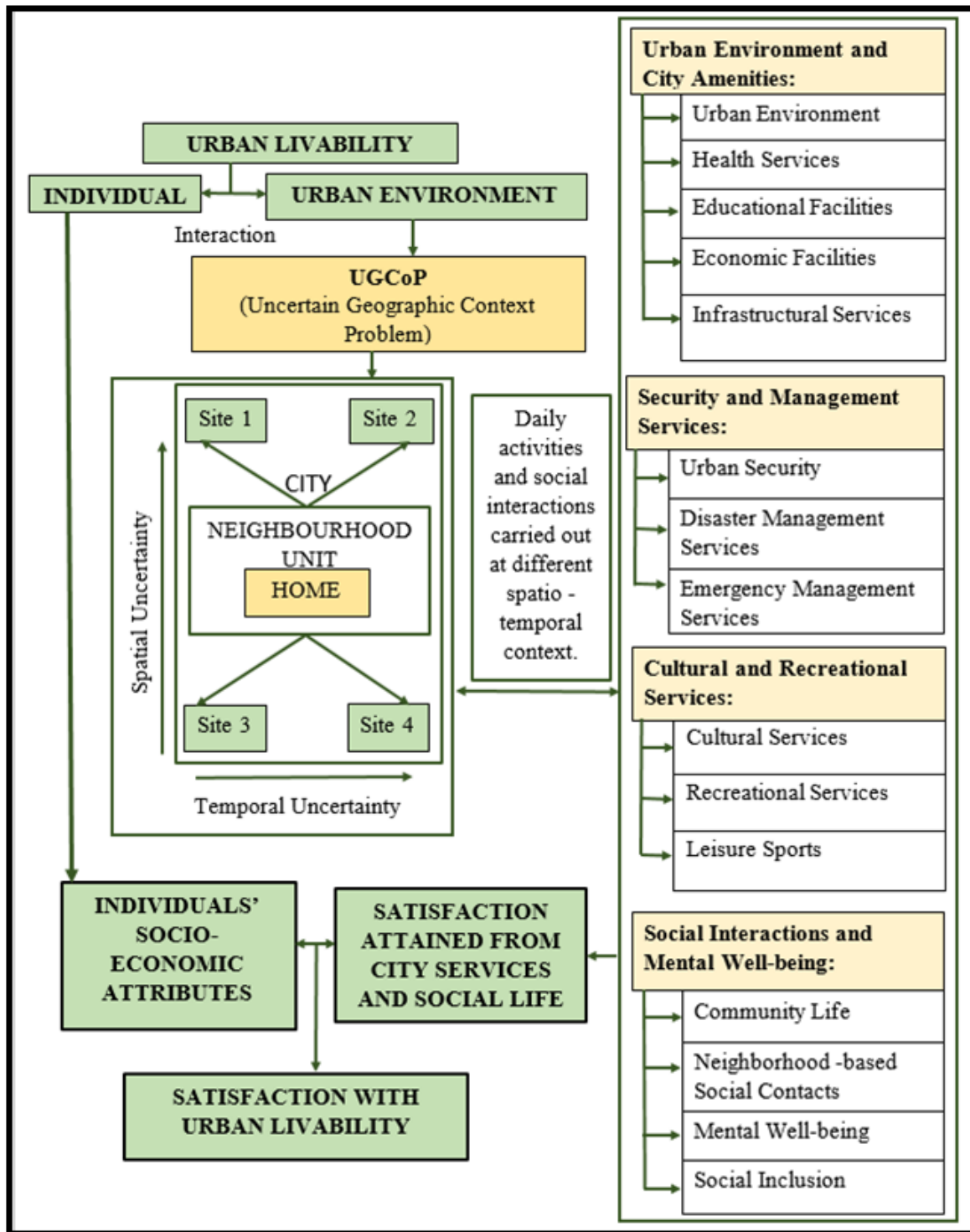
Urban livability is defined as a human behavioral function that signifies the interaction between individuals and the environment (Pacione, 1990). Thus, in accordance with the idea of uncertain geographic context problem (UGCoP) proposed by Kwan (2012), the current study underlines that an individual's satisfaction with the urban environment is not only referred to as residential satisfaction but is also determined by the satisfaction associated with the city services/amenities they enjoy and the areas across the city where they carry out their day-to-day activities, as well as their social life (Kwan, 2012). It is a collective satisfaction residents experience from various places they travel to and social interactions they are engaged in at different timings across a city in their daily routine. The conceptual framework (**Figure 1**) involved the assessment of 15 observed variables, which were clustered under four dimensions of urban livability. Further, the role played by individuals' socio-economic attributes in determining citizens' overall satisfaction was investigated.

4. Methodology

4.1. Study area

The empirical research was based on the data collected from the residents of the Indian city of Guwahati (**Figure 2**). The biggest city in Northeast India and one of the fastest-growing cities

in India, Guwahati is situated on the south bank of the Brahmaputra. The Guwahati Municipal Corporation, the city's local government, administers an area of 216 square kilometers and a total population of 963,429 lives in the city (Office of the Registrar General & Census Commissioner,



Source: Formulated by authors on the basis of different literature reviewed

Figure 1. Conceptual framework of research study.

2011).

There were certain reasons why Guwahati was selected as the empirical research area. First of all, although it is one of the fastest-growing cities in India, the city has scored very poorly (48.52 on a 100-point scale) and secured 46th rank out of 49 Indian cities in the Ease of Living Index 2020 (Ministry of Housing and Urban Affairs, 2021). Moreover, there is a lack of research studies focusing on constructing people-oriented livable cities in India, especially Northeast India. Therefore, the comprehensive conceptual and methodological framework developed in this study can be used as a model reference and scientific base for the construction of livable cities in India, as well as other developing countries.

4.2. Data collection method

According to Cochran's formula, the minimum sample size required to represent the total population of Guwahati was 384. The present study was based on 500 valid questionnaires collected during September and October 2021 using a random sample survey and face-to-face personal interviews with the residents of Guwahati. In the survey, a five-point Likert scale ranging from 1 (very dissatisfied/disliked) to 5 (very satisfied/liked) was used to measure residents' satisfaction with the observed variables representing the dimensions of urban livability, as well as residents' overall satisfaction with urban livability. Moreover, data regarding the socio-economic attributes of respondents, which were sex, age, education, monthly family income, occupation and house type, were acquired in the survey.

4.3. Evaluation methods

A series of statistical methods, which were exploratory factor analysis, structural equation modeling and Spearman's rank correlation, were performed to explore residents' satisfaction with urban livability. The research process is summarized in **Figure 3**.

An exploratory factor analysis was performed to examine whether all observed variables could be grouped into a smaller number of dimensions. The Bartlett test of sphericity was conducted and the Kaiser-Meyer-Olkin (KMO) value was calculated to ensure that the data were suitable for running a factor analysis (Gan et al., 2015). Additionally, Cronbach's alpha was determined to check the reliability of the scale.

The structural equation modeling was applied to examine the effect of the dimensions influencing the residents' overall satisfaction with urban livability in the study area (Liu et al., 2020). The dimensions (latent variables) of urban livability were represented by the observed variables in the model, since they could not be measured directly and accurately.

The structural equation model consisted of two parts: a measurement model (to determine the relationships between the latent variables and the indexes) and a structural model (to describe the causality between the latent variables). The formulas for these two models are as follows:

Formulas (1) and (2) are measurement models, in which:

$$y = \Lambda_y \eta + \varepsilon \quad (1)$$

$$x = \Lambda_x \varphi + \delta \quad (2)$$

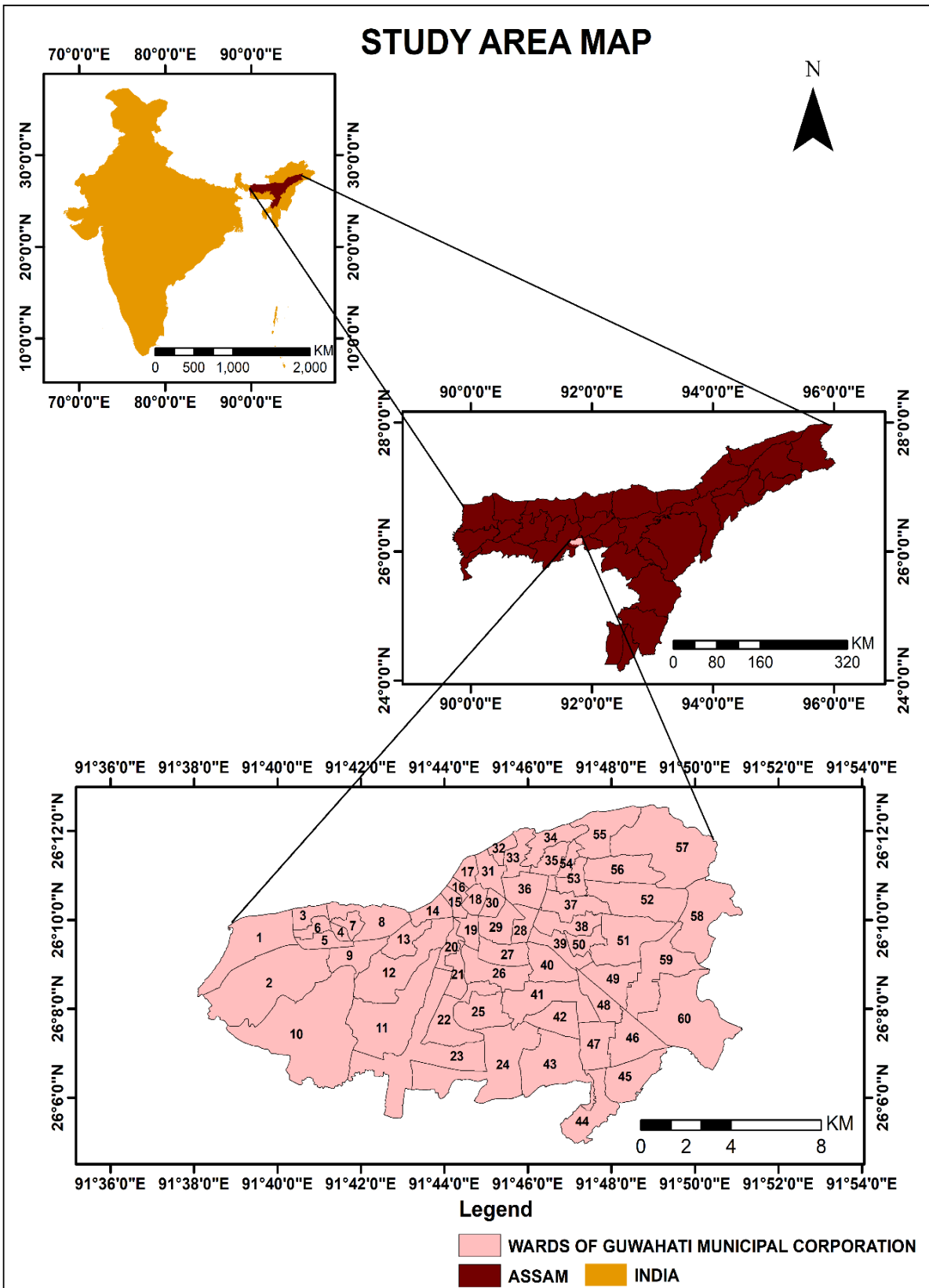


Figure 2. Location map of study area.

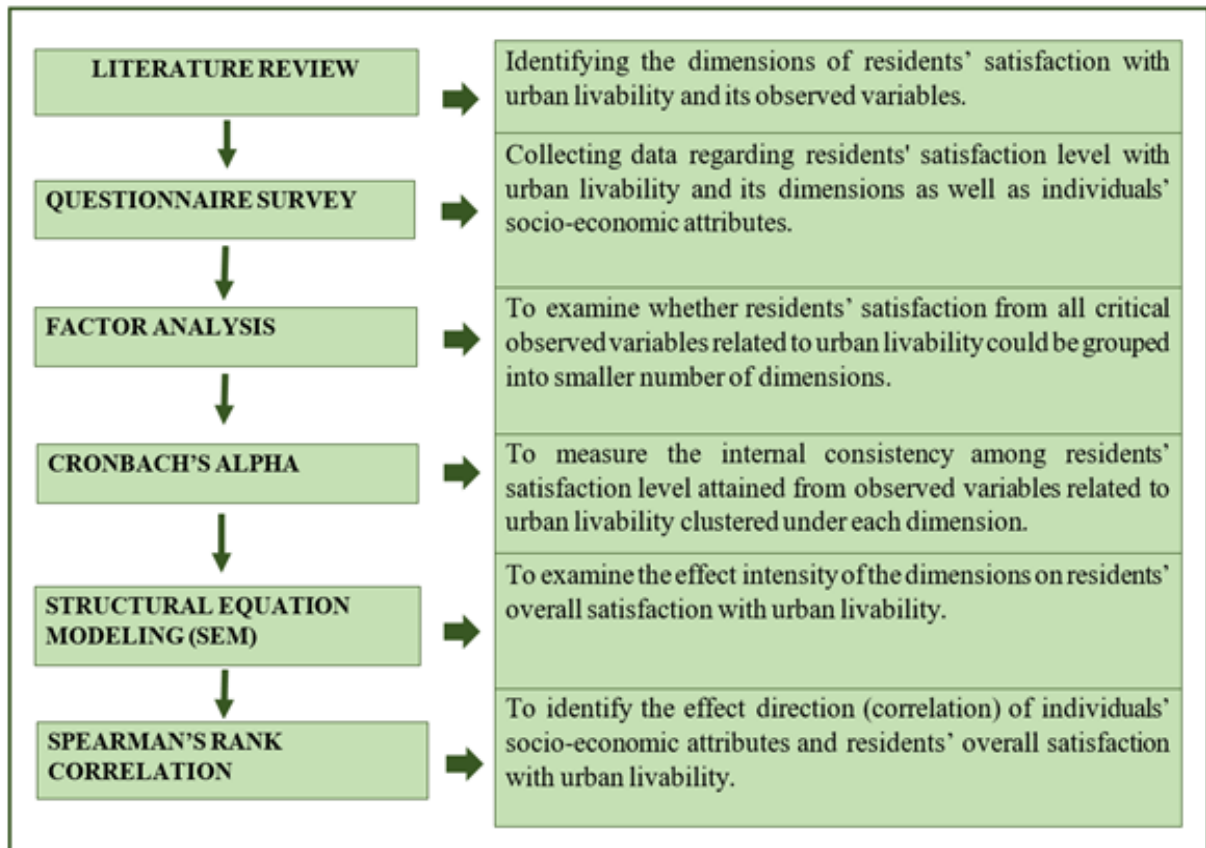


Figure 3. Research process of study.

$$\eta = B_{\eta} + \Gamma\xi + \varepsilon \quad (3)$$

Formulas (1) and (2) are measurement models, in which:

y = measurement indexes of the endogenous latent variables

x = measurement indexes of the exogenous latent variables

η = endogenous latent variables

φ = exogenous latent variables

A_y = relationship between endogenous latent variables and their measurement indexes

A_x = relationship between exogenous latent variables and their measurement indexes

ε and δ = residual matrixes of measurement model, which are parts that cannot be explained by latent variables

Formula (3) is the structure model, in which:

B = influencing relationship between endogenous latent variables

Γ = influence of exogenous latent variables on endogenous latent variables

ζ = error term of structural equation, or unexplained part of η in equation

In addition, Spearman's rank correlation was employed to identify the correlation between individuals' socio-economic attributes and the overall satisfaction with urban livability (Nourian, 2021).

5. Results

5.1. Descriptive statistics of sample population

Among the 500 respondents, there were 51.6% males and 48.4% females (**Table 1**). The majority of the respondents belonged to the age group of 15–24 (28.8%), followed by >60 (23.2%), 55–60 (23.2%), 25–54 (17.4%) and <14 (7.4%). As for education, respondents with Class 12 pass were slightly over-represented (43.4% in total). Moreover, the maximum share of respondents concerning occupation were people engaged in the technical sector (32.8%). As for family monthly income, the most reported range was 40,000–150,000 rupees (37.2%), followed by 20,000–39,999 rupees (22.8%), >150,000 rupees (20.4%) and <20,000 rupees (19.60%). Additionally, the maximum population among the respondents live in apartments (46.8%).

5.2. Residents' satisfaction with urban livability

The current study calculated the mean satisfaction of the 15 observed values related to the dimensions of urban livability and the overall satisfaction with city livability. The satisfaction with urban livability in the study area has a mean value of 2.735 ± 0.667 SD, which reflects that the residents' satisfaction with the livable environment of the city is slightly above dissatisfaction level (**Figure 4**). Moreover, satisfaction levels also vary across all 15 observed variables (**Figure 5**).

In the wider context, findings suggest that the respondents are satisfied with social interactions and mental well-being and recreational and cultural services, but physical environment and city services as well as security and management services fail to satisfy the citizens (**Figure 4**). Moreover, the low standard deviation values, which range from 0.233 to 0.886, signify that the observed variables are well represented by the mean.

5.3. Dimensions of residents' satisfaction with urban livability

The factor analysis was performed to examine whether the observed variables can be clubbed together into a few interpretable underlying dimensions, as hypothesized in the conceptual framework. The Kaiser-Meyer-Olkin (KMO) value was 0.845 and the significance probability of Bartlett's sphericity test emerged as .000, indicating that the data were suitable to undergo a factor analysis. The four factor groupings with Eigenvalues greater than 1 were extracted, accounting for 65.835% of the total variation. Moreover, Cronbach's alpha values were calculated to test the reliability and measure the internal consistency of each extracted factor. Consequently, all values turned out to be more than 0.8 for each extracted factor. Moreover, the calculated Cronbach's alpha value when including all the variables was 0.859. Thus, according to the results obtained from the factor analysis, the 15 observed variables were grouped into four dimensions.

5.4. Effect of dimensions on overall satisfaction with urban livability

To evaluate the magnitude of the effect of the dimensions on the overall satisfaction with urban livability, we ran the structural equation modeling (SEM) using AMOS 26.0 software. Following

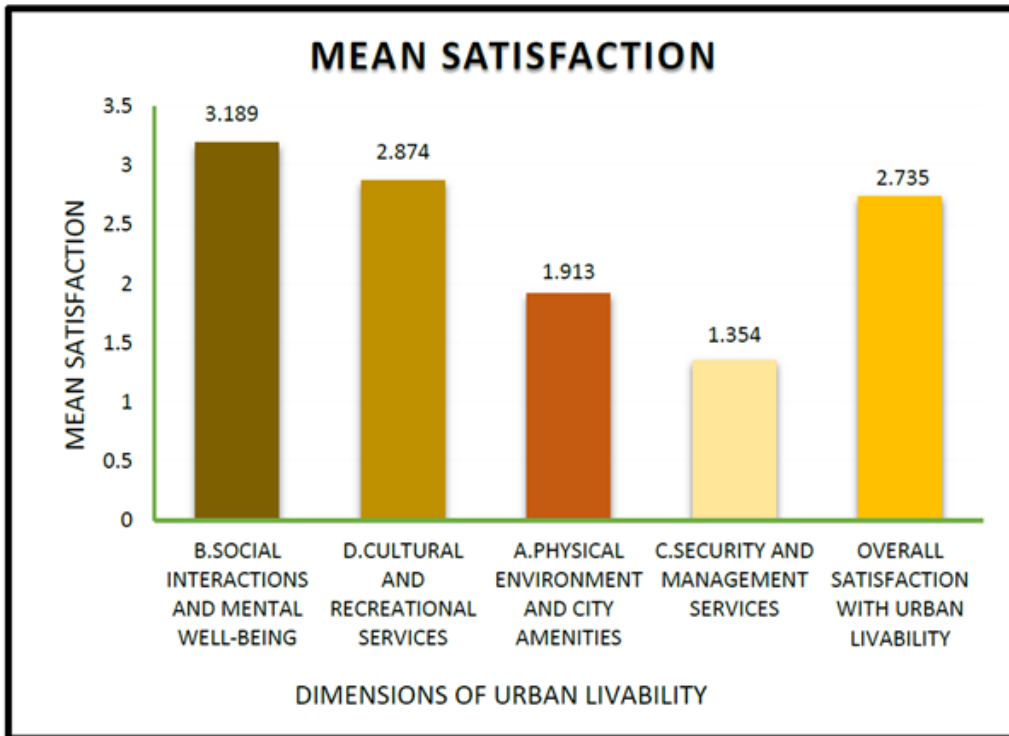
Table 1. Socio-economic characteristics of sample, mean satisfaction and correlation coefficient

Attributes	Sub-Category	Sample Size	Percentage (%)	Mean	Standard Deviation	Correlation Coefficient (Spearman's Rank Correlation)
Sex	Male	258	51.6	2.653	0.699	0.132**
	Female	242	48.4	2.822	0.622	
Age	<14	37	7.4	2.765	0.233	-0.579**
	15–24	144	28.8	3.233	0.442	
	25–54	87	17.4	3.065	0.886	
	55–60	116	23.2	2.261	0.434	
	>60	116	23.2	2.333	0.340	
Education	Middle school and below	66	13.2	2.848	0.242	-0.117**
	High school (Class 10) pass	79	15.8	2.970	0.575	
	Higher secondary (Class 12) pass	217	43.4	2.632	0.732	
	Graduate	97	19.4	2.553	0.742	
	Postgraduate and above	41	8.2	3.073	0.474	
Occupation	Housewife/student/retired (non-pensioners)	76	15.2	2.916	0.278	-0.435**
	Self-employed/freelancer	124	24.8	3.260	0.618	
	Business	47	9.4	2.496	0.386	
	Technical sector	164	32.8	2.493	0.589	
	Service sector	89	17.8	2.419	0.742	
Monthly Family Income (rupees)	<20,000	98	19.6	2.391	0.718	0.141**
	20,000–39,999	114	22.8	2.973	0.583	
	40,000–150,000	186	37.2	2.691	0.601	
	>150,000	102	20.4	2.879	0.679	
House Type	Katcha house	24	4.8	2.736	0.380	0.206**
	Assam type	154	39.6	2.589	0.755	
	Apartment	255	46.8	2.793	0.545	
	RCC (Reinforced cement concrete)	55	8.8	3.083	0.797	

Note:

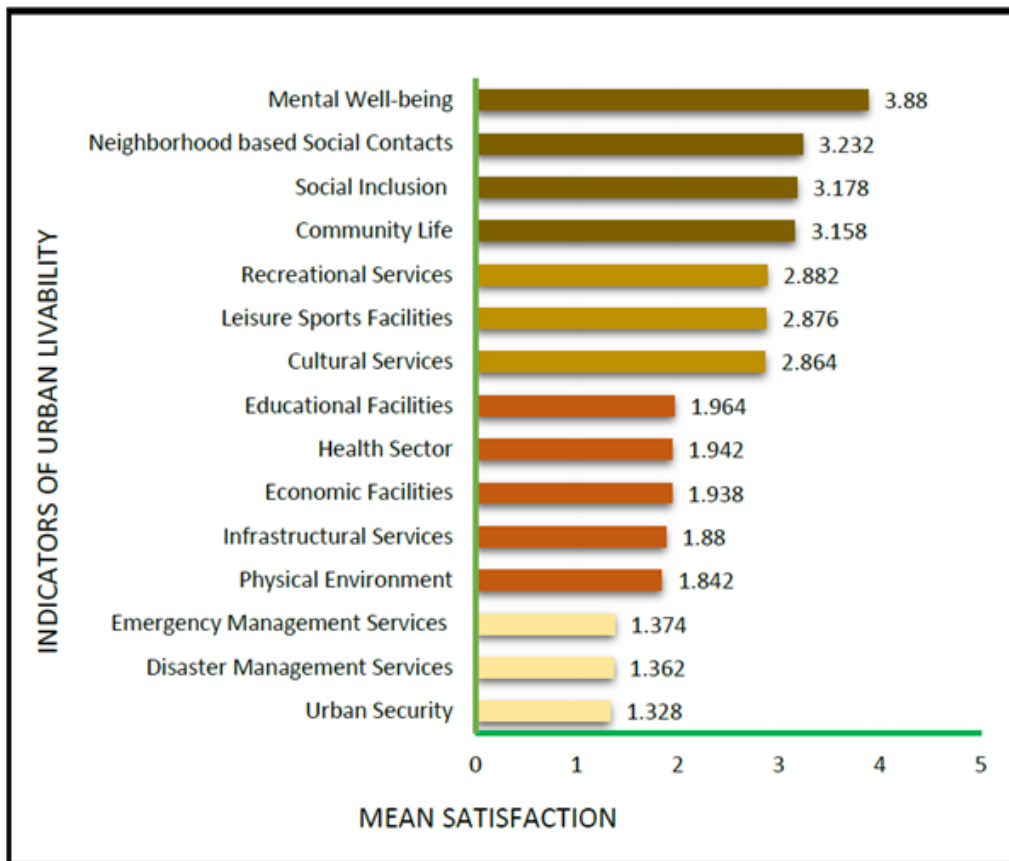
Spearman's rank correlation: Dependent variable = overall satisfaction with urban livability; significance: ** $p < 0.05$

Source: Field survey



Source: Field survey

Figure 4. Residents’ mean satisfaction with urban livability and its dimensions.



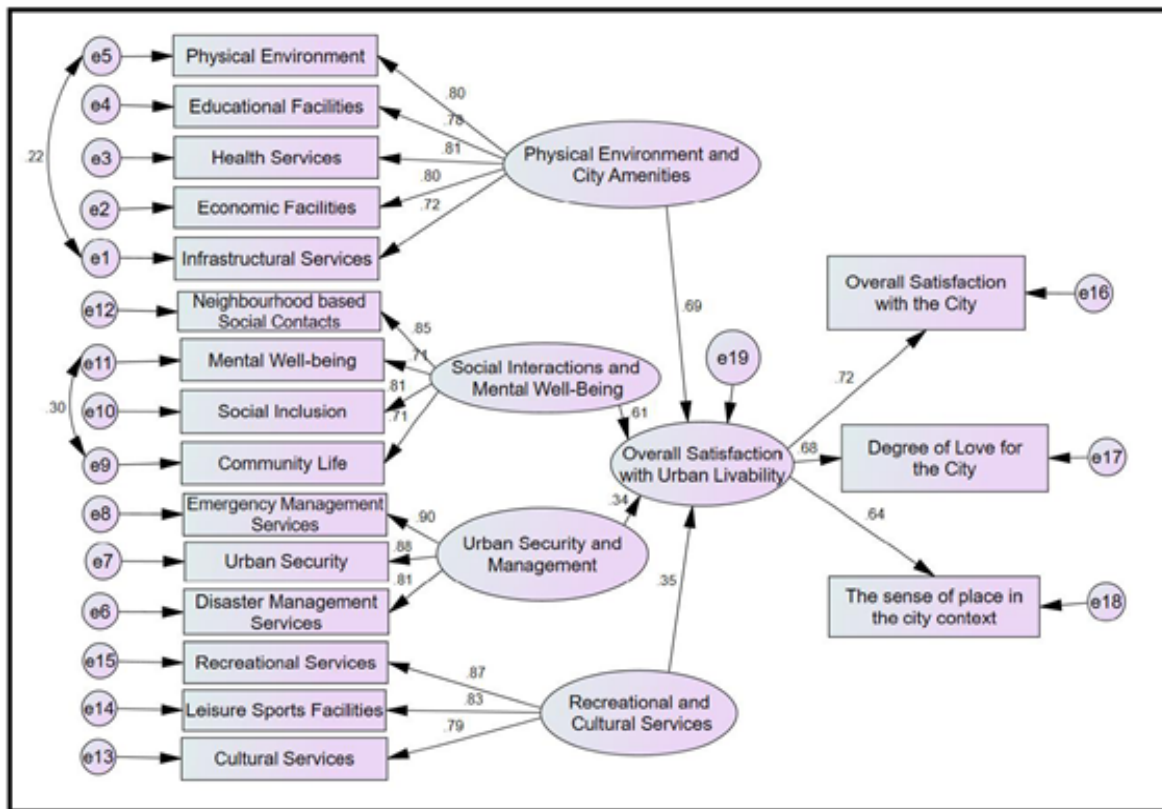
Source: Field survey

Figure 5. Residents’ mean satisfaction with observed variables representing dimensions of urban livability.

multiple checks and modifications, a final structural equation model was established, as shown in **Figure 6**. The model has good inner quality values, with composite reliability larger than 0.8 and the values of average variance extracted were also larger than 0.5. Additionally, the external quality of the model was also ideal and valid, since absolute fit measurements, incremental fit measurements and parsimonious fit measurements values were determined to be within a good range. Thus, the verified theoretical model was adopted for the subsequent analysis process.

The parameter estimation results and standardized path coefficients of this study’s model were obtained using the maximum likelihood estimation method (ML). The results indicate that all the standardized coefficients are <1 and the estimated standard errors of each parameter are confirmed to be relatively small with p -values less than 0.01 (**Table 2**). Therefore, all of the findings mentioned above are valid estimations. The results indicate that higher levels of satisfaction with any of the dimensions of urban livability are associated with higher levels of overall satisfaction with urban livability. However, it is observed that the magnitudes of the effects vary from one factor to another.

With respect to the degree of influence, physical environment and city amenities are reported to have the highest standardized coefficient in the model, which indicates that it has the strongest positive effects on the overall satisfaction levels of urban livability. This is followed by social interactions and mental well-being, cultural and recreational services and security and management services. Moreover, the latent variables (dimensions) could be clearly explained by the observational indexes, since the standardized factor-loading coefficients of each observational variable are determined to be larger than 0.6 at the 0.001 significance level (**Figure 6**).



Source: Field survey

Figure 6. Structural equation model for satisfaction with urban livability.

Table 2. Estimate measurements of structural equation modeling

VARIABLE RELATIONSHIP	Standardized Coefficients	Standard Error (SE)
STRUCTURAL MODEL		
A. Physical Environment and City Amenities → Overall Satisfaction with Urban Livability	0.692***	0.044
B. Social Interactions and Mental Well-Being → Overall Satisfaction with Urban Livability	0.609***	0.040
C. Security and Management Services → Overall Satisfaction with Urban Livability	0.339***	0.032
D. Cultural and Recreational Services → Overall Satisfaction with Urban Livability	0.352***	0.033
MEASUREMENT MODEL		
A. Physical Environment and City Amenities → A1. Physical Environment	0.803***	0.059
A. Physical Environment and City Amenities → A2. Educational Facilities	0.776***	0.066
A. Physical Environment and City Amenities → A3. Health Sector	0.808***	0.068
A. Physical Environment and City Amenities → A4. Economic Facilities	0.804***	0.070
A. Physical Environment and City Amenities → A5. Infrastructural Services	0.721***	0.000
B. Social Interactions and Mental Well-Being → B1. Neighborhood-Based Social Contacts	0.850***	0.074
B. Social Interactions and Mental Well-Being → B2. Mental Well-being	0.710***	0.059
B. Social Interactions and Mental Well-Being → B3. Social Inclusion	0.805***	0.075
B. Social Interactions and Mental Well-Being → B4. Community Life	0.707***	0.000
C. Security and Management Services → C1. Emergency Management Services	0.896***	0.490
C. Security and Management Services → C2. Urban Security	0.883***	0.490
C. Security and Management Services → C3. Disaster Management Services	0.805***	0.000
D. Cultural and Recreational Services → D1. Recreational Services	0.865***	0.550
D. Cultural and Recreational Services → D2. Leisure Sports Facilities	0.830***	0.570
D. Cultural and Recreational Services → D3. Cultural Services	0.791***	0.000

Source: Field survey

Note: *** $p < 0.01$

5.5. Socio-economic attributes and overall satisfaction with urban livability

According to the results of Spearman's rank correlation, respondents' monthly family income and house type have a positive correlation with satisfaction attained from urban livability (**Table 1**). An increase in income will increase residents' ability to purchase and their demand for better housing, which will positively influence their living standards (Baig et al., 2019; Gan et al., 2019). Moreover, females are reported to have higher satisfaction with city livability, whereas age, education and occupation are negatively correlated with satisfaction attained from urban livability.

6. Discussion and policy implication

The extensive urbanization and indiscriminate growth of cities in India have undoubtedly contributed to the growth of messy and hidden urbanization characterized by the huge population pressure on basic services, infrastructure, land, housing and the environment. Although in recent years growing concerns to create a livable city space have been seen among the government, academicians and the public, urban livability from residents' perspective is still understudied. Therefore, this empirical study attempted to fill such research gaps by evaluating residents' satisfaction with urban livability and its dimensions. According to the research findings, the mean satisfaction value of overall satisfaction with urban livability turns out to be 2.735 ± 0.667 , which indicates that residents' degree of satisfaction is above dissatisfaction level but they are still not highly satisfied. Thus, concerned authorities need to pay immediate attention and implement effective strategies to at least reach the intermediate value of 3 (neutral level) in the next few years. Similar to current findings, studies carried out in Asian and African countries on residential satisfaction and neighborhood satisfaction reported a moderate level of satisfaction or a satisfaction value slightly above dissatisfaction (Baig et al., 2019; Mohit et al., 2010; Ibem and Amole, 2013).

Furthermore, in contrast with various literature (Gan et al., 2019; Mouratidis, 2020), the residents are neutral about their satisfaction with their social interactions and mental well-being and recreational and cultural services, whereas they are unhappy with the physical environment and city services as well as urban security and management services in the study area. Upon review, it has been observed that the city has provided a pleasing socio-cultural environment but has failed to mark remarkable progress in addressing problems with regard to the quality of the urban environment, basic infrastructure services and accessibility to city services, including the health sector, educational and economic facilities, as expected by the residents. The city also lacks in developing effective strategies to provide a secure environment, increase disaster resilience and improve emergency preparedness and response capacity.

In line with previous research works (Mohit et al., 2010; Ibem and Amole, 2013), the results of the structural equation modeling signify that all the dimensions of urban livability have a significant and positive effect on the overall satisfaction attained from urban livability in the study area, which highlights its multi-dimensional nature and the importance of developing each dimension to uplift the overall satisfaction level. The overall satisfaction with urban livability is highly influenced by residents' satisfaction level with the physical environment and city amenities and social interactions and mental well-being, since both dimensions reported the highest and second-highest standardized coefficient values, respectively. Thus, it is high time that immediate action be taken to improve city amenities because many people move from rural areas to urban areas to get better access to various

facilities (Lee, 2021). It increases the convenience of their life. Moreover, qualitative developments, such as the integration and revitalization of local communities, are important in urban regeneration, further improving community life and neighborhood relations (Lee, 2021).

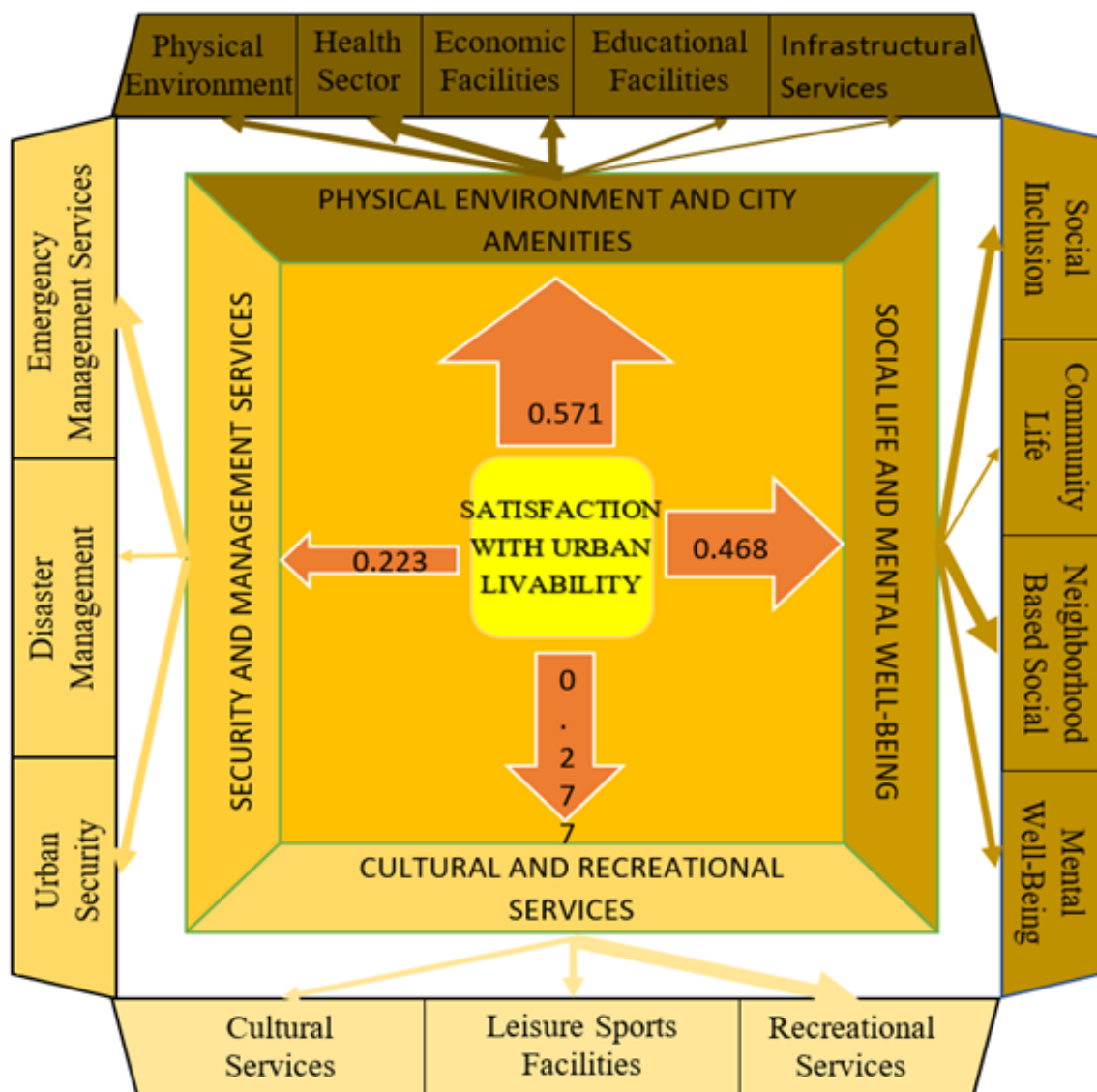
The impact of residents' socio-economic variables on the overall satisfaction with urban livability is very minimal. However, a positive correlation is observed between monthly family income and residents' satisfaction, which is supported by other research evidence, reporting higher mean scores for livability satisfaction by higher-income neighborhoods (Byun and Ha, 2018). Thus, the better economic condition of an individual increases the individual's capacity to access different city services and elevates the overall satisfaction. In concordance with other research studies, the current study also signifies that better housing conditions are associated with higher residential satisfaction (Gan et al., 2015; Byun and Ha, 2018). On the other hand, elderly people are seen to be less satisfied with the livable condition, which is supported by some recent studies (Mohit et al., 2010). As for occupation, there is a negative correlation between occupation type and overall satisfaction. Respondents with better education are disappointed with the city's performance as a livable city and also doubt its sustainability.

Findings in this paper have several important policy and managerial implications. The study proposed an optimization approach to improve the satisfaction with urban livability in the study area based on the field survey and empirical results. This optimization approach could also be applied to many other similar cities. Since urban livability is a multi-faceted complex concept, the study recommends that the government should prioritize developing the most influential factors and find the main weaknesses at the initial stage, as shown in **Figure 7**.

According to the survey results, the dimension that requires utmost attention is physical environment and city amenities. To be specific, the government should adopt urgent measures focusing on physical and ambient features of the urban environment, medical convenience, education convenience, job opportunities, communication facilities and energy supply. Also, certain issues, including urban flood, traffic congestion, environmental pollution, transport security and the lack of proper infrastructures in public educational institutions and hospitals, require immediate action. Infrastructural development requires utmost importance, since it is a key indicator of the physical development and socio-economic progress of any country (Fateye et al., 2021).

Moreover, as security and management services also scored a low mean satisfaction value, urban policies must address the major threats to the safety and security of the city immediately. Thus, the city requires comprehensive solutions, which include physical or technical security measures, neighborhood security services and the use of mediation services as well as community engagement in violence prevention initiatives and in reducing risk factors by focusing on groups that are vulnerable to be perpetrators of crime. Additionally, to reduce disaster risks, the city needs to adopt certain approaches, such as building disaster-resistant infrastructures, upgrading risk mapping, strengthening the emergency response capacity, establishing an effective communication system and enhancing the reconstruction capacity. However, the development of other factors should not be underestimated. A vibrant and diverse socio-cultural environment is a crucial aspect to maintain the vitality of the city.

Although individuals' socio-economic attributes have a negligible impact on the overall satisfaction with the city environment, the government should take up initiatives to empower people



Source: Field survey

Figure 7. Optimization approach for urban livability.

to achieve sustained economic growth through education and employment so that they can maximize their capability to access various essential city services. Lastly, to have a better understanding of the requirements of different sections of society, it is important to encourage active participation of citizens from various socio-economic backgrounds, while formulating urban policies in constructing livable cities.

Globally, various international agendas are calling for new innovative ways to create more livable cities. The New Urban Agenda provides a comprehensive framework to lay out standards and principles for sustainable planning and effective governance of urban areas with its five main pillars of implementation: national urban policies, urban legislation and regulations, urban planning and design, local economy and municipal finance, and local implementation (United Nations, 2017). The Sustainable Development Goals (SDGs), especially SDG 11, pledge to make cities and human settlements inclusive, safe, resilient and sustainable by encouraging collaboration between

stakeholders at the local, regional and national levels (United Nations, 2015). In India, there are three approaches for policy formulation and implementation: 1) master plans and town planning schemes which aim at preparing city/block level development agenda and land use plans; 2) centrally-sponsored national urban development schemes, such as National Smart Cities Mission, Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Swachh Bharat Mission–Urban (SBM-U), which focus on strengthening urban infrastructure, improving city amenities and enhancing livability; and 3) international partnerships and funding from international agencies and networks, such as the World Bank and the European Union, for resolving topical issues of environmental sustainability, climate change crisis, security, well-being, etc. (Singh et al., 2018).

Therefore, both the government of India and the government of Assam have also adopted different urban renewal programs, such as National Smart Cities Mission, Atal Mission for Rejuvenation and Urban Transformation, Pradhan Mantri Awas Yojana (PMAY)–Housing for All (Urban) and National Urban Transport Policy, to improve the quality of life in the study area (Ministry of Urban Development, 2015). However, these schemes have been considered as fragmentary efforts at the city/block level, since they only provide short-term solutions, which tend to lack contextualization, while addressing different livability issues. Thus, there is an imperative need to identify key attributes of livability that can be mainstreamed at the local level or the community level itself in order to construct sustainable and livable urban spaces.

Moreover, a gap persists between policy formulation and implementation, which can be attributed to the lack of public participation and collaboration between stakeholders at the grassroots level. Thus, a collaborative solution interweaving both citizen engagement and participative planning needs to be implemented to comprehend the needs, expectations and perceptions of the citizens and transform the floating concept of livability into a tangible reality. Moreover, the inclusive and systematic approach to civic engagement would provide holistic citizen satisfaction and a sustainable city for the citizens.

7. Conclusion

The implementation of the citizen-centric planning approach in understanding urban livability has enabled the development of an urban environment that truly reflects people's needs and preferences. The present study not only confirms previous findings but also adds new evidence to a growing body of literature supporting people-oriented urban planning. First, in line with uncertain geographic context problem (UGCoP), the study formulated a new conceptual framework highlighting that residents' satisfaction with city livability is associated with the satisfaction they attained from urban spaces where they perform their daily activities and services they enjoy from city amenities at various times of the day. On top of that, the study also gives prominence to the role played by individuals' socio-economic attributes in determining satisfaction with urban livability.

Lastly, the study encourages further research on adopting a human-centric approach in constructing livable cities to ensure greater public participation and shape sustainable urbanization in India.

Disclosure statement

No potential conflict of interest is reported by the authors.

Acknowledgment

The authors are thankful to all the respondents of the study for their cooperation during the field survey.

References

- African Development Bank, Asian Development Bank, European Bank for Reconstruction and Inter-American Development Bank Development (2019). *Creating Livable Cities: Regional Perspectives*. African Development Bank, Asian Development Bank, European Bank for Reconstruction and Inter-American Development Bank Development. <https://doi.org/10.18235/0001939>
- Alderton A, Davern M, Nitvimol K, et al. (2019). “What is the meaning of urban liveability for a city in a low-to-middle-income country? Contextualising liveability for Bangkok, Thailand”. *Globalization and Health*, 15: Art. 51. <https://doi.org/10.1186/s12992-019-0484-8>
- Amati V, Meggiolaro S, Rivellini G and Zaccarin S (2018). “Social relations and life satisfaction: The role of friends”. *Genus*, 74(1). <https://doi.org/10.1186/s41118-018-0032-z>
- Ambrey C and Fleming C (2014). “Public greenspace and life satisfaction in urban Australia”. *Urban Studies*, 51(6): 1290–1321. <https://doi.org/10.1177/0042098013494417>
- Baig F, Rana IA and Talpur MAH (2019). “Determining factors influencing residents’ satisfaction regarding urban livability in Pakistan”. *International Journal of Community Well-Being*, 2(2): 91–110. <https://doi.org/10.1007/s42413-019-00026-w>
- Benita F, Vyacheslav K and Tunçer B (2020). “A spatial livability index for dense urban centers”. *Environment and Planning B: Urban Analytics and City Science*, 48(7): 2006–2022. <https://doi.org/10.1177/2399808320960151>
- Bertelli-Costa T and Neri AL (2019). “Life satisfaction and participation among community-dwelling older adults: Data from the FIBRA study”. *Journal of Health Psychology*, 26(11): Art. 1359105319893020. <https://doi.org/10.1177/1359105319893020>
- Bertram C and Rehdanz K (2015). “The role of urban green space for human well-being”. *Ecological Economics*, 120: 139–52. <https://doi.org/10.1016/j.ecolecon.2015.10.013>
- Blom N, Kraaykamp G and Verbakel E (2019). “Current and expected economic hardship and satisfaction with family life in Europe”. *Journal of Family Issues*, 40(1): 3–32. <https://doi.org/10.1177/0192513X18802328>
- Byun G and Ha M (2018). “The factors influencing residential satisfaction by public rental housing type”. *Journal of Asian Architecture and Building Engineering*, 15(3), 535–542. <https://doi.org/10.3130/jaabe.15.535>
- Chen T, Hui EC-M, Lang W and Tao L (2016). “People, recreational facility and physical activity: New-type urbanization planning for the healthy communities in China”. *Habitat International*, 58: 12–22. <https://doi.org/10.1016/j.habitatint.2016.09.001>
- Cinderby S, Archer D, Mehta VK, et al. (2021). “Assessing inequalities in wellbeing at a neighbourhood scale in secondary cities and their implications for long-term livability”. *Frontiers in Sociology*, 6: Art. 729453. <https://doi.org/10.3389/fsoc.2021.729453>
- Daraei M and Mohajery A (2013). “The impact of socioeconomic status on life satisfaction”. *Social Indicators Research*, 112(1): 69–81. <https://doi.org/10.1007/s11205-012-0040-x>
- De Vos J, Van Acker V and Witlox F (2016). “Urban sprawl: Neighbourhood dissatisfaction and urban preferences. Some evidence from Flanders”. *Urban Geography*, 37(6): 839–62. <https://doi.org/10.1080/02723638.2015>

1118955

- Dirks S, Gurdgiev C and Keeling M (2010). *Smarter Cities For Smarter Growth: How Cities Can Optimize Their Systems for the Talent-Based Economy* (IBM Global Business Services Executive Report). IBM Institute for Business Value.
- Fairchild DG and Revord PJ (2017). “Planning livable communities: Findings from HUD’s regional planning and community challenge grant programs”. *Cityspace*, 19(3): 3–8.
- Fateye TB, Victoria OO, Abayomi SI and Ayodele AI (2021). “Basic residential neighborhood infrastructure financing in Nigeria urban cities: Community development associations (CDAs)-based approach”. *Journal of Infrastructure, Policy and Development*, 5(1): Art. 1242. <https://doi.org/10.24294/jipd.v5i1.1242>
- Gan X, Zuo J, Baker E and Wen T (2019). “Exploring the determinants of residential satisfaction in public rental housing in China: A case study of Chongqing”. *Journal of Housing and the Built Environment*, 34(3): 869–895. <https://doi.org/10.1007/s10901-019-09691-x>
- Gan X, Zuo J, Ye K, et al. (2015). “Why sustainable construction? Why not? An owner’s perspective”. *Habitat International*, 47: 61–68. <https://doi.org/10.1016/j.habitatint.2015.01.005>
- Goel V, Rosella LC, Fu L and Alberga A (2018). “The relationship between life satisfaction and healthcare utilization: A longitudinal study”. *American Journal of Preventive Medicine*, 55(2): 142–150. <https://doi.org/10.1016/j.amepre.2018.04.004>
- Grant N, Wardle J and Steptoe A (2009). “The relationship between life satisfaction and health behavior: A cross-cultural analysis of young adults”. *International Journal of Behavioral Medicine*, 16(3): 259–268. <https://doi.org/10.1007/s12529-009-9032-x>
- Guney S, Kalafat T and Boysan M (2010). “Dimensions of mental health: Life satisfaction, anxiety and depression: A preventive mental health study in Ankara University students population”. *Procedia—Social and Behavioral Sciences*, 2(2): 1210–1213. <https://doi.org/10.1016/j.sbspro.2010.03.174>
- Guzmán J, Alfaro J and Varela JJ (2019). “Sense of community and life satisfaction in Chilean adolescents”. *Applied Research in Quality of Life*, 14(3): 589–601. <https://doi.org/10.1007/s11482-018-9615-2>
- Hartman CL, Barcelona RJ, Trautvein NE and Hall SL (2019). “Well-being and leisure-time physical activity psychosocial factors predict physical activity among university students”. *Leisure Studies*, 39(1): 156–164. <https://doi.org/10.1080/02614367.2019.1670722>
- Hoogerbrugge MM and Burger MJ (2018). “Neighborhood-based social capital and life satisfaction: The case of Rotterdam, the Netherlands”. *Urban Geography*, 39(10): 1484–1509. <https://doi.org/10.1080/02723638.2018.1474609>
- Ibem EO and Amole D (2013). “Residential satisfaction in public core housing in Abeokuta, Ogun State, Nigeria”. *Social Indicators Research*, 113(1): 563–581. <https://doi.org/10.1007/s11205-012-0111-z>
- Kazemi F, Abolhassani L, Rahmati EA and Sayyad-Amin P (2018). “Strategic planning for cultivation of fruit trees and shrubs in urban landscapes using the SWOT method: A case study for the city of Mashhad, Iran”. *Land Use Policy*, 70: 1–9. <https://doi.org/10.1016/j.landusepol.2017.10.006>
- Kundu D, Mueller A, Schmidt-Seiwert V, et al. (2020). “Spatial structures and trends of cities in Europe and Asia: A joint methodological approach based on the global human settlement layer”. *Environment and Urbanization ASIA*, 11(2): 195–217. <https://doi.org/10.1177/0975425320958850>
- Kwan MP (2012). “The uncertain geographic context problem”. *Annals of the Association of American Geographers*, 102(5): 958–968. <https://doi.org/10.1080/00045608.2012.687349>
- Lee KY (2021). “Factors influencing urban livability in Seoul, Korea: Urban environmental satisfaction and neighborhood relations”. *Social Sciences*, 10(4). <https://doi.org/10.3390/socsci10040138>
- Liu Y, Fang F and Li Y (2014). “Key issues of land use in China and implications for policy making”. *Land Use Policy*, 40: 6–12. <https://doi.org/10.1016/j.landusepol.2013.03.013>
- Liu Y, Zhang Q, Liu Q, et al. (2020). “Different household livelihood strategies and influencing factors in the inner Mongolian grassland”. *Sustainability*, 12(3): 1–15. <https://doi.org/10.3390/su12030839>
- Lombardo P, Jones W, Wang L, et al. (2018). “The fundamental association between mental health and life

- satisfaction: Results from successive waves of a Canadian national survey”. *BMC Public Health*, 18(1): Art. 342. <https://doi.org/10.1186/s12889-018-5235-x>
- Lu M (1999). “Determinants of residential satisfaction: Ordered logit vs. regression models”. *Growth and Change*, 30(2): 264–287. <https://doi.org/10.1111/0017-4815.00113>
- Martino N, Girling C and Lu Y (2021). “Urban form and livability: Socioeconomic and built environment indicators”. *Buildings and Cities*, 2(1): 220–243. <https://doi.org/10.5334/bc.82>
- Mesimäki M, Hauru K, Kotze DJ and Lehvävirta S (2017). “Neo-spaces for urban livability? Urbanites’ versatile mental images of green roofs in the Helsinki metropolitan area, Finland”. *Land Use Policy*, 61: 587–600. <https://doi.org/10.1016/j.landusepol.2016.11.021>
- Mohit MA, Ibrahim M and Rashid YR (2010). “Assessment of residential satisfaction in newly designed public low-cost housing in Kuala Lumpur, Malaysia”. *Habitat International*, 34(1): 18–27. <https://doi.org/10.1016/j.habitatint.2009.04.002>
- Mouratidis A (2021). “Smooth integration of transport infrastructure into urban space”. *Journal of Infrastructure, Policy and Development*, 5(2): Art. 1379. <https://doi.org/10.24294/jipd.v5i2.1379>
- Mouratidis K (2020). “Commute satisfaction, neighborhood satisfaction, and housing satisfaction as predictors of subjective well-being and indicators of urban livability”. *Travel Behaviour and Society*, 21: 265–278. <https://doi.org/10.1016/j.tbs.2020.07.006>
- Mouratidis K (2021). “Urban planning and quality of life: A review of pathways linking the built environment to subjective well-being”. *Cities*, 115: Art. 103229. <https://doi.org/10.1016/j.cities.2021.103229>
- Ministry of Housing and Urban Affairs (2021). *Ease of Living Index 2020*. Ministry of Housing and Urban Affairs, Government of India.
- Ministry of Urban Development (2015). *Atal Mission for Rejuvenation and Urban Transformation: Mission Statement and Guidelines*. Ministry of Urban Development, Government of India.
- National Commission on Population (2020). *Population Projections for India and States, 2011–2036*. National Commission on Population, Ministry of Health & Family Welfare, Government of India.
- National Research Council (2002). *Community and Quality of Life*. National Academies Press. <https://doi.org/10.17226/10262>
- Nourian F (2021). “Arzaaba Tathar Amnat br Zastpedara Bafthaa Frswdh Shhra w Ara’ehrahbrdhaa Artqaa an, Mwrd Mtal’eata: Mhlh Ansar Shhr Mshhd [Assessment of the impacts of security on livability of urban distressed textures and provision of strategies to improve it. Case study: Ansar neighborhood, Mashhad]”. *Armanshahr Architecture & Urban Development Journal of Architecture, Urban Design & Urban Planning*, 13(33): 259–275. <https://doi.org/10.22034/AAUD.2021.137079.1583>
- Office of the Registrar General & Census Commissioner (2011). *Primary Census Abstract Total Table*. Office of the Registrar General & Census Commissioner, Ministry of Home Affairs, Government of India.
- Okulicz-Kozaryn A and Valente RR (2019). “Livability and subjective well-being across European cities”. *Applied Research in Quality of Life*, 14(1): 197–220. <https://doi.org/10.1007/s11482-017-9587-7>
- Oshio T (2017). “Which is more relevant for perceived happiness, individual-level or area-level social capital? A multilevel mediation analysis”. *Journal of Happiness Studies*, 18(3): 765–83. <https://doi.org/10.1007/s10902-016-9752-y>
- Pacione M (1990). “Urban liveability: A review”. *Urban Geography*, 11(1): 1–30. <https://doi.org/10.2747/0272-3638.11.1.1>
- Pan L, Zhang L, Qin S, et al. (2021). “Study on an artificial society of urban safety livability change”. *ISPRS International Journal of Geo-Information*, 10(2): Art. 70. <https://doi.org/10.3390/ijgi10020070>
- Sauter D and Huettenmoser M (2008). “Liveable streets and social inclusion”. *Urban Design International*, 13(2): 67–79. <https://doi.org/10.1057/udi.2008.15>
- Shabanzadeh Namini R, Loda M, Meshkini A and Roknedineftekhari A (2019). “Comparative evaluation of livability indicators of the metropolitan Tehran’s districts”. *International Journal of Urban Sustainable Development*, 11(1): 48–67. <https://doi.org/10.1080/19463138.2019.1572611>

- Shekhar H, Schmidt AJ and Wehling H-W (2019). “Exploring wellbeing in human settlements—A spatial planning perspective”. *Habitat International*, 87: 66–74. <https://doi.org/10.1016/j.habitatint.2019.04.007>
- Silverstein M and Parker MG (2002). “Leisure activities and quality of life among the oldest old in Sweden”. *Research on Aging*, 24(5): 528–547. <https://doi.org/10.1177/0164027502245003>
- Singh R, Panda A and Thakur P (2018). *Making Liveable Cities: Challenges and Way Forward for India* (Policy Brief, October 2018). The Energy and Resources Institute.
- Sukmaningsih DW, Suparta W, Trisetyarso A, et al. (2020). *Proposing Smart Disaster Management in Urban Area*. Springer International Publishing. https://doi.org/10.1007/978-3-030-14132-5_1
- Surjono, Yudono A, Setyono DA and Putri JC (2021). “Contribution of community resilience to city’s livability within the framework of sustainable development”. *Journal of Environmental Research, Engineering and Management*, 77(4): 33–47. <https://doi.org/10.5755/j01.erem.77.4.29184>
- United Nations (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*.
- United Nations (2017). *New Urban Agenda*.
- United Nations (2018). *The World’s Cities in 2018—Data Booklet*. United Nations, Department of Economic and Social Affairs, Population Division.
- Weziak-Białowolska D (2016). “Quality of life in cities—Empirical evidence in comparative European perspective”. *Cities*, 58: 87–96. <https://doi.org/10.1016/j.cities.2016.05.016>
- Wheatley D and Bickerton C (2017). “Subjective well-being and engagement in arts, culture and sport”. *Journal of Cultural Economics*, 41(1): 23–45. <https://doi.org/10.1007/s10824-016-9270-0>
- Wheatley D and Bickerton C (2019). “Measuring changes in subjective well-being from engagement in the arts, culture and sport”. *Journal of Cultural Economics*, 43(3): 421–442. <https://doi.org/10.1007/s10824-019-09342-7>
- White MP, Alcock I, Wheeler BW and Depledge MH (2013). “Would you be happier living in a greener urban area? A fixed-effects analysis of panel data”. *Psychological Science*, 24(6): 920–928. <https://doi.org/10.1177/0956797612464659>
- Yu D, Fang C, Xue D and Yin J (2014). “Assessing urban public safety via indicator-based evaluating method: A systemic view of Shanghai”. *Social Indicators Research*, 117(1): 89–104. <https://doi.org/10.1007/s11205-013-0366-z>
- Yu J and Wen J (2016). “Multi-criteria satisfaction assessment of the spatial distribution of urban emergency shelters based on high-precision population estimation”. *International Journal of Disaster Risk Science*, 7(4): 413–429. <https://doi.org/10.1007/s13753-016-0111-8>

Appendixes

Appendix A. Results of exploratory factor analysis and Cronbach's alpha (α)

Dimensions of urban livability and its observed variables	Factor Loading	Eigen value	Variance (%)	Cumulative Variance (%)	Cronbach's alpha (α)	Reliability Coefficient	Average Variance Extracted
A. PHYSICAL ENVIRONMENT AND CITY AMENITIES		4.784	31.893	31.893	0.891	0.887	0.613
A1. Physical Environment	0.814						
A2. Educational Facilities	0.810						
A3. Health Sector	0.801						
A4. Economic Facilities	0.769						
A5. Infrastructural Services	0.742						
B. SOCIAL INTERACTIONS AND MENTAL WELL-BEING		2.234	14.897	46.790	0.863	0.853	0.593
B1. Neighborhood-Based Social Contacts	0.833						
B2. Mental Well-being	0.774						
B3. Social Inclusion	0.761						
B4. Community Life	0.756						
C. SECURITY AND MANAGEMENT SERVICES		1.541	10.270	57.060	0.896	0.896	0.743
C1. Emergency Management Services	0.900						
C2. Urban Security	0.879						
C3. Disaster Management Services	0.803						
D. CULTURAL AND RECREATIONAL SERVICES		1.316	8.776	65.835	0.867	0.868	0.687
D1. Recreational Services	0.871						
D2. Leisure Sports Facilities	0.822						
D3. Cultural Services	0.789						

Source: Field survey

Appendix B. Fit measurements of structural equation modeling

Adaptation Index	Ideal Values of Fit Index	Actual Fitting Results	Test Results
Absolute fit index			
χ^2/df values	Between 1 and 3	2.620	Good fit
GFI values	≥ 0.90	0.928	Good fit
RMSEA values	< 0.07	0.057	Good fit
AGF values	≥ 0.90	0.904	Good fit
Appreciation goodness of fit index			
NFI	≥ 0.90	0.939	Good fit
IFI	≥ 0.90	0.961	Good fit
CFI	≥ 0.90	0.961	Good fit
TLI	≥ 0.90	0.954	Good fit
Simple goodness of fit index			
AIC	The smaller the better	422.602	Reasonable fit
PNFI Good fit	> 0.50	0.792	Good fit

Source: Field survey