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Assessing the Drivers of Urban Sustainability through Community Engagement

Mina Saeidi *

Master of Urban Planning, Shahid Beheshti University, Tehran, Iran.

Corresponding Author Email: minasaeidy@gmail.com

Abstract
Urban sustainability has become a critical priority as cities face increasing challenges from rapid urbanization, environmental degradation, climate change, and growing social complexity. This study investigated the drivers of urban sustainability through community engagement using Structural Equation Modeling (SEM). A cross-sectional survey of 420 urban residents was analyzed using Confirmatory Factor Analysis (CFA), SEM, and mediation analysis. The proposed model examined the effects of governance support, environmental awareness, social capital, and green infrastructure quality on community engagement and assessed its influence on urban sustainability. The measurement model demonstrated satisfactory reliability and validity, while the structural model showed good fit ($\chi^2/df = 2.27$, CFI = 0.96, TLI = 0.95, RMSEA = 0.048, SRMR = 0.039). Governance support emerged as the strongest predictor of community engagement ($\beta = 0.62$), followed by environmental awareness ($\beta = 0.57$), green infrastructure quality ($\beta = 0.53$), and social capital ($\beta = 0.50$) (all $p < 0.001$). Community engagement significantly predicted urban sustainability ($\beta = 0.72$, $p < 0.001$), explaining 51.8% of its variance ($R^2 = 0.518$). Mediation analysis confirmed that community engagement significantly mediated the relationships between all identified drivers and sustainability outcomes, highlighting its central role in translating institutional, environmental, and social capacities into sustainable development. These findings emphasize the importance of participatory urban planning and provide theoretical and practical guidance for policymakers and urban planners seeking to build more inclusive, resilient, and sustainable cities.

Keywords: Urban Sustainability, Community Engagement, Participatory Planning, Governance Support, Structural Equation Modeling.

Introduction

Urban sustainability has become one of the most critical challenges facing cities in the twenty-first century (Chen, et al., 2022). Rapid urban population growth, increasing resource consumption, environmental degradation, climate change, and growing social inequalities have intensified pressures on urban systems worldwide (Monadi, 2025). Although cities represent important centers of economic development, innovation, and social interaction, they are also responsible for significant environmental impacts and face increasing difficulties in maintaining quality of life for their residents (Cacciatore, et al., 2025). Consequently, achieving sustainable urban development requires not only technological advancement and infrastructure investment but also active involvement from communities that experience, influence, and shape urban environments.

The concept of urban sustainability extends beyond environmental protection and encompasses the integration of ecological integrity, economic vitality, social inclusion, and effective governance (Zhang, et al., 2023). Sustainable cities must be capable of balancing development objectives with environmental limitations while ensuring equitable access to resources, services, and opportunities (Bibri, et al., 2023). However, conventional urban planning approaches have often emphasized technical solutions and top-down decision-

making processes, sometimes overlooking the knowledge, values, and experiences of local communities. Increasingly, scholars and policymakers recognize that sustainable urban transformation cannot be achieved without meaningful community involvement and collaborative governance (Zhao & Zhang, 2025).

Community engagement has therefore emerged as a fundamental component of sustainable urban development (Kim, 2022). It refers to the active participation of residents, local organizations, and stakeholders in decision-making processes, environmental initiatives, planning activities, and collective actions aimed at improving urban conditions (Adabanya, et al., 2023). Engaged communities contribute local knowledge, strengthen social relationships, enhance policy acceptance, and encourage behavioral changes necessary for sustainability transitions. Rather than viewing citizens as passive users of urban services, contemporary sustainability approaches emphasize their role as active partners in designing and implementing sustainable solutions.

The importance of community engagement is particularly evident in addressing environmental challenges (Monadi, et al., 2013). Many sustainability objectives, including waste reduction, energy conservation, sustainable mobility, biodiversity protection, and climate adaptation, require behavioral changes and collective commitment among residents (Hussain, et al., 2025). Government policies and technological innovations alone may have limited effectiveness if communities do not understand, support, and participate in sustainability initiatives. Therefore, strengthening community engagement represents a strategic pathway for translating sustainability goals into practical actions at the local level (Rau, et al., 2022).

Several factors contribute to the development of effective community engagement in urban sustainability. Environmental awareness represents one of the most important determinants because individuals who understand environmental challenges are more likely to participate in sustainable practices and support ecological policies (Si, et al., 2022). Awareness influences perceptions of responsibility, motivates pro-environmental behaviors, and increases willingness to participate in collective initiatives. However, awareness alone may not be sufficient; supportive institutional conditions and social environments are also necessary to transform awareness into meaningful engagement (Attia, et al., 2025).

Governance support is another critical factor influencing community participation in sustainability initiatives. Transparent institutions, participatory planning mechanisms, accessible information, and responsive local authorities create favorable conditions for citizen involvement (Abdi, et al., 2025). When residents perceive that governments value their opinions and provide opportunities for meaningful participation, they are more likely to engage in urban development processes. Conversely, limited trust, weak communication channels, and centralized decision-making structures may reduce public involvement and weaken sustainability efforts (Naher, et al., 2020).

Social capital also plays an essential role in facilitating community engagement (Vu, et al., 2026). Networks of trust, cooperation, and mutual support enable communities to organize collective actions and respond effectively to shared challenges (Salinger, et al., 2024). Neighborhood relationships, civic organizations, and community-based initiatives can strengthen residents' capacity to participate in environmental programs and contribute to sustainable urban management (Jang, et al., 2024). Socially connected communities often demonstrate greater willingness to collaborate with local authorities and participate in sustainability-oriented activities.

In addition, the quality and availability of green infrastructure can influence community engagement by shaping residents' relationship with urban environments. Accessible parks, public green spaces, ecological areas, and environmentally friendly urban facilities provide opportunities for social interaction, environmental learning, and community-based activities (Monadi, et al., 2014). Green infrastructure not only improves ecological conditions but also creates spaces where residents can develop stronger connections with their neighborhoods and participate in sustainability initiatives.

Despite increasing recognition of community engagement as an important element of urban sustainability, several research gaps remain. First, previous studies have frequently examined individual factors such as environmental awareness, governance, or social capital without developing integrated models that explain how multiple determinants collectively influence sustainability outcomes. Second, many studies focus on the direct effects of community participation but provide limited empirical evidence regarding the mechanisms through which engagement contributes to urban sustainability. Third, the complex relationship between community-level capacities and sustainable urban outcomes requires analytical approaches capable of examining multiple relationships simultaneously.

Structural Equation Modeling (SEM) provides an appropriate methodological framework for addressing these limitations. SEM enables researchers to examine relationships among multiple latent constructs while accounting for measurement errors (Monadi, 2025). Furthermore, mediation analysis within SEM allows researchers to investigate whether community engagement functions as a mechanism through which environmental, institutional, and social factors influence urban sustainability outcomes. Such an approach provides deeper insights into not only whether specific factors matter but also how they contribute to sustainable urban transformation.

Building on these considerations, this study aims to assess the drivers of urban sustainability through community engagement using an integrated SEM framework. Specifically, the study examines the effects of governance support, environmental awareness, social capital, and green infrastructure quality on community engagement and investigates whether community engagement mediates the relationship between these factors and urban sustainability. By identifying the mechanisms through which communities contribute to sustainable development, this research provides theoretical insights and practical guidance for urban planners, policymakers, and local governments seeking to create more inclusive, environmentally responsible, and sustainable cities.

Methodology

Research Design and Approach

This study adopted a quantitative, explanatory, and cross-sectional research design to examine the drivers of urban sustainability through community engagement. A quantitative approach was selected because the study aimed to empirically investigate the relationships among multiple latent constructs and test theoretically developed hypotheses using statistical modeling techniques. Given the multidimensional nature of urban sustainability and community engagement, SEM was employed as the primary analytical approach. SEM provides an effective framework for examining complex relationships among observed and unobserved variables while simultaneously evaluating measurement quality and structural relationships. In this study, SEM was used to assess the measurement model through Confirmatory Factor Analysis (CFA), evaluate the structural relationships among constructs, and investigate the mediating role of community engagement in explaining how social, environmental, and institutional factors contribute to urban sustainability. The conceptual model proposed that governance support, environmental awareness, social capital, and green infrastructure quality positively influence community engagement, while community engagement subsequently contributes to urban sustainability. Furthermore, mediation analysis was conducted to determine whether community engagement functions as an explanatory mechanism linking the identified determinants to sustainable urban outcomes.

Study Population and Sampling Procedure

The target population consisted of adult residents living in the selected urban area who had sufficient experience with local environmental conditions, municipal services, and community-based urban initiatives. Residents were selected as the study population because they represent key stakeholders in urban sustainability processes and directly experience the outcomes of planning decisions, environmental policies, and community development programs. Participants were required to have lived in the study area for at least one year to ensure adequate familiarity with local urban conditions and sustainability-related initiatives. A stratified random sampling technique was applied to improve representativeness across different geographical areas and demographic groups. Initially, the urban area was divided into administrative districts. Subsequently, respondents were selected proportionally from each district based on population distribution. This sampling approach was adopted to minimize selection bias and ensure that different social groups and residential areas were appropriately represented in the final sample.

Sample Size Determination

The minimum required sample size was determined using G*Power version 3.1.9.7. Following Cohen's recommendations for multiple regression and SEM-based studies, the power analysis was conducted based on a medium expected effect size ($f^2 = 0.15$), a significance level of $\alpha = 0.05$, and a desired statistical power of 0.95. Because four predictor variables were hypothesized to influence community engagement, the G*Power analysis indicated that a minimum sample size of approximately 129 respondents was required to detect statistically significant relationships. However, considering the complexity of SEM, the need for reliable parameter estimation, and possible data screening procedures, a larger sample size was targeted. Accordingly, 450 questionnaires were distributed. After removing incomplete and invalid responses, 420 valid questionnaires were retained for final analysis. This sample size exceeds the minimum requirement and provides sufficient statistical power for CFA, SEM, and mediation analysis.

Inclusion and Exclusion Criteria

Specific inclusion and exclusion criteria were established to improve data quality and ensure that participants were appropriate for the research objectives. Participants were included if they were aged 18 years or older, had lived in the selected urban area for at least one year, were able to understand and complete the questionnaire, and voluntarily agreed to participate in the study. Participants were excluded if they were temporary visitors or non-residents, had insufficient knowledge of local urban conditions, submitted questionnaires with substantial missing information, or demonstrated response patterns indicating careless completion, such as identical responses across all items or unrealistically short completion times. These criteria

ensured that the collected data accurately reflected meaningful perceptions of urban conditions, governance processes, community engagement, and sustainable urban development.

Data Collection Procedure and Research Instrument

Data were collected using a structured questionnaire consisting of two main sections. The first section collected demographic information, including gender, age, education level, occupation, income status, and length of residence. The second section measured the study constructs using previously validated measurement scales adapted from the urban sustainability, environmental behavior, and community participation literature. All measurement items were evaluated using a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. The following constructs were included in the research model:

- **Governance Support:** Governance support was measured using items assessing institutional transparency, responsiveness of local authorities, availability of participatory mechanisms, government encouragement of sustainability initiatives, and effectiveness of communication between authorities and citizens.
- **Environmental Awareness:** Environmental awareness was assessed through items measuring residents' understanding of environmental problems, knowledge of sustainability issues, awareness of climate-related challenges, and recognition of individual responsibility toward environmental protection.
- **Social Capital:** Social capital was measured using indicators related to interpersonal trust, neighborhood cooperation, social networks, mutual support, and willingness to participate in collective community activities.
- **Green Infrastructure Quality:** Green infrastructure quality was evaluated through indicators measuring accessibility, availability, maintenance quality, ecological value, and residents' satisfaction with urban green spaces.
- **Community Engagement:** Community engagement was measured through items reflecting citizen participation in urban planning, involvement in environmental programs, attendance in community activities, willingness to collaborate with local authorities, and participation in sustainability-related decision-making.
- **Urban Sustainability:** Urban sustainability was assessed using indicators representing environmental performance, social inclusion, quality of urban life, sustainable resource management, and long-term urban development outcomes.

Validity and Reliability Assessment

Before the main survey, the questionnaire was reviewed by experts in urban planning, environmental management, and research methodology to establish content validity. Based on expert feedback, several items were modified to improve clarity and contextual relevance. A pilot study involving approximately 30 respondents was conducted to evaluate questionnaire readability, reliability, and completion time. The results confirmed that the instrument was understandable and internally consistent. Construct reliability and validity were assessed during CFA. Internal consistency reliability was evaluated using Cronbach's alpha and Composite Reliability (CR), with values above 0.70 considered acceptable. Convergent validity was examined using standardized factor loadings and Average Variance Extracted (AVE), where factor loadings above 0.70 and AVE values above 0.50 indicated satisfactory validity. Discriminant validity was assessed using the Fornell–Larcker criterion and the Heterotrait–Monotrait ratio (HTMT).

Data Analysis

Data analysis was conducted using IBM SPSS Statistics version 29 and AMOS version 29. First, descriptive statistics were calculated to summarize respondent characteristics and examine the distribution of study variables. Data screening procedures included analysis of missing values, outliers, normality assessment, and multicollinearity testing. Normality was evaluated through skewness and kurtosis values, while multicollinearity was examined using Variance Inflation Factor (VIF) values. Harman's single-factor test and full collinearity assessment were performed to evaluate potential common method bias. The measurement model was then assessed through CFA. Model fit was evaluated using multiple fit indices, including Chi-square/degrees of freedom (χ^2/df), Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). After establishing an acceptable measurement model, SEM was conducted to test the hypothesized relationships among constructs. Maximum likelihood estimation was applied to estimate standardized path coefficients. The significance of direct effects was assessed using critical ratios and p-values. Finally, mediation analysis was conducted using bootstrapping procedures with 5,000 resamples to examine whether community engagement mediated the relationships between governance support, environmental awareness, social capital, green infrastructure quality, and urban sustainability. Indirect effects were considered statistically significant when the bias-corrected 95%

confidence interval did not include zero. The explanatory power of the model was assessed through coefficients of determination (R^2), while effect sizes and predictive relevance indicators were evaluated where appropriate.

Results

Data Screening and Preliminary Analysis

A total of 450 questionnaires were distributed among urban residents. After completing the data screening process, 420 valid questionnaires were retained for final analysis, representing a response rate of 93.3%. The final sample size exceeded the minimum requirement estimated through G*Power analysis and was considered adequate for conducting Confirmatory Factor Analysis (CFA), SEM, and mediation analysis. Before hypothesis testing, the dataset was examined for missing values, outliers, normality, and multicollinearity. The proportion of missing responses was minimal, and cases with substantial missing information were removed before analysis. Univariate outliers were assessed using standardized z-scores, while Mahalanobis distance was applied to detect multivariate outliers. No problematic cases were identified. Normality assessment indicated that skewness values ranged from -0.84 to 0.76, while kurtosis values ranged from -0.91 to 1.18, remaining within acceptable limits. These results suggested that the assumption of normal distribution was reasonably satisfied. Furthermore, Variance Inflation Factor (VIF) values ranged between 1.31 and 2.24, indicating no multicollinearity concerns among predictor variables. Common method bias was examined using Harman's single-factor test. The first factor accounted for 31.6% of the total variance, below the recommended threshold of 50%, suggesting that common method bias was unlikely to significantly affect the findings.

Respondent Characteristics

The demographic characteristics of respondents are presented in Table 1. Among the 420 participants, 218 (51.9%) were male and 202 (48.1%) were female. Regarding age distribution, the largest group consisted of respondents aged 30–39 years (34.8%), followed by those aged 18–29 years (25.2%), 40–49 years (25.0%), and 50 years or older (15.0%). In terms of educational background, most participants held a bachelor's degree (42.6%), followed by master's degrees (31.0%). Regarding occupation, private-sector employees represented the largest group (36.2%), followed by government employees (27.9%), self-employed individuals (21.0%), and students (14.9%).

Table 1. Demographic Characteristics of Respondents

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	218	51.9
	Female	202	48.1
	Total	420	100.0
Age	18–29	106	25.2
	30–39	146	34.8
	40–49	105	25.0
	≥50	63	15.0
	Total	420	100.0
Education	Diploma	78	18.6
	Bachelor's Degree	179	42.6
	Master's Degree	130	31.0
	PhD	33	7.8
	Total	420	100.0
Occupation	Government Employee	117	27.9
	Private Sector Employee	152	36.2
	Self-employed	88	21.0
	Student	63	15.0
	Total	420	100.0

Descriptive Statistics

Table 2 presents the descriptive statistics of the study constructs. The mean scores indicate relatively positive perceptions among respondents regarding governance support, environmental awareness, social capital, green infrastructure quality, community engagement, and urban sustainability. The skewness and kurtosis values for all constructs were within acceptable ranges, confirming that the data approximately followed a normal distribution. Therefore, the dataset was considered suitable for subsequent CFA and SEM analyses.

Table 2. Descriptive Statistics of Study Constructs

Construct	Mean	SD	Skewness	Kurtosis
Governance Support	3.74	0.71	-0.42	0.36
Environmental Awareness	3.89	0.68	-0.51	0.48
Social Capital	3.62	0.73	-0.31	0.22
Green Infrastructure Quality	3.70	0.76	-0.37	0.41
Community Engagement	3.66	0.72	-0.44	0.35
Urban Sustainability	3.78	0.69	-0.47	0.39

Measurement Model Assessment

Confirmatory Factor Analysis (CFA) was conducted to evaluate the reliability and validity of the measurement model. The CFA results indicated that all measurement items loaded significantly on their respective constructs, with standardized factor loadings exceeding the recommended threshold of 0.70. The measurement model demonstrated satisfactory fit: $\chi^2/df = 2.21$, CFI = 0.95, TLI = 0.94, RMSEA = 0.052, SRMR = 0.041. As shown in Table 3, Cronbach's alpha and Composite Reliability values for all constructs exceeded 0.70, confirming internal consistency reliability. AVE values ranged from 0.61 to 0.73, indicating acceptable convergent validity. The square roots of AVE values were greater than the correlations among constructs, confirming discriminant validity.

Table 3. Reliability and Convergent Validity Results

Construct	Items	Factor Loadings	Cronbach's α	CR	AVE
Governance Support	5	0.74–0.89	0.91	0.92	0.70
Environmental Awareness	4	0.77–0.88	0.88	0.90	0.69
Social Capital	4	0.73–0.86	0.86	0.88	0.65
Green Infrastructure Quality	5	0.75–0.90	0.90	0.92	0.71
Community Engagement	5	0.76–0.88	0.90	0.91	0.68
Urban Sustainability	5	0.78–0.87	0.89	0.91	0.69

Table 4. Discriminant Validity (Fornell–Larcker Criterion)

Construct	GS	EA	SC	GI	CE	US
Governance Support	**0.837**					
Environmental Awareness	0.46	**0.831**				
Social Capital	0.51	0.43	**0.806**			
Green Infrastructure Quality	0.49	0.45	0.42	**0.843**		
Community Engagement	0.62	0.58	0.55	0.57	**0.825**	
Urban Sustainability	0.55	0.52	0.48	0.54	0.68	**0.831**

Structural Model and Hypothesis Testing

Following the satisfactory evaluation of the measurement model, the structural model was examined to test the hypothesized relationships among the latent constructs. The structural model demonstrated an acceptable fit to the data, indicating that the proposed theoretical framework adequately represented the observed relationships among the study variables. The model fit indices were within the recommended thresholds: $\chi^2/df = 2.27$, CFI = 0.96, TLI = 0.95, RMSEA = 0.048, and SRMR = 0.039. These results indicate a good model fit and confirm the suitability of the structural model for hypothesis testing. Figure 1 presents the standardized structural model with estimated path coefficients. The path analysis results demonstrated that all proposed direct relationships were positive and statistically significant ($p < 0.001$). As presented in Table 5, governance support had the strongest positive influence on community engagement ($\beta = 0.62$, $t = 12.14$, $p < 0.001$), followed by environmental awareness ($\beta = 0.57$, $t = 10.86$, $p < 0.001$), green infrastructure quality ($\beta = 0.53$, $t = 9.74$, $p < 0.001$), and social capital ($\beta = 0.50$, $t = 9.21$, $p < 0.001$). Furthermore, community engagement demonstrated a significant positive effect on urban sustainability ($\beta = 0.72$, $t = 15.62$, $p < 0.001$), supporting the assumption that active citizen involvement represents an important pathway toward sustainable urban development.

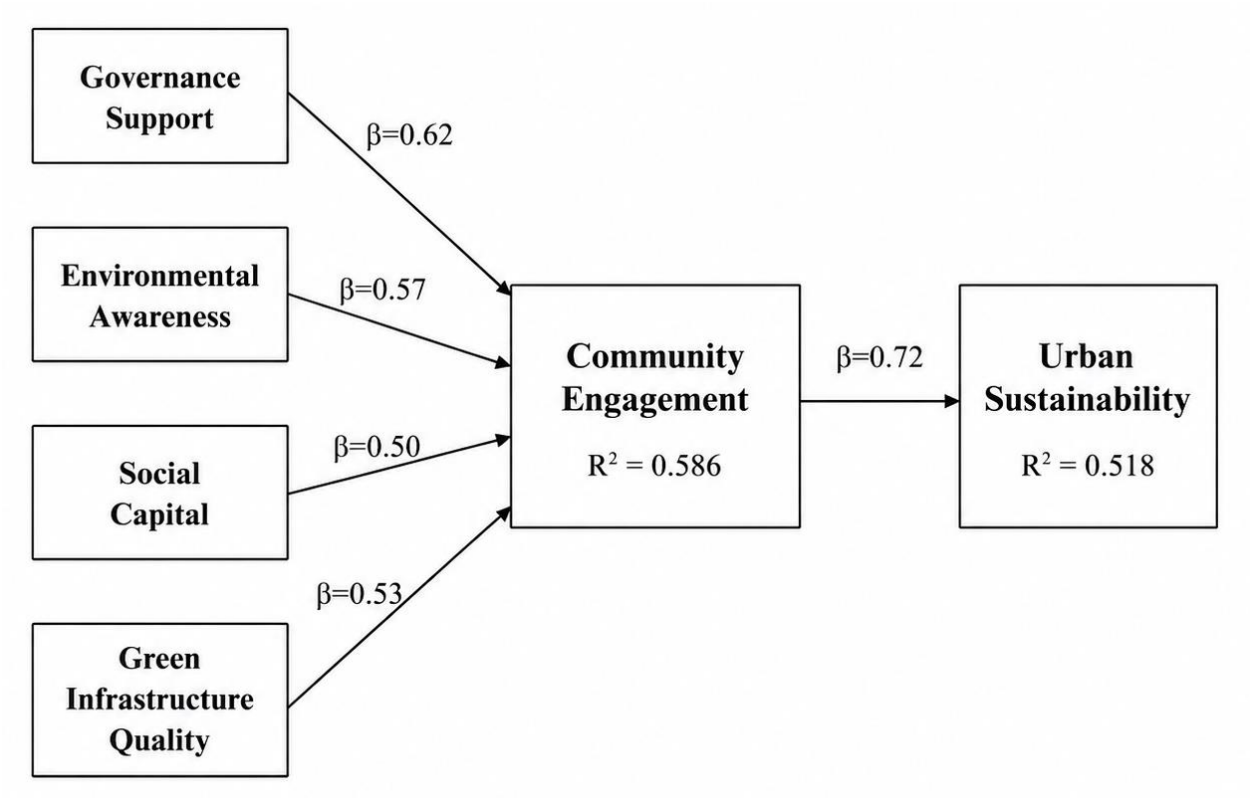

Figure 1. Standardized Structural Model

Table 5. Structural Path Coefficients and Hypothesis Testing

Hypothesis	Path	β	t-value	p-value	Decision
H1	Governance Support → Community Engagement	0.62	12.14	<0.001	Supported
H2	Environmental Awareness → Community Engagement	0.57	10.86	<0.001	Supported
H3	Social Capital → Community Engagement	0.50	9.21	<0.001	Supported
H4	Green Infrastructure Quality → Community Engagement	0.53	9.74	<0.001	Supported
H5	Community Engagement → Urban Sustainability	0.72	15.62	<0.001	Supported

The structural model demonstrated substantial explanatory power. The four predictors (governance support, environmental awareness, social capital, and green infrastructure quality) explained 58.6% of the variance in community engagement ($R^2 = 0.586$). Furthermore, community engagement explained 51.8% of the variance in urban sustainability ($R^2 = 0.518$). These findings indicate that institutional, environmental, social, and physical dimensions collectively contribute to strengthening community engagement, which subsequently plays a central role in advancing urban sustainability.

Mediation Analysis

To examine whether community engagement functions as a mediating mechanism between the antecedent factors and urban sustainability, mediation analysis was conducted using the bootstrapping approach with 5,000 resamples. The significance of indirect effects was evaluated using bias-corrected 95% confidence intervals. An indirect effect was considered statistically significant when the confidence interval did not include zero. The results confirmed that community engagement significantly mediated all hypothesized relationships between the independent variables and urban sustainability. Governance support demonstrated the strongest indirect effect on urban sustainability through community engagement ($\beta = 0.446$, $p < 0.001$), indicating that supportive institutional environments enhance sustainability outcomes primarily by encouraging greater citizen involvement. Environmental awareness also showed a significant indirect effect through community engagement ($\beta = 0.410$, $p < 0.001$), suggesting that informed citizens are more likely to participate in sustainability-oriented activities, thereby contributing to improved urban outcomes. Similarly, social capital ($\beta = 0.360$, $p < 0.001$) and green infrastructure quality ($\beta = 0.382$, $p < 0.001$) significantly influenced urban sustainability through enhanced community engagement. Overall, these findings confirm that community engagement serves as an important explanatory mechanism through which environmental, institutional, social, and physical urban capacities are transformed into sustainable development outcomes.

Table 6. Mediation Effects of Community Engagement

Hypothesis	Indirect Path	β	BootSE	95% Confidence Interval	p-value	Decision
H6	Governance Support → CE → Urban Sustainability	0.446	0.051	0.352–0.558	<0.001	Supported
H7	Environmental Awareness → CE → Urban Sustainability	0.410	0.047	0.321–0.507	<0.001	Supported
H8	Social Capital → CE → Urban Sustainability	0.360	0.043	0.276–0.448	<0.001	Supported
H9	Green Infrastructure Quality → CE → Urban Sustainability	0.382	0.045	0.294–0.474	<0.001	Supported

The mediation results demonstrate that community engagement is not merely an outcome of favorable urban conditions but also an essential pathway through which those conditions contribute to sustainability. Therefore, sustainable urban development requires not only investments in governance, environmental awareness, social networks, and green infrastructure but also mechanisms that actively involve communities in planning and implementation processes.

Discussion

The primary objective of this study was to investigate the drivers of urban sustainability and examine the mediating role of community engagement in explaining how institutional, environmental, social, and physical urban capacities contribute to sustainable development outcomes. Using SEM, the study developed and empirically tested an integrated framework incorporating governance support, environmental awareness, social capital, and green infrastructure quality as antecedents of community engagement, while considering community engagement as a key pathway toward urban sustainability. The findings provide strong empirical evidence that all examined determinants significantly enhance community engagement and that community engagement significantly contributes to urban sustainability. Furthermore, the mediation analysis demonstrated that community engagement functions as an important mechanism through which urban capacities are translated into sustainability outcomes. This finding represents the central contribution of the study because it shifts the understanding of community engagement from being merely a desirable feature of sustainable planning toward being an active process through which sustainability objectives are achieved. The results support the growing recognition that sustainable cities cannot be created solely through technological solutions, infrastructure investments, or governmental policies. Instead, sustainability requires meaningful collaboration between institutions and communities. Urban residents are not passive recipients of sustainability initiatives; they are active participants whose knowledge, behaviors, and collective actions influence the success of urban development strategies.

Among the examined determinants, governance support emerged as the strongest predictor of community engagement ($\beta = 0.62$, $p < 0.001$). This finding highlights the fundamental role of institutional capacity in creating an environment where citizens are willing and able to participate in urban sustainability initiatives. Effective governance provides the organizational structures necessary for meaningful public involvement. Transparent decision-making, accessible communication channels, responsive local authorities, and participatory planning mechanisms increase citizens' trust and encourage their involvement in urban programs (Mansoor, 2021; Martinez-Gil, et al., 2025). When residents perceive that their opinions are valued and incorporated into decision-making processes, they are more likely to participate in sustainability-related activities. The mediation results further demonstrate that governance support contributes to urban sustainability primarily through enhanced community engagement (Wen, et al., 2025). This suggests that institutional improvements alone are insufficient unless they create opportunities for citizens to actively contribute to sustainable development processes. Therefore, urban governments should focus not only on developing sustainability policies but also on creating participatory environments that empower communities to implement these policies.

Environmental awareness was found to have a significant positive effect on community engagement ($\beta = 0.57$, $p < 0.001$). This finding emphasizes the importance of knowledge and awareness in encouraging sustainable behaviors. Residents who understand environmental challenges, climate risks, and sustainability principles are more likely to participate in ecological initiatives and support urban sustainability programs. Environmental awareness increases individuals' perception of responsibility and strengthens their motivation to contribute to collective environmental actions. However, awareness alone does not automatically result in sustainable outcomes (Bøhlerengen & Wiium, 2022). Citizens require supportive institutional structures and opportunities for participation to transform knowledge into practical actions. The mediation analysis confirms that environmental awareness influences urban sustainability through community engagement (Pakravan-

Charvadeh & Maleknia, 2026). This indicates that awareness contributes to sustainability when it encourages residents to become active participants in urban environmental processes. Consequently, policymakers should combine environmental education programs with participatory mechanisms that allow citizens to apply their knowledge through real community actions.

Social capital demonstrated a significant positive relationship with community engagement ($\beta = 0.50$, $p < 0.001$). This finding highlights the importance of trust, cooperation, and social networks in strengthening sustainable urban development. Communities characterized by strong social relationships are generally better able to organize collective actions, exchange knowledge, and respond effectively to shared challenges. Social networks facilitate cooperation among residents, local organizations, and public institutions, creating stronger foundations for sustainability initiatives (Amat & Wang, 2025). The mediation findings indicate that social capital contributes to urban sustainability by strengthening community engagement. Therefore, sustainability strategies should recognize the importance of social relationships and invest in programs that encourage neighborhood cooperation, community organizations, and collective environmental activities.

Green infrastructure quality also significantly influenced community engagement ($\beta = 0.53$, $p < 0.001$). This result demonstrates that the physical characteristics of urban environments can influence residents' willingness to participate in sustainability initiatives. Accessible and well-maintained green spaces, parks, ecological areas, and environmentally friendly urban facilities provide opportunities for social interaction, environmental education, and community activities (Addas, 2022). These spaces strengthen residents' connections with their neighborhoods and encourage collective responsibility for urban environments. The mediation analysis demonstrates that green infrastructure contributes to urban sustainability partly because it encourages greater community engagement. Therefore, green infrastructure should be viewed not only as an ecological intervention but also as a social platform that supports participation, interaction, and sustainability-oriented behaviors.

A major contribution of this study is the identification of community engagement as a mediating mechanism between urban capacities and sustainability outcomes. Previous studies have often examined the relationship between individual determinants and sustainability separately; however, this research demonstrates how different urban resources and capacities are converted into sustainable outcomes through active community participation. The structural model showed that community engagement had a strong positive influence on urban sustainability ($\beta = 0.72$, $p < 0.001$), explaining 51.8% of its variance. Furthermore, the mediation results confirmed that all examined antecedents significantly influenced sustainability through community engagement. These findings suggest that community engagement represents the operational pathway through which sustainable urban transformation occurs (Webb, et al., 2023). Governance support, environmental awareness, social capital, and green infrastructure create the necessary conditions, but community engagement activates these resources and converts them into measurable sustainability outcomes (Hinckson, et al., 2025). This perspective contributes to participatory planning theory by emphasizing that sustainable cities are developed through continuous interaction between institutions, physical environments, and communities.

This study provides several theoretical contributions to the urban sustainability literature. First, it develops an integrated framework combining institutional, environmental, social, and physical determinants of sustainability. Rather than examining these factors independently, the study demonstrates their interconnected influence through community engagement. Second, the study advances theoretical understanding by empirically validating community engagement as a mediating mechanism. While previous research has frequently emphasized the importance of citizen participation, fewer studies have examined the process through which engagement transforms urban capacities into sustainability outcomes. Third, the findings support participatory governance perspectives by demonstrating that institutional support and citizen involvement are complementary rather than separate components of sustainable urban development. Effective sustainability requires both supportive governance structures and active community participation. Finally, the study demonstrates the usefulness of SEM and mediation analysis for examining complex relationships in urban planning research. The validated model provides a comprehensive framework for understanding how cities can mobilize social and institutional capacities to achieve sustainability goals.

The findings provide important implications for urban policymakers and planners. First, local governments should develop stronger participatory governance mechanisms by creating transparent communication channels, citizen consultation platforms, and collaborative planning processes. Second, policymakers should invest in environmental education and awareness programs that encourage residents to understand and participate in sustainability initiatives. However, awareness programs should be accompanied by practical opportunities for community involvement. Third, strengthening social capital should become an important component of urban sustainability strategies. Supporting neighborhood organizations, community networks, and local environmental groups can improve collective capacity and encourage long-term participation. Finally, urban planners should consider green infrastructure as both an ecological and social investment. Designing accessible, inclusive, and attractive public spaces can encourage community interaction and strengthen residents' engagement with sustainability objectives.

Despite its contributions, this study has several limitations. First, the cross-sectional research design limits the ability to establish long-term causal relationships. Future longitudinal studies could examine how community engagement and sustainability outcomes develop over time. Second, the study relied primarily on residents' perceptions rather than objective sustainability indicators. Future research could integrate survey data with environmental measurements, geographic information systems, energy consumption data, waste management indicators, and municipal performance records. Third, although this study identified community engagement as an important mediator, future research could investigate additional mechanisms such as environmental citizenship, institutional trust, social innovation, climate adaptation capacity, and digital participation. Comparative studies across different cities and cultural contexts would also provide valuable insights into how institutional and social conditions influence the effectiveness of community-based sustainability strategies.

In conclusion, this study demonstrates that urban sustainability is achieved not only through physical improvements, technological innovation, or policy interventions but also through meaningful community engagement. The findings confirm that governance support, environmental awareness, social capital, and green infrastructure quality significantly strengthen community engagement, which subsequently promotes sustainable urban development. The central contribution of this research is the empirical demonstration that community engagement serves as a critical pathway through which urban capacities are transformed into sustainability outcomes. Sustainable cities require more than efficient infrastructure and effective policies; they require active communities capable of participating in planning, decision-making, and environmental stewardship. As urban challenges become increasingly complex due to climate change, population growth, and resource pressures, cities must adopt participatory approaches that integrate institutional capacity, environmental responsibility, social networks, and inclusive planning. Strengthening community engagement should therefore be considered not simply as a supportive element of urban sustainability but as a fundamental mechanism for creating resilient, inclusive, and sustainable cities.

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