



Structural Analysis of Factors Influencing the Enhancement of Citizens' Utilization of Urban Green Spaces

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Abstract

The present study aimed to identify and structurally analyze the environmental, social, managerial, and perceptual factors affecting the enhancement of citizens' utilization and enjoyment of urban green spaces in Tabriz. This applied study employed a quantitative descriptive–analytical design using structural equation modeling to examine relationships among variables influencing citizens' engagement with urban green spaces. The statistical population consisted of residents of Tabriz, from which 400 participants were selected through multi-stage cluster random sampling to ensure spatial and demographic representation. Data were collected using a researcher-developed questionnaire grounded in urban planning, environmental psychology, and green infrastructure literature. The instrument measured constructs including accessibility, environmental quality, perceived safety, recreational facilities, social interaction opportunities, management and maintenance quality, environmental awareness, and citizens' utilization behavior. Content validity was confirmed through expert review, and reliability was verified using internal consistency indices. Data analysis was conducted using descriptive statistics, confirmatory factor analysis, and structural equation modeling to evaluate measurement validity and test hypothesized structural relationships among variables. The structural model demonstrated satisfactory goodness of fit, confirming the validity of the proposed conceptual framework. Environmental awareness exerted the strongest positive effect on citizens' utilization of urban green spaces, followed by accessibility and environmental quality. Social interaction opportunities and recreational facilities showed significant positive impacts, indicating the importance of functional and social characteristics of green environments. Management and maintenance quality also significantly influenced utilization, highlighting the role of urban governance performance. Perceived safety had a meaningful but comparatively smaller effect, suggesting that psychological comfort contributes to sustained engagement with green spaces. Overall, all hypothesized paths were statistically supported, revealing that citizens' benefit from urban green spaces results from the combined interaction of environmental, social, and managerial dimensions. The findings indicate that enhancing citizens' utilization of urban green spaces requires an integrated planning approach that simultaneously addresses environmental quality, accessibility, social functionality, governance effectiveness, and environmental awareness. Urban green spaces function as socio-ecological systems whose successful performance depends on coordinated urban management and citizen-centered design strategies.

Keywords: *Urban green spaces, citizens' utilization, structural equation modeling, environmental awareness, urban governance, green infrastructure, sustainable urban development, Tabriz.*

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1. Introduction

Rapid urbanization during recent decades has fundamentally transformed the spatial, ecological, and social

structures of cities worldwide, generating complex environmental challenges alongside unprecedented opportunities for sustainable urban development. One of the most critical responses to the ecological pressures of



contemporary urban growth has been the expansion and strategic management of urban green spaces as multifunctional infrastructures capable of supporting environmental sustainability, social well-being, and urban resilience. Urban greenery is no longer perceived merely as aesthetic decoration but rather as an essential component of urban systems influencing climate regulation, public health, biodiversity conservation, and citizens' quality of life [1]. Increasing urban density, land-use change, and environmental degradation have intensified the need to understand how citizens benefit from green spaces and what structural factors enhance or limit their utilization.

Urban green spaces play a pivotal role in mitigating environmental problems associated with modern cities, including air pollution, rising temperatures, and ecological fragmentation. Studies demonstrate that green infrastructure contributes significantly to urban climate adaptation by reducing urban heat island effects, improving thermal comfort, and enhancing energy efficiency within built environments [2, 3]. The transformation of land use and the reduction of vegetation cover in rapidly growing cities have been directly linked to intensified heat accumulation and declining environmental quality, emphasizing the necessity of preserving and expanding accessible green environments [4]. Consequently, planners and policymakers increasingly recognize urban green systems as strategic tools for environmental governance and climate-responsive urban planning.

Beyond environmental performance, urban green spaces constitute essential public arenas that foster physical and psychological health among urban residents. Exposure to natural environments has been associated with reduced stress levels, improved emotional regulation, enhanced cognitive functioning, and overall mental well-being [5, 6]. Systematic reviews confirm strong links between access to urban greenery and improved public health outcomes, demonstrating that parks, urban forests, and landscaped spaces function as preventive health infrastructures in dense metropolitan settings [7, 8]. The health-oriented perspective highlights that equitable access to green environments is not merely an environmental issue but also a social justice concern connected to urban livability and human rights.

Urban green spaces also facilitate social interaction, collective identity formation, and community cohesion. Public parks create inclusive environments where individuals from diverse social backgrounds engage in shared recreational and cultural activities. Empirical evidence indicates that green environments strengthen social

cohesion, enhance feelings of belonging, and reduce social isolation in urban populations [9, 10]. Furthermore, happiness and life satisfaction levels among urban residents are positively associated with proximity to and quality of green spaces, suggesting that environmental design directly shapes social experiences within cities [11]. The social dimension of green infrastructure therefore expands its significance beyond ecological performance to encompass urban citizenship and collective well-being.

Despite these benefits, the mere existence of green spaces does not automatically guarantee citizens' effective utilization or enjoyment. Research emphasizes that citizens' perceptions, motivations, and behavioral patterns strongly influence how green spaces are experienced and used. Pull factors such as accessibility, aesthetic attractiveness, environmental services, and recreational facilities encourage visitation, whereas push factors including safety concerns, poor maintenance, or inadequate infrastructure discourage participation [12]. Understanding citizens' preferences and experiential perceptions is thus crucial for improving the functionality and inclusiveness of urban green systems. Studies examining stakeholder perceptions demonstrate that different social groups evaluate green spaces based on cultural expectations, environmental awareness, and local governance performance [13].

Urban governance frameworks significantly shape the effectiveness of green space provision and management. The concept of green governance emphasizes coordinated institutional arrangements, participatory planning, and sustainable management practices aimed at integrating ecological objectives into urban policy systems [14]. However, metropolitan municipalities frequently face institutional, financial, and administrative barriers that hinder the establishment of coherent green governance structures [15]. Effective urban green planning therefore requires not only physical interventions but also organizational capacity, public participation, and environmental communication strategies capable of influencing citizens' environmental behavior and awareness [16].

From a planning perspective, contemporary urban design increasingly adopts green infrastructure approaches that conceptualize green spaces as interconnected ecological networks rather than isolated parks. Ecological planning frameworks emphasize resilience, multifunctionality, and integration between natural and built environments, enabling cities to respond more effectively to environmental uncertainty and climate risks [17, 18]. Value-based

development models further highlight the economic, ecological, and social benefits generated through strategic investment in urban greenery, reinforcing the argument that green infrastructure represents a long-term urban asset rather than a secondary land-use category [19].

The experiential quality of green spaces also depends heavily on landscape design and aesthetic perception. Research examining scenic quality demonstrates that visual coherence, vegetation diversity, spatial organization, and environmental maintenance significantly influence citizens' satisfaction with urban parks [20]. Such qualitative characteristics affect emotional attachment to place and encourage repeated visitation, thereby enhancing citizens' sustained engagement with urban nature. In addition, participatory assessments reveal that users interpret green environments not only through physical attributes but also through perceived environmental meanings and cultural symbolism [21].

Recent global crises, particularly the COVID-19 pandemic, have further underscored the essential role of urban green spaces in maintaining social resilience and psychological stability. During periods of mobility restriction and social distancing, urban parks emerged as vital spaces for safe recreation, mental recovery, and social continuity, highlighting their function as critical urban infrastructure rather than optional amenities [22]. These experiences reinforced international recognition that equitable access to green environments must be embedded within long-term urban planning policies.

Another emerging dimension concerns the integration of environmental innovation and sustainability transitions into urban green development. Policies promoting green technological innovation and low-carbon urban strategies increasingly intersect with urban greening initiatives, linking environmental performance with broader sustainability agendas [23]. Such integration demonstrates that green spaces contribute not only to local environmental improvement but also to global climate governance and sustainable urban transformation.

Nevertheless, empirical evidence indicates that cities often experience disparities between the physical provision of green spaces and citizens' actual enjoyment or utilization of them. Spatial inequality, inadequate maintenance, limited accessibility, weak governance coordination, and insufficient environmental awareness may prevent residents from fully benefiting from available green environments. These challenges highlight the necessity of adopting structural analytical approaches capable of simultaneously

examining environmental, social, managerial, and behavioral dimensions influencing citizens' engagement with urban green spaces. Although numerous studies have investigated individual aspects of urban greenery, fewer studies have integrated these multidimensional factors into a comprehensive structural framework capable of explaining citizens' benefit realization processes.

In rapidly growing Middle Eastern and Iranian metropolitan contexts, these issues become particularly significant due to population growth, urban expansion, environmental pressures, and evolving patterns of urban lifestyle. The need to enhance citizens' benefit from urban green spaces requires systematic identification of underlying determinants, evaluation of interrelationships among factors, and development of evidence-based planning strategies aligned with sustainability principles. Structural analysis provides an effective methodological pathway to reveal causal relationships among accessibility, environmental quality, governance performance, social interaction, environmental awareness, and behavioral engagement, thereby enabling urban managers to prioritize interventions based on empirical evidence.

Therefore, considering the environmental, social, health, governance, and planning importance of urban green spaces and the necessity of understanding the structural mechanisms shaping citizens' utilization and benefit realization, the present study aims to analyze structurally the factors influencing the enhancement of citizens' enjoyment of urban green spaces.

2. Methodology

The present study was conducted using a quantitative applied research approach with a descriptive-analytical design aimed at identifying and structurally analyzing the factors influencing the enhancement of citizens' utilization of urban green spaces. Given the multidimensional nature of urban green space use, which involves environmental, social, behavioral, managerial, and spatial dimensions, a structural modeling framework was adopted to examine both direct and indirect relationships among variables. The statistical population consisted of all citizens residing in the metropolitan city of Tabriz, one of the major urban centers of northwest Iran characterized by diverse socio-spatial structures, varying accessibility to green areas, and heterogeneous demographic composition. Considering the large population size of Tabriz and in order to ensure adequate statistical power for structural analysis, a sample

size of 400 participants was determined based on standard sampling adequacy criteria for structural equation modeling and large-scale urban social studies.

Sampling was conducted using a multi-stage cluster random sampling method to achieve appropriate spatial representation across different urban districts. In the first stage, municipal districts of Tabriz were categorized according to geographical distribution and level of access to urban green infrastructure. Subsequently, several neighborhoods were randomly selected from each district, and within each neighborhood respondents were selected using systematic random sampling among citizens present in public areas such as parks, pedestrian zones, cultural centers, and residential spaces. Inclusion criteria required participants to be residents of Tabriz aged 18 years or older and to have at least occasional experience of using urban green spaces. Efforts were made to ensure demographic diversity in terms of age, gender, educational level, and socioeconomic status so that the collected data could reflect realistic patterns of green space utilization among different social groups. Participation was voluntary, anonymity was guaranteed, and respondents were informed about the academic purpose of the research prior to completing the questionnaire. Ethical considerations, including confidentiality of personal information and informed consent, were strictly observed throughout the data collection process.

Data were collected using a structured researcher-developed questionnaire designed based on theoretical foundations of urban planning, environmental psychology, landscape architecture, and urban sociology related to public space utilization. The instrument was developed through an extensive review of scientific literature addressing accessibility, environmental quality, perceived safety, aesthetic attractiveness, recreational facilities, social interaction opportunities, ecological awareness, urban management performance, and citizens' behavioral motivations toward green space use. Following the conceptual identification of relevant dimensions, questionnaire items were formulated to measure latent constructs influencing citizens' enjoyment and utilization of urban green spaces.

The questionnaire consisted of two main sections. The first section included demographic questions aimed at capturing respondents' background characteristics such as age, gender, education level, occupation, residential district, and frequency of park visitation. The second section contained items measuring the structural factors associated

with green space utilization, including physical accessibility, environmental quality, safety perception, functional diversity of facilities, maintenance and management quality, cultural and social attractiveness, environmental awareness, and overall satisfaction with urban green spaces. Responses were recorded using a five-point Likert scale ranging from strongly disagree to strongly agree, allowing quantitative assessment of perceptions and attitudes.

To ensure content validity, the preliminary questionnaire was reviewed by a panel of experts in urban planning, environmental management, geography, and social sciences. Their feedback led to refinement of wording clarity, conceptual consistency, and elimination of redundant items. A pilot study was conducted with a limited sample of citizens to evaluate comprehensibility and response time, resulting in minor modifications prior to the main survey implementation. Construct validity was examined through exploratory factor analysis during the preliminary stage, confirming alignment between theoretical constructs and observed variables. Reliability of the instrument was assessed using internal consistency measures, and acceptable reliability coefficients indicated stability and coherence of measurement scales. The finalized questionnaire was then administered in person across selected urban locations to maximize participation and reduce non-response bias.

Data analysis was performed using a combination of descriptive statistics and advanced multivariate analytical techniques consistent with the structural orientation of the research objectives via SPSS. After data collection, completed questionnaires were screened for missing values, outliers, and response inconsistencies. Valid responses were coded and entered into statistical software for analysis. Initial descriptive analyses were conducted to summarize demographic characteristics of participants and to examine general patterns of citizens' perceptions toward urban green spaces through measures such as means, standard deviations, and distributional properties. Subsequently, inferential analysis focused on identifying the structural relationships among variables affecting citizens' utilization of green spaces. Measurement model evaluation was first conducted to assess reliability and validity of latent constructs through indicators such as factor loadings, composite reliability, and convergent and discriminant validity indices. Confirmatory factor analysis was applied to verify the adequacy of the conceptual model derived from theoretical foundations. After establishing the measurement model, structural equation modeling was employed to test hypothesized

relationships among accessibility factors, environmental attributes, social dimensions, managerial performance, and citizens' perceived benefits and utilization behavior. Model fit indices were examined to evaluate overall adequacy of the structural model and to ensure consistency between empirical data and theoretical assumptions.

3. Findings and Results

The demographic characteristics of the 400 participants indicated an appropriate diversity of respondents representing different social groups within the city of Tabriz. Of the total sample, 52% were male and 48% were female, reflecting a relatively balanced gender distribution. In terms of age, 26% of participants were between 18 and 29 years old, 29.5% were aged 30–39 years, 23% were between 40

and 49 years, and 21.5% were aged 50 years and above, demonstrating participation across both young and older adult populations. Regarding educational attainment, 24% held a diploma or lower qualification, 45.5% possessed a bachelor's degree, 23.5% had a master's degree, and 7% held doctoral degrees, indicating a generally educated sample capable of informed evaluation of urban environmental conditions. Occupational status showed that 36.5% were employees, 22% self-employed, 18% students, 13.5% homemakers, and 10% retirees. Concerning patterns of green space use, 43% of respondents reported weekly visits to urban green spaces, 31% monthly visits, and 26% occasional use, suggesting a high level of citizen interaction with urban green environments and confirming the suitability of the sample for examining determinants of green space utilization.

Table 1. Descriptive Statistics of Research Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
Accessibility to Green Spaces	3.74	0.81	1.80	5.00
Environmental Quality	3.68	0.77	1.95	5.00
Perceived Safety	3.59	0.84	1.60	5.00
Recreational Facilities	3.62	0.79	1.70	5.00
Social Interaction Opportunities	3.71	0.75	2.00	5.00
Management and Maintenance Quality	3.55	0.86	1.50	5.00
Environmental Awareness	3.83	0.69	2.10	5.00
Citizens' Utilization of Green Spaces	3.76	0.73	2.00	5.00

Table 1 presents descriptive statistics for the main constructs examined in the study. The findings show that environmental awareness achieved the highest mean score, suggesting that citizens possess relatively strong ecological attitudes toward urban environments. Accessibility and utilization levels also reported high average scores, indicating that physical proximity and ease of access remain key facilitators of green space use in Tabriz. Management and maintenance quality obtained comparatively lower

mean values, highlighting citizens' expectations for improved service quality and infrastructure management. The moderate standard deviations across variables demonstrate acceptable variability, confirming that respondents' perceptions were sufficiently dispersed to support structural modeling analyses. Overall, the descriptive results indicate generally positive but improvable conditions of urban green space performance from the citizens' perspective.

Table 2. Results of Confirmatory Factor Analysis (Measurement Model Evaluation)

Construct	Factor Loading Range	Composite Reliability (CR)	Average Variance Extracted (AVE)
Accessibility	0.71–0.86	0.88	0.59
Environmental Quality	0.73–0.89	0.90	0.64
Perceived Safety	0.69–0.84	0.87	0.57
Recreational Facilities	0.72–0.88	0.89	0.61
Social Interaction	0.70–0.85	0.88	0.58
Management Quality	0.68–0.83	0.86	0.55
Environmental Awareness	0.75–0.91	0.91	0.66
Utilization of Green Spaces	0.77–0.90	0.92	0.68

The confirmatory factor analysis results presented in Table 2 demonstrate strong measurement model validity. Factor loadings exceeded acceptable thresholds, indicating that observed indicators adequately represented their corresponding latent constructs. Composite reliability values were consistently above recommended standards, confirming internal consistency of measurement scales.

Furthermore, average variance extracted values exceeded the minimum acceptable level, demonstrating satisfactory convergent validity. These results confirm that the measurement instrument reliably captured citizens' perceptions regarding green space characteristics and justified proceeding to structural model evaluation.

Table 3. Structural Model Path Coefficients

Path	Standardized Coefficient (β)	t-value	Result
Accessibility → Utilization	0.32	6.41	Supported
Environmental Quality → Utilization	0.28	5.87	Supported
Perceived Safety → Utilization	0.19	4.12	Supported
Recreational Facilities → Utilization	0.24	5.03	Supported
Social Interaction → Utilization	0.26	5.46	Supported
Management Quality → Utilization	0.21	4.78	Supported
Environmental Awareness → Utilization	0.34	7.02	Supported

Table 3 presents the structural relationships among research variables. The findings reveal that environmental awareness exerted the strongest influence on citizens' utilization of urban green spaces, emphasizing the role of cognitive and cultural dimensions in shaping environmental behavior. Accessibility also demonstrated a substantial positive effect, confirming that spatial proximity and ease of movement significantly increase park usage. Environmental quality and opportunities for social interaction emerged as

important predictors, suggesting that citizens value both ecological conditions and social experiences within green environments. Although perceived safety and management quality had comparatively smaller coefficients, their effects remained statistically significant, indicating that maintenance standards and security perceptions still contribute meaningfully to citizens' engagement with urban green spaces. Collectively, these results confirm the multidimensional nature of green space utilization behavior.

Table 4. Model Fit Indices of Structural Equation Model

Fit Index	Obtained Value	Acceptable Threshold
χ^2/df	2.31	< 3
RMSEA	0.057	< 0.08
CFI	0.94	> 0.90
TLI	0.93	> 0.90
GFI	0.91	> 0.90
SRMR	0.046	< 0.08

The model fit indices shown in Table 4 indicate that the proposed structural model achieved a satisfactory level of goodness of fit. The chi-square to degrees-of-freedom ratio fell within acceptable limits, suggesting appropriate model parsimony. The RMSEA and SRMR values demonstrate low approximation error, indicating strong correspondence between observed data and theoretical structure. Incremental fit indices such as CFI and TLI exceeded recommended thresholds, confirming that the hypothesized model substantially improves explanatory power compared with baseline models. The overall fit assessment verifies that the structural relationships identified in this study provide a

reliable representation of the factors influencing citizens' utilization of urban green spaces in Tabriz.

Taken together, the findings demonstrate that enhancement of citizens' enjoyment and use of urban green spaces is not determined by a single factor but rather emerges from the combined interaction of environmental quality, accessibility, social functionality, managerial performance, and environmental awareness. The structural model successfully explains citizens' behavioral engagement with urban green environments and offers an empirically validated framework for understanding urban green space utilization dynamics.

4. Discussion and Conclusion

The present study sought to structurally analyze the factors influencing the enhancement of citizens' utilization and enjoyment of urban green spaces in the city of Tabriz. The findings demonstrated that citizens' engagement with green spaces is shaped by a multidimensional system consisting of environmental, social, managerial, perceptual, and accessibility-related variables. Structural equation modeling results revealed that environmental awareness, accessibility, environmental quality, opportunities for social interaction, recreational facilities, management quality, and perceived safety all exerted significant effects on citizens' utilization of urban green environments. These results confirm that urban green space use cannot be interpreted through single-factor explanations but instead emerges from complex interactions between physical infrastructure and human behavioral responses.

One of the most prominent findings of the study was the strong influence of environmental awareness on citizens' utilization of green spaces. Individuals with higher levels of environmental consciousness were more likely to visit parks, engage in outdoor activities, and develop stronger emotional connections with urban nature. This finding aligns with research indicating that environmental communication and ecological awareness significantly shape urban environmental behavior and contribute to improved environmental performance within cities [16]. Environmental awareness strengthens citizens' perception of green spaces as valuable public resources rather than merely recreational locations. Similarly, studies examining green governance emphasize that sustainable urban outcomes depend not only on physical infrastructure but also on citizens' ecological literacy and participation in environmental stewardship [14, 15]. Therefore, enhancing environmental awareness can be interpreted as a key leverage point for increasing public engagement with green environments.

Accessibility emerged as another major determinant influencing green space utilization. The results showed that proximity, connectivity, and ease of movement significantly increased citizens' frequency of use. This outcome corresponds with international evidence suggesting that accessibility is among the strongest predictors of park visitation and environmental engagement [12]. Urban green spaces that are physically reachable through pedestrian networks and public transportation systems encourage routine interaction with nature. Planning literature similarly

emphasizes that equitable spatial distribution of green infrastructure is essential for achieving inclusive urban sustainability [1]. The findings therefore reinforce the principle that green spaces must be embedded within everyday urban life rather than isolated at city margins.

Environmental quality was also identified as a significant predictor of citizens' benefit realization. Cleanliness, vegetation diversity, visual attractiveness, and ecological comfort were positively associated with higher utilization rates. Previous studies confirm that aesthetic and ecological characteristics strongly influence user satisfaction and emotional attachment to urban parks [20]. Ecological planning approaches further argue that high-quality green environments provide ecosystem services such as improved air quality, thermal regulation, and biodiversity enhancement, which collectively increase human well-being [17]. Research on climate-responsive urban design also highlights the role of green infrastructure in mitigating urban heat island effects and improving thermal comfort, thereby encouraging outdoor activity [2, 3]. The present findings therefore support the view that environmental quality functions as both an ecological and behavioral driver of green space use.

The role of social interaction opportunities constituted another important outcome of the study. Citizens were more likely to use green spaces that enabled social gatherings, family recreation, cultural activities, and community engagement. This finding is consistent with studies demonstrating that urban parks operate as social infrastructures promoting social cohesion and collective identity formation [9, 10]. Social interaction contributes to perceived safety, emotional comfort, and a sense of belonging, which collectively strengthen citizens' attachment to public spaces. Empirical research linking green spaces with happiness further supports this relationship by showing that socially vibrant green environments enhance life satisfaction and subjective well-being [11]. Thus, urban green planning must consider social functionality alongside ecological performance.

The analysis also indicated that recreational facilities significantly influence citizens' utilization patterns. Availability of walking paths, sports equipment, seating areas, and multifunctional amenities increased users' motivation to visit green spaces regularly. Health-oriented research emphasizes that well-designed green environments encourage physical activity, reduce sedentary lifestyles, and support preventive healthcare outcomes [6, 7]. These findings suggest that citizens' benefit from green spaces

depends not only on natural elements but also on the compatibility between environmental design and human activity needs.

Management and maintenance quality likewise demonstrated a meaningful effect on green space utilization. Citizens responded positively to well-maintained parks characterized by cleanliness, functional facilities, and effective urban services. Studies investigating stakeholder perceptions emphasize that poor maintenance and inadequate management undermine public trust and reduce park visitation despite the presence of physical green infrastructure [13]. Effective governance frameworks therefore play a central role in transforming green spaces into sustainable urban assets. Policy-oriented analyses further highlight the importance of institutional coordination and regulatory support in achieving successful green infrastructure implementation [24]. The findings of the present study reinforce the necessity of integrating management performance within urban green development strategies.

Perceived safety also emerged as a statistically significant determinant, although its effect size was relatively smaller compared to environmental awareness and accessibility. Safe environments encourage prolonged stays and repeated visits, particularly among vulnerable social groups such as women, children, and elderly citizens. Previous research has demonstrated that perceptions of safety influence psychological comfort and shape behavioral decisions regarding public space use [25]. The relationship between safety and well-being further supports findings that green spaces contribute positively to mental health when users feel secure within them [5]. Thus, improving lighting, surveillance, and social visibility within parks remains an essential component of urban green planning.

The integrated structural model developed in this study reflects broader theoretical developments emphasizing urban green spaces as interconnected socio-ecological systems. Resilient design paradigms highlight that successful green infrastructure must simultaneously address environmental sustainability, social inclusiveness, and adaptive urban governance [18]. Value-based development models similarly argue that green infrastructure generates combined ecological, economic, and social benefits when planned holistically [19]. Moreover, global sustainability transitions increasingly link urban greening initiatives with green technological innovation and low-carbon development strategies, demonstrating that urban greenery contributes to broader environmental transformation processes [23].

The findings also resonate with evidence from systematic reviews connecting urban green spaces to human well-being outcomes. Access to high-quality green environments improves psychological restoration, reduces stress, and enhances urban resilience, particularly in densely populated cities [8]. Experiences during the COVID-19 pandemic further confirmed that urban parks function as essential infrastructures supporting mental stability and social continuity under crisis conditions [22]. In this regard, the present study extends existing literature by demonstrating how multiple factors interact structurally to shape citizens' benefit realization rather than acting independently.

Finally, the results emphasize the importance of context-sensitive urban planning. Although universal principles of green infrastructure apply globally, local socio-cultural conditions influence citizens' expectations and usage patterns. Studies examining urban land-use change show that green space transformation significantly affects urban environmental conditions and residents' thermal comfort, highlighting the importance of locally tailored planning strategies [4]. The structural framework identified in this study therefore provides practical guidance for metropolitan municipalities seeking to enhance citizens' engagement with green environments through integrated planning, governance, and community-oriented interventions.

Despite its contributions, the study has several limitations that should be acknowledged. First, the research relied on self-reported perceptions collected through questionnaires, which may be influenced by subjective bias or temporary emotional states of respondents. Second, the cross-sectional design limits the ability to infer long-term causal relationships among variables, as citizens' perceptions and behaviors may change over time in response to environmental or policy developments. Third, although the sample size was statistically adequate, the study focused solely on the city of Tabriz, which may limit the generalizability of findings to cities with different climatic, cultural, or urban structural characteristics. Additionally, qualitative experiential dimensions such as emotional attachment to nature were not explored in depth, which could provide richer interpretative insights into citizens' relationships with green spaces.

Future studies may adopt longitudinal research designs to examine how changes in urban planning policies or environmental interventions influence citizens' utilization patterns over time. Comparative studies across multiple cities could provide broader insights into contextual differences affecting green space engagement. Researchers

are encouraged to integrate mixed-method approaches combining quantitative modeling with qualitative techniques such as interviews, behavioral observation, and participatory mapping to capture deeper experiential aspects of urban nature interaction. Further research could also investigate the role of emerging technologies, smart urban systems, and digital environmental platforms in promoting sustainable green space management and citizen participation.

Urban planners and municipal managers should prioritize equitable spatial distribution of green spaces to ensure accessibility for all citizens. Enhancing environmental awareness through educational campaigns and community participation programs can significantly strengthen citizens' engagement with urban nature. Investment in maintenance quality, safety measures, and multifunctional recreational facilities should be considered essential components of urban green policy. Integrating ecological planning principles with social programming initiatives can transform parks into active community hubs that simultaneously support environmental sustainability and social cohesion. Policymakers should adopt integrated governance approaches that coordinate environmental management, urban design, and public participation in order to maximize citizens' benefit from urban green spaces and promote sustainable urban development.

Authors' Contributions

Authors equally contributed to this article.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

All procedures performed in this study were under the ethical standards.

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