

Research Article

## Effects of Urban Green Space's Physical Features on the Usability of Investment Housing Projects in Erbil City

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Article Info	Abstract
Article History	In the quest to improve urban quality of life, creating functional and visually appealing urban green spaces plays a pivotal role. This study investigates the influence of five key physical characteristics—availability, maintenance, facilities, environment, and design—on the usability of urban green spaces in three case studies in Erbil: Italian City 2, Hewa City, and Ashti City 2 neighborhoods. The research aims to understand how urban green spaces impact investment housing projects, analyze the relationship between physical factors and urban design usability and explore individuals' perceptions regarding the influence of these factors on urban green space design. Through systematic observation and visual analysis of residential areas, the study reveals that these five physical qualities of green spaces consistently scored above 90%, indicating a strong alignment with usability elements. This suggests that these physical attributes significantly enhance the usability of urban green spaces, which, in turn, supports broader urban design goals. This research highlights the importance of integrating these physical characteristics when planning and designing urban green spaces, particularly within the context of investment housing projects in Erbil's case study neighborhoods. Such enhancements can positively impact urban development and residents' quality of life. Future research should delve into the long-term socio-economic effects of these green space improvements.
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### 1. Introduction

Urban green spaces are integral to urban ecosystems, contributing significantly to ecological stability and human well-being [1]. They play a multifaceted role by enhancing cities' environmental sustainability and promoting their inhabitants' physical and mental health. These spaces are essential for providing recreation, leisure activities, and physical exercise opportunities, fostering a healthier urban lifestyle.

Furthermore, urban green spaces offer a unique opportunity for urban dwellers to connect with nature, even in densely populated areas. They serve as oases of tranquility and natural beauty, allowing residents to escape from the hustle and bustle of urban life and experience the restorative benefits of the natural

environment. This connection with nature has been shown to reduce stress, improve mental health, and enhance urban populations' overall quality of life. Urban green spaces, by description, are open spaces in urban areas that are mainly protected by vegetation, which can be public or private [2]. Using this description, urban green space can contain parks, community gardens, natural reserves, sports courts, and playground areas. In addition, urban green space has physical characteristics visually on it. Urban green space usability, in this research, refers to using green space easily by moving from a residential area to the closest green space.

Greenspace is usually, but not always, encompassed by vegetation and associated with natural elements. There has been growing interest in greenspace research due to evidence that nature positively impacts human well-being [3, 4]. In the 1960s, planners tried to develop techniques for evaluating green environments in the countryside. They often used expert judgments [5] and criteria such as shape, color, scale, and texture. These routines live on, and evaluations of landscapes are still connected to obvious, measurable criteria, such as size, topography, distance, and color [5]. However, such evaluations were also criticized early on for the more or less arbitrary variables being judged—a user perspective was considered necessary [6]. Historically, human beings have respected greenery and favored life, forming some physical and psychological dependence on nature. People are influenced by fresh air, natural attractions, and landscapes that indicate public natural perception and social behavior [7-9].

Population growth and urbanization have drastically changed ecosystems and natural landscapes [10, 11]. Human activities are driving these changes and threatening many of the ecological services essential to society [12, 13]. Over the past three decades, more research results have pointed to urban green spaces as a resource for stimulating public health. It has been recommended that green spaces encourage health by renovating mental exhaustion [14], serving as a resource for physical activities [15], and reducing all-cause and cause-specific mortality [16]. However, most studies have concerned the resources that reduce stress levels [5, 17]. Many research studies have compared urban environments with some kind of natural qualities with urban environments with no natural qualities [18, 19]. Visualization is a common sense of greatest importance when visiting urban green spaces. However, other senses are also of excessive significance regarding the connection between using urban green spaces and people's health and well-being.

Previous research has mainly focused on the relationship between urban green spaces and human health within neighborhoods. However, a limited body of research has specifically delved into the impact of urban green spaces on investment housing projects in Middle Eastern cities, with particular emphasis on rapidly expanding cities such as Erbil.

Accordingly, this research aims to assess the relationship between physical characteristics and the usability of urban green spaces to define quality of life empirically. The research seeks to clarify the factors

influencing well-being and health in urban green spaces and establish a theoretical framework for understanding the effects of physical attributes. Additionally, it aims to uncover residents' well-being and health preferences in investment housing projects in Erbil City. Finally, this article sheds light on the intricate relationship between physical attributes, usability, and well-being in urban green spaces, aiming to enhance the quality of life in urban environments.

## 2. Literature Review

In their study, Zhang, et al. [20] examined the influence of residents' levels of engagement with physical activities in urban green spaces, such as walking and sightseeing. They found that the living environment, high-quality vegetation, and the accessibility of urban green spaces significantly affected residents' satisfaction levels. The study underscores the importance of strengthening the relationship between existing urban green spaces and enhancing the maintenance of residential green areas to encourage greater utilization of urban green spaces for physical activities. Urban green spaces can promote an active lifestyle among urban residents, mitigating health risks associated with overweight and obesity.

Richardson, et al. [21] conducted a comprehensive study to assess the correlation between the local availability of green spaces and a spectrum of health benefits. The study sought to elucidate potential underlying mechanisms that substantiate the relationship between green spaces and health. These mechanisms encompassed providing opportunities for physical activity, the stress-alleviating effects of natural environments, and promoting social interactions. Additionally, the study explored whether the levels of physical attributes in these green spaces played a role in moderating any observed relationships. The study revealed that the availability of green spaces was not significantly associated with overweight or poor general health indicators among the population studied. While overall physical attribute levels were notably higher in neighborhoods with greater green space availability, adjusting for this factor only marginally attenuated the observed relationships between green space and health. Therefore, it can be concluded that although physical attributes were more pronounced in greener neighborhoods, they did not entirely account for the robust relationships between the presence of green spaces and improved health outcomes. This research contributes valuable insights to understanding the intricate interplay between urban green spaces and public health, shedding light on the multifaceted nature of the relationship and the potential health-enhancing aspects of these natural environments.

Maas, et al. [22] conducted an empirical investigation into the role of physical activities, encompassing general activities such as walking and cycling for leisure and commuting, as well as engagement in sports and gardening, as potential mediators in the relationship between the quantity of green spaces within individuals' immediate residential environments and their self-perceived health. The study aimed to discern

whether green spaces in one's living environment were associated with heightened levels of physical activity and improved self-perceived health. The findings indicated a correlation between the quantity of green spaces in the residential environment and individuals' engagement in physical activities. However, this correlation did not fully account for the relationship between green spaces and health outcomes, highlighting additional factors contributing to this connection. Maas, et al. [22] research contributes to understanding the intricate relationship between green spaces, physical activities, and self-perceived health. While physical activities play a role in this relationship, they do not serve as the sole explanatory factor, necessitating further exploration of additional mechanisms in green space and health.

Yilmaz, et al. [23] conducted a study to investigate the interrelations among consumption behavior, well-being, and the subjective definitions that users ascribe to their social-mental and physical well-being within urban green spaces. The study aimed to discern whether there exists a discernible connection between patterns of green space consumption, the frequency of green space usage, proximity to green spaces, and the individuals' self-reported well-being experiences. The findings of this research indicate a robust correlation between several key factors. Notably, there is a noteworthy association between users' consumption of green spaces and their mental well-being, with increased utilization of green spaces linked to enhanced mental well-being. Furthermore, proximity to green spaces exhibits a significant relationship with the social comfort experienced by individuals in urban green settings. The study by Yilmaz, et al. [23] contributes valuable insights into the complex relationships between green space consumption, well-being, and individuals' subjective definitions of their social-mental and physical well-being. It underscores the importance of examining the multifaceted aspects of urban green spaces to understand better how they influence various dimensions of well-being.

In the study by Hami and Maruthaveeran [24], the primary focus was examining the correlation between vegetation's longitudinal complexity and urban parks' usability. The research aimed to investigate how the intricacy of vegetation within park landscapes influenced their overall usability. To assess this relationship, a photo-questionnaire survey was administered to public members visiting two urban parks, namely El Gholi Park and Big Park, located in Tabriz, Iran. The survey attempted to gauge participants' perceptions of park usability concerning varying levels of vegetation complexity, categorized as high, moderate, and low. The findings of this study revealed a noteworthy association between landscape design featuring ground cover, such as grass, and an increase in the perceived usability of urban parks. This suggests that ground cover vegetation, like grass, positively contributes to the overall usability of urban park environments. Hami and Maruthaveeran [24] research provides insights into the relationship between vegetation complexity and park usability. It underscores the significance of landscape design elements, particularly the use of ground cover vegetation, in enhancing the overall usability of urban parks.

In their study, Paul and Nagendra [25] examined the significance of urban parks for visitors, focusing on Delhi, one of the world's most densely populated cities. The research drew upon data gathered from 123 interviews conducted with park visitors across four prominent city parks. A prevailing sentiment among respondents was the strong demand for increased availability of green spaces within the urban landscape. Visitors predominantly prioritize parks due to their perceived environmental advantages and the favorable influence these green spaces exert on their psychological and physical well-being.

Their study carries implications for the improved planning and design of urban green spaces. By aligning urban green space development with the expressed needs and preferences of urban communities, policymakers, and urban planners can better cater to the desires of city residents, addressing their aspirations for enhanced access to green environments within densely populated urban areas. Paul and Nagendra [25] research highlights the essential role that urban parks play in the lives of city residents, particularly in highly populated cities like Delhi. It underscores the importance of incorporating the insights gleaned from visitors' perspectives into the planning and design of urban green spaces to serve urban communities' well-being and desires.

Another study by Sreetheran [26] examined the utilization patterns and perceptions of urban parks within the Malaysian social context, specifically focusing on the challenges Malaysians face when engaging with urban parks in Kuala Lumpur. The investigation involved surveying a sample of 669 urban park users (365 males and 304 females) aged 18 to 73 years. These surveys were carried out across five urban parks situated in Kuala Lumpur. The study's findings indicate that many respondents preferred using urban parks in the company of family or friends rather than in solitary visits. Moreover, most respondents tended to schedule their park-related activities for weekends. This choice aligned with their desire for a comfortable and secure environment, contributing to a heightened enjoyment of leisure time spent in these urban park settings. In summary, Sreetheran [26] research contributes insights into the utilization patterns and perceptions of urban parks in the Malaysian context, particularly in Kuala Lumpur. The study highlights the social aspects of park visits, with a preference for group visits and the weekend being a preferred time for such outings, promoting a sense of comfort and safety among park users.

In the research conducted by Zhang, et al. [27], the study centered on the premise that the quality of green space plays a substantial role in influencing district satisfaction and overall well-being, which operates independently of the sheer quantity of green space available. The study systematically examined residents' perceptions concerning the quality of green spaces and their associated beneficial attributes, juxtaposed against objective assessments of accessibility and usability. The findings underscore the pivotal importance of perceived features within green spaces, extending beyond their sheer capacity or size when evaluating the positive impacts of green spaces on residents' satisfaction and well-being. This research

contributes to a nuanced understanding of the multifaceted role that the quality of green spaces plays in urban environments, highlighting the significance of considering not only the quantitative aspects but also the qualitative attributes of green spaces in shaping residents' experiences and well-being.

## **2.1. Physical Qualities in Green Spaces**

The appeal of green spaces within urban settings extends beyond their inherent natural beauty, encompassing the defining physical attributes that characterize them. These physical qualities are central in shaping the functionality, accessibility, and overall attractiveness of these spaces. Elements ranging from the layout and organization of amenities to the caliber of vegetation and maintenance protocols all contribute significantly to the comprehensive experience offered by green spaces. This inquiry embarks on a nuanced exploration of these physical attributes, aiming to illuminate their profound significance in augmenting the well-being of urban inhabitants and the broader environmental landscape.

### **2.1.1. Quality and Availability of Green Space**

The quality and availability of green space may also affect its use. This aspect includes issues of size, green space, and accessibility that affect the usability of the green space [28]. People choose to use or not use green spaces not only for their features but also for the condition of those facilities and features [29]. Places in disrepair are less likely to be visited and contribute to a perceived sense of lack of safety. Also, Accessible district resources are a key factor in physical activity [30]. Evidence consistently shows that people with easy access to physical activity facilities are likelier to engage in physical activity than those without. Access to facilities such as cycle pathways, resident parks, other green spaces, beaches, or restoration centers is strongly and positively associated with physical characteristics [15]. Inadequate facilities, the absence of facilities, or barriers to access, such as steep hills and busy roads to cross, have an undesirable impact on physical characteristics.

### **2.1.2. Maintenance**

Optimizing urban green spaces and elevating maintenance standards constitute prudent and cost-effective measures for enhancing the multifaceted utilization of these spaces, with a specific focus on the physical aspects associated with vegetation, equipment, and sanitation upkeep [31]. In this section, the study delves into the intricate dynamics inherent to enhancing maintenance within urban green spaces, elucidating the manifold advantages stemming from such endeavors.

A pivotal dimension of optimizing urban green spaces revolves around the meticulous care of vegetation. The flourishing and well-preserved greenery within these spaces serves as indicators of environmental vitality and as catalysts for ecological, aesthetic, and psychological benefits [32]. The strategic allocation

of resources for nurturing and sustaining vegetation emerges as a matter of paramount significance. Prudent strategies encompass regular pruning, reforestation initiatives, soil enrichment programs, and the implementation of comprehensive vegetation management protocols [33]. These measures, far from merely preserving the ecological integrity of the green spaces, also augment their aesthetic appeal, cultivating an environment conducive to leisure, relaxation, and biodiversity conservation.

In tandem with the care of vegetation, the maintenance of equipment integrated within urban green spaces assumes a fundamental role. Fitness apparatus, playground structures, seating arrangements, and recreational amenities require rigorous oversight and maintenance to ensure optimal safety and functionality [34]. Diligent inspection, timely repairs, and, when warranted, equipment replacement are integral components in preserving these amenities, thereby assuring the community of a secure and enjoyable recreational experience [35]. Moreover, the conscientious upkeep of equipment contributes to the longevity of these investments, ultimately optimizing cost-effectiveness over the long term.

Sanitation emerges as a pivotal facet of the overall maintenance of urban green spaces. The presence of litter and an unkempt environment not only diminishes the aesthetic allure of these spaces but also engenders health and environmental risks [36]. Robust sanitation measures encompass routine cleaning regimens, the provision of waste disposal infrastructure, and public awareness campaigns to instill responsible usage practices [37]. A pristine and hygienic environment fosters a sense of community pride and ownership and serves as a bulwark against adverse environmental impacts, thereby preserving the ecological equilibrium of the green spaces [38].

Enhancing maintenance practices within urban green spaces necessitates a multifaceted approach targeting vegetation, equipment, and sanitation. These collective endeavors stand as instrumental conduits for amplifying the utilization and effectiveness of these spaces, nurturing their capacity to cater to the diverse needs of urban populations. By rigorously implementing these strategies, communities can harness the full potential of urban green spaces, transforming them into invaluable assets that contribute to residents' physical well-being and enrich the urban fabric with their ecological, recreational, and aesthetic attributes.

### **2.1.3. Facility**

Within the purview of this investigation, a meticulous examination of the components constituting the urban green space unfolds, culminating in a comprehensive enumeration of the diverse array of facilities seamlessly integrated into the study area [39]. These facilities collectively assume distinct roles, synergistically contributing to the overall utility and functionality of the urban green space. The enumeration process is pivotal in furnishing a detailed catalog of these amenities, thereby affording a nuanced comprehension of the resource landscape within the research site [40].

The inventory of facilities nested within the urban green space unveils an assemblage of key features that augment its allure and cater to the multifarious requirements of its user demographic. Specifically, the facilities in scrutiny encompass the following:

### ***Resting Area***

A designated resting enclave ensconced within the urban green space serves as a veritable oasis of respite for visitors seeking solace from the rigors of their daily routines [41]. This enclave boasts carefully curated seating arrangements, often manifesting as inviting resting chairs. Here, individuals can luxuriate in tranquility, unwinding and partaking in leisurely pursuits while nurturing avenues for social interaction.

### ***Fitness Equipment***

In an earnest commitment to the health and well-being of the community, the urban green space thoughtfully incorporates fitness equipment. This strategic provision empowers residents and visitors to exercise physically, fostering a salubrious lifestyle [42]. Including a fitness apparatus underscores the space's dedication to promoting holistic wellness and an active, health-conscious ethos.

### ***Sport Court***

A dedicated sports court, firmly entrenched within the urban green space, constitutes an indispensable facet catering to the recreational predilections of ardent sports enthusiasts [43]. This multifunctional facility proffers a versatile platform conducive to various sports activities, including basketball, tennis, and other court-based athletic pursuits. Through this amenity, the urban green space kindles community engagement and fosters the cultivation of athletic prowess.

### ***Playground Area***

In recognition of the pivotal role played by family and children's recreation, the urban green space incorporates a meticulously designed playground area. This amenity is conceived to provide a secure and enjoyable milieu for children to partake in play, engage in social interactions, and embark upon physical endeavors [44]. In doing so, it contributes substantively to the holistic well-being of the local community, nurturing its younger denizens' physical and socioemotional growth.

The enumeration of these facilities underscores the panoramic nature of the urban green space's amenity portfolio, encapsulating facets of relaxation, fitness, sports, and family-centric recreation. This meticulous inventory not only underpins the structured analysis of the urban green space's offerings but also establishes a foundational cornerstone for the comprehensive evaluation of its usability, accessibility, and overarching contribution to the quality of life within the community it dutifully serves.

#### **2.1.4. Environment**

Grounded in empirical evidence, it becomes incontrovertibly apparent that individuals' perceptions of their residential neighborhoods are intricately entwined with their holistic health and well-being [45].



Moreover, empirical investigations that delve into objective measurements of urban districts reveal a coherent and compelling connection between these locales' physical environment and their inhabitants' general health status [46]. This subsection elucidates the complex interplay among environmental factors within urban districts and their profound ramifications for the mental and physical health of the populace.

### ***Perceived Hostility, Dirtiness, and Maintenance***

The perceptual prism through which residents perceive their residential districts assumes a potent role in shaping their psychological and physiological health. An environment perceived as hostile, characterized by feelings of insecurity or unfriendliness, exacts a psychological toll on individuals residing within such contexts [47]. Similarly, perceptions of dirtiness and subpar maintenance within districts breed sentiments of discontent and disarray. These negative perceptions engender a pervasive sense of unease, which, in turn, can manifest as heightened anxiety, depression, and a discernible deterioration in overall health.

### ***Lack of Safe Recreational Spaces***

The dearth of secure and easily accessible recreational spaces within urban districts represents another facet of the intricate interplay between the environment and health [48]. When residents perceive an absence of safe areas for leisure and outdoor activities, their opportunities for physical exercise, social interaction, and stress alleviation become unduly constrained [49]. This dearth of essential outlets for recreation and relaxation significantly heightens the risk of experiencing adverse mental health outcomes, exacerbating conditions such as anxiety and depression.

### ***Differential Impact on Vulnerable Populations***

Notably, the adverse impact of suboptimal physical environments within districts does not uniformly affect all segments of the population [50]. Empirical evidence consistently underscores that women, older individuals, and those grappling with unemployment are particularly susceptible to the detrimental consequences of unfavorable district environments [51]. The vulnerabilities inherent to these demographic groups render them more predisposed to experiencing heightened levels of stress, anxiety, and depression when confronted with hostile, unsanitary, or inadequately maintained district settings.

The intricate nexus between environmental factors within urban districts and health outcomes underscores the physical environment's pivotal role in shaping residents' well-being. These findings furnish compelling motivation for prioritizing urban planning and policy initiatives geared toward enhancing the quality of district environments [52]. Particular emphasis must be directed toward mitigating hostile perceptions, improving cleanliness, and furnishing secure recreational spaces. Recognizing the disproportionate impact on vulnerable populations further underscores the urgency of these endeavors, which aim to cultivate urban districts that mitigate negative health outcomes and engender environments conducive to positive well-being for all residents.

### 2.1.5. Design

The deliberate and strategic design and planning of urban green spaces, executed with a clear objective of augmenting connectivity and engagement within urban settings, have yielded substantial and notable distinctions when juxtaposed with control neighborhoods lacking such interventions [53]. The scrupulous design of green spaces, focusing on enhancing accessibility, usability, and opportunities for social interaction, has induced conspicuous transformations in the patterns of engagement observed among residents within these experimental neighborhoods [54]. These findings underscore the tangible efficacy of purposeful urban green space design interventions in fostering elevated levels of connectivity among residents, thereby imparting a significant impetus to the overall livability and well-being of the urban environment. In urban planning and design, these outcomes assume particular significance as they accentuate the latent potential inherent in thoughtfully conceived green spaces, which can act as catalysts for community interaction, ultimately enhancing the overall quality of urban life.

The deliberate design and planning of urban green spaces, grounded in a comprehensive understanding of human behavior and urban dynamics, culminate in environments that transcend aesthetic appeal to become intrinsically functional and socially enriching [55]. Central to this design philosophy is enhancing accessibility, ensuring that green spaces are easily accessible for diverse population segments. Equitable access fosters inclusivity and facilitates broad-based community engagement regardless of age, mobility, or socio-economic status [56]. Moreover, the usability of green spaces hinges upon their versatility and adaptability, catering to a wide spectrum of recreational, social, and cultural activities. Well-conceived amenities and infrastructure within these spaces not only accommodate a diverse range of user needs but also facilitate serendipitous social encounters. This dynamic encourages spontaneous interactions among residents, nurturing a sense of belonging and a shared urban identity [57].

The pivotal role of green spaces as venues for social interaction cannot be overstated. Providing conducive settings for communal gatherings, cultural events, or casual encounters with neighbors is instrumental in forging and sustaining social bonds [58]. Such interactions foster a sense of collective identity and solidarity within urban communities, forming the bedrock of vibrant and cohesive neighborhoods. The empirical evidence presented herein underscores the profound implications of thoughtful urban green space design on connectivity and well-being among urban residents [59]. These findings resonate deeply within urban planning and design, emphasizing the potential of purposefully designed green spaces as pivotal instruments for nurturing community interaction and elevating the overall quality of urban existence. This research substantiates the imperative for urban policymakers and designers to prioritize the intentional creation of green spaces that align with the diverse needs and aspirations of the urban populace, thereby contributing to the holistic enhancement of urban life.

Table 1 condenses the literature review and summarizes key studies that focus on various aspects of urban green spaces. It categorizes the research based on multiple criteria, such as the authors, the factors or variables studied, the methodology employed, the location of the study, and the publishing source. This table provides a structured overview, enabling readers to quickly grasp the scope and methods of existing research on the subject under study.

**Table 1.** Literature review analysis

Study	Year	Category	Factors (variables)	Methodology	Location	Publisher
1. [20]	2015	Physical characteristics	Availability Maintenance Facility	Questionnaire.	Residents in Beijing	Elsevier China
2. [21]	2013	Physical characteristics	Environment Design	Using the software Statistics.	Residents in New Zealand	Elsevier New Zealand
3. [22]	2008	Physical characteristics	Availability Environment	interviewed about physical activity, and calculated for each individual.	Residents in Dutch people	<i>BMC Public Health</i> 2008
4. [27]	2017	Usability	Quality of green spaces, accessibility and usability, and environmental perception, play equipment, hard court, grass pitches for football). And are easily accessed, there are many access points and enough walking paths, and the roads around are not busy.	Questionnaire and Measures	Dutch city of Groningen	International Journal of environmental research and public health.
5. [23]	2017	Usability	Environmental quality, green areas, walking, sports activities, and topographic variety.	Questionnaire. And survey data.	Turkey	<a href="http://www.researchgate.net">www.researchgate.net</a>
6. [24]	2018	Usability	Walking, cycling, spatial arrangement of urban setting, and environment (vegetation visual).	Questionnaire. And survey data.	Tabriz, Iran	Australian journal of basic and applied sciences.
7. [25]	2017	Usability	Frequency of use (time, mode of transportation, easily accessible), age groups, visits alone or within groups (friends and family).	Questionnaire. And survey data	INDIA, Delhi	<a href="http://www.researchgate.net">www.researchgate.net</a>
8. [26]	2017	Usability	Frequency of time and age group, length of spent time, preferred visit time, and preferred time to visit.	Survey data	Kuala Lumpur, Malaysia	Elsevier Malaysia

Table 2 provides a detailed breakdown of variables that influence the quality and usability of urban green spaces. Divided into two main categories—Physical Characteristics and Usability—this table enumerates variables such as availability, maintenance, facility under physical characteristics, frequency of visits, age, and preferred time to visit under usability. The table also lists possible values for each variable, offering a nuanced framework for understanding the factors contributing to green spaces' perception and utilization.

**Table 2.** Physical characteristics and usability of green spaces

Category	Variables (5)	Possible value
Physical characteristics	1- Availability	Area of green space Percentage of green space Walking and cycling path within green space Quality of green space. (Variety of trees, flowers, shrubs, and grass) Accessibility (distance) connection
	2- Maintenance	Maintenance of vegetation and equipment Sanitation (litter, dirty ground)
	3- Facility	Resting chair and fitness equipment Sports court and playground area
	4- Environment	Pet problems, mosquitoes and insects from trees, and dog shit Noise effect Vegetation visual
	5- Design	Appealing or unappealing design The spatial arrangement of urban setting and lack of green vegetation.
Usability	1- Frequency of green space visit	Daily Once in a week Twice a week Monthly
	2- Age	Children Adult Elderly Older
	3- Preferred time to visit	Morning Afternoon Evening Night
	4- Length of time spent	1-2 h 2-3 h 3-4 h
	5- Visit alone or with a group	Individual With family With friends

### 3. Materials and Methods

This research adopts a mixed-methods approach, harmoniously combining qualitative and quantitative methods to offer a holistic view of urban green spaces. A case-study design is employed to allow for an in-depth, context-specific analysis. The study is cross-sectional and conducted over six months, from January to June 2023.

#### 3.1. Data Collection

The research commenced with an exhaustive data collection phase, where a multifaceted approach was rigorously employed to ensure a comprehensive grasp of the subject matter. Primarily, a qualitative survey was conducted, employing a structured checklist meticulously designed to amass pertinent information systematically. This survey method was thoughtfully crafted to capture pivotal data about the urban green space under investigation.

Complementing the survey, direct observation assumed a pivotal role in data collection. Observational techniques were conscientiously deployed to document and photograph the urban green space in question scrupulously. This facet of data collection aimed to furnish a visual record of the urban green space's physical characteristics and usability facets. Such a methodological choice facilitated an in-depth exploration of the spatial and environmental dimensions of the urban green space, thereby enabling a nuanced analysis of its inherent attributes.

#### 3.2. Data Analysis

Following the data collection phase, meticulous data analysis was initiated to extract meaningful insights and draw substantiated conclusions. Visual analysis emerged as a central method employed to interpret the amassed data. This analytical approach judiciously used the photographs and visual documentation acquired during the data collection phase. Visual analysis facilitated a profound exploration of the physical attributes and design elements characterizing the urban green space, thereby facilitating a nuanced interpretation of its visual aesthetics, spatial layout, and overall functionality.

Furthermore, statistical analysis was rigorously conducted utilizing the Statistical Package for the Social Sciences (SPSS) software. This analytical tool enabled the quantitative examination of specific variables derived from the survey data, ultimately generating statistical findings and empirical evidence. By leveraging SPSS, a wide array of statistical tests and techniques were skillfully applied, thereby augmenting the rigor and objectivity of our analytical pursuits. Thus, the research methodology implemented in this study harmoniously amalgamates qualitative and quantitative data collection techniques, synergistically reinforced by visual and statistical analysis methodologies. This comprehensive and judicious approach has been meticulously designed to safeguard the robustness of our research findings and ensure the attainment

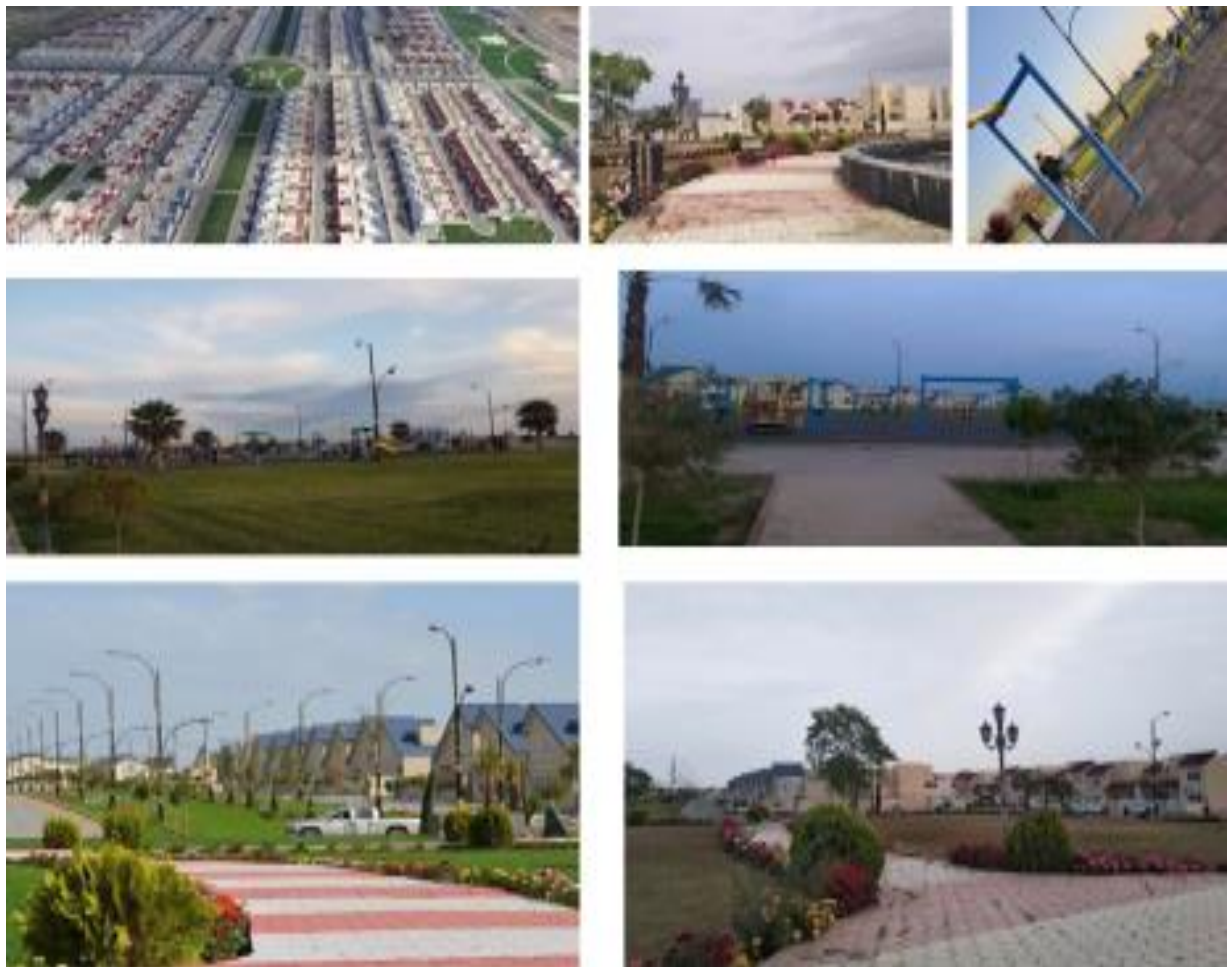
of our research objectives while effectively addressing the central research problem under investigation. Prior to analysis, data underwent a cleaning phase where incomplete or inconsistent records were managed, ensuring the quality and reliability of the data set.

#### 4. Results and Discussion

The results of observations and the checklist creation are discussed below. The answers are supported by photos taken by the authors to verify the availability of the factors in the Italian City 2, Hewa City, and Ashti City 2 neighborhoods.

##### 4.1. Case Studies

This part of the paper will introduce an analytical study of 3 investment house examples (Italian City 2, Hewa City, and Ashti City 2) that have applied the urban green space approach. From June to January 2023, visits were made to document the urban green space in investment houses.



**Figure 1.** Italian City 2 neighborhood

#### 4.1.1. Italian City 2 Neighborhood

The project comprises 1,561 houses alongside the 120-meter highway adjacent to Shaqlawa Road. It was constructed in 2004 and boasts approximately 30% green space coverage across various areas. This project includes a courtyard playground, sports and fitness facilities, resting areas with chairs, and pathways for walking and cycling within the green spaces. Regular monthly maintenance is conducted for all equipment and sanitation needs. Furthermore, it provides excellent accessibility to nearly all houses. It has been assessed and surveyed in terms of design, and the arrangement of green space areas is considered well-designed.

#### 4.1.2. Ashti City 2 Neighborhood

This project contains 1,200 housing units located on the Kasnazan road. It was built between 2010-2013, and %25 of the project area is dedicated to green space.



**Figure 2.** Ashti City 2 neighborhood

#### 4.1.3. Hewa City

Hewa City is the most private and planned central housing design project of Hewa Holding in Kurdistan. This city consists of 4000 villas offering every section of the society a home that provides to all needs.





**Figure 3.** Hewa City neighborhood

#### 4.2. Variables of the Study

It is concluded that the significant variables (factors) of physical characteristics' effects on the usability of urban green space are increasing efficiency and influence of different factors. These are (availability, maintenance, design, environment, facility) and (Frequency of green space visits, age, preferred time to visit, and visit alone or with the group) the opportunity for outcomes of urban green space as shown in Table 1.

The studies in Table 1 collectively explore the various factors that impact the use and perception of urban green spaces across different global locations. Methodologies primarily include surveys and questionnaires, with some studies using statistical software for more in-depth analysis. Key themes covered include the availability and quality of facilities, environmental design, and the role of physical activity in



health outcomes. Some research also delves into the effects of green spaces on neighborhood satisfaction and individual well-being. Others investigate user preferences such as frequency and length of visits, modes of transportation to access these spaces, and the influence of age groups. Overall, the studies aim to provide a comprehensive understanding of the multifaceted influences on the usability and perception of urban green spaces, and they are published in a variety of platforms including Elsevier and ResearchGate.

The theoretical framework for this study has two main categories of the patterns: "physical characteristics" and "usability." Each of those categories includes five variables. as shown in Table 2.

Table 3 outlines a comprehensive assessment of green spaces in three different locations: Italian City 2, Hewa City, and Ashti City 2. Each area is evaluated based on various physical characteristics such as availability, maintenance, facility, environment, and design, with possible values graded as "Good, more than 30%," "Satisfactory, medium," or "Bad, less than 30%." This table serves as a structured tool for comparing the quality of green spaces across different regions, shedding light on areas that may require improvement.

**Table 3.** Evaluation of checklist results for three districts or samples according to physical characteristics factors (variables) of urban green space (Prepared by the authors).

Category	Variables	Possible value	Italian City 2	Hewa city	Ashti City 2	
Physical characteristics	Availability	Area of green space	1	2	2	
		Percentage of green space	1	1	2	
		Walking and cycling path within green space	2	1	2	
		Quality of green space (variety of trees, flowers, shrubs and grass)	1	3	1	
	Maintenance	Accessibility (distance) connection		2	1	2
			Maintenance of vegetation and equipment	2	2	3
		Sanitation (litter, dirty ground)	2	3	2	
	Facility	Resting chair and fitness equipment	2	2	2	
		Sports court and playground area	1	2	1	
	Environment	Pet problems, mosquitoes and insects from trees, and dog shit		2	2	2
			Noise effect	2	1	2
		Vegetation visual	3	3	2	
	Design	Appealing or unappealing design	1	2	1	
		Spatial arrangement of urban setting and lack of green vegetation	2	2	2	
			1	2	3	
		Good, more than 30%	Satisfactory, medium	Bad, less than 30%		

The results of this study reveal noteworthy disparities in the proportion of green space across different neighborhoods or districts within the cities under examination. Specifically, it is observed that the Italian City 2 and Hewa City neighborhoods exhibit a substantial percentage of green space, exceeding 30% of the total area in these urban units. In contrast, the Ashti City 2 neighborhood registers a comparatively lower proportion, with green spaces accounting for approximately 30% of its total area.

Furthermore, the quality of green spaces varies significantly among these cities. Italian City 2 and Ashti City 2 neighborhoods are characterized by well-maintained green spaces featuring diverse trees, flowers, shrubs, and grass. Additionally, these areas are designed in an aesthetically pleasing manner. Conversely, the quality of green spaces in Hewa City is perceived to be subpar, characterized by a lack of variety in vegetation and an unappealing design.

Regarding amenities and infrastructure within green spaces, Hewa City distinguishes itself by providing a conducive environment for walking and cycling, marked by easily accessible paths and a tranquil ambiance with minimal noise pollution. In contrast, Italian City 2 and Ashti City 2 also offer favorable conditions for walking and cycling within their green spaces, with easy access and a serene atmosphere with reduced noise levels.

Maintenance practices within green spaces exhibit notable disparities. Italian City 2 and Hewa City are marked by satisfactory maintenance levels concerning vegetation and equipment within the green spaces. However, Ashti City 2 lags in this regard, experiencing deficiencies in the upkeep of vegetation and equipment.

Across all the cities under investigation, there is a shared sentiment of satisfaction concerning the provision of resting chairs and fitness equipment. However, there is a collective concern regarding the spatial arrangement of the urban setting and the perceived lack of green space in these locales, namely Italian City 2, Hewa City, and Ashti City 2.

In summary, this study discerns substantial variations in the extent and quality of green space among the cities, signifying the importance of urban planning and management practices in shaping the urban environment. These findings emphasize the need for tailored strategies to enhance the accessibility, maintenance, and overall quality of green spaces within these urban areas to promote the well-being and satisfaction of their residents.

The findings of this study elucidate a conspicuous inclination towards frequent visits to green spaces within all examined neighborhood units, specifically Italian City 2, Hewa City, and Ashti City 2 neighborhoods. These visits are primarily undertaken by individuals, with a noteworthy representation of children among the visitors. Notably, the preferred time for green space visits tends to be during the evening, with

morning visits less prevalent. Moreover, the typical time spent within these green spaces consistently falls below the three-hour threshold across all three neighborhood units.

**Table 4.** Evaluation of results of three districts or samples according to the usability of green space (Prepared by the authors).

Category	Variables	Possible value	Italian City 2	Hewa city	Ashti City 2
Usability	Frequency of green space visit	Daily	2	1	2
		Once in a week	1	1	2
		Twice in a week	1	1	1
		Monthly	1	1	1
	Age	Children	2	3	3
		Adult	3	3	3
		Elderly	1	2	3
	Preferred time to visit	Older	3	2	2
		Morning	3	3	3
		Afternoon	1	1	1
		Evening	3	2	3
	Length of time spent	Night	1	1	1
		1-2 h	1	2	1
		2-3 h	3	3	3
		3-4 h	3	3	2
	Visit alone or with group	>4 h	3	3	3
Individually		2	3	3	
With family		1	1	1	
	With friends	2	2	1	
			1	2	3
			Good, more than 30%	Satisfactory, medium	Bad, less than 30%

Family visits to green spaces exhibit a favorable trend, with a notable proportion of visitors accompanying their families. However, the data suggest that the designation of these spaces as 'social parks' or 'family parks' may not be the primary driver for visits by a segment of the population.

The final results, as depicted in two tables assessing physical characteristics and usability, illustrate a positive and corresponding relationship between the two variables. In other words, an increase in the

quality of physical characteristics within these green spaces is positively associated with enhanced usability by the visiting public. This signifies that the improvement or maintenance of favorable physical attributes contributes to the community's increased utilization of green spaces, aligning with urban green space planning and design principles.

## 5. Conclusion and Recommendation

Urban green spaces encompass a diverse array of characteristics that exert significant influence on human well-being and mental health. These characteristics include availability, design, environmental conditions, maintenance, and the provision of facilities, all of which contribute to the usability of urban green spaces. Analyzing these factors reveals that Italian City 2 has high green space usability. This conclusion is drawn from the fact that three of the four physical characteristics assessed were available in this city. Specifically, four factors, namely the availability of green space cover, accessibility, environment quality, and size and design of green spaces, were present at rates exceeding 90%.

Additionally, the viability percentage for factors related to the availability of green space size and design was at a commendable 75%. However, other factors exhibited a presence percentage of 50%. Furthermore, the study indicates that most of these factors positively and significantly impacted the usability of green spaces in Italian City 2. These findings underscore the interdependence between physical characteristics and the usability of urban green spaces, highlighting the pivotal role of these attributes in shaping residents' interactions with and perceptions of such spaces.

The results indicate that designing urban green spaces is a critical task, requiring that practitioners involved in this process are equipped with accurate evidence of the impact of different variables of physical features on usability of these spaces. Since this paper only analyzed the influence of physical characteristics and usability interaction on designers' creativity because it has positive results on the health and well-being of people, future studies might consider examining other factors, such as environmental sustainability, psychological impact, and community engagement. In addition, interdisciplinary approaches involving urban planning, psychology, and public health could provide a more holistic understanding of how green space design impacts human well-being.

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