Hindawi
Security and Communication Networks
Volume 2023, Article ID 9891626, 1 page
https://doi.org/10.1155/2023/9891626

Retraction

Retracted: A Study on Urban Spatial System Planning of Qingdao City Park Based on Intelligent Monitoring Sensors

Security and Communication Networks

Received 26 December 2023; Accepted 26 December 2023; Published 29 December 2023

This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] J. Luo, X. Wang, Y. Zhao et al., "A Study on Urban Spatial System Planning of Qingdao City Park Based on Intelligent Monitoring Sensors," *Security and Communication Networks*, vol. 2022, Article ID 8932773, 13 pages, 2022.

Hindawi
Security and Communication Networks
Volume 2022, Article ID 8932773, 13 pages
https://doi.org/10.1155/2022/8932773

Research Article

A Study on Urban Spatial System Planning of Qingdao City Park Based on Intelligent Monitoring Sensors

Jie Luo,[1] Xiao Wang,[2] Yang Zhao,[1] Ling Meng,[1] Yuemei Gou,[1] Yingdong Yuan,[3] Jie Sun,[4] and Na Qin[5]

[1]*Qingdao School of Landscape and Forestry Technology, Qingdao, Shandong 26600, China*
[2]*Qingdao Laoying Haina Opto-Electronic Environmental Protection Group Co., Ltd, Qingdao, Shandong 26600, China*
[3]*Qingdao Municipal Engineering Design & Research Institute, Qingdao, Shandong 26600, China*
[4]*Quality and Safety Supervision Station of Qingdao Landscaping Project, Qingdao, Shandong 26600, China*
[5]*Qingdao Lanscape Architecture Design Planning Co., Ltd, Qingdao, Shandong 26600, China*

Correspondence should be addressed to Jie Sun; sj18669726677@126.com and Na Qin; qinna19771977@163.com

Received 16 June 2022; Revised 18 July 2022; Accepted 29 July 2022; Published 21 September 2022

Academic Editor: Tao Cui

Since the release of the 13th Five-Year Plan, the construction plan of the smart city and Internet of Things (IoT) has once again pushed the sensors into the limelight. In the current situation, whether in China or around the world, the construction of smart communities has become an irreversible trend. In this environment, the sensor as a smart city "bridge" will certainly usher in an industrial explosion. "Smart city" is a new concept and model for urban development. Academics have also explored the concept and theoretical model of smart cities from different perspectives in different forms. With the gradual establishment of the national smart city system, the Internet of Things and other technologies are being widely used to serve other aspects of human social life, such as urban smart communities, intelligent transportation, and intelligent home security systems. The application of technology is gradually penetrating into the life of our human society. In the context of building a smart city, scholars have also brought an unprecedented broader idea. By seeking a reasonable balance between human and urban nature, the concept of "park city," which aims to create a good ecological habitat where people and nature can coexist and develop in harmony, has emerged as China's urbanization process accelerates and the conflict between people and land becomes more and more prominent. As an important factor to promote the harmonious development of humans and nature, the planning and construction of urban parks is an important means to meet the needs of people for a better life and to improve the ecological environment of cities; therefore, the planning and design of urban parks under the concept of "park city" is getting more and more attention. Qingdao, as a typical coastal city, has a mosaic of green areas and urban construction land, so urban ecological parks with the carrier of nonconstruction land exist in large numbers in the city and become a key link in the practice of the "park city" concept. However, while urban ecological parks provide ecological and social services to citizens, their special land use has also led to a series of problems. At present, there is not enough basis for the planning and management of such special parks in Qingdao, and it is not possible to guide the planning and construction of such parks with universal standards, so how to effectively protect and reasonably utilize them to promote the construction of "park city" is an urgent problem to be solved. Based on the above background, this study takes Qingdao urban ecological park as the research object and summarizes the typical problems in the process of planning, construction, and use of this kind of park through relevant data research and extensive studies. Based on this, we propose three aspects, namely, the location and layout of parks at a macro level, the construction of the park system at meso-level, and the design optimization of parks at a micro level. The specific research content includes the following aspects: the first part defines the background, purpose, and significance of the topic and the research object and summarizes and reviews the existing research results at home and abroad, and then proposes the overall idea and framework of the research. The second part analyzes the problems of Qingdao urban ecological parks with the concept of "park city." Based on the connotation and characteristics of the "park city" concept, the impact of the concept on urban parks is analyzed, and the significance of the "park city" concept on the planning and construction of urban ecological parks is clarified based on the special characteristics of urban ecological parks. Finally, we provide the basis for the proposed strategy by combining case studies at different levels. Finally, we propose a better spatial planning for the construction of a park city in Qingdao using smart detection sensors and other means of building a smart city.

1. Introduction

The rapid development of the Internet of Things, cloud computing, mobile Internet, and other technologies is constantly promoting the degree of informationization of urban construction at home and abroad; from the initial "digital city" to the "smart earth" proposed by IBM in 2008, "smart city" has attracted wide attention from all walks of life, and the construction of smart city has become a trend and research hotspot of urban development at home and abroad [1]. China's smart city construction is ahead of the international, domestic scholars began to learn from foreign smart city construction as early as 2005 and the absorption of development experience, with Premier Wen Jiabao's visit to Wuxi in 2009. All major cities in China have launched their smart city development strategies one after another. At present, there are 193 pilot smart cities in China. For the construction of new urbanization and smart city development, the State Council also clearly proposed to actively accelerate the development of China's urban digital integration and management of integrated information technology; to enhance the level of capacity and comprehensive services for the national urban development of information technology integrated services management, intelligent digital urbanization will become the future of China's smart city development of another important basic strategic state policy that will not only be the construction of green, low-carbon, and harmonious social life. Intelligent digital urbanization will become another important strategic national policy in the future development of China's smart cities not only as an inevitable choice to build a green, low-carbon, and harmonious social lifestyle, but also as a major engine to promote the future integration of urban science and technology innovation and social and economic development in China [2].

In the rapid development of urbanization in China, the development of the city is also facing huge challenges. The successful establishment of the smart city system application and innovative development model to help China's smart cities break through the bottleneck and bottleneck to alleviate the problems of urban development to promote the effective transformation of the urban model application and urban innovation development model proposed scientific and effective and feasible system solutions. The gradual establishment and rapid development of smart cities have also presented and given some effective and feasible specific solutions for how to deal with the various development challenges that we are currently facing in China's smart cities [3]. In terms of social development and public services, smart cities can collect and analyze huge urban population information through the use of emerging information technologies such as the Internet of Things and cloud computing to achieve effective management of the urban mobile population, through the establishment of corresponding information platforms to achieve the sharing of various information such as labor force education and skills, helping cities to grasp the supply and demand situation of talents, better implement urban talent strategy. By establishing a convenient and transparent public service platform for citizens, we can promote the sharing of public service information and resources and achieve a balance between supply and demand of public services. In terms of economic transformation and development, the investment and information technology application of smart cities can promote the development of strategic emerging industries including the Internet of Things, cloud computing, and the next-generation Internet, as well as the transformation and upgrading of traditional industries. By building the interconnection of various types of information and enhancing the government's public service capacity for enterprises, it provides a more favorable external environment for urban innovation and entrepreneurship. In terms of environment and ecology, smart cities can evaluate and optimize the use of natural resources, protect, and improve the regenerative capacity of natural resources; find and control pollution flexibly and effectively through advanced monitoring means, and take effective remedial measures in a timely manner. In addition, the application of advanced information technology tools will greatly enhance the government's urban management capabilities; the government can use intelligent technology to predict the future demand and supply of infrastructure, so as to enable reasonable planning of infrastructure construction and improve the utilization rate and operational efficiency of infrastructure, but also through intelligent infrastructure it can easily collect data to establish early warning mechanisms, rapid impact on public crises, and strengthen public safety and emergency management. It can be seen that the promotion of smart city construction brings new opportunities for China's cities to break through development bottlenecks, solve the problems encountered in urban development, and promote urban transformation and innovative development. The relevant departments of our country and local governments attach more importance to the construction of smart cities, and the promotion and strengthening of smart city construction have important practical significance for the development of our cities.

In recent years, the construction of smart cities has received the attention and support of the national and local government departments. At present, there is a wave of smart city construction in China, and more than 250 cities in China have proposed to build smart cities [4]. In order to better promote the construction of smart cities in China, since January 2013, the Ministry of Housing and Urban-Rural Development has announced 290 pilot smart cities in three batches. In order to strengthen the guidance of smart city construction practice around China and promote the coordination of smart city construction work, in July 2013, eight ministries and commissions, including the National Development and Reform Commission, the Ministry of Industry and Information Technology, the Ministry of Science and Technology, the Ministry of Public Security, the Ministry of Finance, the Ministry of Land and Resources, the Ministry of Housing and Urban-Rural Development, and the Ministry of Transportation, jointly researched and

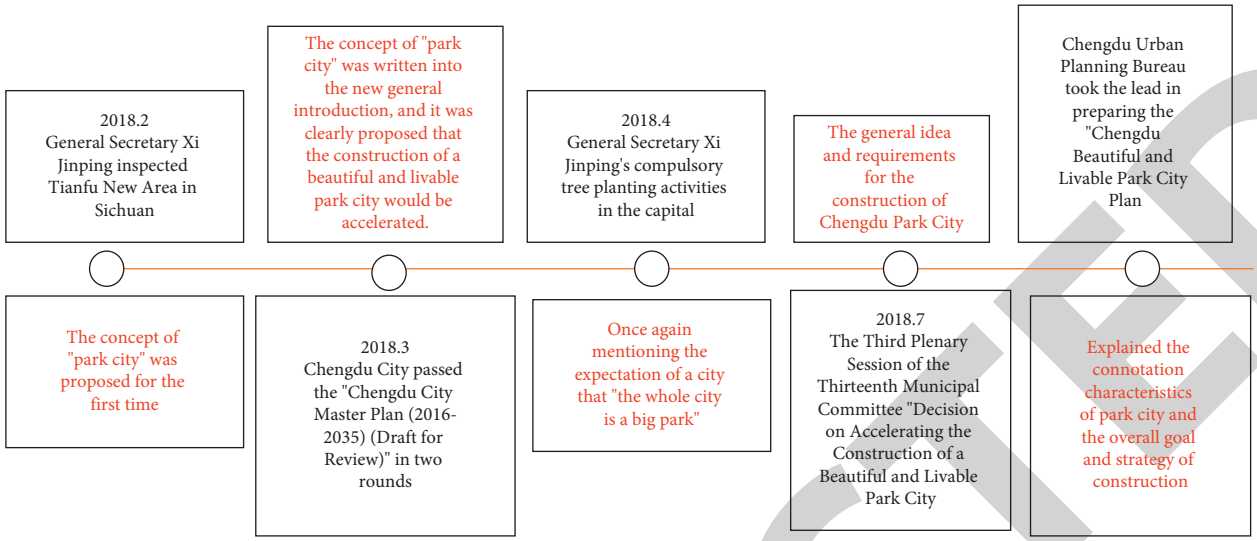

Figure 1: "Park City" proposed.

drafted the "Guidance on Promoting the Healthy Development of Smart Cities," which was approved by the State Council. At the same time, local governments also pay more attention to the construction of smart cities and write the construction of smart cities into the government work report or into the local "12th Five-Year Plan" [5].

In February 2018, General Secretary Xi Jinping put forward the concept of "park city" for the first time during his research in Chengdu Tianfu New Area, and emphasized that the construction should "highlight the characteristics of park city, consider the ecological value, and create a new growth pole" as a new concept of urban construction and development, which is in line with the development requirements of the times and fully reflects the ecological civilization and "people-centered" ideology. As a new concept of urban construction and development, it meets the requirements of the times, fully reflects the high degree of unity between ecological civilization and "people-centered" thinking, and pays attention to the protection of the ecological environment and urban and rural characteristics. Related practical exploration is gradually being carried out throughout the country. Since 2018, Sichuan Province has taken the lead in the construction of park cities, and relevant departments have issued documents such as "Guidance on the construction of park cities to promote high-quality urban development". Chengdu, as the first place where "park city" is proposed, has promulgated the "Chengdu City Beautiful and Livable Park City Plan (2018–2035)" and "Chengdu City Beautiful and Livable Park City Construction Regulations (Draft)," and carried out academic seminars such as the Park City Forum to accelerate the pace of construction and development of the whole area [6]. Subsequently, many cities, including Yang and Nam, carried out relevant planning studies one after another. However, because the construction standards and practices of park cities are still in the initial stage, the real meaning of park cities has not yet been built. Therefore, actively exploring the effective path of integrating the park city concept with urban planning and improving the corresponding technical methods are still the keys to promote the scientific construction of park cities as shown in Figure 1.

2. Review of the Domestic and Foreign Literature

The review of the existing research starts from two aspects: firstly, the summary of smart cities, and secondly, the summary of the existing research on the concept of "park city," which is the perspective of this research.

2.1. Discussion of the Concept of Smart City in Domestic and International Research. As a typical representative of the smart city program proposed by IBM, many scholars pay more attention to the technical connotation of the smart city. IBM, the first company to propose a smart city construction program, states that a smart city is a city that uses information technology to transform its core systems and optimize the use of limited resources. That is, by creating a connected, interoperable, and intelligent urban system, policy makers and citizens can gain insight into urban activities and their new trends from large amounts of data to make more informed decisions [7]. Similarly, Colin Harrison and Ian Abbott Donnelly (2011) argue that a smart city is a city that makes full use of urban information systems to plan, design, invest, build, manage, and operate urban infrastructure and services. Similarly, many scholars in China also pay more attention to the technical connotation of smart cities. For example, Wang Jiayao et al. (2011) believe that a smart city is to make the city smarter; it is through the Internet to connect the ubiquitous intelligent sensors implanted in the city to form the Internet of Things, to achieve a comprehensive perception of the physical city, and then use cloud computing technology for intelligent processing and analysis of the

perceived information, to achieve the integration of the online "digital city" and the Internet of Things, and issue instructions for government, people's livelihood, environment, public safety, public services, and the then, cloud computing technology can be used to intelligently process and analyze the sensory information to achieve the integration of online "digital city" and IoT, and issue commands to make intelligent responses and intelligent decision support for various demands including government, people's livelihood, environment, public safety, public services, and business activities [8]. According to Lee, a smart city is an intelligent city management and operation that is visualized and measurable on the basis of comprehensive digitalization of the city, which is more concisely stated as "smart city = digital city + Internet of Things". Many scholars believe that information technology is only the foundation of a smart city, and only when information technology is well integrated and integrated with the main development areas of the city, such as economy, society, and ecology, can such a city become a smart city [9]. According to Georgios et al., smart cities are all urban solutions that pursue multiple economic and social goals such as prosperity, efficiency, and competitiveness through purposeful and strategic investments in emerging information and communication technologies [10]. After analyzing many cases of self-labeled smart cities in North America, Europe, and Southeast Asia, Holland (2008) found that the main factors involved in these smart cities are information technology and networks, education and learning, entrepreneurial and innovative environments, and economic development, public services and governance paradigm shift, social capital and social integration, environment and sustainable development, and he pointed out that the development of smart cities should start from focusing on the reality of people in the city (such as needs, knowledge, skills) and the corresponding status of human capital, based on which a balance should be struck between the application of information technology in business, government, community, and other areas and the general citizens of the city, as well as between economic development and sustainable development [11]. The concept of a smart city has been extensively analyzed by scholars at home and abroad from different perspectives, but the specific kind of city is a smart city. There are several distinct categories of views, and the views of different scholars in different categories are not the same. The definition of the concept of a smart city is the starting point of smart city research; at the same time, different definitions of the concept of a smart city have an important role in guiding the practice of smart city construction, such as the definition of the technical level is likely to make the construction of smart city into the misunderstanding of technology-only theory. Nevertheless, different scholars' definitions of the concept of a smart city reflect the theoretical definition of the new thing called smart city based on different perspectives, and the relevant views lay the foundation for an in-depth analysis of the new thing called a smart city in this paper.

Secondly, in February 2018, General Secretary Xi Jinping pointed out during his inspection of Tianfu New Area in Sichuan that "Tianfu New Area is an important node in the construction of "One Belt and One Road" and the development of Yangtze River Economic Belt, and must be well planned and constructed, especially to highlight the characteristics of park cities, take ecological values into account, strive to build a new growth pole, and build an inland open economic highland. On April 2 of the same year, General Secretary Xi Jinping once again emphasized that the greening of the motherland should adhere to the people-centered development ideology when he attended the compulsory tree-planting activities in the capital. In recent years, before and after the park city concept was proposed, many cities such as Guiyang, Yangzhou, Chengdu, and Qingdao have also promoted urban planning and construction around the park city concept [12]. Wang and other cities have promoted the planning and construction of park cities through the enactment of park system planning and park regulations before the park city concept was proposed. In April 2016, Guiyang proposed to build an urban park system with a "balanced layout, reasonable structure, perfect function, beautiful environment, close to life, and service to the public" and promoted the action plan for the construction of the "City of a Thousand Gardens" according to the basic principle of "municipal coordination, district and county-oriented." In September 2017, Yangzhou proposed to promote the construction of park cities and improve the level of park management, and adopted the "Yangzhou City Park Regulations" at the fourth meeting of the Standing Committee of the Eighth National People's Congress, which has a profound impact on its urban development and livelihood construction. In Chengdu and other cities, after the park city concept was proposed, the three plenary sessions of the 13th Municipal Committee made a decision to accelerate the construction of beautiful and livable park cities and started the planning and construction of park cities.

The "park city" concept is a new goal and a new stage of urban development and a new process of China's habitat development, which is adapted to the new era of China's urban ecology and habitat development situation and demand, and to ensure the sustainable development of urban construction. Since its introduction in February 2018, "park city" has aroused widespread attention and discussion, and different scholars have carried out research in terms of historical combing, connotation characteristics, guiding ideology, principles, and planning and construction practices. By sorting out the historical evolution of "park-city" in relation to the development of habitat civilization, it was clarified that park city is an inevitable stage of historical development in the current new era. Michele et al. proposed five typical characteristics of the "park city" concept: "people-oriented, ecological foundation, urban-rural coexistence, beauty-led, and multiple coexistence" and the corresponding practical paths [13]. Michele et al. analyzed the development concept and connotation characteristics of the park city by reviewing the classical ideas of park-making in ancient and modern times in China, proposed the

development strategy of "three major, three plastic and three senses" and used the planning method of "four new and one soul" to build a hierarchical construction system of the urban park from four levels: ecological base, spatial construction, infrastructure, and human living environment [14]. Richard et al. explored the positioning of the "park city" concept in terms of spatial integrity, park system, and stage development through a review of its origin and historical development process, and proposed that the park city should meet people's aspirations for a better and happier life under the guidance of people and national demand and resource integration and that the park should lead the development of the city and the "three lives". On the basis of this, the characteristics of the park city are proposed to meet people's aspirations for a better and happier life, park-led urban development, and the integrated development of "three lives" under the guidance of people and national needs and resource integration [15]. Wang et al. explored the landscape gardening practice strategy under the goal of building a beautiful and livable park city in Chengdu and proposed corresponding practice strategies in five aspects: urban ecological pattern, urban morphological pattern, the whole area park system, beautiful and livable environment and livable life [16]. Through understanding the connotation of "park city", Valente et al. proposed the guiding ideology and basic principles of park city construction and "constructing ecological network system, expanding and improving green space system, establishing and improving park system, constructing urban green shade network, carrying out "urban double repair", promote cultural inheritance, enhance the comprehensive functions of parks, and innovate park management mode" [17]. Maru and Worku discussed the theoretical value and significance of the "park city" in contemporary China through the analysis of the history of urban civilization and several cases of urban areas [18]. Miroslava and Katarína summarized the history and scientific experience of the development of habitat environment and analyzed the origin of the park city concept from it. At the same time, he explored the concept of life, space time, analysis, and synthesis of the park city with the help of the epistemology of habitat environment, and on this basis, he discussed the goal and value system of building a park city and proposed the realization path of the trinity of "people, city, environment and industry" and the development model of ECD park city center [19]. On the basis of the value and significance of park city construction, Wu and Guo analyzed the purpose and connotation of the development concept of "unity and coordination of environment and people's livelihood, high integration of landscape and ecology, harmonious coexistence of city and nature, and integration of internationalization and regionalization" and proposed the construction contents and paths of "optimizing urban space, protecting ecological resources, improving human living environment and guiding green life" [20]. The study also proposed the construction contents and paths of "optimizing urban space, protecting ecological resources, improving living environment and guiding green life" [20].

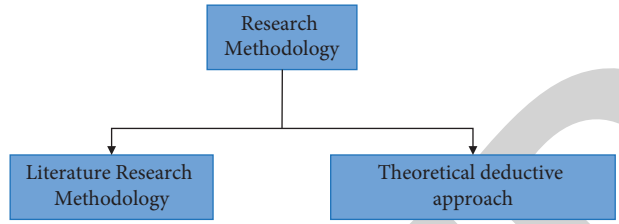

Figure 2: Research methodology.

3. Research Content and Methodology

3.1. Research Content. In this study, we firstly propose the important research question of "what is a park city" and analyze the significance of this question from the current situation of the emergence and construction of park cities. Secondly, the study will absorb the experience of other regions in building park cities. Finally, the study will combine the intelligent detection sensors with the construction of Qingdao park city and summarize the theoretical research of this study.

3.2. Research Methods

3.2.1. Literature Research. In order to explore the theoretical connotation of the park city system systematically and deeply, this study has extensively reviewed and analyzed the literature and data of park city research at home and abroad, and has comprehensively summarized and concluded the connotation of the concept of park city in related research at home and abroad, which has laid the foundation for analyzing the connotation of park city and park city system in this study.

3.2.2. Theoretical Deduction Method. This study combines the definition of a system, the metaphorical view of system, the hierarchy and emergence of system, the communication and control of the system and other related theories in the theory of system, as well as the elements and characteristics of the urban system in the theory of urban system, and carries out a standardized theoretical analysis of the concept, elements, and structure of smart city system, and constructs a model of the smart city system, forming some basic ideas about smart city system in this study. Some basic ideas about the smart city system are shown in Figure 2.

4. Results and Discussion

4.1. Results. This study uses the Natural Breaks classification method to classify the area scale of urban ecological parks. The Natural Breaks classification method is based on the natural grouping inherent in the data to identify the classification interval, so as to group the similar values most appropriately and maximize the differences between the categories. Natural Breaks is a statistical classification method based on the natural characteristics and laws of data

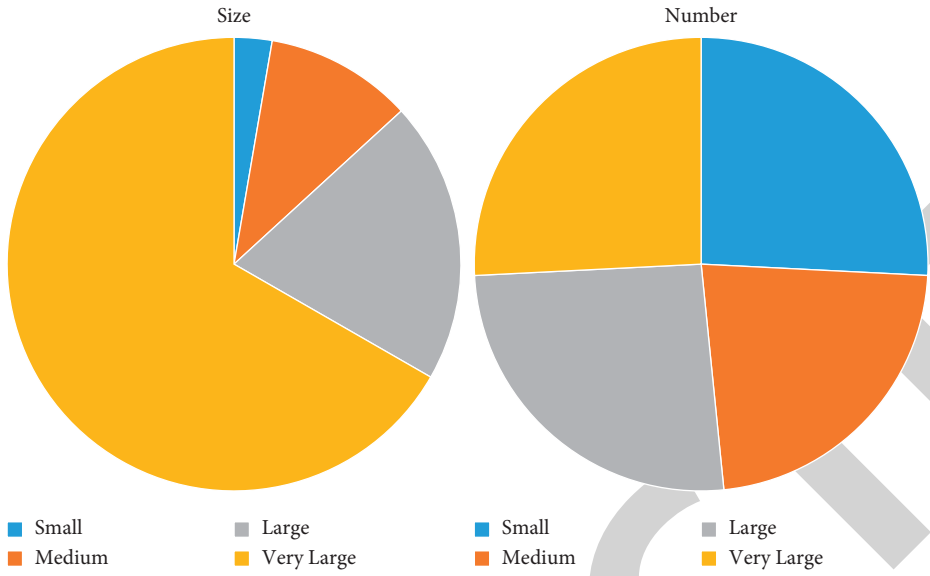

Figure 3: Analysis of the area and number of urban ecological parks.

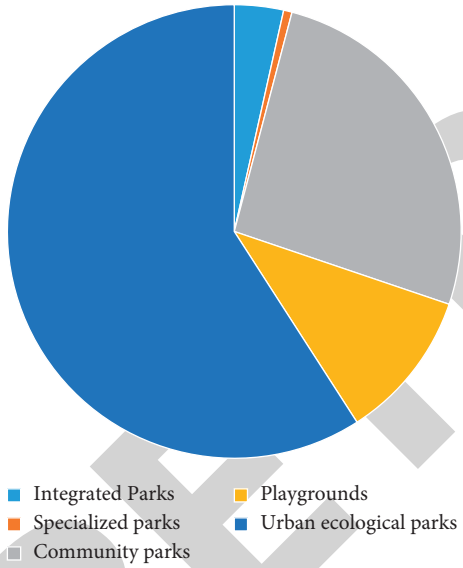

Figure 4: Per capita park green space statistics for various types of parks.

distribution, which is more scientific and reasonable than the subjective classification method, so this study adopts this classification method and uses the analysis results in ArcGIS software to classify the area scale of urban ecological parks into four categories: small 1–10 hm^2, medium 10–35 hm^2, large 35–60 hm^2, and small 1–10 hm^2; 35 hm^2, large 35–60 hm^2, and extra-large 60–255 hm^2. Among them, there were 7 medium-sized urban ecological parks with a total area of 178.37 hm^2, 8 small-sized, large-sized, and mega-sized, with a total area of 45.6 hm^2, 339.87 hm^2, and 1131.61 hm^2 respectively and, thus, it can be seen that the number of various types of urban ecological parks is relatively even, but the area percentage varies greatly, and mega-sized urban ecological parks with an area of more than 60 hm^2 account for the most, 66.7%, while small-sized ones account for the least, only 2.7% as shown in Figure 3. The largest urban ecological park with an area of more than 60 hm^2 is 66.7%, while the smallest one is 2.7% as shown in Figure 3.

It is planned that by 2022, the green area of the Northern New Area will reach 5330.62 hm^2, the green area rate will be 46.29%, the green coverage rate will be 51.29%, and the per capita park green area will be 20.58 m^2/person. Among them, the area of park green space is 672.97 hm^2, the area of EG regional green space is 2228.26 hm^2, and 973.03 hm^2 of regional green space is included in the park green space index for statistics. The green space included in the calculation of park green space per capita in the regional green space accounts for 59.1% of the overall green space, accounting for the largest proportion and the largest area. Among the park green areas, the proportion of comprehensive parks is about 3.5%, the proportion of special parks is about 0.6%, the proportion of community parks is about 26.1%, and the proportion of pleasure gardens is about 10.7% as shown in Figure 4.

Ecological parks have better natural resources and are more attractive than ordinary urban parks in meeting people's desire for nature and, therefore, have a wide range of users. Based on the analysis of field research results, the following statistics are provided on the age and group composition of urban ecological park users.

4.1.1. Age Composition. The age of the survey respondents was divided into four stages: under 18, 18–40, 41–60, and over 60 years old. The survey results show that the age distribution of park users is relatively wide, with minors accounting for 5.3% of the total number of users, young people aged 18–40 accounting for 17.1%, middle-aged people aged 40–60 accounting for 50.7%, and elderly people aged 60 or older accounting for 26.9% as shown in Figure 5.

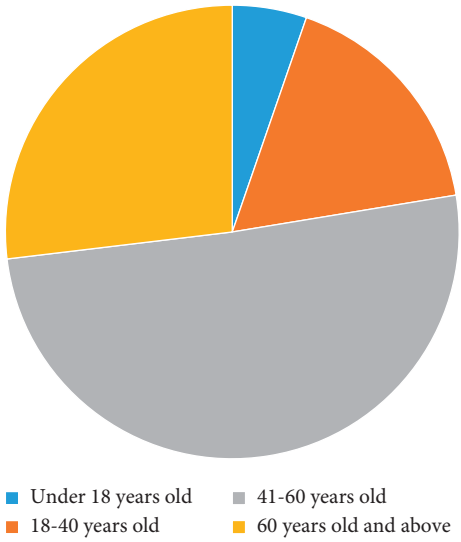

Figure 5: Analysis of age composition of users.

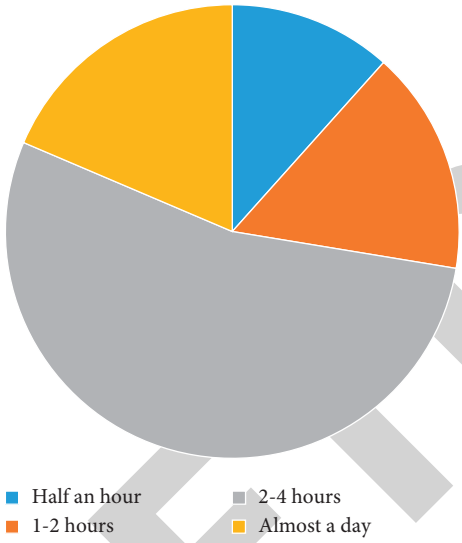

Figure 6: Length of stay of users.

4.1.2. Length of Stay. The length of stay in the park was divided into 4 levels: about half an hour, 1–2 hours, 2–4 hours, and almost a day, as shown in Figure 6.

4.1.3. Use Function. The analysis of the use function of urban ecological parks can provide a quick and effective understanding of the characteristics of the arrangement of park functions and activities. Therefore, this study conducted a statistical analysis of the functional layout of Chongqing's urban ecological parks based on field research and data studies. From the analysis results, the functional layout of urban ecological parks in Chongqing is divided into seven types, which are ornamental tours, leisure activities, quiet rest, children's games, elderly activities, sports and fitness, and science demonstration, among which leisure activities and quiet rest account for the most of all parks, followed by an ornamental tour and sports and fitness, and children's games, elderly activities, and sports and fitness are set in some parks as shown in Figure 7.

Under the guidance of the "park city" concept, the city will become a green ecological system, and urban parks, as an important part of the system, play a leading role in the planning and construction of the "park city" concept. In Qingdao's urban planning, a large number of urban ecological parks, unique land conditions, and rich landscape resources make it an important grip for the construction of a good living environment and an important support system for the construction of a "park city". The planning and design of urban ecological parks under the concept of "park city" needs to play the basic role of environmental and ecological protection, the main role of green functional space, the leading role of park features, and the need to meet people's demand for suitable human living activities as shown in Figures 8 and 9. Therefore, based on the current problems of urban ecological parks, the concept of "park city" is used to solve many problems of urban ecological parks from macroscopic site selection and layout to microscopic use level.

4.2. Discussion. At the macro level, the site selection and layout of urban ecological parks should protect the continuity and integrity of the original natural landscape and green space of the city, take the planning of urban ecological parks combined with the green space system as a prerequisite element of urban planning, give full play to the land reservation capacity of parks, and prevent the destructive construction of interrupted mountains and water in the process of urban development. At the same time, on the basis of protecting and restoring the natural texture, the city and the park should be integrated and nested to form an urban pattern that reveals the mountains and water, and the blue and green, so as to facilitate the maintenance of the ecological environment inside the city and the introduction of natural patches at the edge of the city, and thus improve and strengthen the green ecological space system in the city. At the meso-level, since urban ecological parks are characterized by a large number, large scale, and rich landscape resources, it is necessary to fully consider the scale level and type characteristics and clarify the scale level and type positioning of urban ecological parks, so that urban ecological parks can have more scale coordination and functional relevance under the influence of the "park city" concept. The scale and type of urban ecological parks should be clearly defined, so that they can be more coordinated in scale and function under the influence of the "park city" concept. At the same time, it is necessary to pay attention to connectivity and form a complete park system with other parks in the city. At the micro level, the existing problems of the urban ecological parks are combined with the traffic, space, functions, activities, and supporting facilities to propose corresponding design optimization strategies, in order to create a convenient, comfortable, green, energetic, and applicable urban ecological parks, to create a good feeling of park use, and to create a livable and green life for urban residents.

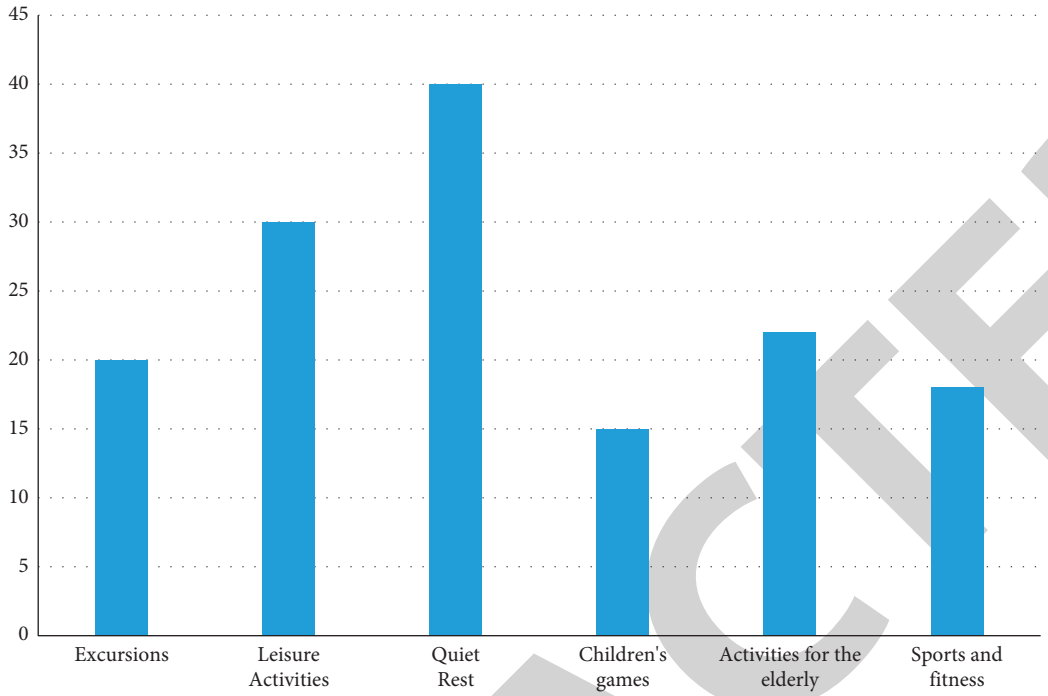

Figure 7: Park use function.

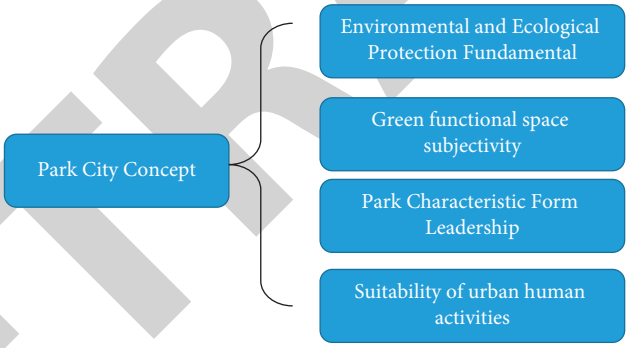

Figure 8: "Park City" concept.

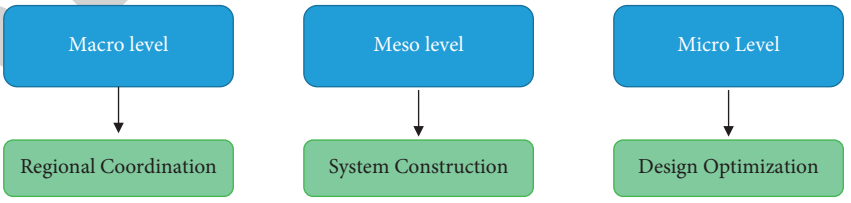

Figure 9: Different planning levels of "Park City."

At the meso-level, since urban ecological parks are characterized by a large number, large scale, and rich landscape resources, it is necessary to fully consider the scale level and type characteristics and clarify the scale level and type positioning of urban ecological parks so that they can be more coordinated in scale and relevant in function under the influence of the "park city" concept. The scale and type of urban ecological parks should be clearly defined, so that they can be more coordinated in scale and function under the influence of the "park city" concept. At the same time, it is necessary to pay attention to connectivity and form a complete park system with other parks in the city.

At the micro level, the existing problems of the urban ecological parks are combined with the traffic, space,

functions, activities, and supporting facilities to propose corresponding design optimization strategies, in order to create a convenient, comfortable, green, energetic, and applicable urban ecological parks, to create a good feeling of park use, and to create a livable and green life for urban residents.

4.2.1. The Urban Ecological Park Site Selection and Layout Optimization. First of all, we need to use scientific methods and technologies to determine the suitable green areas for urban ecological parks. In the specific operation, we can use index evaluation, demand research, and other methods to evaluate the ecological services and social services of green areas through mature evaluation and analysis methods such as ecological sensitivity analysis and ecological service trade-offs. In terms of ecological services, the three-dimensional green volume, biodiversity, impact on hydrological processes, and microclimate of green areas are evaluated; in terms of social services, the location conditions, accessibility, and demand for surrounding uses of green areas are evaluated. By integrating the results of ecological and social services assessment and grading the green areas, we can, on the one hand, more scientifically determine the green areas suitable for development as urban ecological parks and, on the other hand, more reasonably guide the direction of urban ecological park construction and development. As we can see from the previous analysis, the scale of urban ecological parks ranges from a few hectares to hundreds of hectares, and the construction of a multi-level balanced urban ecological park system is conducive to giving full play to the ecological benefits and equalizing the social services of parks in the construction of park cities. The ecological attributes of urban ecological parks are different from those of general urban parks in the construction of park cities, and related research shows that the ecological attributes of urban ecological parks are directly related to their area size when other conditions are the same. When the area of an urban ecological park reaches a segmented value, the increase in ecological benefits brought by the increase in area is extremely slow, but the increase in the service scope and attractiveness of the park requires more activity space to match it. Therefore, based on theoretical and practical experience and the morphological and functional characteristics of urban ecological parks, this study classifies urban ecological parks into four levels: regional, urban, community, and belt type.

According to the park city concept and the previous analysis, we can conclude that urban ecological parks not only have the functions of ordinary urban parks, but also their functional characteristics are focused on the protection of natural landscape resources, overall ecological maintenance, diversified activity development, and introduction of ecological technology. In the planning and design of urban ecological parks, we can classify urban ecological parks according to different landscape resource conditions, and regional characteristics and locate different leading functions on the basis of the overall functional complexity of urban ecological parks, which can help guide the construction of urban parks scientifically and realize the reasonable configuration of urban parks.

(1) Nature Conservation Type. Nature conservation type urban ecological park is an urban ecological park with a good natural ecological environment or important ecological significance, and its function is realized mainly by protecting and using the original resources. In order to avoid ecological damage caused by construction activities in the city, important natural resources, and ecological areas are protected through the planning and construction of the park, and on this basis, various activities such as scenery viewing, hiking, and trekking, which are suitable for the environment, are developed, balancing the relationship between protection and utilization, with the main orientation is to protect the environment and resources, to maintain the originality of the ecological environment, to ensure the ability of the park to maintain itself in the system as much as possible, to bring into play the functional characteristics of the park, and to ensure the green base of the park city construction.

(2) Development-Led Type. Development-led urban ecological parks are built on the basis of the urban skeleton of important mountains and primary and secondary river systems within the city and at the edges of the city, and their planning and construction are based on preserving and protecting the urban landscape pattern, protecting the urban landscape skeleton, maintaining its ecological function in the overall system, controlling the spread and encroachment of urban land, and linking with other urban green space to form an ecological The ecological park is formed with ecological conservation and resource protection as its core. This type of park planning and construction is based on the determination of the scope of protection and the development of activities with a low degree of interference, in order to promote the formation of a good environmental foundation of the city while guiding the rational development of the urban spatial structure.

(3) Environmental Restoration Type. Environmental restoration type urban ecological park is an urban ecological park whose original base is deserted but is in an important urban ecological process or the natural ecological environment has been damaged by pollution, and its function is realized mainly by restoring the damaged environment and ecosystem through ecological technology. In the planning and construction of this type of urban ecological park, ecological technology is mainly introduced to restore and repair the environment in the area with a purpose and direction to enhance the ecological nature of the park, and on this basis, the park's science education activities are developed through the introduction of relevant technology, experience and demonstration of the restoration process to realize the composite function of the park.

(4) Landscape Recreation Type. The landscape recreation type urban ecological park is established on the basis of some of the remaining green areas in the city or the periphery of the core ecological buffer zone which is closely connected

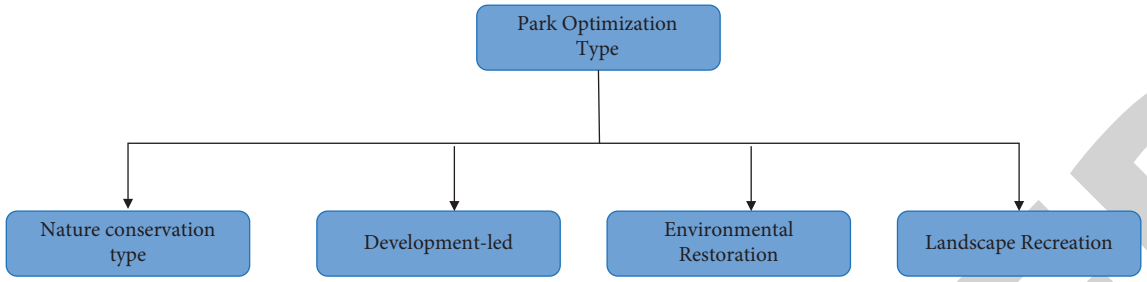

Figure 10: Optimization of urban ecological parks in terms of site selection and layout.

with the city, and after a certain degree of artificial transformation, the landscape of the park activity space is upgraded and improved to meet the diverse nature experience and outdoor interaction needs of urban residents. Landscape recreation type urban ecological park is the most developed and utilized type, and its functions are more comprehensive. In the planning and construction, it is necessary to pay attention to reasonable restrictions on the intensity, mode, and content of development and utilization, and to balance the contradiction between protection and utilization in a scientific and orderly manner as shown in Figure 10.

4.2.2. Urban Ecological Park Design Strategy Improvement. On the one hand, since most urban ecological parks are built on the basis of mountainous water systems in cities, there is a significant height difference between the park and the urban interface, so it is an important way to improve the accessibility of the park by enriching the multi-dimensional traffic structure and overcoming the height difference between inside and outside. On the other hand, the boundary space of urban ecological parks has the functions of behavior guidance, connection and transition, landscape display, etc. Therefore, strengthening the permeability between the boundary space of parks and urban space is also conducive to improving people's perception of parks and attracting them to parks.

(1) Traffic Management. On the one hand, we pay attention to the connection between the internal and external transportation systems of urban ecological parks. The park entrances and exits should be close to existing roads, highways, and bus stops to improve the convenience of entering the park; at the same time, additional hiking entrances should be set up near the urban greenways to interconnect the park with the urban slow walking system, improve the walkability of the park, and increase the service efficiency of the park. On the other hand, we pay attention to the optimization of the internal transportation system of the park. The height difference between the park interface and the urban interface will be fully considered, and a multi-dimensional traffic system will be formed through the horizontal and vertical traffic combing to realize the height difference into zero. In terms of horizontal traffic, the park road is designed parallel to the city road and the boundary space to guide people into the park in a hierarchical way, and at the same time to ensure a good connection between up and down traffic.

In vertical traffic, vertical traffic such as steps and ramps and barrier-free traffic facilities such as elevators and escalators are used to solve the problem of height difference, and full attention is paid to the design of railings, handrails, and resting platforms, and the platforms are extended and resting facilities such as seats are set in places where conditions are available. In order to meet the safety problems and practical needs of urban residents, we also provide a good leisure place for community residents.

(2) Border Penetration. On the one hand, to increase the permeability of the boundary space of urban ecological parks, soft and permeable walls are used instead of hard walls in places where boundaries are needed to blur the boundaries between the inside and outside of the parks, to enhance the visual openness of the parks, and to a certain extent, to dispel the psychological implication that the boundary space is inaccessible, so as to attract people to enter the parks more often. On the other hand, in places where there is a natural height difference, it is necessary to strengthen the guidance and identifiability of the border space, using the form of greening of the fortress and greening of the platform to form a good border landscape experience, while strengthening the continuity of the border space by means of continuous greening and signs to guide people into the park.

4.2.3. Rational Development of Landscape Resources to Enhance the Comfort of Visiting. On the one hand, the construction and functional arrangement of the park should be integrated with the original environment to protect the original natural habitat conditions; on the other hand, according to the differences of different landscape resources in terms of spatial form and sensory characteristics, the appropriate functional areas should be reasonably arranged to achieve the harmonization of the park functional areas and natural habitat. On the other hand, according to the differences in different landscape resources in terms of spatial forms and sensory characteristics, we can reasonably arrange suitable functional areas to achieve the harmonization of park functional areas and natural habitats.

(1) Rational Use of Space in Different Terrain Types. The complex and changing topography of the city constitutes the unique topographic space of the urban ecological park, and the differences in the characteristics of different topographic

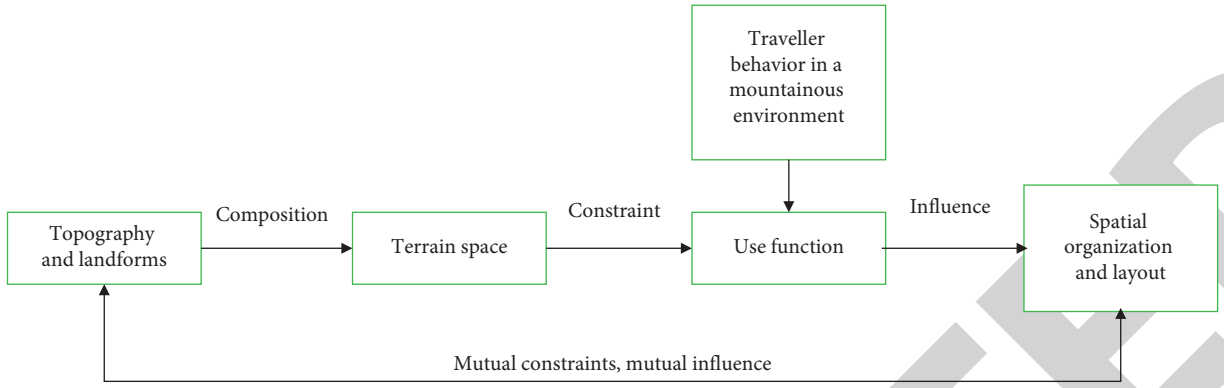

Figure 11: Relationship between topographic layout and spatial organization.

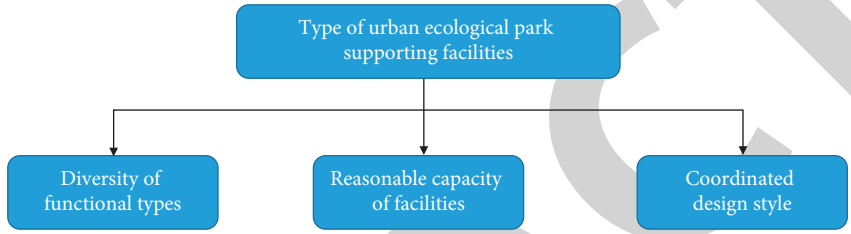

Figure 12: Types of urban ecological park facilities.

spaces restrict their different functions. At the same time, the behavior of visitors' recreational activities also affects the distribution of different functional spaces of the park under various topographic conditions. Therefore, different topographic conditions and the organization of various spaces in the park are mutually influenced and constrained by each other as shown in Figure 11.

Combined with the previous analysis, it can be seen that urban ecological parks can realize people's needs for close proximity to nature and ecological experience in the city. Therefore, in the planning and design of urban ecological parks, it is important to provide more types of activities and spaces that meet people's needs, so as to highlight the characteristics of urban ecological parks. The characteristics of urban ecological parks also strengthen the park's recreation service capacity.

4.2.4. Urban Ecological Parks and Their Supporting Facilities. The type, quantity, and design style of the supporting facilities of urban ecological parks are closely related to the leading functions of the parks, the behavioral activities of users, and the style characteristics of the parks, which are important carriers to support and improve the functions of the parks, and the configuration of the facilities also has a great impact on the protection and utilization of the park environment. On the one hand, a complete set of functional facilities is the guarantee for the realization and full utilization of the functions of urban ecological parks; on the other hand, a reasonable and scientific allocation and arrangement of facilities can effectively balance the contradiction between the protection and utilization of resources in urban ecological parks, effectively protect and maintain the park environment, and also promote the reasonable and effective utilization of resources in parks. The characteristics of the urban ecological park are shown in Figure 12.

(1) Various Types of Functions. The various types of supporting facilities in the urban ecological park are an important manifestation of its perfect functions, such as activity facilities and rest facilities, which can meet the different needs of visitors and improve the park's recreation and basic service capacity; sanitation facilities, which can effectively protect the environmental health of the park and implement effective protection while reasonably organizing and guiding the use of natural resources in the park; a perfect signage system can guide visitors to tour in an orderly and a perfect signage system can guide visitors to visit the park in an orderly and purposeful manner, and also present the environmental characteristics and resource features of the park clearly, which enhances the recognizability of each park recreation space. Therefore, in the specific design of urban ecological parks, we should try to diversify the functional types of supporting facilities and choose the corresponding supporting facilities in each recreation space by combining the site resource conditions and visitors' activity preferences, so as to realize the perfect function of the park and the effective use of recreation space.

(2) Reasonable Capacity of Facilities. Due to the special land type of urban ecological park, there is no land index for the supporting facilities in the park, so the arrangement of their quantity and volume is greatly restricted. Therefore, in the specific design, on the one hand, we should try to convert the single large volume supporting facilities into scattered small volume supporting facilities, and the fixed supporting

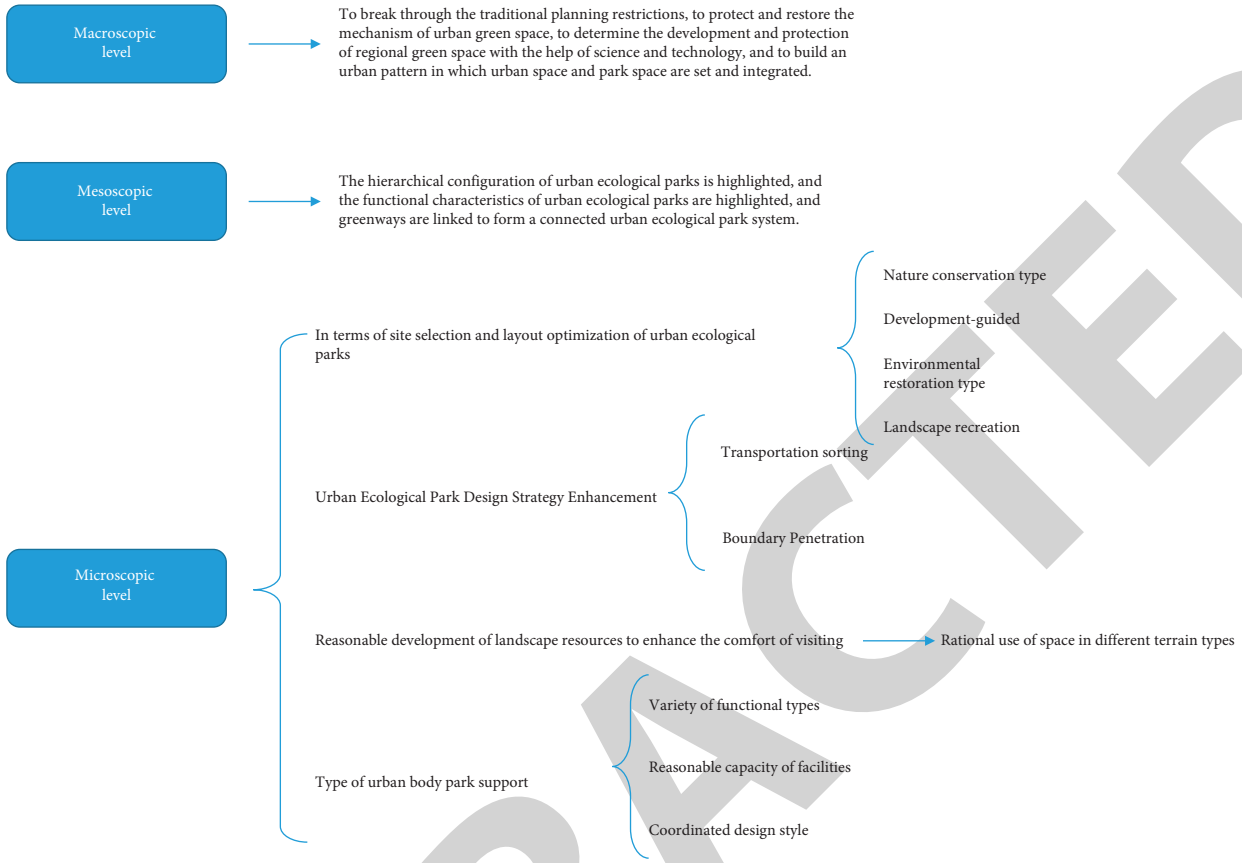

Figure 13: Different levels of "park city" construction.

facilities into movable temporary supporting facilities, and at the same time, link the infrastructure service facilities around the city to form a perfect infrastructure service facility system inside and outside, so as to guarantee the perfect park facilities and solve the dilemma of limited land for supporting facilities in the park at the same time. On the other hand, in the case of limited land for supporting facilities in urban ecological parks, the arrangement should follow the principles of resource conservation and centralized utilization, increasing the configuration of facilities in areas with frequent and intensive activities, and reasonably dividing the site into small spaces in areas with less visitor activities, and appropriately reducing the configuration of facilities. At the same time, temporary movable facilities are used to alleviate the instantaneous pressure of facility use in the park during the holiday season when there are a large number of people. By controlling the number and volume of facilities and arranging them in a reasonable manner, the efficiency of the utilization of the facilities can be improved.

(3) Coordinated Design Style. The natural and wild style of the urban ecological park is the characteristic that distinguishes it from other parks, so the design style of the supporting facilities should be coordinated with the style of the park. On the one hand, the arrangement of the facilities should be integrated with the atmosphere of the site space to reduce the interference with ecologically sensitive areas and avoid conflicts with the original natural environment of the park or damage to its ecological functions. On the other hand, the form and material of the facilities should be coordinated with the style of the site, and natural elements should be used as much as possible, such as native green materials, recyclable and biodegradable ecological materials, to ensure the functionality of the facilities while reflecting the green, ecological and wild park style as shown in Figure 13.

5. Conclusion

The rapid development and widespread application of new generation information and communication technologies have triggered changes in urban development patterns, and smart cities have become a new urban development concept that has come into view in recent years and has triggered a boom in the exploration and practice of smart cities around the world. This study takes Qingdao city as the research object and finds out the problems in the planning and construction of such parks through relevant data and extensive research. This study analyzes the planning and construction of ecological parks in Qingdao based on the theoretical guidance of the "park city" concept and case studies at different levels and proposes appropriate planning and design strategies for the construction of park city in Qingdao from a macroscopic site selection and layout, mesoscopic system construction and microscopic use.

Data Availability

The labeled dataset used to support the findings of this study is available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] M. Stanley and D. Vitalis, "The next Frontier: human settlements in the marine environment[J]," *Futures*, vol. 140, Article ID 102953, 2022.

[2] Y. Liu, Y. Gao, and L. Liu, "Nature-based solutions for urban expansion: integrating ecosystem services into the delineation of growth boundaries[J]," *Habitat International*, vol. 124, Article ID 102575, 2022.

[3] A. Brandner and C. Schunko, "Urban wild food foraging locations: understanding selection criteria to inform green space planning and management," *Urban Forestry and Urban Greening*, vol. 73, Article ID 127596, 2022.

[4] Y. B. Cai, Z. J. Wu, Y. H. Chen, L. Wu, and W. B. Pan, "Investigate the difference of Cooling effect between water Bodies and green spaces: the study of Fuzhou, China," *Water*, vol. 14, no. 9, p. 1471, 2022.

[5] M. Renato, F. J. Carlos, and A. Paula, "Green infrastructure planning principles: Identification of Priorities using Analytic hierarchy process[J]," *Sustainability*, vol. 14, no. 9, p. 5170, 2022.

[6] J.H. Yang and K. W. Nam, "Modelling the relationship of infrastructure and Externalities using urban scaling," *Sustainability*, vol. 14, no. 9, p. 5091, 2022.

[7] L. Zhang, Y. Liu, Y. Jing, and Y. Zhang, "How Does Quota-oriented land Use planning affect urban expansion? A spatial analysis of 280 Chinese cities[J]," *Land*, vol. 11, no. 4, p. 528, 2022.

[8] S. Lee, "The safety of public space: urban design guidelines for neighborhood park planning," *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, vol. 15, no. 2, pp. 222–240, 2022.

[9] T. Georgios, G. Anestis, and D. E. Theodora, "Spatial planning incompetence to discourage urban sprawl on Greek Islands. Evidence from Paros, Greece[J]," *Journal of Coastal Conservation*, vol. 26, no. 2, 2022.

[10] C. Zhou, X. He, and R. Wu, "Using food Delivery data to identify urban -rural areas: a case study of Guangzhou China [J]," *Frontiers of Earth Science*, 2022.

[11] D. Ravinder, K. Pradip, and B. I. Arun, "Integrated geospatial approach for environment-sensitive planning of coastal urban regions: a case study from the megacity of Mumbai, India[J]," *Ocean & Coastal Management*, vol. 220, Article ID 106092, 2022.

[12] Yu Wang, "Study on urban green space planning strategy considering ecological effect[J]," *Academic Journal of Humanities amp; Social Sciences*, vol. 5, 2022.

[13] G. Michele, V. Piergiorgio, and C. Andrea, "A Mobility-based Deployment strategy for edge data centers[J]," *Journal of Parallel and Distributed Computing*, vol. 164, pp. 133–141, 2022.

[14] L. R. Richard, I. Luis, and Z. Harald, "Does urban climate follow urban form? Analyzing intraurban LST trajectories versus urban form trends in 3 cities with different background climates," *The Science of the total environment*, vol. 830, Article ID 154570, 2022.

[15] W. Wang, Di Wang, and H. Chen, "Identifying urban ventilation corridors through quantitative analysis of ventilation potential and wind characteristics[J]," *Building and Environment*, vol. 214, Article ID 108943, 2022.

[16] D. Valente, M. V. Marinelli, E. M. Lovello, C. G. Giannuzzi, and I. Petrosillo, "Fostering the Resiliency of urban landscape through the sustainable spatial planning of green spaces," *Land*, vol. 11, no. 3, p. 367, 2022.

[17] M. Maru and H. Worku, "Unpacking principles of resilience mainstreamed in Ethiopia's local urban spatial planning documents: practices from Kombolcha, an urbanizing secondary city," *Heliyon*, vol. 8, no. 3, Article ID e09137, 2022.

[18] K. Miroslava and S. Katarína, "The impacts of climate change on urban structures in Slovak cities: Identifying vulnerable urban structures[J]," *Architecture Papers of the Faculty of Architecture and Design STU*, vol. 27, no. 1, pp. 33–39, 2022.

[19] Y. Wu and W. Guo, "Analysis of the relationship between urban planning and design and building design based on urban space[J]," *International Conference on Social Science, Education and Management*, vol. 45, pp. 1163–1173, 2022.

[20] K. Sujata, K. Mani Shibu, B. Guru, and B. Somnath, "Earthquake and flood resilience through spatial planning in the complex urban system[J]," *Progress in Disaster Science*, vol. 14, Article ID 100219, 2022.