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GIS-Based Study on the Suitability of Site Selection for Community Complexes in Old Residential Areas in Xi'an, China

Xixi Guo * and Xiaoping Cui

College of Architecture, Xi'an University of Architecture & Technology, Xi'an 710055, China; greatestapple@126.com
* Correspondence: 18292841043@163.com

Abstract: As an important means to improve the construction of community services, community complexes can not only provide residents with "one-stop" services, but also promote the coordinated development of communities and cities while improving the efficiency of urban land use. In this paper, the distribution characteristics and influencing factors of the corresponding complex construction were sorted out by combing and investigating the problems of the old residential areas in Xi'an, China. GISmap10.2 software was used to obtain the data of social resource allocation, surrounding service facilities, and land use efficiency characteristics within the living circle. Combined with field research, the traditional communities were classified and discussed, so as to put forward strategies for the construction of community complexes with different types of community spaces.

Keywords: old residential areas; community complex site selection; GISmap; urban geographic information

1. Introduction

With the deepening of China's urban modernization, the community, as an important part of the city, has received extensive attention from the current society in terms of the construction of public service facilities, community management, and community resource integration. The concept of community in China is now commonly used to refer to the self-organization of sub-districts under the administrative hierarchy. The academic definition of a community is the place where a group of people living in a certain area and sharing a common culture are located. Community construction refers to the optimization and improvement of residential areas in the city according to the ideal model of a complete residential community [1]. Scientific planning and rational layout of community service facilities is necessary and important according to the National Guidelines [2,3]. Specifically, definite requirements for the functional configuration and construction of residential areas are claimed in the guidelines, which also emphasize the continuous improvement of the level of community service facilities. As one of the main components of urban communities, traditional communities are areas with relatively slow development in the process of urban construction. Both the overall spatial organization plan and the local built environment need to be improved and updated. As Jacobs [4] proposed, human activity and life place constitute the diversity of city life, which boosts urban vitality. In response to the urban development strategy for enhancing the living environment as well as solving the existing problems of various traditional communities, an effective path of urban renewal is to develop a composite community complex with a variety of spaces. Compared with general urban complexes, it is small and flexible, which can effectively improve the services of traditional communities and promote the coordinated development with the city.

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In November 2019, the municipal government of Xi'an issued the "Implementation Plan for the Renovation of Old Residential Areas in Xi'an" (Municipal Affairs Office Letter [2019] No. 225), in which the renovation of the old residential areas includes the residential areas built before 2000, with poor environmental conditions, incomplete structures or serious damage, imperfect management and service mechanisms, legal property rights, and areas not included in the scope of demolition of dilapidated houses and shantytowns [5,6]. The old residential areas in Xi'an have a large number base and wide distribution, and their density spreads outward along the city center and gradually decreases. Mainly distributed in Beilin District, Lianhu District, Xincheng District, Yanta District, and Weiyang District, these old residential areas are densely populated and relatively saturated with building development in Xi'an. The distribution of the five regions in Xi'an is shown in Figure 1, with Yanta District and Weiyang District having a large area and a wide span; Beilin District, Xincheng District, and Lianhu District are relatively small in area, but most of the old residential areas are clustered in these three districts, and they are distributed from the center of the three districts to the periphery.

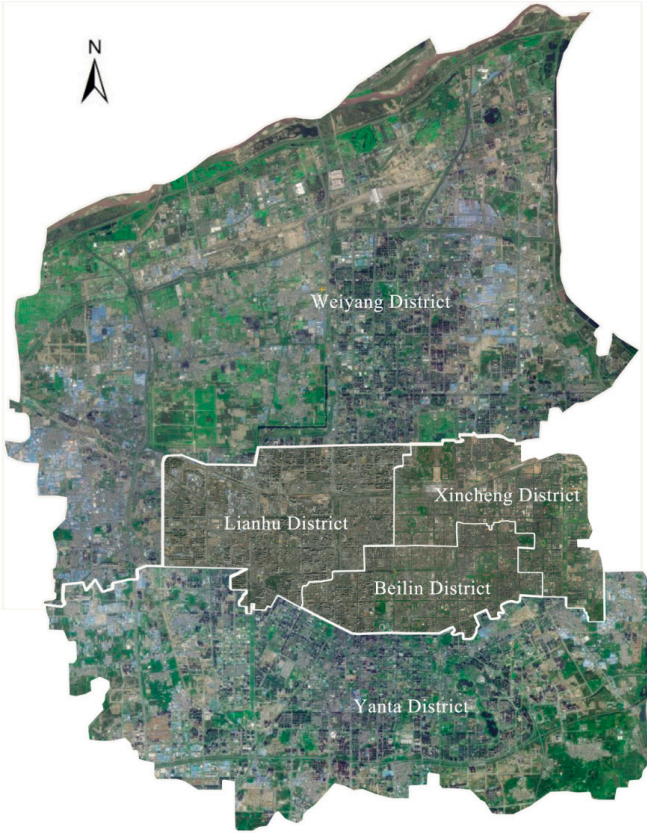


Figure 1. Satellite image of the five administrative divisions of Xi'an.

The government identified the goal of achieving safe, harmonious, competitive, and sustainable development by 2035 [7]. The policies have been put forward to support the urban renewal of traditional communities one after another since 2020 [8]. Under the social background of the saturation of urban land, the low efficiency of the use of stock space, the uneven distribution of spatial resources, and the scattered and chaotic functional land, and due to the difficulty of the early planning regulations to adapt to the current urban development, the government strictly controls the plot ratio [9]. As well as the State Council's opinion on prohibiting large-scale demolition and construction (the scope of each demolition should not exceed 20% of the renewal units, etc.), the lack of supporting infrastructure, and high transaction costs, the renewal of old residential areas faces complex problems [10]. In order to systematically and effectively solve the existing problems of

old residential areas and propose corresponding strategies [11] for the construction of community complexes [12], it is necessary to carry out hierarchical analysis on the city block community layer by layer, and thus put forward corresponding countermeasures.

The Guidelines for the Construction of Complete Residential Communities clarify the basic requirements for complete residential communities as well as the construction goals and construction standards [7]. Yan Ling Chi focused on the future city development from comparative and statistical assessments of the livability and health conditions of districts in Hong Kong [13]. In the study of public service settings, Xiao Hanyu [14] studied the distribution of five types of community service facilities, namely, community service stations, cultural and recreational life, medical and health care, commercial services, and trusteeship and elderly care. In this study, emphasis is laid on exploring the coverage of community commerce, community medical and health care, and educational resources in traditional communities. Xiaojin Liang proposed livability assessments of urban communities considering the preferences of different age groups [15]. Yuanyuan Ye discussed the community regeneration path guided by the culture of the Dongshan Xinhepu area in Guangzhou and proposed that there is an important logical relationship between "local culture" and the autonomous regeneration of the community [16].

Previous studies have analyzed the influencing factors, mainly focusing on population distribution and aggregation level, existing functional facility layout composition, and road accessibility. The density of pedestrian flow and functional spatial distribution play an important role. From the analysis of previous research objects, it can be seen that the main focus has been to analyze the land resources of a single city in a complex or commercial center to draw conclusions, but there is a lack of existing research analysis on the suitability of the location of community complexes focusing on old residential areas. As a relatively sluggish area in the city, the demand for community complexes is flexible and small, the service scope is small, and the target population varies greatly from region to region. The construction status is generally crowded, there is a lack of available vacant land, and it is very difficult to move space due to the limitation on the demolition and construction ratio in urban construction management and the complex interweaving of space ownership. Therefore, the problems faced are diverse and complex, and when discussing the construction of the problem, we should consider not only the need for functional space but also the history, development causes, and current situation of the traditional community, as well as the special needs of residents in different areas. The problems faced by urban complexes and commercial centers in the existing studies are macro and universal, so when discussing the corresponding construction issues, more attention is paid to their comprehensiveness, urbanity, and whether they can obtain multiple flows and high returns. This study explores the coverage of community commerce, community medical and health care, and educational resources in traditional communities and focuses on the site selection strategy for old residential community complexes. GIS software is used to integrate and analyze urban geographic information data and obtain conclusions by combining the impact factor ratios of the current practical applications. This research provides new insights and perspectives on the dilemma of the renewal of traditional communities in China, highlighting some important practical significance of urban land use integration in old residential areas.

2. Literature Review

2.1. Overview of the Software Analysis

Urban design, accompanied by different programming languages, tools, and technologies, has entered the stage of technological use [17]. The Geographic Information System (GIS) is one of the digital solutions that have been identified as disruptive technologies to facilitate and enhance productivity in the built environment [18]. It is a spatial processing

and computer analysis tool that includes massive spatial data storage, management, analysis, and operation, and finally integrates the unique visualization effect and geographic analysis function of the map with general database operations such as query and statistical analysis. It is more convenient for urban planners to obtain effective information in the scientific decision-making stage, which provides a reference when solving complex problems of multi-factor coexistence and has great practical value for interpreting events, predicting results, and planning strategies. With the rapid development of science and technology, GIS has been widely used in various industries and many aspects of them, such as smart earth, cloud computing, big data, artificial intelligence, and the sharing economy. The planning and site selection of a community commercial complex is one of the core decisions made in the process of public service resource allocation. The spatial analysis function can be used to assist decision making quantitatively, and the spatial analysis methods used in the planning and site selection process of community commercial complexes mainly include kernel density analysis, buffer analysis, superposition analysis, etc.

Since Goodchild [19] proposed to extend GIS to geographic information science, international academic organizations have conducted in-depth discussions on topics such as geographic information science, geographic information systems, and geographic information services [20]. Information geography is the product of the in-depth development of the information age, representing the maturity of geographic information systems, and it has gradually entered into the practical stage [21]. Canadian geographer Roger Tomlinson defined GIS from the perspective of cartography and computer cartography by digitizing paper maps so that they could be processed and analyzed by computers [22]. With the development of the times, GIS has gradually become an important tool for information visualization and standard judgment.

2.2. Delphi Method

The Delphi method, also known as the expert scoring method, is a method of statistically processing and summarizing expert opinions by consulting the opinions of relevant experts and analyzing the value, weight, or contribution value of the factor after multiple rounds of consultation, feedback, and adjustment [23]. In recent academic research, Nadia Giuffrida used spatial participatory processes combined with GIS models and real-time spatial Delphi methods to determine the appropriate location of logistics facilities [24]. Bagheri Milad investigated Coastal Land Use Assessment (CLUA) mapping using a hybrid model of analytic hierarchy processes (D-AHP) and GIS techniques to detect the most suitable and unsuitable areas in the Gila Terengganu coastal zone [25]. Ibrahim Alkhaldy used the Delphi method to assess the socioeconomic status of local communities in Jeddah. GIS was applied to understand the distribution of dengue fever based on the socio-economic status of communities in Jeddah city [26]. Foroozesh Farzaneh screened the influencing factors of urban sustainable development, including 7 criteria and 24 sub-criteria, which provided a basis for their research on urban sustainable development [27].

2.3. Community Complex

Compared with the traditional community commercial and other supporting facilities, the community complex has the characteristics of diversification and compounding, and its functions include community management, culture, sports and leisure, medical and health care, kindergartens, and so on. Compared with urban complexes, community complexes are relatively small in scale, and they are more convenient, accessible, and life-oriented. On the one hand, the community complex is conducive to improving land use efficiency and facilitating planning control, implementation, and management, and on the other hand,

because it integrates a variety of functions, it can form a distinctive, dynamic, and easily identifiable community center place that is convenient for residents to use [28].

2.4. Influencing Factors of Community Complex Site Selection

Community complexes often undertake the service needs of regional residents, and their construction is also affected by many factors. In the study on the construction of community commercial centers in Xi'an, the influencing factors of site selection mainly refer to three aspects—the concentration of residents, the distribution of existing commercial space, and the good relationship with traffic arteries—which are in the proportion of 11:6:3 [29]. In the study of the optimal layout of community public service facilities based on GIS, Zhou Yonggen [30] carried out analysis using the data of population density distribution, current layout of school facilities, and layout of cultural and sports activity centers, and they set the proportions to 5:2:3. Guo Shanshan [31] used Arc GIS to visually analyze the spatial distribution and occupancy rate of different types and sizes of elderly care institutions in Dongguan City and intuitively present the differences in the resource allocation of elderly care institutions in various districts and towns. Charles Bakolo [32] recommended the optimal location for green space intervention in the city of Lilongwi, Malawi, based on nine factors: population density, proximity to roads, slope, digital elevation model (DEM), normalized vegetation index (NDVI), land cover, existing green space, proximity to water bodies, and nitrogen dioxide concentrations.

It can be seen that in the previous studies on the construction of community service functions, the influencing factors mainly concentrated on population distribution and agglomeration level, layout and composition of existing functional facilities, as well as road accessibility, and the density of people flow and the spatial distribution of functions play an important role. Therefore, in this study, with the aim to figure out the suitability of building a community complex in a certain plot, the following influencing factors are selected through a review of the relevant research based on regional conditions, among which the density of people flow is used as the primary filter condition for reference.

3. Methods

The theme of this study is to study the suitability of the spatial location of the community complex in the traditional community in Xi'an, and, according to the previous literature research, it can be seen that the public service complex through GIS simulation tool is scientific and practical in terms of functional requirements. This study continues the analysis method of previous studies, and the methods are as follows.

3.1. Holistic Analysis

First of all, the community complex is different from the previous urban commercial complex; it is generated according to the community needs of a certain area. The existing policies do not need to be overlaid for the functions of the community, such as commercial, medical, recreational, municipal, kindergarten, and primary and secondary schools, because the needs of different types of communities in different cities are different.

The GIS-based analysis of the traditional communities in Xi'an is helpful to screen out unnecessary analysis functions, because if all the traditional communities or 90% of the traditional communities are within the service scope of certain functions, then the analysis of this function is useless for the site selection of community complexes. Therefore, this paper first analyzes the GIS buffer zone of the five elements around the traditional community in Xi'an, including commercial, medical, kindergarten, primary school, and middle school, and judges whether it is necessary to invest in the next step of research through the coverage of the traditional community. The second is the analysis of the traffic

accessibility of the traditional community in Xi'an, which can obtain the accessibility of the traditional community to the city's municipal functions, vegetable market functions, stadium functions, etc., and this step can also judge whether they can be put into the next step of analysis from the perspective of functional requirements.

3.2. Delphi Analysis

After the overall analysis, the influencing factors can be streamlined to make the results more targeted and useful. The overall analysis is mainly based on the needs of the traditional community for community functions, and the purpose is to screen out the factors that do not need to be analyzed. In addition to the functional requirements, the site selection of the community complex also needs to consider the following:

1. The distribution of traditional communities, because the community complexes built are mainly for the traditional communities.
2. In the context of the saturation of urban space and the diffusion development of Xi'an from the inside to the outside, most of the old residential areas located in the central area of the city lack completely vacant construction land, so the sluggish development of the old residential areas and the need to improve the low-efficiency land will be regarded as one of the important factors for site selection.
3. Whether there is a similar type of complex or urban complex around the community.

Combined with the above analysis, the Delphi method is used to divide the reduced influencing factors into proportions, and the final results are output through the buffer simulation, kernel density simulation, and superposition simulation of GIS. Therefore, according to the results, the suitability of the site selection of the traditional community complex in different areas of the city can be obtained so as to guide the site selection of the traditional community from a macro perspective.

3.3. The Strategy for the Construction of Community Complexes Is Proposed

The above research is a discussion on the suitability of the site selection of community complexes, that is, whether a certain area is suitable for building a community complex, which areas are suitable for construction, and which areas are not suitable for construction. When it comes to specific construction strategies, they need to be discussed according to the actual situation. The discussion section of this paper proposes strategies for community complex construction, classifying different areas of the city according to the actual situation of the city, and the specific content is written in the subsequent sections, which is not repeated here.

4. Results

4.1. Overall Service Facility Analysis

The data for this study are categorized and sourced below (Table 1):

Table 1. Data sources.

Data Elements	Data Form	Data Source
Distribution of old residential areas	Vector point data, attribute data	Housing transaction website
Distribution of urban service-oriented complexes	Vector point data, attribute data	Gaode map
Distribution of community service facilities	Vector point data, attribute data	National Center for Basic Geographic Information
Administrative divisions	Vector polygon data	National Center for Basic Geographic Information

The latest points of interest (POIs) in 2023, obtained through GISmap, were used to analyze the coverage of traditional communities. Based on the radiation range of different

community formats, 5 min and 10 min walking distance is taken as the radiation radius for kindergartens and primary schools, respectively, while 15 min walking distance is taken as the service radius for secondary schools, community health service centers, and community business centers [33].

According to the analysis, among the 5 densely populated central urban areas (administrative districts) of Xi'an, namely, Yanta District, Weiyang District, Xincheng District, Beilin District, and Lianhu District, 38.1% of the communities are fully covered by 5 service facilities, but there are still 1140 traditional communities that are not fully covered with community service facilities. Among the 642 communities covered with 4 service facilities, 390 communities have a demand for health service centers, 108 communities lack kindergartens, and 24 communities have a demand for primary schools and kindergartens. Therefore, there are still not enough educational resources in the community construction of Xi'an, and the community-level commercial centers are distributed irregularly, small in scale, and poor in functions, and they cannot provide complete and convenient services for community residents. The results are shown in Figure 2 and Table 2.

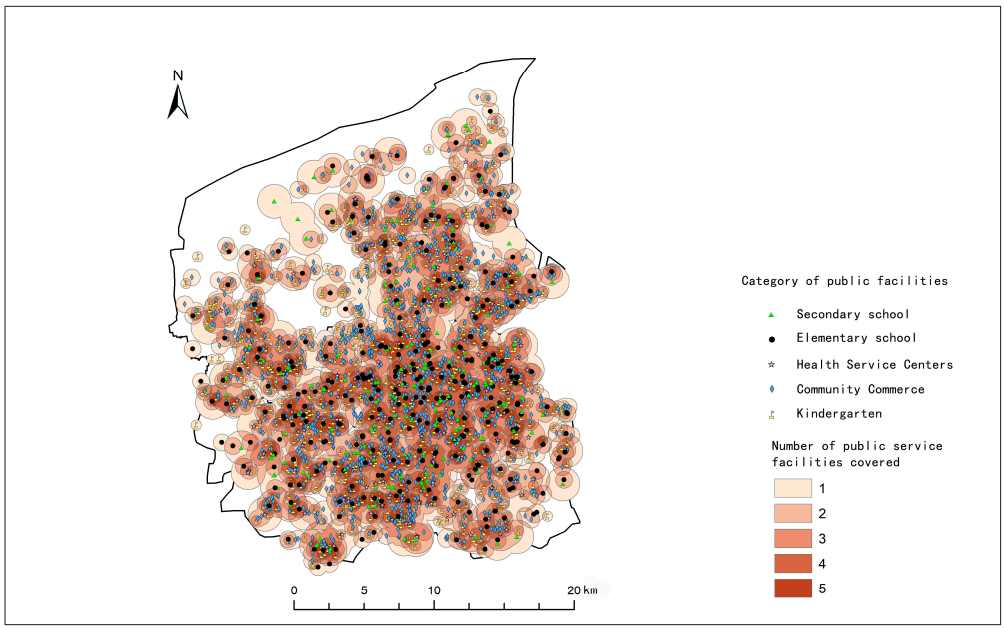


Figure 2. Coverage of old residential areas by public service facilities.

Table 2. Number of old residential areas covered by public service facilities.

Number of Public Facilities	Number of Cells	Secondary School	Elementary School	Health Service Center	Community Commerce	Kindergarten
0	4	0	0	0	0	0
1	26	8	5	1	8	2
2	88	48	20	16	68	24
3	380	294	207	138	324	177
4	642	639	592	252	642	443
5	702	702	702	702	702	702

According to Figure 3, based on the transportation commuting in Xi'an city as a carrier, the accessibility of the old residential areas has been analyzed. Most old residential areas are located in the central urban area, with well-developed transportation and basic commuting times of less than 5 min.

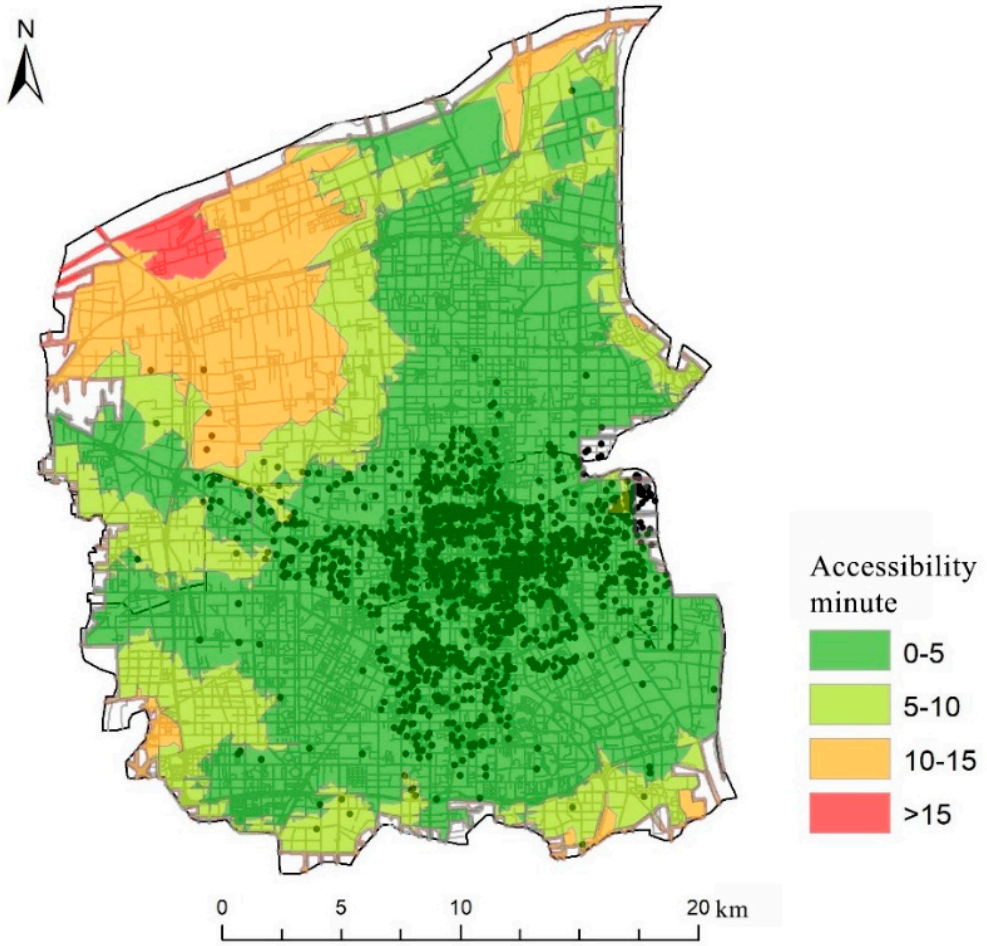


Figure 3. Analysis of the accessibility of old residential areas by time.

In conclusion, the community service facilities in the traditional communities in Xi'an analyzed above are insufficient and need to be investigated in the next step of the Delphi analysis. The analysis of transportation accessibility shows that Xi'an has dense subway and bus stations, which can meet the travel needs of residents in traditional communities, so as to meet the needs of people for the use of related municipal and other functions. Therefore, municipal-related functions do not need to be investigated in the next step of the analysis.

4.2. Analysis of Influencing Factors of Site Selection

4.2.1. Convenience of Daily Life Services

In the "Guidelines for the Construction of Urban Quarter-Hour Convenient Living Circle" issued by 11 departments including the General Office of the Ministry of Commerce, the urban 15 min convenient living circle is defined as a community business circle formed by multi-format agglomeration with community residents as the service object, and the service radius is about 15 min walking distance, so as to meet the goal of basic consumption and quality consumption in residents' daily lives [34]. As a commercial service facility frequently used by residents, the community commercial complex should be planned and constructed based on the principles of convenience and benefit to the people, with full consideration given to the convenience of residents' walking in terms of spatial fairness and space efficiency (see Figure 4).

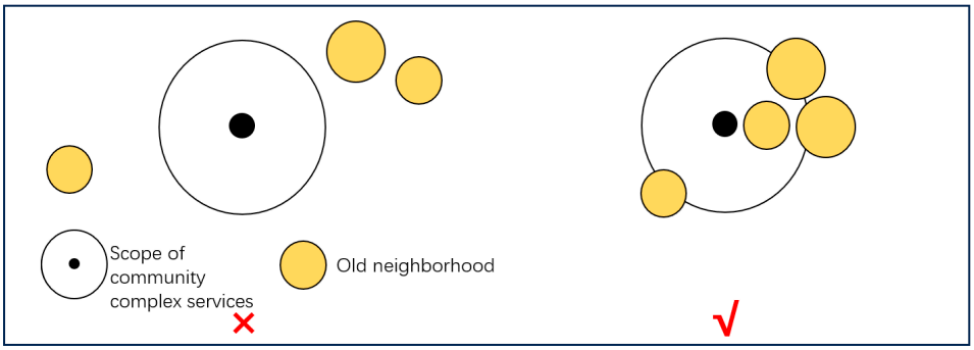


Figure 4. Concentration of residential areas in old residential areas.

4.2.2. Coverage of Community Service Facilities

Community service facilities are one of the important components and an important carrier of community construction. Community service facilities have their own service scope, that is, coverage, mainly including community commerce, community education and learning, community medical care, community leisure and entertainment, and activity service facilities (see Figure 5). In November 2022, the Ministry of Housing and Urban-Rural Development and the Ministry of Civil Affairs, China, issued a notice on carrying out the pilot work of complete community construction, proposing to promote the pilot work of complete community construction with a comprehensive service facility area of no less than 30 m^2 for every 100 households [34].

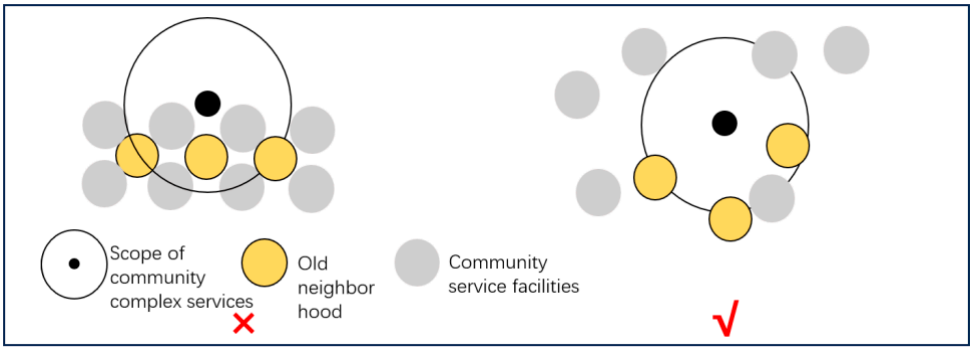


Figure 5. Coverage of community service facilities.

4.2.3. Spatial Distribution of Urban Complexes

The analysis of the spatial distribution of various types of urban complexes is the basis for further planning and layout of community commercial complexes. The planning and selecting of sites for community complexes should not only meet the reasonable coverage of all residents in the target area but also avoid overlapping with other, surrounding commercial resources. Since residents' demand for community commercial consumption and services within the coverage of the community commercial complex will not change greatly in a short period of time (that is, the residents' demand for the allocation scale of commercial supporting facilities within the scope is fixed in a short period of time), an upper limit should be set on the corresponding commercial services. Any excessive allocation or overlap between business formats will not only result in a waste of commercial resources, but also lead to undesirable competition among businesses, hindering the healthy and long-term operation of community commercial complexes (see Figure 6).

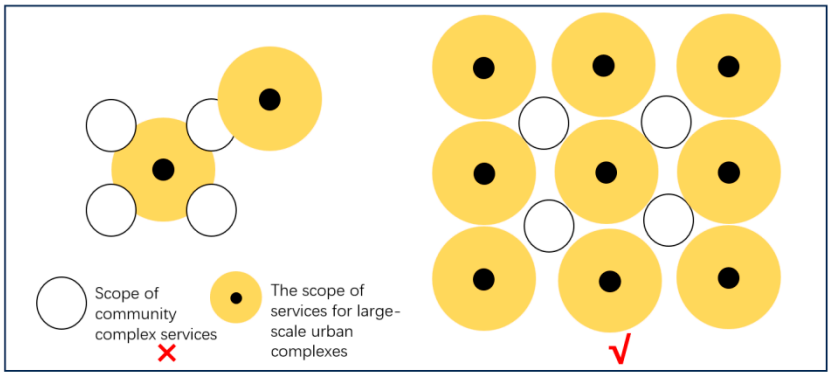


Figure 6. Spatial analysis of community services.

4.2.4. Distribution of Low-Usage Land

Low-usage land mainly refers to residential buildings, activity rooms, community vacant land, and green spaces that have been unused for a long time in urban communities. The usage rate involves the issue of efficiency, so the low-usage land also includes ground parking lots, vacant old factories, and the space around the gate in the community. In order to improve the service function of traditional communities, the land with inefficient use has been integrated and utilized for the construction of supporting service facilities in the renovation of traditional communities in recent years in Jiangxi, Zhejiang, Sichuan, and other places, which has improved the land use efficiency of traditional communities, meeting the diverse needs of residents [35].

4.3. Analysis of Influencing Factors

The influencing factors were simulated using data collection and GISmap software, and the results are presented in Figures 7–10.

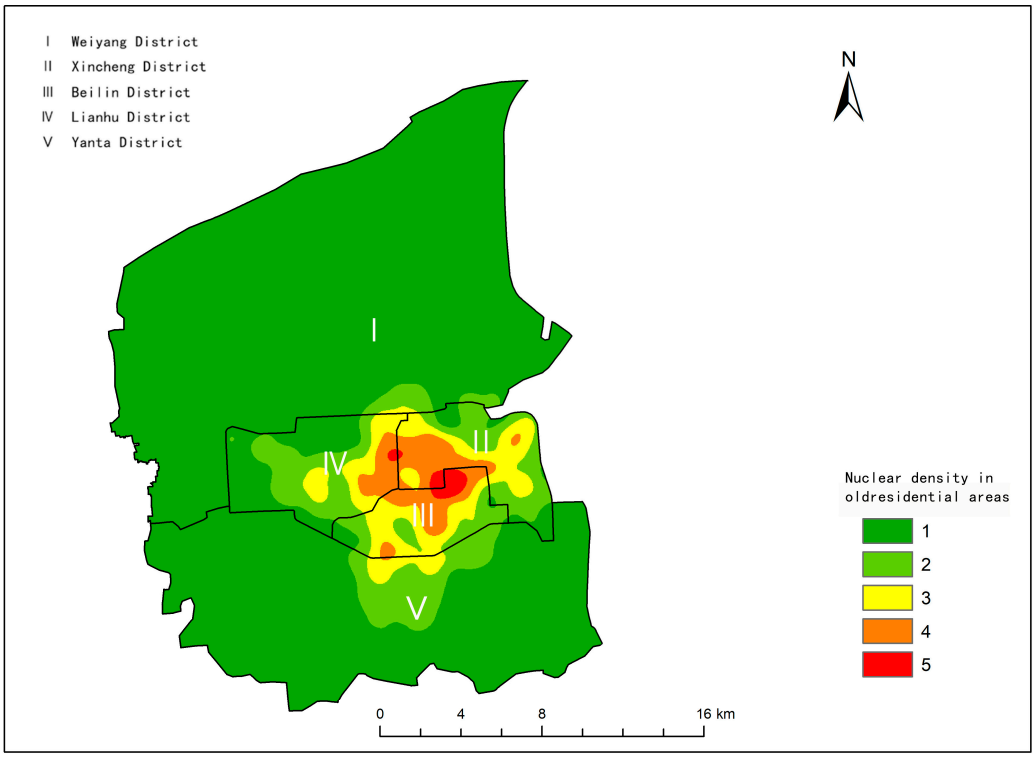


Figure 7. Kernel density of old residential areas in Xi'an, China.

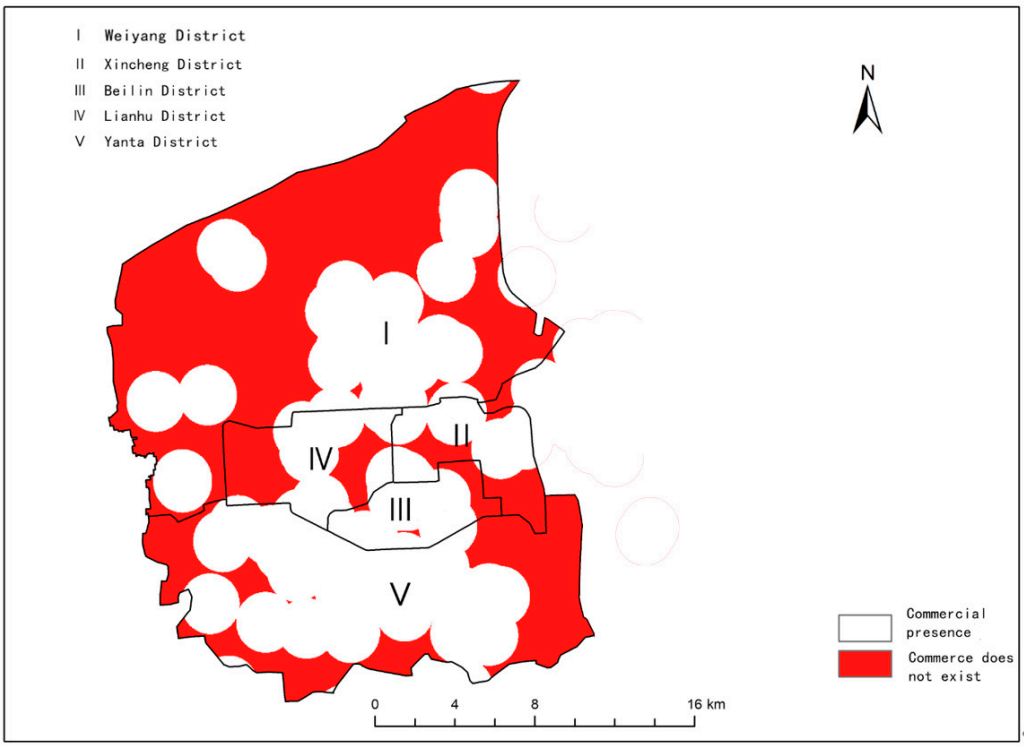


Figure 8. Distribution of service-oriented complexes in neighboring cities.

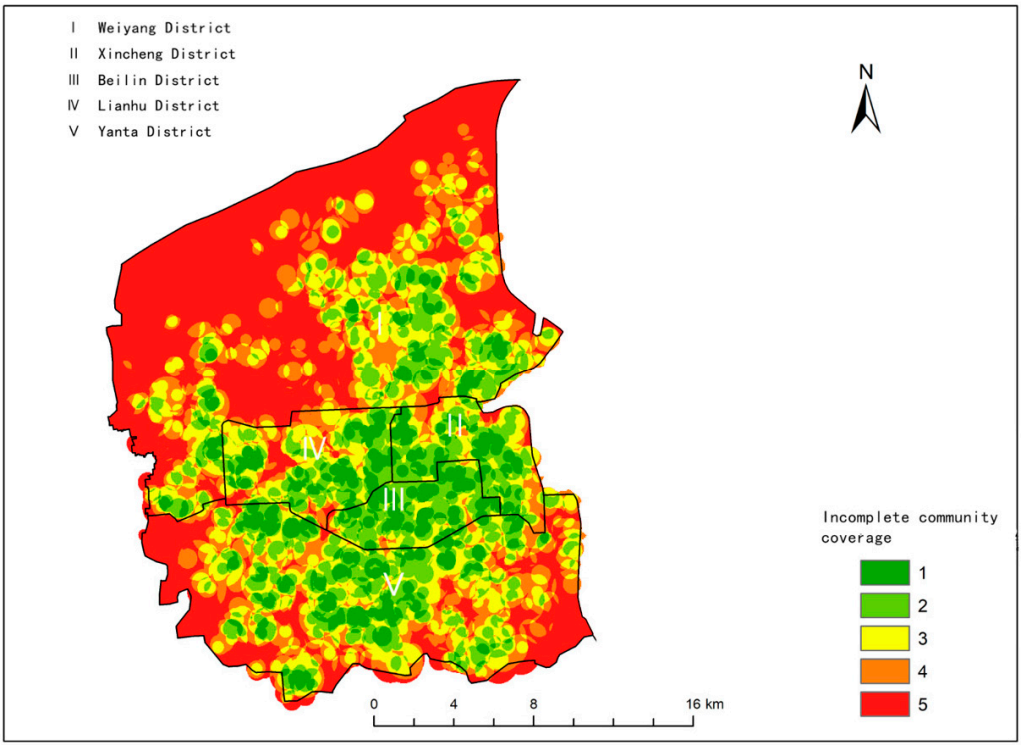


Figure 9. Degree of incomplete coverage of old residential areas in Xi'an, China.

According to the statistical results, the distribution density of old residential areas in Xi'an is relatively high in the boundary areas of Beilin District, Xincheng District, and Lianhu District, and it spreads from the center to the surrounding areas, with the density gradually decreasing.

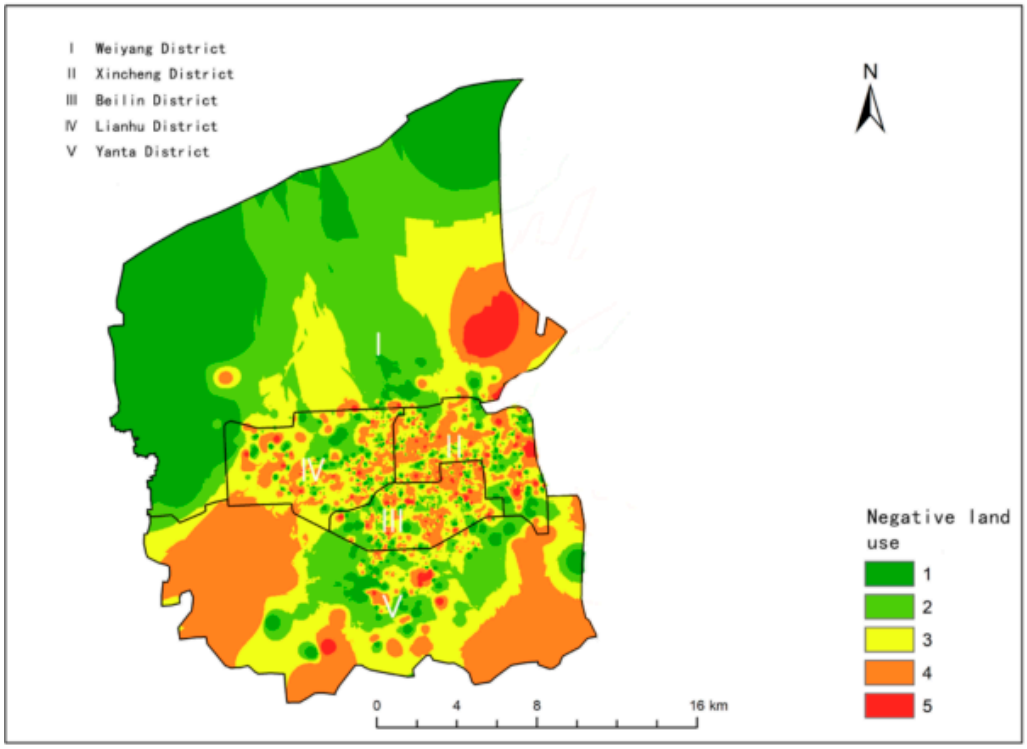


Figure 10. Low land use efficiency.

The analysis of the radiation range of large-scale service-oriented commercial complexes shows that in relatively uniform distribution, large-scale service-oriented commercial complexes in Xi'an can be found in all areas of the city. On the other hand, when conducting suitability analysis for the construction of community complexes in old residential areas, efforts should be made to avoid overlapping in order to prevent space waste and excess resources.

As shown in Figure 6, the numbers represent the degree to which the traditional community is not covered by the service facilities, in which the community area covered by 0 community service facilities is red in the figure, representing the urgent need for community service facilities, while the community area covered by 4–5 community service facilities is green. According to Figures 5–8, the community service facilities are comprehensively equipped in the junction of Beilin District, Lianhu District, and Xincheng District in Xi'an City, as well as some areas of Yanta District, but most of the old residential areas are equipped with only 2–3 community service facilities. Thus, the grassroots construction of the community still needs to be improved.

The sorting and analysis of low-usage land in Xi'an shows that the low-usage land is dotted in the central areas of Lianhu District, Beilin District, Xincheng District, and Yanta District, suggesting that the low-usage land in the city is loose and fragmented and needs to be appropriately improved and utilized.

The analysis of the four influencing factors can further obtain the dynamic changes in urban functional space under different data processing, which can have some impact on the site selection of community complex construction in terms of demand and space utilization.

In this study, the GIS spatial analysis function was used to select the suitable site selection area for the community commercial complex in the main urban area of Xi'an. Firstly, the data of planning and site selection elements were collected, and the database of influencing factors in the study area was established. Secondly, the methods of kernel density analysis and buffer analysis in spatial analysis were used to quantitatively study the location, attributes, and relationships of the current related elements in the region. Finally,

the influencing factors were superimposed to obtain the visual results of the suitability of planning and site selection.

After the spatial analysis of each factor, the Delphi method was used to synthesize the opinions of 10 experts and analyze the scoring results so as to define the weights of each overlaid factor. The weight values of each factor under the Delphi method were as follows: 0.49 for the concentration degree of the residential area, 0.31 for the distribution of community service facilities, 0.15 for the urban service complex, and 0.05 for the low-usage land. Then, the standard grid of the study area was divided, with 30 × 30 as the basic unit (see Figure 11). After overlaying the influencing factors, a new map was generated that had all the attributes in the original layer, and the area with a high degree of suitability was calculated for planning and site selection.

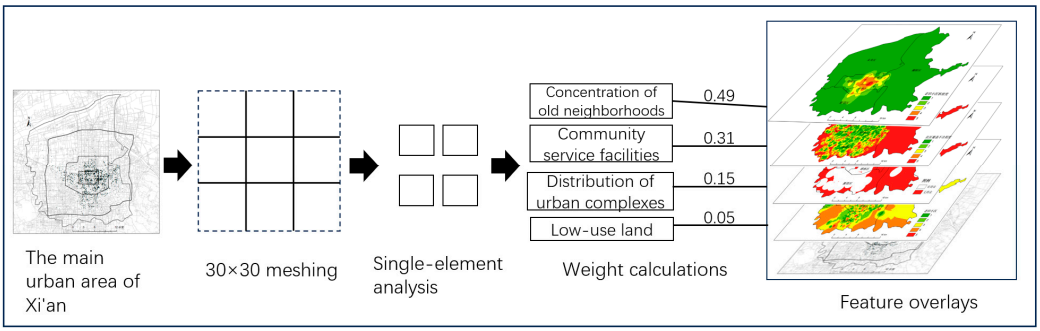


Figure 11. GIS spatial analysis.

The spatial analysis function of GISmap software was used to analyze the comprehensive analysis map after overlaying multiple influencing factors (see Figure 12), where the red area is the area with high suitability for the community commercial complex, indicating that the area has a large number of residential areas, convenient transportation, and a lack of commercial service facilities. Finally, after the overlaying process, the attribute extraction tool was used to exclude the unreasonable areas, obtaining the areas suitable for construction in the urban area of Xi'an, which are mainly concentrated in Xincheng District, Lianhu District, and Beilin District. Specifically, there are four areas with high suitability in Xincheng District, three areas in Lianhu District, and one area in Beilin District (Figure 10), and the streets and central coordinates of each site selection area are listed in Table 3.

Table 3. Areas suitable for construction.

Administrative Division in Which the Site Is Located	Street on Which the Site Is Located	Coordinates (°E, °N)
Xincheng District	Changle West Road Street	108.977198, 34.27385944
Xincheng District	Zhongshanmen Street	108.9631908, 34.26770107
Xincheng District	Jiefangmen Street	108.9550139, 34.27707443
Xincheng District	Hansenzhai Street	109.0123054, 34.25064825
Lianhu District	Beiyuamen Street	108.9249054, 34.2609778
Lianhu District	Tumen Street	108.8766282, 34.26032356
Lianhu District	Youth Road Street	108.931219, 34.27354626
Beilin District	Changlefang Street	108.9752069, 34.26471805

Through the above GIS spatial analysis, the model calculation results can be used as technical assistance for planning site selection in Xi'an. To select areas suitable for construction, it is necessary to further understand the actual situation in the area and take comprehensive consideration of the expansive elements and other realistic conditions, thus further determining the specific location of the construction, which can enhance the level of community service facilities for residents of old residential areas in Xi'an.

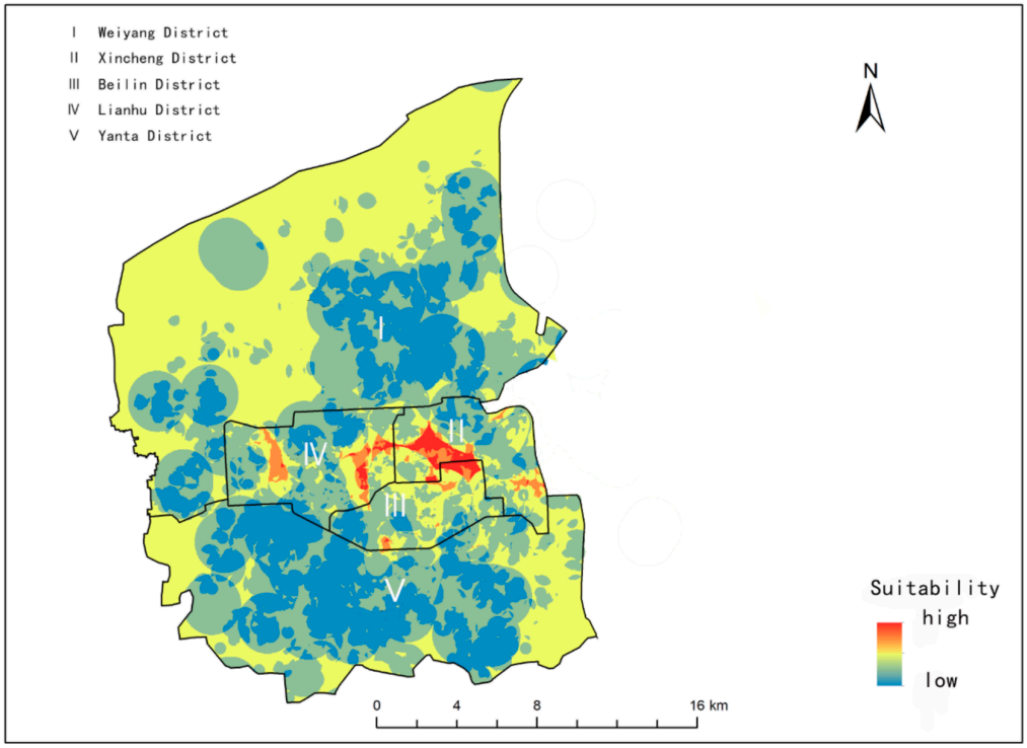


Figure 12. Map of areas suitable for construction.

5. Discussion

In the study of the site selection of community complexes in old residential areas, urban geographic information acquisition and GISmap software simulation can accurately screen for areas suitable for the construction of community complexes in high-density cities. However, since the old residential areas have differences in construction year, development status, and activity arrangement, there are diverse problems formed in these areas in Xi'an. Therefore, analysis should be made to solve specific problems, and further research is needed to put forward specific construction measures for the construction of community complexes in the traditional communities.

The development of Xi'an was a diffusion from the inside out; the historical evolution and earliest founding center of Xi'an were mainly located in the Ming District of Xi'an (i.e., Zone A selected in the map below), and the urban expansion was carried out from this center outward. In the process of urban expansion, due to the different needs of the times, construction technology and service objects, as well as the relatively obvious differences in traditional communities, and because most community types and service objects depend on the pace of urban expansion, the spatial problems presented in different expansion stages were often the same. And according to the author's field research and reading of the existing literature on the Internet, what is actually presented is indeed the case. Therefore, in this case, classification and analysis according to the background of Xi'an's urban development can help to propose a comprehensive community strategy according to the local situation and practical problems.

Through the investigation of the areas with high construction suitability after simulation, the areas can be divided into three types of community spatial land use based on the internal development status and space use of the community (Figure 13).

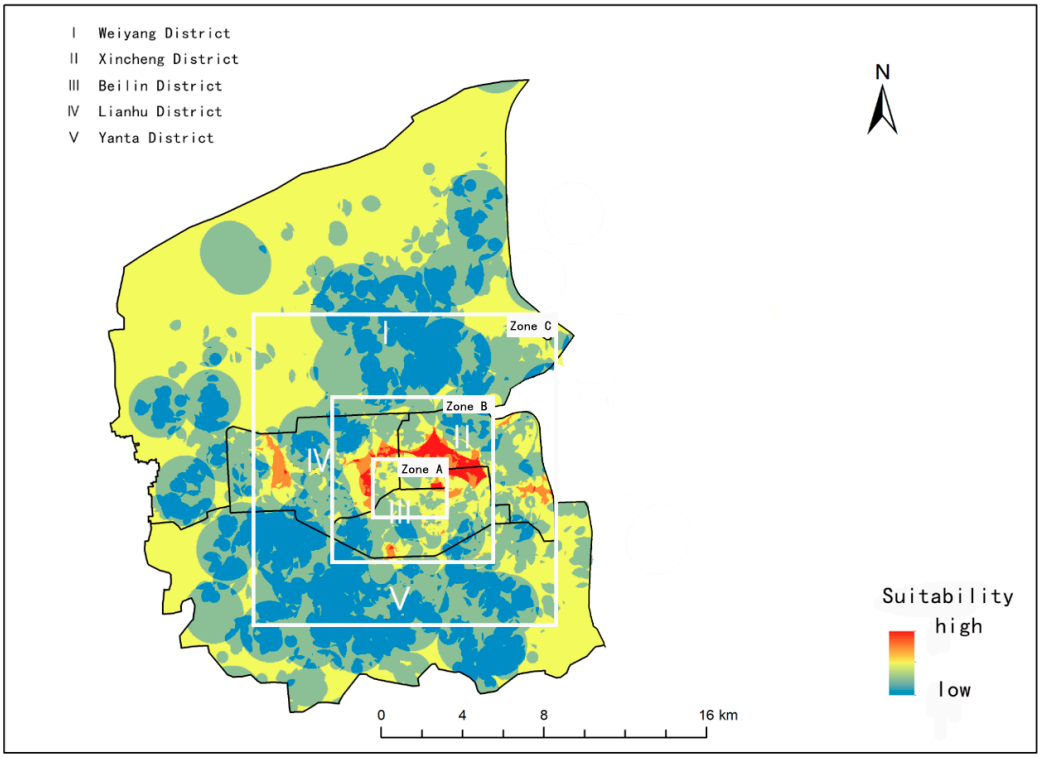


Figure 13. Schematic diagram of area division.

The land use types of Area A, Area B, and Area C were integrated and sorted out in Table 4, so as to put forward corresponding strategies. Through research and visits, among the areas with high suitability for the construction of community complexes, the old residential areas in Zone A are mainly located in the inner and marginal areas of the old city wall of Xi'an, which have the characteristics of crowded land use and rich business forms. Due to location reasons, they also undertake tourism and other functions, and the surrounding business spaces have a high degree of spatial integration. However, most of the old residential areas in Zone A have lost the integrity of the community structure, leaving separate or connected residential buildings and lacking parking lots and outdoor activity spaces; most of the residential areas have narrow spaces, and people often need to go to nearby squares, shopping malls, and streets for public activities. Thus, in order to achieve the needs for efficient land use and fill the functions for the traditional community in the first ring, due to the limited operable space in the community, it is necessary to take into account the degree of aggregation of the community and the status quo of the surrounding business forms and create an outward-oriented community space to provide services for the neighboring residential areas.

Located in the urban transition zone, Zone B embraces many types of old residential areas, including family homes, relocation houses, and ordinary traditional communities, so the problems it faces are quite complex. In addition, with the urban renewal, large parts of the residential areas have lost their community structure, leaving only single residential buildings.

Built in the course of the early development of the city, the old residential areas in Zone C began construction relatively late, and thus, there are relatively small numbers of old residential areas scattered around. Moreover, the existing old residential areas are complete in structure with a high degree of modernization in surrounding areas and relatively perfect overall development, and the surrounding services and medical and other industries are becoming saturated.

Table 4. Land use matching and strategy proposals.

	Old Residential Areas in Zone A	**Old Residential Areas in Zone B**	**Old Residential Areas in Zone C**
Type of land use	Clustered export-oriented land	Clustered mixed land	Compound inward-oriented land
Interior land	Main door adjacent to the rooms with isolated buildings	Community room, parking lot, facility court	Community building, community room, parking lot, medical center
Exterior land	Community business center adjacent to squares	Community business centers, vegetable markets	Community business center adjacent to regional parks, squares
Site selection strategy	Promote the outward-oriented development of the community, and build a window facing the city in a complex manner, to fulfill the functions and promote the development of internal influence.	Add new space to a single functional space and promote the composite use of space to meet residents' needs for sufficient functional space and places.	Enhance the vitality of the surrounding streets and adjacent business formats, reconstruct and optimize the functional space, and improve the efficiency of land use.

6. Conclusions

As urban planning and construction become more and more humanistic and refined, community complexes, as a gathering place for a number of community services in the community life circle, are the basic carrier of people's daily life needs and play an important role in cultivating community social capital and stimulating a sense of belonging and identity. In this study, the construction of community complexes is proposed to solve the problems of insufficient community functions and lagging development in old residential areas. Furthermore, based on the discussion of the current status of old residential areas and the layout of service facilities, areas suitable for complex construction are selected with the help of GISmap software, and the classification discussion and strategy are proposed. Through the study of the community complex of the old residential areas, relevant data cases are collected, analyzed, and overlaid, which make supplements for the existing traditional community database and community complex model database, providing references for the follow-up research. At the same time, it is of great practical significance to make up for the shortcomings of urban infrastructure and public services, improve the residents' quality of life, and optimize the urban spatial structure.

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