Application of the Results Management of the Third National Cadastral Survey in Urban Renewal and Construction: a Case Study of Qingdao City

Chunli Shao [1,2,a], Chengyi Huang [3,b*], Benshuai Li [4,c]

{8419471@qq.com[a], hcyhero@163.com[b*],15153244390@163.com[c]}

[1]Qingdao Survey and Mapping Research Institute, Shandong, Qingdao, 266000, China
[2] Shandong Engineering Research Center of Digital Intelligence Technology in Underground Space, Shandong, Qingdao, 266000, China
[3] Qingdao Huanhai Offshore Engineering Survey Instituite Co., Ltd, Shandong, Qingdao, 266000, China
[4] Qingdao Yuehai Information Service Company Ltd., Shandong, Qingdao, 266000, China

Abstract. As China's economic development has entered a "new normal", China has for the first time upgraded urban renewal to a national strategy, and urban development is undergoing a new period of shifting from large-scale incremental expansion to improvement of the quality of stock. The Third National Land Survey (hereinafter referred to as the " The third survey ") is a major national survey after socialism with Chinese characteristics enters a new era, and it is of great significance to the development of key inefficient areas and other urban renewal construction work. This paper takes Qingdao City as an example, builds a mixed database of urban cadastre and housing and sea area use right survey of Qingdao City based on HBase database, and delineates the inefficient areas of Qingdao City through hierarchical analysis method, discusses the application of the results of the three surveys in the urban renewal construction, and solves the "urgency, difficulty, worry, and hope" of the people, and provides solution ideas to the problem of unbalanced and insufficient development of the city. It also discusses the application of the results of the three surveys in urban renewal construction, so as to effectively solve the people's "urgent problems, worries and expectations" and to provide ideas for improving the unbalanced and inadequate urban development.

Keywords: Third National Land Survey; Cadastral Survey; HBase Database; hierarchical analysis

1 Introduction

Land is the fundamental carrier of urban renewal and construction. [1-3] It is the basis of all work to find out the ownership and utilization of land. Finding out the urban inefficient area is an important space and starting point for accelerating urban renewal and urban construction. Based on the results of the " The third survey " urban cadastral survey, this paper uses the single factor evaluation method to identify and delineate the inefficient area, and analyzes the land use structure, land use intensity, ownership, construction scale and construction period of the inefficient area [4-5].Combined with the land space planning, it provides accurate data support and scientific decision-making basis for the development and construction of key inefficient areas, so as to formulate the key development strategy of Qingdao, analyze and

PMBDA 2023, December 15-17, Nanjing, People's Republic of China

DOI 10.4108/eai.15-12-2023.2345397

predict the land reserve potential, and study the development direction of urban renewal and urban construction in Qingdao. To formulate a reasonable industrial structure adjustment strategy and formulate a long-term land acquisition and storage mechanism.

2 Research on the data management of land and cadastral survey in Qingdao

2.1 Cadastral distribution status of Qingdao city

Cadastre and sea cadastre management is the basic work of natural resources management, which relies on cadastral survey technology and centers on the acquisition and management of real estate ownership, natural resources and economic information [6-8]. The city's cadastral property rights were mapped out, and the land was divided into five types: licensed land, land with approvals not yet licensed, reserve land, land without land use procedures and virtual land, so as to achieve seamless full coverage. The city's cadastral property is founded out.The registration and certification of real estate, land approval, land reserve are verified.The owner,the right,the location,the use of issue, practical use,etc of land are investigated clearly.

2.2 Cadastral data collection in Qingdao

This Qingdao cadastral data utilizes drone technology for efficient and accurate data collection. First, an advanced Geographic Positioning System (GPS) was used to locate the drone's position to ensure the accuracy of the data. Then, an appropriate flight path is set so that the drone can fully cover the target area. During flight, the drone carries a high-resolution remote sensing camera and LiDAR equipment. The remote sensing camera captures high-definition images of the target area, while the LIDAR acquires three-dimensional information about the terrain and features. These devices have high precision and sensitivity and can provide rich and detailed cadastral data.

During the flight, the UAV transmits the real-time captured images and laser data to the Qingdao Cadastral Hybrid Database through a data chain. In the Qingdao Cadastral Hybrid Database, computer vision and image processing algorithms are used to quickly and automatically analyze and identify the collected images. These algorithms can recognize land boundaries, house structures, geomorphic features, etc., so as to extract key information about the cadastre.

At the same time, the point cloud model is generated using LiDAR data, which can obtain detailed information such as surface elevation and feature height, integrate and label the processed data, and use Geographic Information System (GIS) for spatial analysis and visualization. In this way, Qingdao's cadastral data can be presented to users in an intuitive and easy-to-understand way for geographic decision-making and planning. This advanced UAV cadastral data collection method has the advantages of high efficiency, accuracy and automation. Not only can it dramatically improve the efficiency and accuracy of data collection, but it is also able to cope with various terrains and complex environments.

2.3 Three-dimensional modeling of urban buildings in Qingdao

There are three main types of three-dimensional modeling methods for urban buildings. First, DEM is used to establish terrain surface morphology, and DOM is superimposed to generate virtual environment. Secondly, based on the boundary line of the bottom of the building and the corresponding height attribute, the three-dimensional reconstruction of the building is carried out by using three-dimensional editing software, such as 3DMAX and Sketch Up. The third is to use photogrammetry, laser scanning or other means to collect three-dimensional coding data and the surface texture of the building to realistically represent the urban landscape.

The first method is fast and efficient, but it belongs to the' pseudo' three-dimensional modeling method ; the second method is simple and easy to operate, but requires detailed basic data. According to the different modeling software, the modeling process and detail expression are slightly different. The third method is effective in detail performance, but the amount of data is large and the modeling is complex. In order to construct a more complete three-dimensional scene in the study area, this paper uses the first method to model the natural landscape around the town, and uses the second method to model the three-dimensional modeling of urban buildings.

2.4 The establishment of Qingdao cadastral mixed database based on HBase

In the third land and cadastral survey of Qingdao, some pilot areas were selected to establish the three-dimensional ownership space model, building model and building layered household BIM model on the ground, surface and underground, which made up for the shortcomings of Qingdao 's cadastral results, such as untimely update, inconsistent premises and land and sea. In addition, the data format of land and cadastral survey is diverse and the amount of data is large. Therefore, it is becoming more and more important to establish an efficient, scalable and stable database management system, and the hybrid database based on HBase can meet this demand.

HBase is a column-oriented distributed database based on Hadoop with advantages of high availability, scalability and high performance [9-11]. This hybrid database system can not only store a large amount of structured data, but also support the storage of unstructured data at the same time, thus taking into account the problem of large data volume and data type diversification, which is more in line with the actual needs of the land management department.

The hybrid database system based on HBase proposed in this paper has high data processing speed and low latency, which can quickly respond to users' cadastral query requests and provide faster, more accurate and more comprehensive data support for the land management department. In addition, the hybrid database established in this paper has good scalability, and when more data need to be processed, the database system can be expanded by adding more nodes, thus improving the processing capacity and throughput of the system.

The Fig.1 shows the integrated database management model of Qingdao Urban Cadastre and Housing and Sea Area Right of Use Survey established by this paper based on the hybrid database management model of HBase.

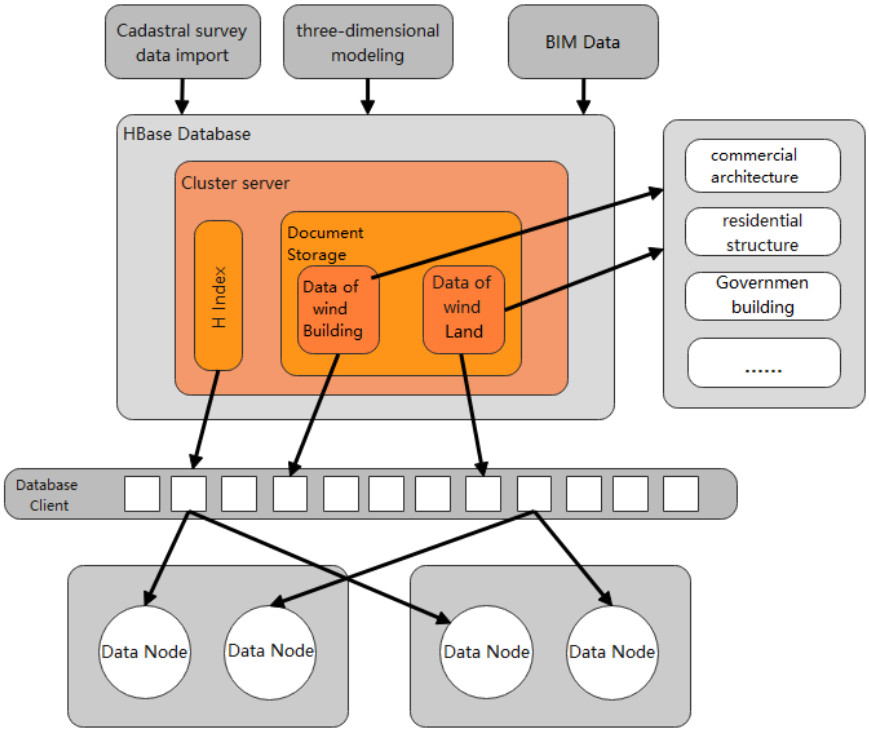

Fig1. Database management diagram

This paper establishes a hybrid database system based on HBase, which is a useful attempt to realize land management informatization, and will provide efficient, stable, secure, scalable, and high-performance data management services for the land management department, and further promote the modernization, informatization, and intelligentization process of land management work.

3 Study on the delimitation of urban inefficient area in Qingdao

Land is the fundamental carrier of urban renewal and construction. Finding out the ownership and utilization of land carrier is the basis of all work [12-13]. The development and construction of key inefficient areas is an important way for Qingdao to accelerate urban renewal and urban construction. According to the " Guiding Opinions on Further Promoting the Redevelopment of Urban Inefficient Land (Trial) " issued by the former Ministry of Land and Resources in 2016, urban inefficient land is defined as urban stock land with scattered layout, extensive use, unreasonable use and dilapidated construction in construction land, and the ownership is clear and not controversial. Although the relevant documents issued by the Ministry of Natural Resources give the definition of urban inefficient land, in practical work, each region will take into account its own regional characteristics and economic development level, and make more specific criteria for the identification of urban inefficient land.

Based on the characteristics and development level of the study area, this paper adopts the hierarchical analysis method to delineate the land, and firstly delineate the land that does not conform to the urban master plan, the residential land that fails to meet the standard, and the industrial, mining and storage land with plot ratio lower than 0.7 or building coefficient lower than 30%, and then invites experts and scholars in the field of urban construction to score and evaluate the above mentioned areas based on the hierarchical evaluation system, and comprehensively evaluate the results to delineate the development inefficiency areas in Qingdao City. Experts and scholars in the field of urban construction were invited to score and evaluate the above areas according to the hierarchical evaluation system, and the comprehensive evaluation results were used to classify the inefficient areas in Qingdao City.Fig.2 is the distribution map of some key inefficient districts in Qingdao.

Fig2. Distribution map of some key inefficient districts in Qingdao

4 Rectification strategy of urban inefficient area in Qingdao

In this paper, the above-mentioned inefficient areas of Qingdao are proposed from three aspects : land use structure, land use intensity and land use ownership.

4.1 Rectification of land use structure

Land use structure refers to the proportion of land occupied by various departments of the national economy and the synthesis of their mutual relations[14-15]. It is a collection of various land uses according to a certain structure. According to the requirements of the classification of land use status in China (GB / T21010-2017), the cadastral survey results of ' The third survey ' in Qingdao City divided the actual use of parcels into 12 first-level

categories and 73 second-level categories, and achieved seamless full coverage. This paper takes the area on both sides of Zhuzhou Road in the key inefficient area of Laoshan District of Qingdao as an example, and uses the cadastral survey results to provide data support and research basis for the analysis of the current land use structure in the key inefficient area. Fig.3 is the current land use structure area ratio map of Laoshan District and Zhuzhou Road on both sides.

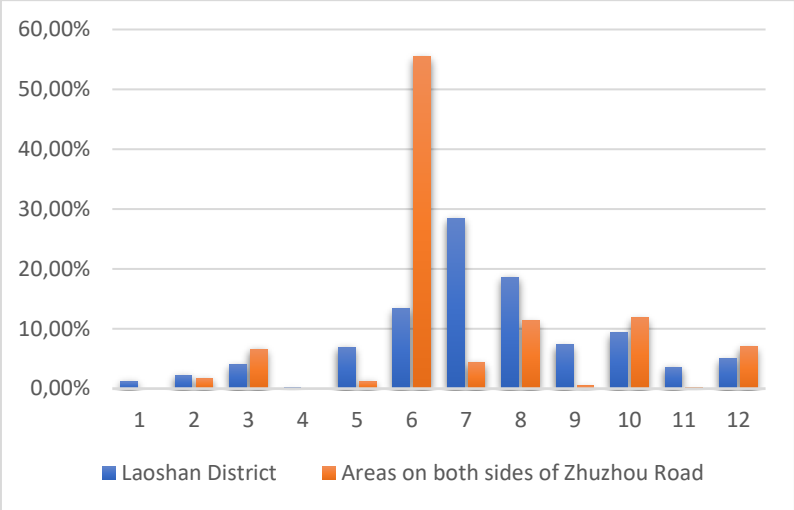

Fig.3 The current land use structure area ratio map of Laoshan District and Zhuzhou Road on both sides of the region

Table 1 Statistical table of land use structure data on both sides of Zhuzhou Road in Laoshan District

Land class name First class (coding)	Laoshan district			Areas on both sides of Zhuzhou Road		
	Number of parcels (parcels)	Aggregate area (hectare)	Area ratio	Number of parcels (parcels)	Aggregate area (hectare)	Area ratio
cultivated land(01)	36	100.3	1.2%	0	0	0
garden plot(02)	55	186.4	2.2%	1	16.0	1.7%
woodland(03)	68	344.3	4.0%	9	63.7	6.6%
grass land(04)	10	7.9	0.1%	0	0	0
commercial land(05)	371	592.3	6.9%	14	11.8	1.2%
mining storage land(06)	529	1141.2	13.3%	183	535.1	55.5%
residential land(07)	926	1602.8	18.6%	106	108.8	11.3%
specially-designated land(08)	101	630.6	7.3%	2	5.3	0.5%
Waters and water facilities land(09)	131	306.8	3.6%	1	0.8	0.1%
other land(10)	231	425.9	5.0%	37	67.4	7%

grand total	3873	8578.2	100%	183	964.0	100%

Through the comparative analysis of the land use structure on both sides of Zhuzhou Road and Laoshan District, the land use is concentrated in the industrial and mining storage land, with the land area accounting for 55.5 %, which is much higher than the average 13.3 % of Laoshan District, followed by the transportation land area accounting for 11.8 % and the public management and public service land area accounting for 11.3 %. The area is dominated by industrial land, and other land mainly serves industrial production activities. The transportation land ranked second is similar to the average land use level of Laoshan District, and the land for public management and service is slightly lower than that of Laoshan District. Residential land and commercial land are far lower than the average land use level in Laoshan District.

From the Table 1, the blocks are distributed on both sides of Zhuzhou Road, forming a parallel trend with Zhuzhou Road, and the terrain is high in the north and low in the south. This study believes that the three-year urban renewal and urban construction in this area should be combined with the scenic tourist location of Laoshan District to protect the ecological environment, adjust the construction direction from the perspective of land use structure, introduce new industries, and formulate reasonable industrial structure adjustment strategies. It plays an important role in the overall urban function positioning and development of Laoshan District.

4.2 Rectification of land use intensity

From Table 2, the building floor area ratio on both sides of Zhuzhou Road and the floor area ratio in Zhonghan subdistrict are both 0.58, but the building density on both sides of Zhuzhou Road is 20.1 %, which is much larger than 9.6 % in Zhonghan subdistrict, and 7.7 % in Laoshan District, reflecting the " high density " degree of buildings on both sides of Zhuzhou Road and the " flat " laying form. From the perspective of the whole city, the building volume rate on both sides of Zhuzhou Road is 0.58, which is much smaller than 0.91 in Shibei District and 1.03 in Shinan District. The building density of the area on both sides of Zhuzhou Road is 20.1 %, which is slightly larger than 18.1 % of Shinan District and 17.0 % of Shibei District. Therefore, according to its industrial orientation and structural adjustment direction, the urban renewal and urban construction on both sides of Zhuzhou Road can appropriately increase the building volume rate and enhance the degree of intensive land use.

Table 2 Statistical table of land use intensity data in Laoshan District

Area name	Total survey area (hectare)	The total area of the building (hectares)	Constructo n area (hectare)	Building density	Architectural volume rate
Zhonghan Subdistrict	5172.9	498.5	3006.8	9.6%	0.58
Shazikou Subdistrict	1989.0	99.6	379.5	5.0%	0.19
Beizhai Subdistrict	918.6	39.3	143.0	4.3%	0.16
Wanggezhuang Subdistrict	497.7	25.0	74.2	5.0%	0.15
Areas on both sides of Zhuzhou Road	964.0	193.6	560.72	20.1%	0.58

Laoshan district	8578.2	662.4	3603.5	7.7%	0.42

From the statistics of building density and building volume rate of each area, Zhuzhou Road on both sides of the regional building volume rate and the volume rate of Zhonghan Area are 0.58, but the building density of Zhuzhou Road on both sides of the region of 20.1%, which is much higher than the 9.6% of Zhonghan Area, greater than the Laoshan District of 7.7%, responding to the "high density" degree and "flat" laying form of the buildings on both sides of the Zhuzhou Road area. This reflects the "high density" of the buildings on both sides of Zhuzhou Road, as well as the "flattened" form of laying. Putting into the dimension of the city, Zhuzhou Road on both sides of the regional building plot ratio of 0.58, much smaller than the Shibei District's 0.91, Shinan District's 1.03; Zhuzhou Road on both sides of the regional building density of 20.1%, slightly larger than the Shinan District's 18.1%, Shibei District's 17.0%. Therefore, the urban renewal and urban construction of the areas on both sides of Zhuzhou Road can appropriately increase the building volume ratio according to its industrial orientation and structural adjustment direction, so as to improve the degree of intensive utilization of land.

4.3 Land use ownership rectification

Cadastral management is the basic work of natural resource management, and the core is the information management and application of ownership related attributes. From Table 3, the development and utilization of land, this paper divides the land parcels in the survey area of Laoshan District into five categories according to the types of land parcels, which are issued on the ground (category A), approved by goverment (category B), have no formalities (category C), “virtual”parcel (category D) (“virtual” parcel refers to agricultural land, barren hills within the town, or roads, water systems, green spaces, forests and other natural plots without clear ownership for public services.) and reserve land (category E).

Table 3 Statistical table of land parcel type data on both sides of Zhuzhou Road in Laoshan District

Type of parcel land	Quantity (case)	number fraction	Area (hectare)	area ratio
A Issued certificate	177	37.9%	484.2	50.2%
B Approved by Goverment	6	1.3%	3.0	0.3%
C No formalities	72	15.4%	268.5	27.9%
D “virtual”parcel	191	40.9%	185.5	19.2%
E Reserve land	21	4.5%	22.9	2.4%
Grand total	467	100.0%	964.0	100.0%

According to the estimation of the five types of parcel land, the workload and difficulty of land acquisition and storage are measured, which provides a reasonable data basis for the overall work and formulates a reasonable plan. In this area, A has issued certificates, B has approval documents and E reserves, and the ownership is clear and clear. It can directly communicate with the land use right holders to negotiate the issue of land acquisition and storage, accounting for 39.2 %. In 21 reserve plots, the government has the initiative and does not involve the collection and storage of land. It can directly carry out urban construction and urban renewal planning demonstration or promotion. As a pilot project, although the number is not large, it plays a leading role. 40.9 % of the virtual land is mainly for urban roads, rivers and other land, not the main object of urban renewal and urban construction. 15.4 % of the useless land is used for formalities, and the ownership is complex and unclear. It may hide

complex ownership disputes, which is the difficulty of land acquisition and storage in this area.

Table 4 Statistical table of land ownership type data on both sides of Zhuzhou Road in Laoshan District

Land parcel feature code	Quantity (case)	number fraction
GB	417	37.9%
GS	12	1.3%
GX	4	15.4%
JA	27	40.9%
ZW	7	4.5%
Grand total	467	100.0%

From Table 4, it can be seen that GB-national land (sea area) ownership construction land use right parcel land (surface), GS-national land (sea area) ownership construction land use right parcel land (ground), GX national land (sea area) ownership construction land use right parcel land (underground), JA-collective land ownership, ZW-land (sea area) ownership is not determined or disputed land use right is not determined or disputed land (sea area), 433 national ownership land, of which 417 surface construction land use right parcel land, urban renewal and urban construction in this area. Underground land is mainly for the new subway land in recent years, not the object of this work. Involving 27 collective land, in accordance with the current land construction management regulations in the development and construction of agricultural land to transfer construction land procedures. Understand the ownership of land from different angles, formulate scientific work plans, and support urban renewal and urban construction.

5 Conclusion

The results of “The third survey” widely serve the key work of various departments in other countries and the scientific decision-making of the government, and promote economic and social development. Based on the results of the " The third survey", this paper takes Qingdao as an example to establish a hybrid database based on HBase, and uses the single factor principle to delineate the inefficient urban areas of Qingdao, and proposes rectification strategies for the inefficient areas. The important role of survey results in urban renewal and construction is analyzed and demonstrated.

The research results of this paper have been widely used by the Bureaus of Natural Resources. The result of cadastral survey in Qingdao provides true and accurate basic data for land utilization, land reserve, land registration, housing management, marine resource development and protection, and provides basic data for the management of natural resource and construction of ecological civilization.

References

[1] YANG Yiming, WU Qun, WANG Jian et al. A review of research on the impact of local government construction land supply strategy on economic high-quality development[J]. Resource Development and Market

[2] Yao Shujuan,Zhang Guilian,Guo Zhongkai et al. Natural resources survey, asset evaluation and remote sensing application[J]. Western Resources,2023,(05)

[3] Hou Li. Research on Optimization of State-owned Land Resources and Integration of Intelligent Engineering Technology[J]. Shanxi Construction,2023,49(21)

[4] Wu Jianping. Analysis of the idea of intelligent territorial spatial planning[J]. Intelligent Building and Smart City,2023,(10).

[5] Tan Zhengxiang. Exploration of organic integration development of urban-rural planning and land use master planning[J]. Low Carbon World,2023,13(10).

[6] Feng Shangquan. Discussion on the Importance and Application of Cadastral Surveying and Mapping in Land Resources Management[J]. Real estate world,2023,(10).

[7] Xiao Qianliu,Hu Haichen. Exploration on the application of geographic information system in land resources management[J]. Science and Technology Information,2022,20(22).

[8] Li Gang. Impact and application of cadastral surveying and mapping in land resources management[J]. Hebei Agriculture,2022,(08).

[9] Cao Lirong. A distributed data storage method based on HBase database[J]. Journal of Lanzhou Institute of Technology,2022,29(05):46-50

[10] Ding Linlin,Wang Zhihan,Gu Yinghao et al. Optimization of coal mine microseismic time series big data storage based on HBase and Netty[J]. China Mining Engineering,2023,52(05).

[11] Cai Chunhua,Huang Siyuan,Gao Jimei. Design and implementation of cloud storage platform for learning behavior data based on Hadoop[J]. Software Engineering,2022,25(10).

[12] Li Chengpeng. Discussion on the form of spatial unit in the three-dimensional management of land[J]. Intelligent City,2022,8(09).

[13] Liu L. Research on the Importance of Cadastral Surveying and Mapping in Natural Resources Management[J]. Western prospecting engineering,2022,34(09).

[14] Aquino S D ,Pizarro G G ,Rescia J A , et al.Wetland responses to non-stationary hydro-climatic dynamics in the context of land cover and land use change[J].Remote Sensing Applications: Society and Environment,2024,34101156-.

[15] Dumbrell P N ,Wheeler A S ,Zuo A , et al.Comparing Australian public and farmer views on agricultural land use and management practices for sustainability[J].Ecological Economics,2024,219108149-.