



Exploring Strategies for Developing Xuzhou Red Cultural Heritages through the Lens of Digital Technology

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Abstract. Boasting rich red cultural heritages, Xuzhou City represents an important nodal city of China's "Belt and Road Initiative" and a central city of the Huaihai Economic Zone. Utilizing the geographic information system (GIS) technology, this paper classifies, evaluates, and analyzes the red cultural heritages in Xuzhou, and explores the long-term protection and utilization mechanism for these heritages. The objective of the study is to propose suggestions and strategies for the development of local heritages, filling the existing gaps in research on the sustainable development of red cultural heritages in the Huaihai Economic Zone.

Keywords: GIS, Xuzhou, red-cultural heritage, protection, development.

1 Introduction

This study takes Xuzhou City as the research object, a well-known history- and culture-laden city in China, recognized as a national comprehensive transportation hub and a central city in the Huaihai Economic Zone. As an important nodal city of the national "Belt and Road Initiative", Xuzhou City is rich in red cultural heritage resources, with many major historical events leaving important marks in this area. Situated at the heart of the "Revolutionary Bases of Shandong, Jiangsu, and Anhui Provinces", the city plays an essential role in the Chinese revolution history.

In this study, we employ geographic information system (GIS) technology to classify the various types of red architectural heritages in different periods in Xuzhou and analyze their status quo. The research findings identify the following problems in the protection and utilization of local heritages: (1) The building structures in modern heritages are poorly preserved; (2) The exhibition and utilization are inadequate; (3) The resources are widely distributed, involving many subjects and substantial integration challenges. Based on the above analysis, this paper proposes the idea of protection, utilization, and sustainable development in a hierarchical and focused manner ^[1].

2 Global Research Status and Trends

The planning policy of cultural relics protection during the 14th Five-Year Plan period put forward on March 2021 in the *Outline of the 14th Five-Year Plan (2021-2025) for National Economic and Social Development and Vision 2035 of the People's Republic of China* points out that China now is amid a crucial period to realize the transition from a major country with abundant cultural relics resources to a powerful country excelled in cultural relics protection and utilization. Looking forward, protecting red cultural heritages is expected to become the requirement of inheriting the revolutionary spirits and the consensus of both the country and the people.

Through a thorough investigation of China's red cultural heritages, it is found that the research on the protection and sustainable development of red cultural heritages in China is still in its infancy, with the protection and utilization planning of Xuzhou City, a region rich in red cultural heritages in northern Jiangsu Province, receiving minimal research attention. Therefore, employing the GIS technology, this project aims to classify, evaluate, and analyze Xuzhou's red cultural heritages, explore the long-term protection and utilization mechanism for local heritages, and offer suggestions and strategies for their development, so as to fill the gaps in research on the sustainable development of red cultural heritages in the northern Jiangsu area.

3 Research Methods and Ideas

3.1 Applicability of GIS technology in the Development and Dissemination of Red Cultural Heritages

GIS is a technology for data storage and analysis. It is capable of capturing and describing, editing and computing, managing and querying related geographical distribution data^[2]. Since the 1990s, the technology has been applied to heritage protection planning and utilization and has begun to proliferate, establishing itself as a powerful tool for heritage protection and addressing a great deal of practical issues. Nonetheless, the utilization of this technology in the practice of red cultural heritage protection planning is rarely seen in China. To the gap, this study introduces the GIS technology to the protection of red cultural heritages in the Xuzhou region, aiming to provide a scientific basis for the precise investment of architectural protection funds and technical support for the sustainable development of local heritages^[3].

3.2 General Ideas

In this study, new methods and technologies are introduced in the protection, utilization, and sustainable development of red cultural heritages. Specifically, we start by using the GIS technology to systematically classify the red cultural heritages in the Xuzhou region, establishing a "basic database of historical heritages", and evaluating the protection and development situation of local heritages. Subsequently, the attributes and distribution characteristics of cultural relics in the Xuzhou region are analyzed

based on the GIS data to create advantages for the development and utilization of red cultural heritages. At the meso-micro level, we designate the meso-micro core areas to coordinate the resources of various regions, thus giving play to the coupling effects of various regions to form a showcase for regional cooperation and creating favorable conditions for international communication [4].

4 Evaluation of Xuzhou Red Architectural Heritage Resources Based on the GIS Technology

4.1 General Situation of Xuzhou Red Cultural Heritages and Database Construction

In Xuzhou, there are about 80 red cultural heritage sites. Through the compilation of basic data, attributes such as the level of heritage significance, as well as the current situation such as preservation and utilization status, are entered into spreadsheets; these data are then processed and entered into the GIS, wherein an attribute database of the Xuzhou red cultural heritages is constructed by GIS software data analysis. Through data processing, the overall distribution of red cultural heritage in the Xuzhou region is finally obtained, as shown in the following figure(Figure 1).

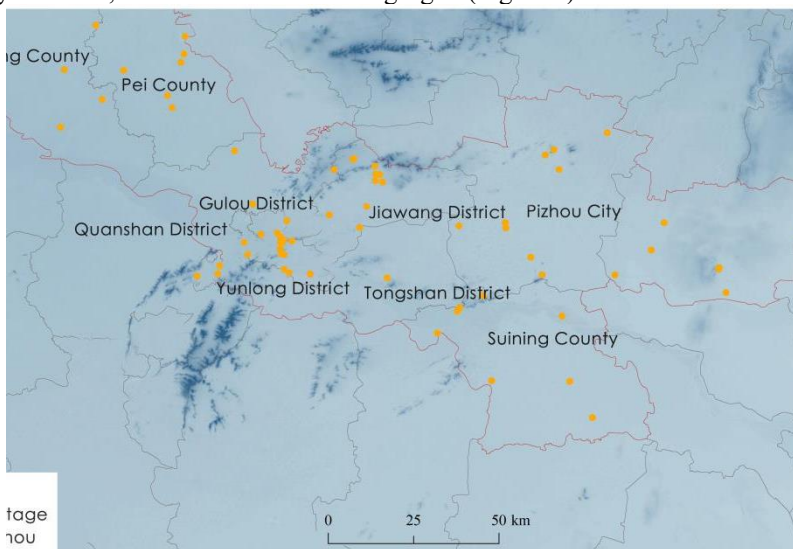


Fig. 1. Construction and geometrical dimensions of specimens.

Classification of Cultural Heritage Sites. Overall, red cultural heritages in the Xuzhou region can be classified into the following categories: former homes and regularly visited places of celebrities, former sites of important institutions, sites of significant battles and events, memorial venues, martyrs' cemeteries, tombstones, cemeteries, etc., among which memorial venues and martyrs' cemeteries are of high numbers. Given

this, these sites are grouped into the following five categories: 1. tombs and cemeteries; 2. battle sites; 3. former site buildings; 4. stone carvings; 5. memorial venues. The specific distribution is displayed below.

Preservation and Utilization Status. In accordance with the Guidelines for the Determination of Immovable Cultural Relics (Trial) issued by the National Cultural Heritage Administration of China, the protection level of Xuzhou red cultural heritages is divided into national, provincial, and prefecture- and county levels. A random inspection of Xuzhou red cultural heritages has revealed that some wall bricks have fallen off and some wall masonry mortars are loose and pulverized; wind crack, decay, and flexural deformation parallel to the grain of wood have been observed on the side of some timber roof trusses. Therefore, reinforcement measures can be carried out in a hierarchical and focused manner according to the current situation of architectural preservation.

In terms of exhibition and utilization of cultural relics, the existing issues include: 1. Monotonous theme of exhibitions: Exhibitions are dominated by traditional two-dimensional, static pictures. 2. Lack of in-depth exploitation: There is a relative stagnation in the means of expression, leading to a disparity with market demands. 3. Single development mode: Human and natural landscapes are not well integrated, resulting in insufficient resource consolidation.

4.2 GIS Data Analysis of Xuzhou Red Cultural Heritages

Spatial Density Analysis. The spatial distribution of cultural relics in Xuzhou can be divided into three major levels: 1. Regions with the highest concentration of cultural relics, which is the first level; 2. Regions with a secondary number of cultural relics, identified as the second level; 3. Regions where cultural relics are partially concentrated, forming the third level.

Transportation Analysis. From the perspective of transportation, Xuzhou is a national comprehensive transportation hub, which has the strategic geographical advantages of connecting the east and west, north and south, facilitating two-way transport and gradual development. Its railways form a "1-hour city circle" with the four provincial capitals of Nanjing, Zhengzhou, Jinan, and Hefei. In recent years, its status as a central city has been further elevated, enhancing its ability to drive the development of other regions and strengthen the connection and collaboration among cities in the Huaihai Economic Zone. Its highways extend a total mileage of 464 kilometers, achieving 2-hour accessibility to any city in the Huaihai Economic Zone.

On this basis, we conduct a transport accessibility analysis of Xuzhou red cultural heritages, which reveals that most of the heritage sites can be accessed within 30 minutes of transportation, owing to the convenient road networks.

4.3 Evaluation of Xuzhou Red Cultural Heritage Resources

According to the spatial data visualization and analysis of heritages, the characteristics of Xuzhou red cultural heritage resources are summarized as follows.

4.3.1. Varied Heritage Categories and Distinctive Themes. Xuzhou red cultural heritage resources boast rich historical, sentimental, and environmental values. The city is home to ample historical and cultural resources, especially the large number of precious revolutionary heritages left during the War of Liberation.

4.3.2. "Agglomerated and Clustered". *distribution* Xuzhou red cultural heritage sites encompass heritages of national, provincial, prefecture- and county levels, mostly concentrated in areas under the administration of Xuzhou City. In a large spatial context, these heritage sites feature a central clustering distribution, forming key protection areas. Within county clusters such as Feng County and Pei County, however, the distribution of heritage sites is relatively scattered. Based on such a distribution pattern, concentrated development can be undertaken, with key protection areas driving the industrial development along the corridor.

4.3.3. Broad and Cross-regional Distribution, Multi-subject Engagement, and Substantial Integration Challenges. The heritage resources in Xuzhou are widely distributed, involving the Xuzhou metropolitan region, Tongshan District, Jiawang District, Feng County, Pei County, Pizhou City, Suining County, Xinyi City, and other districts and counties, covering almost the entire region. The level of industrial cooperation and development is comparatively low.

4.3.4. Distinct Geographical Advantages with Excellent Transport Accessibility. Through the GIS transport accessibility analysis of heritage sites among various counties and districts, the following results are obtained: The road networks are well-developed in general, with the metropolitan region and Jiawang District having the densest cultural relics sites and other heritage sites within county clusters can be reached within a short period, indicating a superior transport accessibility. As one of the seven central high-speed rail hub stations along the Beijing-Shanghai high-speed railway, it can consolidate resources and achieve interconnected development with neighboring provinces and cities in the future.

4.3.5. Poor Preservation and Low Revitalization Rate of Building Structures. By organizing fundamental information, it is found that the preservation status of red cultural heritages in the Xuzhou region varies a lot. Significant architectural heritages, such as those at the national and provincial levels, are well-preserved, whereas many prefecture- and county-level cultural relics are scattered and haven't received sufficient attention, posing substantial challenges for restoration (Figure 2). In terms of heritage revitalization, most cultural relics are poorly displayed and utilized with inadequate maintenance funds, which has diminished their practical value. Confronted with these issues, this study selects heritage sites in urgent need of restoration utilizing GIS technology, providing a scientific basis for the sustainable development pathway.



Fig. 2. Key Red Heritage Sites in Xuzhou

5 Strategies for the Protection and Sustainable Development of Xuzhou Red Cultural Heritages Based on the GIS Technology

5.1 Planning Framework and Protection and Development Ideas

Taking the status quo of Xuzhou red cultural heritages into account, this study divides the sustainable development planning strategies into macro and micro levels.

Macroscopically, the planning scope encompasses the entire Xuzhou region, and the framework of protection and revitalization system construction, sustainable development planning, theme-based unit division, and exhibition route design is proposed. Microscopically, the focus is narrowed to key protection areas, which are centered on the Xuzhou metropolitan region and Jiawang District and supplemented by Tongshan District and other surrounding areas with a concentrated distribution of cultural relics. These regions hold about 58% of the total number of revolutionary cultural relics in Xuzhou. The remaining 42%, found in Pizhou City, Feng County, Pei County, Xinyi City, and Suining County, are consequently designated as secondary protection areas.

5.2 Protection and Revitalization System

5.2.1. Preserve the Status Quo of Cultural Relics and Maintain Their Original Appearance. The protection and sustainable development planning adheres to the first principle of preserving the status quo of cultural relics and maintaining their original appearance. According to the analysis results of GIS, a protection and utilization scheme of building structures is advanced, aiming to maintain the original style of Xuzhou red cultural heritages to the maximum extent ^[5].

5.2.2. Upgrade Infrastructure and Protect the Surrounding Environment. The major steps to improve the situation include water supply and drainage engineering, road traffic engineering, electrical engineering, parking lot and other infrastructure engineering. From an environmental perspective, initiatives can focus on optimizing the transportation system near the heritage sites, managing the natural water system and surrounding greenery, and renovating the nearby buildings.

5.2.3. Broaden the exhibition route based on the revolutionary historical value. Culturally, we can set up revolutionary education bases, instilling patriotic education

into the exhibition of martyrs' tombstones, former homes of celebrities, and revolutionary sites. Economically, we can create projects centered around folk customs experiences based on the function of buildings.

5.3 Framework for Sustainable Development Planning

By integrating cultural relics, transportation conditions, resource distribution, and other factors, we propose a hierarchical and clustered protection and development model that pursues interconnected development with regional central cities close to the project base, such as Huaibei, Suqian, Zaozhuang, Heze, and Jining. The overall structure of spatial layout is "one core, one cluster, and multi-point continuous belt," which are delineated into different thematic zones and connected in series to form the key exhibition routes.

The "one core" refers to the "core protection area of Xuzhou heritages", where the heritage relics are well preserved, rich in quantity, and high in protection level, mainly including the Gulou District, Yunlong District, and Quanshan District of Xuzhou City.

The "one cluster" signifies the "key protection cluster of Xuzhou heritages", covering six jurisdictions of Xuzhou City.

The "multi-point continuous belt" extends from Xinyi City in the east to Feng County in the west, covering a number of critical revolutionary cultural relics in modern times. This configuration facilitates integrated development and utilization.

6 Conclusion

Red cultural heritages hold significant social and economic value and serve as critical carriers and components of red spirit and culture. This study introduces the geographic information system (GIS) technology into the current sustainable development practices of red cultural heritages. Through the systematic classification and organization of architectural heritages from different historical periods in the Xuzhou region, a historical information database is established, and the protection and development status of these heritage sites are evaluated. Furthermore, by conducting a comprehensive GIS data analysis on the protection levels, spatial density, etc., of cultural relics in Xuzhou, core protection areas are identified for the interconnected development of resources in various regions and the sustainable utilization of cultural relics at both macro and micro levels^[6-7]. However, due to the large number of heritage sites involved in this study, the present research is in the initial stages of establishing and analyzing the database. Future efforts will be directed to accommodate the use of innovative methods and technologies to formulate optimization strategies tailored for the sustainable development of Xuzhou red cultural heritages.

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References

1. Chen LW, Zheng Y. The intelligent direction of historical building protection management. *Industrial Construction*. 2023,53(S2).
2. Cheng G, Guo LS. Construction and Accessibility Analysis of Public Transport Transfer Network Based on GIS. *Journal of Jiangsu University (Natural Science Edition)*. 2024,45(02).
3. WU J. Research on the Application of GIS Technology in Urban Planning and Design. *China Construction*. 2024(03).
4. Gao WJ, Xiao DW. Research on the Protection and Renewal Design of Rural Historical Buildings—Taking the Repair Practice of Huangwu Grand Theater as an Example. *Development of Small Cities & Towns*. 2024,42(01).
5. Jiang N, Wang JG. Comprehensive evaluation of conservation and adaptive reuse of modern architectural heritage. Nanjing, China: Southeast University Press; 2016. ISBN: 9787564167837.
6. Feilden, B.M. *Conservation of Historic Buildings*. 3rd ed.; Routledge: London, UK, 2015; ISBN: 1138170941, 9781138170940.
7. Powell, K. *Architecture Reborn: The Conversion and Reconstruction of Old Buildings*; New Line Books: New York, USA, 2005; ISBN: 1597640441, 9781597640442.

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