Construction of a Model for Traditional Village Landscape Design System in Xuzhou City from a Low-Cost Perspective

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Abstract

This article examined the construction of a model for traditional village landscape design in Xuzhou City, Jiangsu Province, from a low-cost perspective. Addressing key problems in the protection and development of traditional village landscapes, the research employed sampling surveys, literature reviews, and data analysis to investigate the environment and landscape needs of villagers in 22 famous traditional villages in Xuzhou City, Jiangsu Province. The data was collected and analyzed by using ArcGIS, Spars, and other data analysis tools to explore the core elements and influencing factors of traditional village landscape design in the Xuzhou area. The study proposed principles and strategies for low-cost landscape design and explored a low-cost control model using the Marxist economic cost formula. Additionally, a systematic review of design principles from economic and sociological perspectives was conducted, leading to the development of a comprehensive low-cost design system model. This model provides both theoretical foundations and empirical guidance for the sustainable protection and development of traditional village landscapes in Xuzhou City.

Keywords: Xuzhou, Traditional Village, Landscape Design, Low Cost, System Model

Introduction

Rural settlements are a settlement form that emerged after humans entered the agricultural civilization from prehistoric hunting and gathering civilization. These settlements serve as the primary locations for agricultural producers to live, work, and reproduce. Traditional villages are a new concept proposed in the new stage of rapid economic and social development in China (Hu, 2014). With the development process of urban industrial civilization, the protection and development of traditional villages have received high attention from all sectors of society. With the help of science and technology and modern tools, research on regional rural origin characteristics, spatial distribution,

evolution, and other aspects has emerged endlessly. The design behavior and engineering practice of rural protection have gained unprecedented prosperity and development, Design behavior and engineering practice activities have become extremely common contents and phenomena in rural development (Che, 2016).

Many contemporary design behaviors and engineering practices are largely driven by specific single purposes, neglecting the inherent attributes of traditional villages and lacking a multidisciplinary and holistic approach to thinking. For design and practical behavior, it is difficult to form a closed-loop, benign social cycle structure, which can be summarized as a closed-loop structure of "design theory design practice design criticism", where multiple links interact and influence each other. The protection and development issues of traditional village landscape design inevitably involve aesthetic judgment, functional judgment, and value judgment, pointing to practical results with sustainable value and relatively rational design evaluation. From the reality of social development, the global ecological crisis caused by the anthropocentric development model and ethical characteristics of modern industrial civilization is a typical manifestation of the hidden drawbacks of human social civilization development (Jin, 2021). In the context of Chinese path to modernization era, this study believes that the protection and development of traditional village landscape should be based on a holistic approach, in the dimensional framework of inheriting agricultural civilization, to minimize energy consumption and reduce production costs (Martin, 2016).

The comprehensive protection and improvement of traditional village landscapes is an important aspect of rural ecological revitalization in China. In the protection and development of traditional village landscapes, researchers are constantly pursuing the goal of inheriting local culture, continuing the functional value of the ecological landscape environment, and meeting basic needs, using the lowest cost investment and resource consumption to achieve the best environmental effect. Under limited funding conditions, choosing low-cost landscape design and construction is not only a practical need but also an

inevitable necessity to protect the ecology and characteristics of the village. The purpose of low-cost landscape construction is to reduce construction and maintenance costs, make up for the shortage of rural construction funds, and build a high-quality rural environment that satisfies the general public (Başkent, 2023). However, in the practice of landscape protection and comprehensive renovation design and construction in traditional villages, the lack of scientific design methods and a technical guidance system often leads to a "one village, one side" situation, and many other factors restrict it, preventing the full achievement of the expected goals of comprehensive protection and renewal. Meanwhile, the corresponding research results are relatively scarce, and the theoretical research and guidance system for low-cost traditional village landscapes still need improvement. The research scale and design model require further exploration.

Xuzhou City is an important hub in northern Jiangsu Province and also the central city of the Huaihai Economic Zone. The protection and development of traditional villages share commonalities with the evolution and development of traditional villages in surrounding areas, and the prominent geographical advantages determine that the traditional villages in the Xuzhou region are representative of common developmental trends. This article is based on years of research and practice by researchers on the renewal of traditional village environments. Based on relevant research results and utilizing principles from design, economics, sociology, and statistics, this article explores and examines the low-cost control issues of traditional village landscape environment design and construction, aiming to maintain the local characteristics of the landscape and to construct a model of the entire landscape design process (Tetteh, N., 2020). The aim is to provide technical support for the protection and development of traditional village landscape environments in the context of current rural revitalization, and to continuously maintain landscape efficiency, which is of great significance for social development (Aparo, 2022).

Research Objectives

Focusing on 22 provincial-level traditional villages in Xuzhou, this study aims to protect the landscape of these villages and preserve their local characteristics. The main objectives are as follows:

1. To identify the core elements and develop a framework of influencing factors for rural landscapes, and to analyze the spatial distribution patterns of traditional villages in Xuzhou City.

2. To develop a low-cost design path system for traditional village landscapes in Xuzhou City.

3. To establish a low-cost design system model for traditional village landscapes in Xuzhou City.

Literature Reviews

The concept of rural landscape design and creation from the perspective of "low cost" tends to be more inclined towards the overall process and requirements of rural landscape ecological protection. Referring to Professor Mark Lehman's perspective on landscape ecology, landscape costs are divided into four parts: direct cost (first cost), operational cost (second cost), management cost (third cost), and environmental impact cost (fourth cost) (Jin, 2010). It means that the landscape design of traditional villages should be based on protection, reduce the deprivation of resources, reduce resources such as materials, construction, and services, maintain the regional style and ecological diversity of the environment (Tetteh, 2020), maintain the quality of animal and plant habitats, and help improve the health of the living environment and ecosystem.

At present, there is no complete research system on traditional village landscapes from a low-cost perspective, either domestically or internationally. Professor Alan Ruff from the United States used the theory of landscape efficiency pursuit to clarify that reducing landscape maintenance costs and

achieving efficient returns with low-cost investment is a disguised way of improving social benefits (Thompson, 1999). The book Sustainable Landscape Construction written by Thompson (1989) emphasizes that construction should first be protected and ecologically restored under existing conditions and then developed in stages. The entire process should maintain the maintenance of the process. After the concept of landscape was first proposed in the United States, its design and construction management went through urban movements, referencing postmodern aesthetic changes, and ultimately embarked on a low-cost landscape path that balances landscape design costs and usage effects (Melby & Cathart, 2005). These concepts have, to some extent, laid the theoretical research foundation for the study of low-cost landscape design.

In China, as early as 2003, when the Chinese government proposed the concept of "building a conservation-oriented society," the study of conservation-oriented and low-cost landscapes attracted the interest of experts and scholars from different disciplines in China. The low-cost landscape design system has not yet emerged, and there is little research on regional landscape design and sustainable landscape ecology in rural areas (Gelazanskas & Linas, 2014). Domestic scholars have conducted some research on the low-cost theory of rural landscape design, exploring the theory, principles, paths, and strategies of low-cost design for rural landscapes. For example, Professor Wu Jianguo proposed suggestions for minimum resource consumption and minimum intervention scale design, and some research results involve the evaluation of "core values of landscape architecture." Shen Jie (2020) proposed the idea of breaking the inevitable relationship between landscape quality and cost. The paper Research on Low-Cost Control Methods and Technical Measures for Comprehensive Renovation of Rural Landscape Environment (Pang, 2021) proposes that low cost is not cheap but involves the use of advanced technological control methods, approaches, and technical measures to control design and construction costs, ultimately achieving the sustainable development of rural landscapes. Famous scholar Dong Ya (2015) proposed that there are many contradictions between non-local derived Chinese landscape design

theories and landscape design applications and analyzed traditional Chinese garden construction ideas, reconstructing modern landscape design theoretical models. In recent years, there have been relevant achievements in the field of design under the guidance of the "low-cost" theory. Scholar Gao Ning (2017), for example, took Wenyu Village, Yuling Town, Lingbao City as an example to attempt low-cost landscape design strategies for tourism-oriented rural areas, initially achieving the maximization of low-cost investment and benefits in landscape design. The above research has explained the origin, principles, and ideas of low-cost landscapes, which, to some extent, reflect the low-cost nature of rural landscapes (Tony, 2015).

In terms of policies and documents, China has successively released several policy documents on the development of traditional villages at the national and local levels, aiming to grasp the differences and connections of various elements in different rural areas during the continuous implementation of the rural revitalization strategy, and to manage the relationship between the protection path and the development path (Jin, 2022). The specific policy documents are shown in Table 1.

Table 1 List of Policy Documents on the Development of Traditional Villages in China

Level	File Name	Key Content	Time
Country	Guiding Opinions on Effectively Strengthening the Protection of Traditional Chinese Villages	Maintain the integrity, authenticity, and continuity of traditional villages, and establish a protection management information system.	2014
	Excerpt from Discussion on the Construction of Socialist Ecological Civilization	Based on the concept of system engineering, carry out ecological and environmental protection construction across all directions, regions, and processes.	2017

Table 1 (continued)

Level	File Name	Key Content	Time
	Opinions of the Central Committee of the Communist Party of China and the State Council on Implementing the Rural Revitalization Strategy	We will solidly promote agricultural modernization and the construction of new rural areas. By 2050, rural areas will be fully revitalized, with strong agriculture, beautiful rural areas, and prosperous farmers fully realized.	2018
	Comprehensive Work Plan for Energy Conservation and Emission Reduction during the 14th Five-Year Plan	Vigorous promotion of energy conservation and emission reduction, accelerating the establishment and improvement of a green, low-carbon, and circular development economic system.	2021
	Notice on Conducting Demonstration Work of Centralized and Continuous Protection and Utilization of Traditional Villages in 2022	Determine the protection and utilization implementation area based on traditional villages as nodes. Strengthen technical guidance, utilize effective regional resources, and promote the construction of traditional village protection and utilization projects.	2022
Local	Measures for the Protection of Traditional Villages in Jiangsu Province	Promote the protection of traditional villages onto a legal and standardized track, and establish a protection system.	2017
	Implementation Opinions of the People's Government of Jiangsu Province on Implementing the Rural Revitalization Strategy	Promote the modernization of agriculture and rural areas, and accelerate the construction of a strong agricultural province with Chinese characteristics and rich Jiangsu characteristics.	2019

Table 1 (continued)

Level	File Name	Key Content	Time
	Implementation Opinions on Doing a Good Job in the Key Work of Comprehensively Promoting Rural Revitalization in 2023	Comprehensively accelerate the construction of a strong agricultural province with Chinese characteristics and rich Jiangsu characteristics, and contribute Jiangsu's strength to building an agricultural power.	2023
	Measures for the Protection of Famous Historical and Cultural Cities, Towns, and Villages in Xuzhou City	The rational use of historical buildings and landscape environments, in accordance with the law, as well as their protection and repair, should be carried out according to regulations.	2022
	Implementation Opinions on Doing a Good Job in the Key Work of Comprehensively Promoting Rural Revitalization in 2023	Build a suburban urban agricultural landscape with "cohesive highlights, connecting points with lines, and weaving lines to create a surface."	2023

Source: Author

Research Methodology

Firstly, the Jiangsu Provincial Department of Housing and Urban-Rural Development released 22 traditional villages in Xuzhou in four batches from 2018 to 2021 and conducted research and analysis on the current state of these villages. A survey was conducted to collect data on the names, locations, environmental factors, population, and user satisfaction of traditional villages in Xuzhou City. A literature review and interviews were used to obtain questionnaires from villagers, designers, and industry personnel regarding their needs for

traditional rural landscape design. This information was analyzed to determine the needs and design requirements for traditional villages in Xuzhou City, including the core elements and influencing factors of the village landscape. This analysis formed the foundation of a basic demand database (Khan, 2023).

Secondly, using Wushao Village in Xuzhou City as a case study, spatial analysis was conducted to obtain the longitude and latitude coordinates of the ancient village using the Baidu Map API coordinate picker. Geographic Information Systems (GIS), digital elevation maps (DEM), and other tools were employed to analyze the terrain, elevation, and other geographic features of Wushao Village. Through theoretical research on existing low-cost rural areas, the model of audience needs for traditional rural landscapes in Xuzhou City was clarified. The principles and strategies of low-cost landscape design in Xuzhou City were analyzed from the perspectives of low intervention, low waste, low construction, and low maintenance (Joost, 2022).

Finally, based on landscape design theory, low-cost landscape construction methods were examined. The cost formula of Marxist economics (C=Cs+V+Ct) was used to reconstruct the model, incorporating village landscape control factors, resulting in the development of a low-cost design system model for village landscapes.

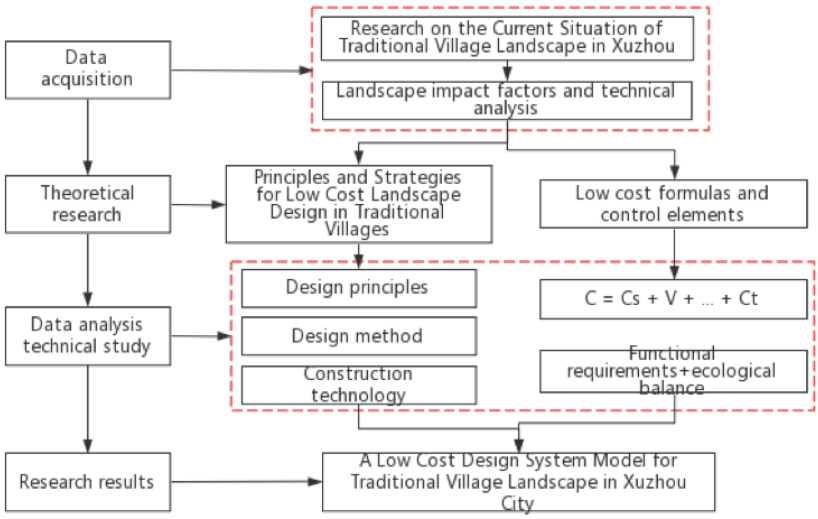

Figure 1 Research Framework Diagram
Source: Author

Research Results

1. Analysis of core elements, influencing factor framework, and spatial distribution of traditional villages in Xuzhou City

Through literature review and survey analysis, the core elements and influencing factors of traditional village landscapes in Xuzhou mainly include: Cultural factors, natural factors, and economic factors (Table 2, Table3).

Table 2 Framework of Core Elements and Impact Factors of Traditional Village Landscape Table 1 (Classified by Landscape Composition)

Influencing factors		Image factors
Cultural elements	Regional customs	Dietary habits, wedding and funeral customs, festivals, temple fairs, markets, and other activities.
	Local culture	Historical changes, race, production and lifestyle, and local wisdom.
Natural elements	Natural elements	Seasonal and temperature characteristics; Rainfall, sunlight, temperature and humidity, wind direction, etc.
	Terrain and Landform	The spatial distribution and area, evolution and shape, elevation and slope of plain and hilly terrain; Natural and geomorphological features, etc.
	Geology and Soil	Geological structure mechanism and spatial distribution of rocks; Soil composition, color, etc.
	Water system and water bodies	The distribution, shape, and hydrological characteristics of rivers and lakes; The source, area, distance, scale, form, quality, and storage capacity of water bodies; Water source utilization and degree of protection, etc.
	animals and plants	The preservation and habits of wild animals and livestock; The types, growth cycles, growth environments, and management of local and foreign plants, as well as the ecological habits and growth patterns of plants; Care needs; Crop types, etc.

Table 2 (continued)

Influencing factors		Image factors
Economic factors	Rural industries	Cultural industry, tourism industry, agricultural industry, technology industry, art industry, etc.
	Building	Architectural relics; The style, form, and volume of residential and public buildings; The physical properties and texture of building materials; Construction technology, etc.
	Roads and other infrastructure	The type and form of roads; The area and material of the ground pavement; The configuration of infrastructure such as drainage, lighting, and public health.
	Square	The nature, location, scale, form, and function of the square.
	Landscape sketch	The configuration of leisure and entertainment facilities and other landscape items, village signage, and promotional and exhibition facilities.
	Construction Cycle	Seasonal and climatic construction impacts; Policies, human factors, and other construction cycles.
	Other	Regional and cultural differences, later management and maintenance levels, and unexpected events.

Source: Author

Table 3 Framework of Core Elements and Impact Factors of Traditional Village Landscape Table 2 (Classified by Landscape Construction Carrier)

Landscape construction elements		Impact factors
Hard landscape	Settlements, Buildings, and Infrastructure	Settlement distribution, morphology, etc.; Courtyard layout; Texture and texture of building and living infrastructure materials; Construction techniques, etc.
	Road	The type, material, width, thickness, etc. of the road.
	Square	The nature, function, area, form, and materials of the square.

Table 3 (continued)

Landscape construction elements		Impact factors
	Landscape sketch	Landscape sketches related to life, cultural leisure, sports, and sanitation.
softness landscape	Plant	The current situation, ecological habits, and growth patterns of native plants; The types and flower and fruit characteristics of local plants; Spatial distribution, volume, form, color, etc. of farmland; Crop types and characteristics, production techniques, etc.
	Water body	The distribution, shape, scale, water storage capacity, hydrological characteristics, etc. of water bodies.
	Culture	Local history, lifestyle and production techniques, such as material cultural heritage and intangible cultural heritage.
	Custom	Dietary habits, weddings, funerals, festivals, temple fairs, and market activities.

Source: Author

A statistical analysis was conducted on the distribution of traditional villages across 10 counties and districts under the jurisdiction of Xuzhou City. In terms of quantity distribution, the regions with the highest number of traditional villages were Tongshan District and Peixian County, which together accounted for 59.1% of the total in the province. In terms of spatial agglomeration, the traditional villages in the city exhibited a distribution pattern that combined two bands of agglomeration and dispersion (see Figure 2). Specifically, there was a scattered distribution around the center of Xuzhou, while the villages were more concentrated along the border areas of Xuzhou. Additionally, there was scattered distribution in the eastern and southern parts of Xuzhou. The distribution map revealed a “one center, two belts” feature in the spatial arrangement of these villages.

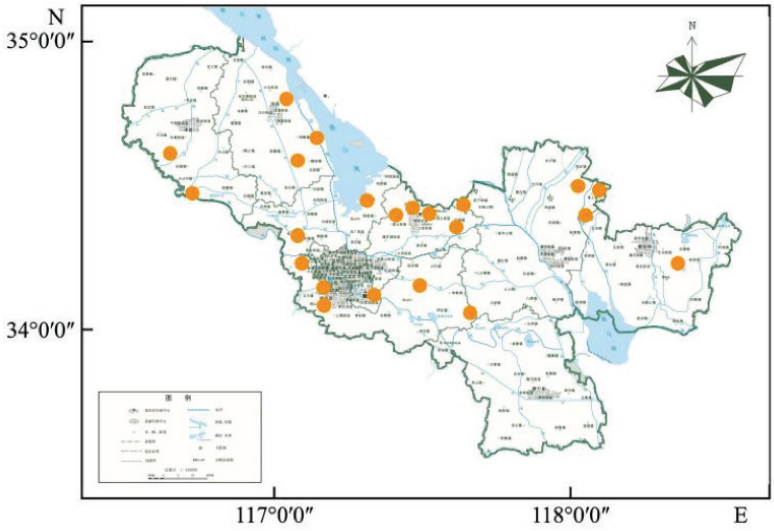

Figure 2 Distribution of Traditional Villages in Xuzhou
Source: Author

A statistical analysis was conducted on the layout and spatial distribution of traditional villages in Xuzhou at different elevations using GIS (see Figure 3). The results showed that the spatial distribution of traditional villages was significantly influenced by terrain and topography. Specifically, 22 traditional villages were concentrated at altitudes between 50 and 200 meters, accounting for 77% of all traditional villages. The distribution pattern revealed that below an altitude of 150 meters, the number of traditional villages increased with elevation, peaking between 100 and 200 meters. Above 200 meters, the number of traditional villages decreased as elevation increased. Conversely, below 50 meters, there were only two traditional villages. This suggests that the distribution of traditional villages does not follow a simple linear relationship with elevation. Moderate elevations in the local area appeared to support the formation and preservation of traditional villages, whereas very high or low altitudes were less conducive to their establishment and maintenance.

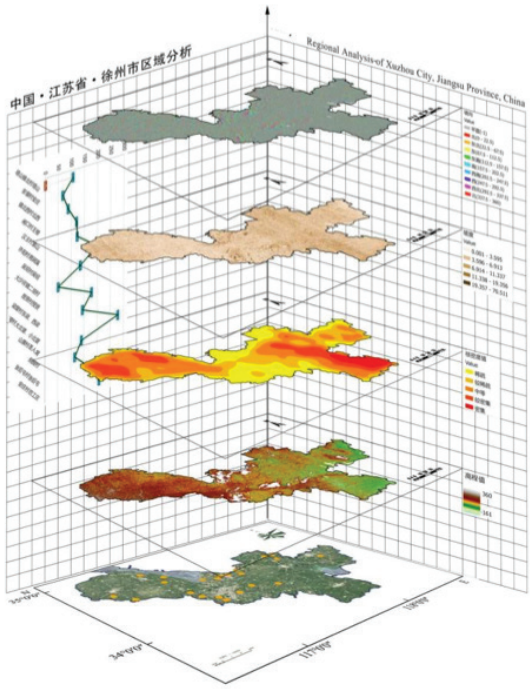

Figure 3 GIS Spatial Analysis of Traditional Villages in Xuzhou
Source: Author

2. Low-cost design path system for traditional village landscapes in Xuzhou

2.1 Principles of low-cost design and construction

(1) Emphasize people-oriented, focus on functional requirements, and build a sustainable traditional village landscape design system. The main body of traditional village landscape protection and renewal design services is people, which is to establish a livable village landscape environment, with the core being people-oriented. Therefore, traditional village landscapes should be built on real needs, and modern landscape design methods should be used to construct an external environment with regional culture. It can be found that some rural landscape design cases blindly pursue innovation, one-sided pursuit of personality, style, and other performance factors, while neglecting regional and overall characteristics, resulting in serious homogenization of rural landscapes

and irreversible construction of rural landscapes. Therefore, traditional village landscape design should always adhere to the core concept of putting people first, pay attention to the actual functional needs of the landscape, and build a recyclable and sustainable landscape system.

(2) Respect natural landscapes, reduce human intervention, and maintain a complete and diverse village landscape ecology. Reasonably developing and utilizing resources, utilizing effective resources, reducing intervention efforts, utilizing low-cost design concepts, and maximizing the preservation of traditional village style, the more complete and diverse the landscape structure of traditional villages will be. On the contrary, the integrity and diversity of traditional village landscapes are difficult to maintain. At present, many landscape renewal designs adopt the method of destroying the original ecological environment for environmental reconstruction, which not only goes against the sustainable design concept of landscapes, but also causes serious consequences of ecological imbalance in traditional villages that are difficult to measure. Therefore, only by adhering to the integrity and diversity of natural landscapes and ecological environments can we maintain the ecological balance and development of traditional village environments.

(3) Based on local design, reduce maintenance costs, and achieve comprehensive economic, social, cultural, and ecological benefits. The process of designing and constructing traditional village landscapes is also a process that conforms to nature. Adhering to local design and respecting local landscape culture can minimize the impact on the landscape environment. By tapping into the potential of local resources and using local materials, we can maximize the preservation of local style, save transportation and construction costs, and better inherit regional culture. As time goes by, traditional village landscapes rely more on the length of their quality life cycle, and the social, ecological, economic, and cultural benefits of the landscape should also gradually increase. Only by taking the long-term benefits of traditional village landscapes as the starting point, and correctly evaluating and optimizing the entire process of landscape creation, can the long-term development of traditional village

landscapes be achieved. (Tobias, 2022)

2.2 Low-cost design and creation strategies

(1) The 'low waste' strategy. Advocating the use of waste materials generated during the construction and maintenance of traditional village environmental sites, and establishing a resource recycling mechanism. The focus of "low waste" should be on several key methods such as "preserving the original state as much as possible, weak transformation and reconstruction, light optimization and repair, and promoting the integration of new and old" (Table 4), and optimizing the use of scientific and reasonable control methods and technical measures to achieve scientific argumentation, optimized design, fine construction, and strengthened management. Improve the utilization rate of village landscape resources and reduce the generation and discharge of agricultural waste through the "ecological cycle" approach. For example, in modern village landscape design, it is often used to recycle and reuse waste materials from the original site, decompose and reshape them as new site paving, retaining gaps for plant growth. This not only saves the cost of purchasing materials, but also increases the greening rate of the site, making the landscape more vibrant and innovative.

Table 4 Analysis of Low Waste Content in Traditional Village Landscape

Optimization Method	Concrete Content	Basic Site Conditions	Site Legend
Keep it as it is	Preserve the original high-quality resource elements of traditional village sites as fully as possible, including space, form, materials, mechanisms, and colors.	The original terrain, water bodies, plants, architectural sketches, roads, and infrastructure of traditional village sites have landscape value and well preserved value.	

Table 4 (continued)

Optimization Method	Concrete Content	Basic Site Conditions	Site Legend
Reduce renovation and reconstruction	Exclude the advantages and disadvantages of existing resources in the traditional village environment, remove and dismantle unfavorable elements, and use weaker external forces to reorganize and utilize them as elements of other landscape reconstruction.	Decompose and reshape the environmental materials of traditional villages into other related individual elements such as ground paving, decoration, flower beds, or crush them into foundation cushions.	
Gently optimize and repair	The existing resources in traditional village sites can be optimized and utilized with less effort to improve the value elements and control the ecological environment pollution of the site.	Repair the landscape elements that have been less damaged in traditional villages, partially polluted water bodies, and damaged exterior but intact internal structures.	
Promote the integration of old and new	Combine the existing high-quality elements of traditional village sites with new landscape elements to form a cohesive and mutually integrated whole.	Combining new and existing buildings, artificial revetments, and existing water bodies, and introducing complementary new vegetation types based on local plant configuration.	

Source: Author

(2) The 'low intervention' strategy. Minimal involvement in site facilities emphasizes reducing the depth and breadth of intervention in the development of traditional village landscape environment sites, and utilizing nature as a landscape resource supply to reduce interference with the ecological environment. For the architectural landscape of villages, the "low intervention"

strategy emphasizes preserving the texture, courtyard layout, and building materials of the existing villages, and only appropriately transforming the outer surface of the buildings to increase the viewing effect while minimizing the consumption of construction costs. For example, during the construction renovation of Wuchao Village in Tongshan District, Xuzhou City, the spatial pattern of the ancient village was preserved to the greatest extent possible, protecting its unique architectural space and stone building style. In addition, during the construction process, the opinions of the villagers were fully listened to, and the repair and protection plan of the village buildings was repeatedly adjusted. Three types of on-site building materials, including rubble, wood, and adobe, were determined for building repair. Weakening modern materials that contradict the original style of Wushao Village, while also making the overall style of the village more local.

(3) The 'low build' strategy. Emphasize meeting people's basic functional needs for landscapes, and achieve low consumption in landscape development by selecting low-cost materials and improving construction methods (Suppa,2023). The 'low construction' strategy selects materials that are easy to obtain, low-cost, and durable to create a simple rural landscape. For example, during the renovation along the river in Erba Village, Fengxian County, Xuzhou City, local stones were used to fill and stack multi-level revetments to resist the impact of water flow, which is also conducive to the infiltration and growth of plants. Stones, loading and stacking follow standardized and modular standards, reducing the difficulty and cost of the project, and allowing local villagers to participate in riverbank construction projects (Liu, S, 2022). The purpose is to meet the functional and aesthetic needs of villagers, and to understand the scope of daily activities, types of leisure activities, and preferences for materials and colors through a survey questionnaire.

(4) Low maintenance strategy. It plans materials, energy, and labor on a time axis. At the same time, through the benefit compensation mechanism, economic benefits are created to comprehensively reduce the maintenance costs of the landscape, preserve its original state, optimize restoration, renovation and reconstruction, integrate old and new, optimize materials, and scientifically analyze the site for construction control, make reasonable use of the terrain,

and adapt to local conditions. The 'low maintenance' strategy encourages villagers to participate and create diversified economic benefits compensation. The village committee will lease the strip of land along the street to each household according to the corresponding location of the houses, and provide unified guidance for villagers to plant seasonal vegetables with ornamental value. At the same time, open up agricultural product trading venues to guide tourists to participate in crop purchasing and picking activities to increase the income of villagers. Through this approach, the villagers' enthusiasm for planting has significantly increased, reducing the human cost of landscape maintenance and providing financial support for the maintenance of other areas. The design also incorporates local stress-resistant tree species, enhancing plant survival and resilience to catastrophic climate, while reducing maintenance costs related to pests and disease control.

The low-cost landscape design strategy of traditional villages should combine basic local and village conditions, adhere to the concept of sustainable development, adhere to the "low waste", "low intervention", "low construction", and "low maintenance" strategies (Table 5), and aim to reduce resource consumption and minimize environmental impact. The renewal of traditional village landscapes is a dynamic and continuous organic process, and its origin, emergence, evolution, and development must be scientifically developed step by step like metabolism to ensure its long-lasting vitality (Wang, 2008).

Table 5 Analysis of "Low Abandonment, Low Intervention, Low Construction, and Low Maintenance"

Name	Measure	Case	Image schema	Technical examples
A Low waste - establish a recycling mechanism to efficiently utilize existing resources.	A1 The transformation and utilization of existing resources in the site.	The Beijing Nanhai Wetland Park utilizes the existing garbage on the site as road and foundation materials, saving a large amount of earthwork investment.		Try to preserve and repair the existing rural landscape as much as possible, and utilize mountain and water resources.

Table 5 (continued)

Name	Measure	Case	Image schema	Technical examples
	A2 Explore ways to reuse waste materials.	Huaibei Nanhu Wetland Park utilizes the organic sludge of Nanhu Lake as a nutrient soil for plant growth.		Establish ecological circular agriculture and utilize agricultural and aquaculture waste resources based on the food chain.
	A3 Increase the plasticity and disassembly of material usage.	Architect Xie Yingjun designed a detachable settlement house for Tibetan herdsmen, meeting the usage requirements of warm winter and cool summer.		Adopting flexible mobility and combination of facilities to meet the usage needs of different time periods.
B Low intervention - guiding natural work and reducing manual intervention.	B1 Guiding the process of natural formation	Xuzhou Pan'an Lake Wetland Park utilizes the purification effect of microorganisms to improve polluted soil and enhance fertility.		Utilize changes in light and temperature to plan crop rotation reasonably.
	B2 Minimal involvement of venue facilities	Xuzhou Jinlong Lake Dangkou Park, pine strips are used instead of masonry steps to form a mountain road with lower environmental intervention leading to the valley.		Reduce the use of urbanization materials such as cement and steel, and maintain the continuity of ecological corridors.

Table 5 (continued)

Name	Measure	Case	Image schema	Technical examples
	B3 Empower multiple use functions	The Jinmei Plank Road is derived from the original bridge bottom, which not only saves construction costs but also creates vertical greening and safe pedestrian space.		Expand the landscape function and use the vegetable garden as a place for tourists to watch, participate in practical activities, and purchase crops.
C Low construction - following human needs and selecting practical resources.	C1 Selection of local materials and cheap manpower	Fengxian Liyao Village utilizes local villagers and local stones to achieve low-cost construction of village buildings.		Make more use of common soil, wood, stone, bamboo, grass, and crops in rural areas for construction.
	C2 Research on Characteristic Materials and Human Needs	Village buildings in the Central Plains region of China are made by hand using adobe technology, consisting of clay, grass, and mud glued together in brick molds.		Utilizing the extensive nature of local materials to create landscape architecture that differs from urban new materials.
	C3 Drawing inspiration from industrial technology processes and construction processes	In the waterfront landscape, ecological stone cages made of locally collected crushed stones are used as water banks, which are simple to make and easy to stack and move.		Standardized production is achieved through modularization, prefabrication, batch production, and unitization.

Table 5 (continued)

Name	Measure	Case	Image schema	Technical examples
D Low maintenance - planning resources with the concept of sustainable development.	D1Scientific planning of plant material selection and matching	By using the least amount of engineering means, preserve the original vegetation and form habitats such as beaches, ponds, marshes, islands, and forests, in order to cultivate a rich vegetation landscape.		Preserve existing vegetation and use a large number of local tree species to reduce plant diseases, pests, and maintenance costs.
	D2Establish a water body recycling system	The landscape design of Ningbo Eastern New City Ecological Corridor (Phase III) includes planting tree islands in the water, increasing the contact surface between organisms and water, and purifying urban surface runoff.		Collect rainwater through roofs, water collection tanks, and drainage ditches as a source of water for plant irrigation.

Table 5 (continued)

Name	Measure	Case	Image schema	Technical examples
	D3Creating economic benefits as maintenance supply	The "Eagle Street Roof Farm" in New York uses the roofs of abandoned warehouses to grow organic vegetables, increasing green space and generating economic income.		Increase farmers' income through vegetable sales, citizen cultivation, and crop picking.

Source: Author

3. Low-cost control model and control method model for traditional village landscape in Xuzhou City

In the planning, design, and construction process of traditional village landscape protection, feasible control implementation plans are formulated based on the cost components of economics, and cost control is achieved by establishing low-cost models.

3.1 Cost Control Model Formula

(1) In Marxist economics, the cost model is:

C=Cs+V (I)

Among them: C is the total cost of the product, in 10000 yuan; Cs represents the cost of materialized labor, namely the transfer value, including depreciation costs of machinery and equipment, raw material consumption costs, energy consumption costs, etc., in 10000 yuan; V is the cost of live labor, i.e. worker wages, etc., in 10000 yuan.

(2) In modern development economics, the cost model is: C=Cs+V+Co+Ce+Crd(II)

Among them, Ce represents the environmental cost, i.e. the cost of environmental degradation, including environmental protection expenses and environmental degradation costs, in 10000 yuan; Crd is the research and development cost, which refers to the cost of innovative research and development activities paid by enterprises to increase product types and improve product quality, in 10000 yuan. The meanings and units of other symbols are the same as above (Pang, 2021).

(3) The comprehensive improvement of rural landscape environment belongs to engineering construction projects, which are different from general commodities and have certain differences in cost composition. Based on our research and analysis, as well as the construction practice of rural environmental improvement projects, we believe that the cost model for comprehensive improvement of rural landscape environment should be:

C=Cs+V+Co+Ce+Ct (III)

Among them, Ce represents the cost of ecological environment, i.e. the cost of ecological environment degradation, including ecological environment protection expenses and ecological environment degradation costs, in 10000 yuan; Ct is the technical cost, which refers to the cost of using advanced and new technologies in the renovation project (the practical application of advanced and new technologies can reduce other costs), in 10000 yuan. The meanings and units of other symbols are the same as above.

3.2 Low-cost control model and control methods

Based on the cost model (III) of comprehensive improvement of rural landscape environment mentioned above, a low-cost control model is established, with the objective function being:

$$\min C = \sum_{i=1}^{n} (C_{si} + V_i + C_{oi} + C_{ei} + C_{ti}) \quad (IV)$$

The constraint conditions are:

(1) Meeting the main functional requirements; (2) Inheriting local regional culture; (3) Maintain ecological balance.

In the formula: C - is the objective function, which means the

total cost of the renovation project, with the minimum requirement; Csi is the physical and chemical cost of the i-th unit project; Vi is the labor and other costs of the i-th unit project; Coi is the opportunity cost of the i-th unit project; Cei is the ecological environment cost of the i-th individual project; Cti is the technical cost of the i-th unit project.

When applying model (IV) for research and judgment, it should be based on meeting the main functional requirements, inheriting local regional culture, and maintaining ecological balance, and meeting the wishes of both Party A and Party B, based on the overall implementation plan and individual project construction plans of traditional village landscape protection design in Xuzhou area, combined with the cultural elements of traditional village landscape Analyze, study, and make judgments on the cost of traditional village landscape protection implementation based on the constraints of various parameters that affect the cost in the implementation plan, as well as the influencing factors of natural and economic factors. Since there are many parameters affecting the cost and they are uncertain, the interactive research and judgment optimization method combining analysis and calculation with judgment and decision-making can be used, that is, in the process of analysis and judgment, each step of Party A and Party B (the decision-maker) should evaluate the results of analysis and judgment, then adjust and optimize the low-cost implementation plan, and then conduct analysis and judgment, Repeat this process until satisfactory results are obtained from both Party A and Party B (decision-makers). Namely: Analysis, Evaluation, Adjustment, and Optimization Analysis, Evaluation, Adjustment and Optimization find the best solution.

The table method can be used for research evaluation, as shown in Table 6. Using the landscape construction of Wushao Village in Xuzhou City as an example, specific cases are illustrated. This includes four individual projects: cultural engineering, hard engineering, soft engineering, and other engineering. Three feasible implementation plans have been developed. The analysis and assessment of the costs and total cost of each individual landscape project and feasible implementation plan are presented in Table 7.

Table 7 shows that without the scientific allocation of resources, the construction cost of the landscape project in Wushao Village was 1.69 million yuan. However, by applying low-cost control methods for effective resource allocation, the minimum cost of the landscape project can be reduced to 1.5 million yuan, saving 190,000 yuan, which is an 11.24% reduction compared to the original cost.

Table 6 Low-Cost Control Judgment Table for Traditional Village Landscape Construction Project (in 10,000 yuan)

A single project		Implementation						Minimum cost determination
		1	2	...	j	...	m	
1	C_{s1}	C_{s11}	C_{s12}	…	C_{s1j}	…	C_{s1m}	Compare and judge from 1-m schemes
	V_1	V_{11}	V_{12}	…	V_{1j}	…	V_{1m}	
	C_{o1}	C_{o11}	C_{o12}	…	C_{o1j}	…	C_{o1m}	
	C_{e1}	C_{e11}	C_{e12}	…	C_{e1j}	…	C_{e1m}	
	C_{t1}	C_{t11}	C_{t12}	…	C_{t1j}	…	C_{t1m}	
	合计	C_{11}	C_{12}	…	C_{1j}	…	C_{1m}	C_1
2	C_{s2}	C_{s21}	C_{s22}	…	C_{s2j}	…	C_{s2m}	Compare and judge from 1-m schemes
	V_2	V_{21}	V_{22}	…	V_{2j}	…	V_{2m}	
	C_{o2}	C_{o21}	C_{o22}	…	C_{o2j}	…	C_{o2m}	
	C_{e2}	C_{e21}	C_{e22}	…	C_{e2j}	…	C_{e2m}	
	C_{t2}	C_{t21}	C_{t22}	…	C_{t2j}	…	C_{t2m}	
	合计	C_{21}	C_{22}	…	C_{2j}	…	C_{2m}	C_2
…	…	…	…	…	…	…	…	…
i	C_{si}	C_{si1}	C_{sii}	…	C_{sij}	…	C_{sim}	Compare and judge from 1-m schemes
	V_i	V_{i1}	V_{ii}	…	V_{ij}	…	V_{im}	
	C_{oi}	C_{oi1}	C_{oii}	…	C_{oij}	…	C_{oim}	
	C_{ei}	C_{ei1}	C_{eii}	…	C_{eij}	…	C_{eim}	
	C_{ti}	C_{ti1}	C_{tii}	…	C_{tij}	…	C_{tim}	

Table 6 (continued)

A single project		Implementation						Minimum cost determination
		1	2	...	j	...	m	
	合计	C_{i1}	C_{ii}	…	C_{ij}	…	C_{im}	C_i
…	…	…	…	…	…	…	…	…
n	C_{sn}	C_{sn1}	C_{snn}	…	C_{snj}	…	C_{snm}	Compare and judge from 1-m schemes
	V_n	V_{n1}	V_{nn}	…	V_{nj}	…	V_{nm}	
	C_{on}	C_{on1}	C_{onn}	…	C_{onj}	…	C_{onm}	
	C_{en}	C_{en1}	C_{enn}	…	C_{enj}	…	C_{enm}	
	C_{tn}	C_{tn1}	C_{tnn}	…	C_{tnj}	…	C_{tnm}	
	合计	C_{n1}	C_{nn}	…	C_{nj}	…	C_{nm}	C_n

Source: Author

Table 7 Low-Cost Control Judgment Table for Traditional Village Landscape Construction Project (in 10,000 yuan)

A single project		Implementation			Minimum cost determination
			2	3	
1	C_{s1}	11	10	12	Compare and judge from 1-m schemes
	V_1	5	7	6	
	C_{o1}	3	3	4	
	C_{e1}	2	1	2	
	C_{t1}	2	1	3	
	Amount to	23	22	27	22
2	C_{s2}	46	45	43	Compare and judge from 1-m schemes
	V_2	12	11	10	
	C_{o2}	5	3	4	
	C_{e2}	4	3	3	
	C_{t2}	2	3	2	
	Amount to	69	65	62	62

A single project		Implementation			Minimum cost determination
		1	2	...	
3	C_{s3}	29	30	32	Compare and judge from 1-m schemes
	V_3	8	9	9	
	C_{o3}	5	5	4	
	C_{e3}	3	4	3	
	C_{t3}	2	4	1	
	Amount to	47	52	49	47
4	C_{s4}	9	10	8	Compare and judge from 1-m schemes
	V_4	3	4	3	
	C_{o4}	2	2	1	
	C_{e4}	2	2	3	
	C_{t4}	4	3	3	
	Amount to	20	21	19	19
The minimum total cost of landscape construction in Wushao Village is : C=C1+C2+C3++C4=22+62+47+19=150（万元）					

Source: Author

In summary, by analyzing and understanding the core elements and influencing factors of traditional village landscapes in Xuzhou City, and promoting the establishment of design path systems—such as principles and strategies for landscape protection based on the distribution patterns of traditional villages—low-cost landscape control models and methods have been implemented. These efforts have successfully reduced physical, labor, opportunity, ecological, and technical costs, resulting in the construction of a low-cost design system model for traditional village landscapes in the Xuzhou region (see Figure 4).

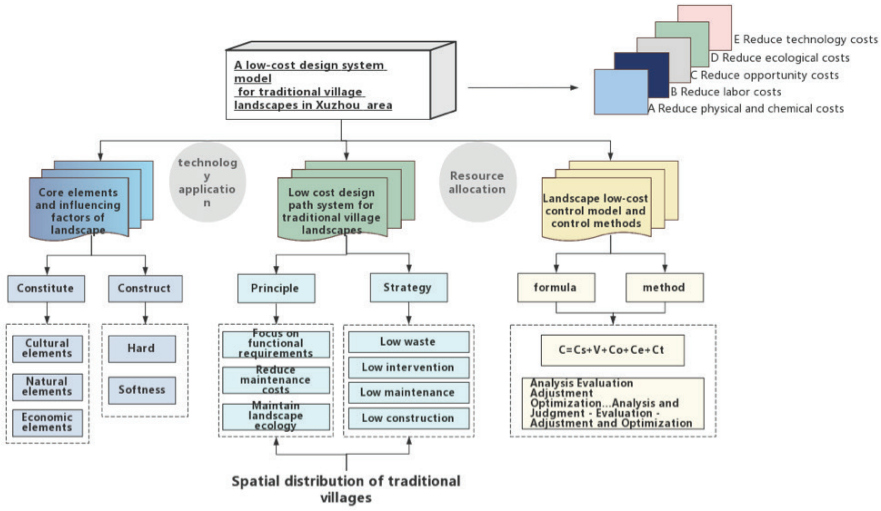

Figure 4 Low cost design system model for traditional village landscapes in Xuzhou
Source: Author

Conclusions

This research investigated the landscape of traditional villages in Xuzhou City, focusing on identifying core elements and influencing factors, such as cultural, natural, and economic components, as well as developing low-cost design strategies. The study emphasized a people-oriented approach, minimal human intervention, and resource optimization, leading to the formulation of a low-cost design model that reduces physical, labor, ecological, and technological costs. The findings highlight the importance of sustainable design principles and strategies that ensure the long-term preservation and renewal of traditional village landscapes.

The core elements and influencing factors of traditional village landscapes in Xuzhou were identified, including cultural, natural, and economic aspects. The spatial distribution is characterized by a “one center, two belts” pattern, where moderate elevations are conducive to the formation and preservation of traditional villages, while higher or lower elevations prove less favorable for their development.

The study developed key low-cost design principles, such as prioritizing functional needs, respecting natural landscapes, reducing human intervention, and minimizing maintenance costs. These principles informed a design strategy based on "low waste, low intervention, low construction, and low maintenance," which formed the foundation of a systematic approach to landscape design for traditional villages in Xuzhou.

The application of low-cost landscape control models and methods effectively reduced costs across various dimensions, including physical, labor, opportunity, ecological, and technological costs. The renewal of traditional village landscapes is a dynamic and continuous process, where optimizing resource allocation and incorporating new technologies are vital for ensuring the sustainability and long-term development of these landscapes.

Discussion

This study examines the protection and development of traditional village landscapes from a low-cost perspective. Through questionnaire surveys, expert consultations, and government statistical data, the spatial layout, mechanism characteristics, and driving factors of traditional villages in Xuzhou City were analyzed. The results align with the research findings of Professor Wang Yunxia (2015), supporting the notion that moderate elevation and cultural factors play a critical role in village preservation.

The theory of "low waste, low intervention" proposed by renowned scholar Professor Luo Pingjia (2019) has had a significant influence on rural living environment improvement, which is consistent with the "low waste, low intervention, low construction, and low maintenance" strategies proposed in this study. Both approaches have proven effective in reducing the costs associated with rural landscape design and construction by employing similar low-cost control methods.

While this study successfully developed a low-cost rural design model, it also has limitations. For instance, the reliance on questionnaire surveys and

expert consultations might introduce subjectivity, and the scope of the study was confined to Xuzhou City. Future research could benefit from expanding the geographical scope and incorporating more diverse data sources, including quantitative measures of landscape quality over time.

The low-cost rural design model presented here provides valuable guidance for landscape architects, designers, decision-makers, and stakeholders in making informed decisions. It offers a practical framework for reducing costs without compromising the integrity of traditional village landscapes. However, the model's applicability to other regions requires further validation. Additionally, the traditional village design and construction technology model needs to deepen research in areas such as data sources, method systems, research scales, and key content.

An in-depth analysis of low-cost elements and formulas in traditional village landscape protection and renovation should involve quantitative, qualitative, or a combination of both methods to explore "hidden elements," such as cultural preservation and community engagement, which are critical yet understudied aspects. Future research should also focus on integrating new technologies, such as GIS and remote sensing, to improve the accuracy and efficiency of landscape planning.

References

Aparo, N. O., Odongo, W., & De Steur, H. (2022). Unraveling heterogeneity in farmer's adoption of mobile phone technologies: A systematic review. **Technological Forecasting and Social Change,** 185, 122048.

Başkent, E. Z. (2023). Assessing and developing improvement strategies for the protected area management (PAM) planning process/effectiveness in Turkey. **Environmental Development,** 46, 100867.

Che, Y. (2016). Spatial imagery and cultural value of village landscape: Taking the ancient village of Sanmenyuan in Longyou County as an example. **Journal of Guangxi University for Nationalities (Philosophy and Social Sciences Edition),** 6, 16-21.

Dong, Y. (2015). Reconstruction of modern landscape design theory system model. **Journal of Tianjin University (Social Sciences Edition),** 4, 343-346.

Gao, N. (2017). Research on low-cost planning and design strategies for tourism-oriented rural landscapes: Taking Wenyu Village, Yuling Town, **Lingbao City as an example. Architecture and Culture,** 10, 141-143.

Hu, Y. (2014). The concept and cultural connotation of traditional villages. **Research on Urban Development,** 1, 10-13.

Ian, H. (1999). **Ecology, community, and delight: Sources of values in landscape architecture**. London: E&FN Spon.

Jin, L. (2010). Landscape design influenced by the concept of conservation. **Journal of Northwest Forestry University,** 5, 203-206.

Jin, R. (2022). Theoretical resource basic research on the protection path of traditional villages in Northern Jiangsu. **Hubei Agricultural Science,** 23, 256-261.

Joost, H. V., Kort, H. S. M., Hensen, J. L. M., Duijnstee, M. S. H., & Rutten, P. G. S. (2022). Thermal comfort and integrated building design for older people with dementia. **Building & Environment.**

Khan, A. K., & Faisal, S. M. (2023). The impact on employees through the use of AI tools in accountancy. **Materials Today:** Proceedings, 80, 2814–2818.

Linas, G., Kelum, A. A., & Gamage. (2014). Demand side management in smart grid: A review and proposals for future direction. **Sustainable Cities & Society.**

Liu, S., Koupriyanov, M., Paskaruk, D., Fediuk, G., & Chen, Q. (2022). Investigation of airborne particle exposure in an office environment. **Building & Environment.**

Luo, P. (2019). From external factors to internal factors: A study on the impact mechanism of rural human settlement environment improvement from the perspective of village participation: Taking Wushao Village in Xuzhou City as an example. **Rural Economy,** 10, 101-108.

Martin, W., Bauer, N., Allum, N., & Steve, H. (2016). What can we learn from 25 years of PUS survey research? Liberating and expanding the agenda. **Public Understanding of Science.**

Melby, P. (2005). **Sustainable landscape design technology (Zhang Ying & Li Yong, Trans.).** Beijing: Mechanical Industry Press.

Pang, J. (2021). Research on low-cost control methods and technical measures for comprehensive improvement of rural landscape environment. **Journal of Shandong Agricultural University (Natural Science Edition),** 6, 1063-1068.

Shen, J. (2012). Reflections on the values of landscape architecture [Doctoral dissertation, Beijing Forestry University]. **Beijing Forestry University.**

Suppa, A. R., & Ballarini, I. (2023). Supporting climate-neutral cities with urban energy modeling: A review of building retrofit scenarios, focused on decision-making, energy and environmental performance, and cost. **Sustainable Cities and Society.**

Tetteh, N., & Amponsah, O. (2020). Sustainable adoption of smart homes from the Sub-Saharan African perspective. **Sustainable Cities and Society,** 63, 102434.

Tobias, P. (2022). The development of ecosystem cultural services promotes the diversification of research perspectives on “humans and nature” - Dialogue with Tobias Plininger. **Landscape Design (Chinese and English),** 5, 72-83.

Tony, A., Ghoshray, A., & Michalis, P. (2015). Agricultural commodity price shocks and their effect on growth in Sub-Saharan Africa. **Journal of Agricultural Economics**.

Wang, H. (2008). **Characteristics and integration of village landscape.** Beijing: China Forestry Press.

Wang, L. (2020). Analysis and protection research on the characteristics of traditional villages in Northern Jiangsu Province: Taking Wushao Village in Xuzhou City as an example. **Meihe Times (Urban Edition),** 11, 43-44.