

Research on the Practice and Effectiveness of Prefabricated Buildings Empowering Rural Revitalization

-- Taking Jingxia Village in Huangpu, Guangzhou as an example

Xian Luo^{1, 2}, Wei Xu^{1, 2, *}

¹ School of Civil Engineering and Architecture, Wuhan Institute of Technology, Wuhan 430074, China

² Village Culture and Human Settlements Research Center, Wuhan Institute of Technology, Wuhan 430074, China

* Corresponding author: Wei Xu

Abstract: In the strategic framework of rural revitalization, the construction and development of rural housing and the improvement of human settlements are the top priorities. Traditional rural house construction methods generally have problems such as high safety hazards, low construction efficiency, heavy environmental pollution, and difficult style management and control. Therefore, rural construction urgently needs to transform into modernization. Prefabricated buildings have become a key path to achieve the goal of modernizing rural construction with the advantages of standardized production, green and low carbon, high efficiency and safety. This article takes the prefabricated farm house demonstration project in Jinxia Village, Huangpu District, Guangzhou City as the research object. Through literature research and case analysis, it systematically exp lains the construction model, MIC modular technology system, and implementation path of the project. At the same time, it evaluates the implementation effectiveness from the four dimensions of residential safety, ecological low-carbon, industrial economy, and rural governance, summarizes replicable practical experience, analyzes the practical dilemma of rural prefabricated building promotion, and proposes optimization strategies.

Keywords: Prefabricated buildings, rural revitalization, Jingxia Village, rural house renovation.

1. Introduction

With the acceleration of my country's rural revitalization construction process, rural prefabricated buildings have ushered in a critical period of high-quality development [1]. Rural housing is the core carrier of rural living environment, and its construction level is directly related to farmers' quality of life and high-quality rural development. At present, rural housing in my country is still dominated by traditional cast-in-situ brick-concrete structures. According to the Ministry of Housing and Urban-Rural Development's "2024 Urban and Rural Construction Statistical Yearbook", about 38.2% of my country's existing rural houses are brick-concrete and adobe structure houses built before 2000. There are common pain points such as substandard structural safety, backward construction technology, high energy consumption and pollution, and disordered spatial layout. It is difficult to meet the rural revitalization requirements of ecological livability and prosperous industries. As an emerging construction model, prefabricated buildings integrate environmental protection, energy saving, emission reduction, and comfort. They are closely connected with the rural revitalization strategy and provide a new direction for the development of rural green residences [2].

2. Related Concepts

2.1. Definition of Core Concepts

As a major strategy for rural development in my country, rural revitalization aims to promote rural development, create a healthy living environment for farmers, improve farmers' happiness index, and achieve coordinated development of

urban and rural areas [3], covering five major revitalizations: rural industry, talent, culture, ecology, and organization. Among them, ecological livability is the key, and the core is to improve the rural living environment and improve the level of rural housing construction and infrastructure; effective governance is the guarantee, which requires improving the grassroots governance system and standardizing rural construction management behaviors. As the core content of rural construction actions, rural housing construction is directly related to rural ecological livability and effective governance. It is an important concrete carrier for the implementation of rural revitalization strategy.

Prefabricated buildings refer to buildings whose structural systems, peripheral protection systems, equipment and pipeline systems, and interior systems are mainly assembled with prefabricated components. According to the degree of integration, they can be divided into component assembly and modular assembly. Prefabricated buildings not only reduce pollution and meet the requirements of green, low-carbon, energy-saving and environmental protection, but also help to promote the upgrading and renewal of the rural construction industry, actively respond to the national carbon neutrality and carbon peak "double carbon" strategic goals, assist the construction of beautiful countryside, and promote the development of rural revitalization strategies [4].

2.2. Typical Basis for Case Selection

Nowadays, prefabricated buildings have been gradually promoted and applied in various provinces and cities across the country [5]. Jinxia Village, Huangpu District, Guangzhou City (Figure 1), as the first future rural building industrialization demonstration project in Guangdong

Province and the first pilot zero-carbon village and town promotion project in the country, takes the whole-area prefabricated farm house transformation as the core and integrates land, energy, and production. With industrial resources, it has completed a comprehensive transformation from an old village to a smart zero-carbon village. It innovatively adopted MIC concrete modular integrated construction technology to complete the transformation of farm buildings and rural reconstruction in the entire area, forming a unique rural prefabricated construction model. The project construction has achieved remarkable results and has strong typicality and demonstration value. Based on this, this article takes Jinxia Village as a case to conduct an in-depth study of the practical path and comprehensive effectiveness of prefabricated buildings in empowering rural revitalization, extract successful practical experience, and provide empirical reference for the promotion of rural construction across the country.



Figure 1. Jinxia Village, Huangpu District, Guangzhou (Image source: CCTV.com)

3. Overview of Guangzhou Huangpu Jinxia Village Project

3.1. Basic Overview of the Project

In terms of geographical location, Jinxia Village belongs to Longhu Street, Huangpu District, Guangzhou City, and is geographically located in the core circle of the Guangdong-Hong Kong-Macao Greater Bay Area. It is a typical suburban village. Jinxia Village is about 30 kilometers away from the center of Guangzhou. The transportation is very convenient. It has inherent advantages in undertaking urban industrial radiation and urban population spillover. In addition, Jinxia Village is adjacent to Huangpu Innovation Valley, which can better Linked with science and technology innovation resources, it promotes the cross-field integrated development of "rural revitalization + science and technology innovation parks". Its own suburban and rural attributes provide superior location conditions for the implementation of prefabricated buildings and the empowerment of science and technology innovation industries (Figure 2).

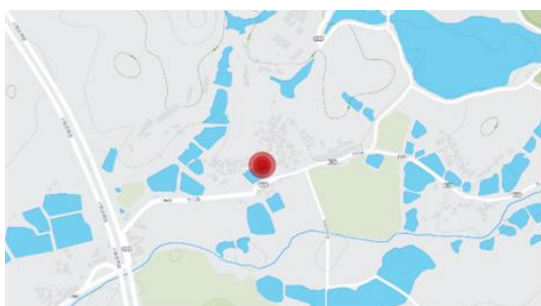


Figure 2. Geographical location of Jinxia Village (Image source: drawn by the author)

In terms of resource conditions, Jinxia Village has superior natural resources. The rivers in the village are crisscrossed, the vegetation is dense, and it has clear lakes and indigo mountain views. It has a good foundation for the development of ecological rural tourism. The original rural residential layout is scattered, a large amount of land and old farmhouses are obviously occupied, and the land use efficiency is low. The land resources with potential for transformation are as high as 20,000 square meters, providing sufficient space for the centralized construction of prefabricated farm buildings and the expansion of industrial space. In addition, Jinxia Village can also rely on the huge tourism market in Guangdong, Hong Kong and Macao to quickly radiate tourists from surrounding cities, and in this way provide a broad market for the development of the local rural cultural tourism industry.

3.2. Core Dilemma Before Transformation

The problems faced by Jinxia Village before the reconstruction were diverse, and the multifaceted hidden dangers jointly constituted the core dilemma of the development of Jinxia Village:

At the construction level, the safety hazards of farm houses are outstanding, and the construction methods are traditional and backward. Before the renovation, there were about 512 old farm houses in Jinxia Village, most of which were traditional brick-concrete structures. The old farm houses were built for a long time, and their seismic performance no longer meets the standards of contemporary houses. Some farm houses also have safety hazards such as wall cracks and roof leaks. The existing farm houses can no longer meet the safety requirements of local residents. demand; at the same time, there is a lack of professional planning guidance during the construction of rural houses. The architectural style is difficult to unify, the apartment layout is messy and the functions are single. There are common problems of poor lighting and ventilation conditions. The construction method is mostly traditional cast-in-situ construction. The construction technology is backward and the construction personnel lack professional construction training. This results in a long construction period, a large amount of labor, and it is difficult to guarantee the quality of the building.

At the spatial level, the layout of homestead sites is scattered and the land utilization rate is low. The layout of homestead sites in Jinxia Village before reconstruction was scattered. The lack of professional planning guidance led to local residents to build farmhouses at will. The village space was disorganized. As a result, a large amount of land and old farmhouses were idle, resulting in serious waste of land. It is heavy and difficult to improve the utilization rate, which has become the biggest obstacle to the construction of public service space and the large-scale expansion of industries; in addition, the narrow rural roads, poor spatial connectivity and imperfect supporting facilities have also seriously affected the convenience of local residents' lives and the overall style of the village.

At the industrial level, the local industrial structure of Jinxia Village is single, mostly based on traditional agriculture. The main crops grown are rice and vegetables. The added value of the industry is low and there is a lack of stable income-increasing channels. The overall economy of local residents is weak. The total annual income of the village collective in 2019 was only 430,000 yuan. Local employment is difficult, and residents have to go out to work to increase

their income. The loss of personnel makes it more difficult to achieve the development goal of rural revitalization.

At the ecological level, there are problems such as large carbon emissions from traditional energy sources and serious construction pollution caused by traditional construction methods. Traditional energy sources such as coal and firewood are the most widely used energy sources by local residents. The utilization efficiency of traditional energy sources is low and carbon emissions are large. They pollute the air seriously and are contrary to the goal of a green countryside with zero carbon emissions. In addition, traditional farm house construction The process will produce a large amount of construction waste, dust and noise, which seriously pollutes the environment and is an important factor in destroying the ecological environment of the village. At the same time, the lack of basic supporting facilities prevents local residents from properly disposing of the garbage and sewage generated in daily life. The ecological environment governance capacity is weak, which also causes great damage to the ecological environment.

4. Analysis of the Practical Path of The Prefabricated Construction Project in Jinxia Village

4.1. Technology Path Adaptation: Rural Localization Transformation of MIC Modular Buildings

The Jinxia Village project team fully considered the geological conditions and climate characteristics of Jinxia Village, combined with the living needs of local residents, selected concrete MIC modular assembly technology as the core construction technology, and carried out local optimization in terms of module specifications and performance. The size of the modules was adapted according to the size of the rural homestead in Jinxia Village, and 17 house modules and 2 roof modules were designed, which can be customized according to the needs of the residents. The needs of local residents can be freely combined, allowing villagers to customize the house type. At the same time, the performance of the module has been optimized according to the geographical conditions of Jinxia Village. The seismic performance meets the 7-level seismic standard, and a full concrete exterior wall is used to improve the anti-seepage, moisture-proof, and sound insulation performance. In addition, in order to meet the needs of rural living and ecology, and adapt to the integrated application of zero-carbon energy, the module has reserved photovoltaic installation interfaces.

In order to solve the problems of high transportation costs and long construction period of prefabricated modules in rural areas, the project has also made local adaptations in the production mode of prefabricated components, adopted a local production and on-site assembly model, and innovatively laid out a "nomadic" mobile prefabricated factory to achieve "on-site production and on-site assembly" of modules; mobile factory It can be flexibly adjusted according to the project progress to reduce losses and costs during module transportation, while shortening the construction cycle and adapting to the actual needs of rural construction. In addition, the factory adopts standardized production processes and uses BIM technology and intelligent construction systems to achieve data collaboration throughout the design and production process to ensure

module quality.

Jinxia Village adopts the "four-free" construction technology of "no support, no formwork, no need to tie steel bars, and no need for plastering" to simplify the construction process, reduce the difficulty of construction and labor requirements; after the modules are transported to the construction site, the main construction can be completed only through grouting and anchorage assembly, and the construction labor consumption is lower than that of traditional methods. It is reduced by 60%. There is no need for professional and technical craftsmen. Ordinary villagers can participate in the construction after simple training. This effectively solves the shortage of rural craftsmen and also simplifies the process and shortens the construction period. The overall construction period is saved by about 50% compared with traditional construction, achieving "quick completion and quick move-in" of rural houses.

4.2. Model Path Innovation: Full-Chain Collaboration and Villager Participation Mechanism Design

Jinxia Village innovatively adopts REMPC's third-party implementation model integrating the entire industry chain. Central enterprises serve as third-party entities to integrate all-link resources such as design, production, construction, operation and maintenance, and industry introduction to achieve "one-stop" services. The third-party entity is responsible for overall project planning, technology research and development, module production, construction, and overall planning. Industrial introduction and later operation and maintenance have solved the problem of imperfect rural prefabricated construction industry chain and disconnected links; the government guides project implementation through policy support and financial subsidies, and village collectives and villagers participate in supervision throughout the process to ensure that project construction meets the needs of villagers and the village's development positioning, and achieves a "professional-led, multi-party collaboration" construction pattern.

The enthusiasm of villagers is low, and demolition and resettlement are unavoidable problems in rural construction. Therefore, Jinxia Village has designed a villager collaboration model of "build first and then demolish, rolling relocation, and menu selection". Priority was given to the construction of prefabricated model houses and transitional resettlement houses, which eliminated the villagers' concerns about "having no house to live in" and ensured the villagers' housing needs during the relocation period; at the same time, the project team gradually optimized the space in Jinxia Village and promoted the renovation of rural houses in batches to avoid conflicts caused by large-scale demolition; in addition, the project The project provides a variety of housing modules and decoration plans. By taking villagers to visit the mobile factory and calculating long-term benefits, the villagers are further motivated to participate. Villagers can choose independently according to their own needs and economic conditions, fully respecting the villagers' wishes, and improving the villagers' acceptance and satisfaction with the project.

Jinxia Village breaks through the limitations of "single farm house renovation" and builds a linkage and integration model of prefabricated buildings, land remediation, zero-carbon energy, and rural cultural tourism. The first is to link with land remediation, through the centralized construction of

prefabricated farm houses, to release 21,500 square meters of industrial space and 18,500 square meters of public service supporting space, optimize the layout of homesteads, and improve land use efficiency; the second is to link with zero-carbon energy, fully cover the roofs of prefabricated farm houses with photovoltaic panels, and build a "source-grid-load-storage" "The new rural power system realizes 100% consumption of clean energy and promotes the construction of zero-carbon villages and towns; the third is to link with rural cultural tourism, rely on prefabricated farm houses and ecological resources, introduce rural hotels, specialty restaurants, farms and other business formats to create a "technological innovation pastoral + ecological agricultural tourism" development path to achieve coordinated advancement of building renovation and industrial development.

4.3. Integration of Design Paths: Balance Between Regional Culture and Modern Functions

In order to pursue construction efficiency and facilitate unified planning and management, coupled with the late start of prefabricated buildings in my country and the relatively backward technology and design, the types and styles of components produced by the equipment are limited [6]. Therefore, prefabricated buildings may bring about the problem of "one thousand villages". In the exterior design of the building, Jinxia Village incorporates traditional elements such as Lingnan arcades and wok-eared gables, and uses Lingnan characteristic color matching to make the prefabricated farm houses consistent with the village's ecological style and regional culture, and combined with the Lingnan climate characteristics , optimize the layout of doors and windows, improve the ventilation and lighting performance of the building, and adapt to the hot and humid

climate conditions in Lingnan; at the same time, the overall style of the village is unified to make the prefabricated farm buildings, public service facilities and natural landscape form an organic whole, and achieve the style positioning of "modern quality + regional characteristics". In addition, the Jinxia Village project has also made ingenuity in adapting to the elderly and being green and energy-saving by setting aside handrails, using energy-saving doors and windows, and insulating walls. At the same time, it has built 11 public service facilities such as a comprehensive service station and a village cultural center to improve villagers' living facilities and improve living comfort.

5. Multi-Dimensional Evaluation of The Implementation Effectiveness of the Jinxia Village Project

5.1. Assessment Methods

Adopt "assembled vs. "Traditional construction" comparison method quantitatively compares the differences between prefabricated buildings and traditional cast-in-place construction in terms of construction period, labor volume, construction waste, construction costs, seismic performance, etc.; uses a combination of quantitative and qualitative methods to quantitatively evaluate quantitative indicators in dimensions such as living quality, ecological low-carbon, and industrial economy, qualitatively analyze difficult-to-quantify indicators such as governance effectiveness and villager satisfaction to ensure the comprehensiveness and objectivity of the evaluation results; at the same time, combined with the changes in the village before and after the renovation, a "baseline-effectiveness line" comparison system is formed to clearly present the enabling effect of prefabricated buildings (Table 1).

Table 1. Comparison of Energy Efficiency Between Self-Built Houses and Prefabricated Houses (Table Source: Author's Own Illustration)

Energy Efficiency Indicator	Before	After	Change	source
Building overall energy efficiency rate	Baseline 0%	≥30%	↑30%	1
Annual energy consumption per unit area	120kWh/m ² ·a	84kWh/ m ² ·a	↓30%	2
Construction period	Reference period	Reduce by 40%–50%	↓40%–50%	3
Labor Quantity	Benchmark	Reduce by 60%	↓60%	4
electricity self-sufficiency rate	0%	≥80%	↑80%	5
Annual PV Power Generation	0 kWh	≥437w kWh		6
Average monthly power generation per household	0 kWh	870 kWh		3
Annual carbon emissions per unit area	≈80kgCO ₂ / m ² ·a	≤24kgCO ₂ / m ² ·a	↓≥70%	7
Amount of construction waste generated	≈150 kg/ m ²	≤45 kg/ m ²	↓70%	5

Huangpu Housing and Urban-Rural Development Bureau
Official Website
Guangzhou Government Official Website
China State Construction Technology
People's Daily Online
Guangzhou Huangpu District Government
Southern Power Grid
Zero-Carbon Village and Town Pilot Announcement

5.2. Dimension of Living Quality

The renovated prefabricated farmhouses in Jinxia Village use concrete MIC module structures, which significantly improve the earthquake resistance and anti-seepage performance. The building life span can reach a hundred years,

which fundamentally improves the safety of living. At the same time, the layout of the units is optimized and reasonable, lighting and ventilation and the per capita living area are significantly improved. Many public service facilities have been added in the village to complete the education, medical, leisure and other supporting facilities. The aging-friendly design has improved the living comfort of the elderly, and comprehensively improved the living quality of the villagers.

5.3. Ecological Low-Carbon Dimension

Jinxia Village adopts the prefabricated construction model, which greatly reduces construction waste, dust and water consumption during the construction phase, achieving green and low-carbon construction, effectively reducing the impact

on the village ecology and villagers' lives. During the operation phase, it relies on full photovoltaic coverage on the roofs of rural houses in the village to achieve self-sufficiency in electricity. In conjunction with energy-saving building design, the annual carbon emission reduction is significant, effectively promoting zero-carbon operation of the village. As the only pilot project in South China for the United Nations Zero-Carbon Village Promotion Project, the village deeply integrated prefabricated buildings and zero-carbon energy to build a new rural power system and achieve full consumption of clean energy. It formed a zero-carbon construction model that can be replicated and promoted. It was listed as a typical experience by Guangdong Province and became a demonstration benchmark for rural zero-carbon development.

5.4. Industrial Economic Dimension

Jinxia Village effectively reduces the construction cost of prefabricated farm houses through on-site production and large-scale construction, and superimposes special government subsidies to form a multi-party cost model to effectively reduce the economic burden of villagers; at the same time, it relies on land transfer, photovoltaics, cultural tourism, etc. With diversified industries, the village collective economy has achieved leapfrog development, with annual income jumping from 430,000 yuan in 2019 to over 13 million yuan in 2024. The project construction and operation phases have created more than 900 jobs nearby, and the per capita annual income of villagers has increased. 12,000 yuan, and further expand income-increasing channels through B&B, catering and other business formats to truly achieve employment and income increase at home.

5.5. Dimensions of Governance Energy Efficiency

Jinxia Village has established a system of "government coordination, enterprise leadership, village collective coordination, and villager participation". The four-party collaborative governance mechanism has divided labor and promoted efficiently, forming a win-win situation for the government, enterprises, villagers and households. Through menu-based selection, construction first and demolition and other measures, villagers' enthusiasm for participation has been fully mobilized. Villagers have widely participated in house type selection, construction supervision and industrial decision-making. The right to know, the right to participate and the right to supervise have been effectively guaranteed, and the right to participate has been realized. The transformation from passive acceptance to active participation; the project not only improved the public service facilities in the village, greatly improved the convenience and happiness of villagers' lives, but also strengthened the service capabilities of the village collective organization, improved the autonomy and conflict mediation mechanism, promoted rural governance to be more standardized and refined, and achieved the goal of rural revitalization with effective governance and civilized rural customs.

6. Research on Experience Extraction and Promotion of the Jinxia Village Case

6.1. Core Successful Experience of the Case

The practice of promoting prefabricated buildings in the countryside in Jinxia Village has improved the mature

experience that can be replicated and promoted in many aspects such as policy guarantee, technological adaptation, collaborative operation and industrial integration. Through the government's overall planning, prefabricated buildings will be organically combined with policies such as rural revitalization, zero-carbon village and town construction, and land remediation. At the same time, special financial subsidies will be provided to reduce the burden on villagers and enterprises, and pilot status at all levels will be relied on to secure policy, technology, and financial resources to provide solid support for project implementation; technically, it will be based on rural geology, climate, etc. Optimize technology selection based on actual conditions, deploy mobile prefabricated factories to achieve on-site production and assembly, simplify construction processes to adapt to the shortage of rural craftsmen, and promote the localization of prefabricated construction technology; introduce third-party entity collaboration to carry out integrated operations of the entire industry chain, establish menu-based selection, construction first and then demolition and other in-depth villager participation mechanisms to build The four-party collaborative pattern of "government, enterprise, villagers" effectively resolves implementation conflicts and ensures long-term advancement of projects; at the level of industrial integration, it is not limited to rural house renovation itself, but deeply integrates prefabricated building construction with land remediation, zero-carbon energy application, and rural cultural and tourism development. While optimizing land use, it expands green industries and cultural tourism formats, and achieves coordinated development of building renovation and industrial empowerment, ecological improvement, and villagers' income increase.

6.2. Differentiation Analysis of Case Promotion

Although the prefabricated building construction model in Jinxia Village has replicable experience, it has obvious promotion limitations and cannot be directly copied to various villages. The core limitations are concentrated in three major aspects. First, regional development conditions are limited. Its success relies on the strong financial strength of Huangpu District and the strong cultural and tourism radiation of the Guangdong-Hong Kong-Macao Greater Bay Area. For underdeveloped areas with weak finances and unable to afford special subsidies and early investment, as well as remote villages that are far away from cities and lack cultural and tourism resources, and it is difficult to achieve long-term income growth through agricultural and cultural tourism, the cost of this model is too high and the operation is unsustainable. It is only suitable for suburban villages with strong financial strength, close to cities, and rich cultural and tourism resources. Secondly, there are boundaries in technical adaptation. The concrete MIC modules used in the project were specially optimized for the hot and humid climate and plain geology of the Pearl River Delta. The scope of adaptation is limited. Cold northern regions require additional modifications to improve thermal insulation performance and increase costs. Module transportation and assembly in mountainous and geologically complex areas are difficult, and local production and assembly models cannot be implemented. Seismic performance needs to be further optimized in areas with high seismic intensity. Technical replication must be combined with localized adjustments to local climate and geological conditions, and cannot be copied blindly. Third, the basic conditions at the grassroots level are

restricted by differences. The implementation of the model relies on the strong organizational coordination ability of the village collective and the high acceptance of the villagers. If the village collective cohesion is weak and it is difficult to coordinate the villagers' wishes and resolve conflicts, or the villagers are conservative and have low awareness and acceptance of prefabricated buildings, or the homesteads are scattered and the villagers' living wishes are not unified, the core models such as centralized construction and rolling relocation cannot be implemented, which will directly hinder the advancement and implementation of the project.

7. Conclusion and Outlook

7.1. Research Conclusion

Relying on the advantages of policy pilots, Huangpu Jingxia Village innovatively adopts MIC modular technology, mobile factory production mode and REMPC full industry chain implementation mode to build a "four-dimensional integration" empowerment model of prefabricated buildings and residential quality, ecological low-carbon, industrial economy, and governance efficiency. It has achieved a leap-forward transformation of the village from a "backward suburban village" to a "future demonstration village", effectively solved the pain points of traditional rural construction, and provided a complete practical sample for the sinking of prefabricated buildings into the countryside.

The success of the Jinxia Village case is the result of the joint action of many factors. Innovation in technology, model, and integration are the core factors for the success of the project. The project has realized the rural localization innovation of prefabricated technology at the technical level. In terms of selection, local geographical conditions, customs and other factors have been fully considered, and improvements have been made in the production and construction of prefabricated buildings based on actual conditions, providing a The implementation of the project has laid a good foundation; the collaborative model of full industry chain collaboration and in-depth participation of villagers is undoubtedly the icing on the cake based on technological innovation. Advanced technology requires good systems to implement. The full participation and collaborative model of residents in the Jingxia Village project provides a win-win example for the country; at the integration level, a deep integration of construction industrialization and rural diversified development has been achieved. At the same time, there are clear boundary restrictions on the promotion of this case, which is affected by regional economic conditions, technical adaptation conditions, and subject collaboration conditions. It cannot be copied blindly and needs to be differentiated and adapted based on the actual situation of the countryside.

Seeking common ground while reserving differences is the key idea for the promotion and development of rural prefabricated buildings. One-sided complete imitation is not advisable, and a "one size fits all" approach cannot be adopted. Adhering to the combination of "differentiated adaptation" and "common guarantee" is the key to the localization of prefabricated buildings. Differentiated technical solutions should be formulated according to different regional economic levels, climate and geological conditions, and

village collective organizational capabilities. Technical path, model selection and subsidy policy ensure that prefabricated buildings can adapt to the actual needs of rural areas; at the same time, it is also necessary to improve the common guarantee system for the development of rural prefabricated buildings, improve technical standards, build an industrial chain, and establish a case demonstration mechanism to provide all-round support for the promotion of prefabricated buildings in rural areas and promote the deep integration of prefabricated buildings and rural revitalization.

7.2. Future Prospects

This article only uses Jinxia Village in Huangpu, Guangzhou as a single case study and the data are all from the Internet. It failed to select different regions and different types of rural prefabricated building cases to conduct cross-regional multi-case comparative studies. Therefore, the research results are not universal. Subsequent research should focus on analyzing the differences in technology selection, model adaptation, policy support, etc. in different types of villages, refine the technical paths and mode selection of prefabricated building adaptation in different types of villages, and further enrich the theoretical system and practical experience of prefabricated buildings empowering rural revitalization. At the same time, big data, artificial intelligence and other technologies can be combined to build an evaluation model for the adaptability of rural prefabricated buildings, providing an accurate quantitative reference for the promotion of prefabricated buildings in various places and solving the core problem of "difficulty in adaptation". In addition, in-depth micro-level research can be carried out, and through on-site visits, in-depth interviews, etc., micro-operation and maintenance data of prefabricated building projects can be obtained, factors affecting the long-term sustainability of the project can be analyzed, the post-operation and maintenance mechanism of prefabricated buildings can be improved, and the long-term operation capabilities of the project can be improved.

References

- [1] Liu, H. T. (2025). Research on fully prefabricated residential systems in the context of rural revitalization. *Northern Architecture*, 10(4), 7–11.
- [2] Zhu, Y. (2025). Discussion on development strategies of rural prefabricated buildings under the background of rural revitalization. *Contemporary Agricultural Machinery*, 2, 43–45.
- [3] Wang, Z. Y., Wang, C., Yang, J. R., et al. (2025). Cost reduction and efficiency increase of rural prefabricated buildings. *Village Committee Director*, 1, 238–240.
- [4] Tang, X. X. (2020). Design and construction of small-scale prefabricated landscape buildings based on BIM technology. *Construction Technology Development*, 47(19), 19–20.
- [5] Li, G. L. (2023). Discuss the application and promotion of prefabricated building technology. *Chinese Science and Technology Journal Database (Full-text version) Engineering Technology*, 4, 91–94.
- [6] Wang, Y. J. (2023). Research on development strategies of rural prefabricated buildings under the background of rural revitalization. *Housing and Real Estate*, 35, 55–57.