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Unpacking the Dynamics of Heritage-Led Regeneration: A Structural Equation Modeling Approach for Traditional Villages of Hebei, China

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Abstract

Unlike widely examined urban settings, heritage-led rural regeneration remains an urgent yet insufficiently explored challenge. Grounded in stimulus–response theory, this study examines how heritage capacity influences the regeneration of traditional villages in Hebei Province, China. Drawing on community-building theory, heritage capacity (stimulus) is conceptualized through five dimensions: Public Participation, Media Platform Construction, Adaptive Reuse, Heritage Industry Development, and Landscape Maintenance. Village regeneration (response) is evaluated across economic, social, and environmental dimensions. Using PLS-SEM analysis of questionnaire data and expert consultations, the study shows that regeneration outcomes arise from an integrated system in which tangible and intangible capacities reinforce each other. It further highlights that the most effective strategy combines priority investment with strategic repositioning. For economic sustainability, Adaptive Reuse and Media Platform Construction serve as immediate drivers, while Heritage Industry Development and Landscape Maintenance provide long-term foundations. For social sustainability, Public Participation and Media Platform Construction act as key enablers by strengthening social connections. For environmental sustainability, Adaptive Reuse offers the most direct benefits, whereas Landscape Maintenance and Public Participation contribute gradual but essential outcomes. This study offers practical guidance for the regeneration of Hebei's villages, proposing a scalable model for sustainable rural development that has broad implications for similar historical regions worldwide.

Keywords: heritage-led regeneration; traditional village; sustainable development; Hebei Province; China; stimulus–response theory; SEM

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1. Introduction

Global historic areas face increasing threats from urbanization and modernization, which jeopardize cultural heritage, weaken communities, and may lead to their gradual disappearance [1]. With rich heritage resources, these areas hold potential for driving regional development [2–4]. Since the early 2000s, culture and heritage have been recognized as the fourth pillar of sustainable development [5,6], leading to the emergence of heritage-led

regeneration as a key approach to halting the decline of historic places [7]. This approach is increasingly recognized in the global academic community as a strategic intervention for enhancing rural resilience and promoting territorial development.

While heritage-led regeneration has been extensively studied in urban settings, addressing policy, governance, stakeholder collaboration, and financing [2,8–13], research in rural contexts remains limited. Rural villages often face more severe challenges—such as population decline, economic stagnation, and insufficient institutional support—making systematic study even more urgent. Existing rural studies often focus on case-specific preservation strategies or the application of new technologies. However, they frequently overlook the underlying mechanism through which a village's internal heritage capacities translate into sustainable economic, social, and environmental outcomes. There is a significant gap in understanding how to systematically measure and leverage different dimensions of heritage as a driver for holistic, long-term village vitality [14,15].

This study focuses on China's traditional villages, which encapsulate over 7000 years of agricultural civilization and serve as repositories of both tangible and intangible heritage [16,17]. In response to the rapid decline of these villages, the Chinese government launched the "Protection of Traditional Chinese Villages" initiative in 2011, designating 8155 villages for official protection [18,19]. While government and scholars have examined various dimensions of these efforts—such as preservation policies, protective funding, heritage planning and management, and technical guidance [16,20–23]—many approaches have treated villages as passive objects of protection, often depending on fragmented, short-term external support that is disconnected from local development. This siloed perspective overlooks the inherent potential of heritage to act as a catalyst for comprehensive, long-term vitality.

To address this fundamental research gap, this study adopts a heritage-led regeneration perspective, utilizing Stimulus–Response (S-R) theory to systematically examine how specific heritage capacities can elicit economic, social, and environmental responses that foster the long-term vitality of traditional villages in China. By moving beyond descriptive case studies, this research provides a mechanism-based understanding of how heritage can drive sustainable development from within. The findings will offer actionable insights for policymakers and planners, providing evidence-based guidance to design more effective and comprehensive rural development strategies that leverage heritage as a core asset. This work aims to contribute to both the theoretical understanding of rural heritage regeneration and the practical implementation of resilient rural development policies in China and beyond.

2. Research Framework and Hypotheses Development

2.1. Research Framework

2.1.1. Heritage-Led Regeneration and Stimulus-Response (SR) Theory

Heritage-led regeneration can be understood as a dynamic causal process in which heritage functions as the stimulus driving regenerative outcomes. This perspective aligns with S-R theory, originally proposed by Pavlov, which posits that behavior constitutes a predictable response to external or internal stimuli [24–27]. Compared with other frameworks, such as asset-based community development that emphasize the use of local resources but often lack a mechanism-based explanation, S-R theory offers a more systematic lens for analyzing how heritage capacities translate into concrete development outcomes [28].

Originally developed in behavioral psychology, the S-R theory has been widely applied in disciplines such as environmental psychology, marketing, education, and consumer behavior [29–33]. In heritage-related studies, it has informed the analysis of tourist motivations, cultural game engagement, and immersive virtual heritage experiences [34–37].

However, its application in heritage-led rural regeneration remains largely unexplored, offering new theoretical potential.

To operationalize this perspective, this study reconceptualizes heritage-led regeneration through the lens of S-R theory: heritage capacity within traditional villages serves as the stimulus—an endogenous driver that activates change—while village regeneration represents the response, reflected in improved sustainability, vitality, and resilience. This framework allows us to not only identify key heritage capacity elements but also to systematically analyze the precise causal pathways through which they trigger specific regenerative outcomes. This provides a mechanism-based understanding that moves beyond simple asset identification, as illustrated in Figure 1.

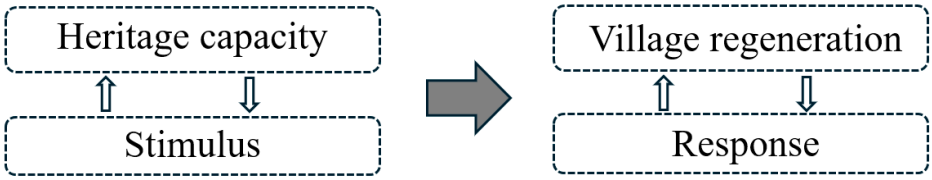

Figure 1. Heritage-led Regeneration and Stimulus-response (SR) theory.

2.1.2. Heritage Capacity and Community Building Theory

The concept of heritage capacity was introduced by UNESCO [38] as the ability to understand, manage, and conserve World Heritage sites using updated knowledge and skills. Within the context of traditional villages, this concept is re-imagined and expanded: it refers to the community's ability to leverage cultural and historical assets to achieve sustainable development, social cohesion, and resilience [16,39,40]. This encompasses an integrated framework of both tangible and intangible resources, local knowledge, institutional mechanisms, and participatory practices that collectively support heritage conservation and contemporary rural transformation.

To systematically operationalize this comprehensive concept, this study draws upon community-building theory, which shares a core objective with heritage capacity building—fostering community-driven development. While a broad field, community-building theory offers a robust framework for identifying the key dimensions of local capacity. Building on the influential work of Kiyoshi Miyazaki [41,42], who divides community-building into five core dimensions (people, culture, land, industry, and landscape), and integrating insights from the latest research, this study identifies five core components of heritage capacity in traditional villages. These are: Public Participation (PP), Media Platform Construction (MPC), Adaptive Reuse (AR), Heritage Industry Development (HID), and Landscape Maintenance (LM), as summarized in Table 1. These five dimensions reflect a holistic and symbiotic system where heritage capacity is embedded in the everyday life and productive systems of villages.

Table 1. Identify the variables of heritage capacity.

Community-Building	Heritage Capacity	Reference
People: Foster public participation to enhance well-being and quality of life. Culture: Preserve local history while exploring new ways to promote it.	Public participation (PP)	[43–46]
	Media platform construction (MPC)	[47–50]

Table 1. *Cont.*

Community-Building	Heritage Capacity	Reference
Land: Maintain and develop geographic features, emphasizing local uniqueness.	Adaptive reuse (AR)	[51–54]
Industry: Develop and market local products to boost the economy.	Heritage industry development (HID)	[55–57]
Landscape: Preserve the distinct characteristics of the local environment.	Landscape maintenance (LM)	[58–62]

2.1.3. Village Regeneration and Village Sustainability

Regeneration refers to renewing or restoring something, particularly after it has been damaged or lost [63]. In the context of traditional villages, "village regeneration" is synonymous with "village sustainability." Both concepts emphasize fostering long-term sustainability and resilience within traditional villages while integrating cultural heritage and resources into modern practices [64]. A common framework for describing sustainability involves three interrelated pillars: economic, social, and environmental variables, as illustrated in Table 2 [65–67].

Table 2. Identify the variables of village regeneration.

Village Regeneration/Village Sustainability	Reference
Economic Sustainability (ES) Society Sustainability (SS) Environment Sustainability (ENS)	[65–67].

2.2. Hypotheses Development

Based on the above discussion, heritage capacity functions as the external stimulus (S) in the S-R theory, encompassing five key dimensions: PP, MPC, AR, HID, and LM. In contrast, village regeneration represents the response (R), expressed through three outcome dimensions: ES, SS, and ENS. This study aims to empirically examine the relationships between these components to explore how heritage capacity drives sustainable regeneration in traditional villages.

PP plays a foundational role in ensuring the effectiveness and long-term sustainability of regeneration efforts [68]. It involves the active engagement of residents, stakeholders, and local actors in planning, decision-making, and implementation processes [69,70]. Beyond heritage preservation, meaningful participation fosters social cohesion, economic resilience, and environmental responsibility—all of which are essential to sustainable rural transformation [71–75]. Accordingly, this study proposes the following three hypotheses.

H1. *PP has a positive effect on ES.*

H2. *PP has a positive effect on SS.*

H3. *PP has a positive effect on ENS.*

With the rapid advancement of information and communication technologies, MPC have emerged as vital channels for promoting the culture of traditional villages by enhancing communication, raising public awareness, and engaging a wide range of stakeholders [76]. Empirical evidence shows that social media significantly shapes the development of village tourism, reinforces cultural identity, and supports the preservation

and commercialization of traditional handicrafts—all key pillars of sustainable village development [77–81]. Accordingly, this study proposes the following three hypotheses.

H4. *MPC has a positive effect on ES.*

H5. *MPC has a positive effect on SS.*

H6. *MPC has a positive effect on ENS.*

AR is a multifaceted process that seeks to conserve the values of heritage buildings while adapting them to meet contemporary needs [82,83]. Repurposing these structures allows communities to preserve their historical significance while promoting sustainable development, thereby supporting the pursuit of sustainable village development [84–86]. Accordingly, this study proposes the following three hypotheses.

H7. *AR has a positive effect on ES.*

H8. *AR has a positive effect on SS.*

H9. *AR has a positive effect on ENS.*

HID is a consistently prominent topic in traditional villages, serving as a direct driver for promoting village growth [87,88]. The most discussed aspect is tourism development, which includes not only tourism itself but also the development of related handicrafts, service industries, and supporting sectors [89–93]. Accordingly, this study proposes the following three hypotheses.

H10. *HID has a positive effect on ES.*

H11. *HID has a positive effect on SS.*

H12. *HID has a positive effect on ENS.*

LM is essential for preserving the ecological balance, aesthetic value, and cultural significance of a village [94,95]. Proper management of the landscape can support ecological balance, promote tourism, and preserve the traditional character of the village, all while fostering long-term sustainability [96,97]. Accordingly, this study proposes the following three hypotheses.

H13. *LM has a positive effect on ES.*

H14. *LM has a positive effect on SS.*

H15. *LM has a positive effect on ENS.*

In summary, Figure 2 presents a conceptual framework illustrating the relationships between five heritage capacity dimensions and three village regeneration dimensions, with further validation provided in later sections.

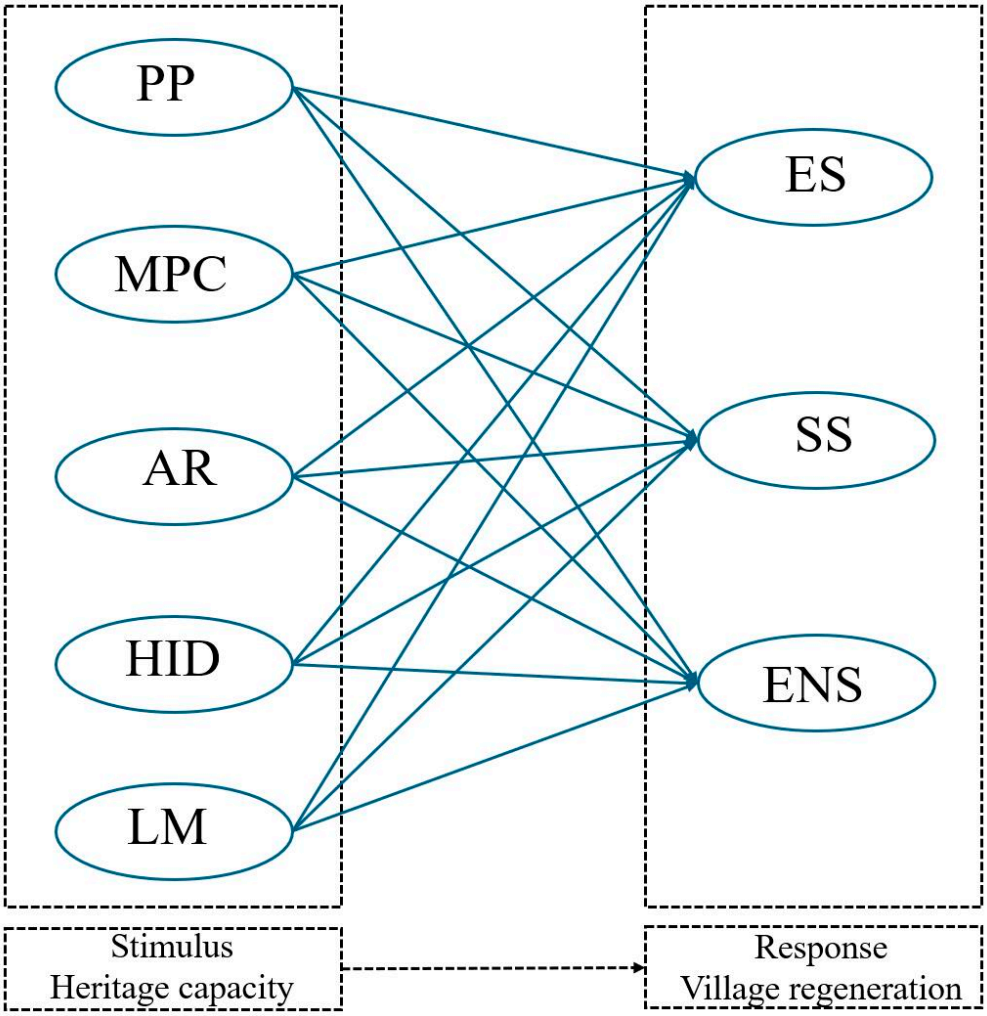

Figure 2. Conceptual framework.

3. Materials and Methods

3.1. Research Area

Hebei Province, with its rich heritage resources and a history spanning over 2500 years, provides an ideal case study for this research. The province is home to 276 officially listed traditional villages, the second largest number in northern China [98–100]. Despite its cultural richness, Hebei faces acute challenges common to many rural areas in developing countries, including significant population loss and weakened village vitality due to its proximity to major urban centers like Beijing and Tianjin, as shown in Figure 3 [101–103]. Therefore, Hebei Province is chosen as a perfect case study for this research, as it offers a unique context that is highly relevant to our theoretical framework and practical objectives:

Abundant Heritage Capacity: The province's rich heritage resources, evidenced by its 276 listed villages, provide a robust and diverse set of 'stimuli' to be analyzed within our S-R model.

Practical Significance: The acute challenges faced by Hebei's villages highlight the urgent need for effective regeneration strategies, ensuring our findings address a real-world problem.

Policy Context: The Jing-Jin-Ji regional integration strategy offers a unique opportunity to provide highly valuable policy insights for national-level heritage protection and regional planning.

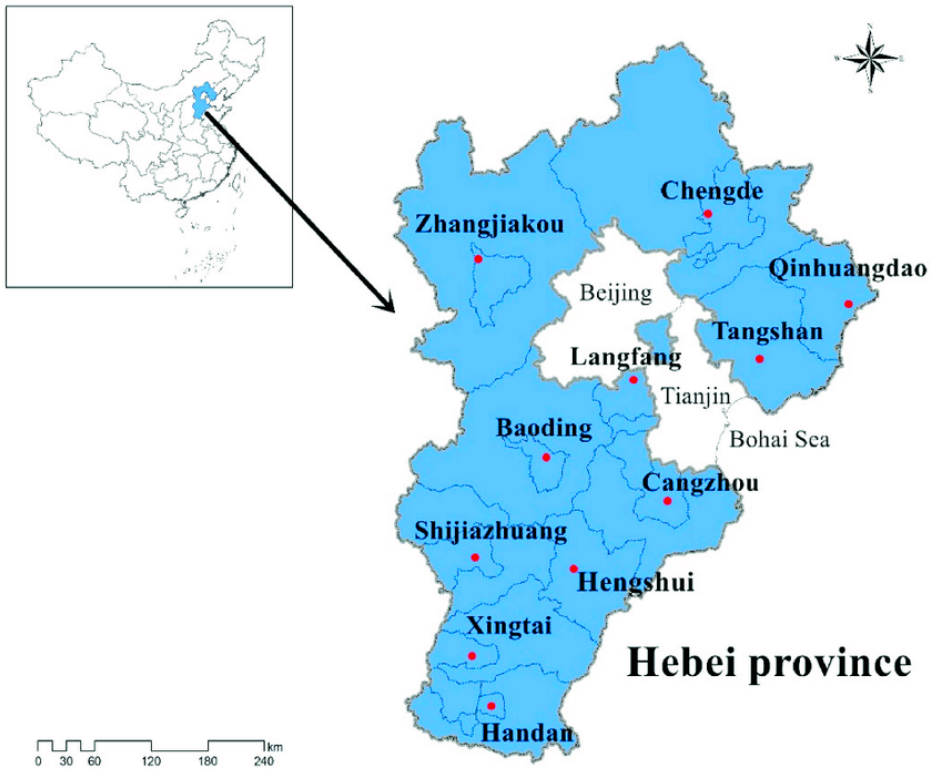

Figure 3. The location of Hebei province in China.

3.2. Research Design

This study employs a multi-stage research design combining quantitative and qualitative methods. First, structured questionnaires were used to collect data from relevant stakeholders. The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the proposed relationships. Subsequently, expert consultant meetings were conducted to interpret and validate the key findings. Ethical approval was obtained from the University of Malaya. This sequential design enhances the rigor, credibility, and contextual relevance of the results, as shown in Figure 4.

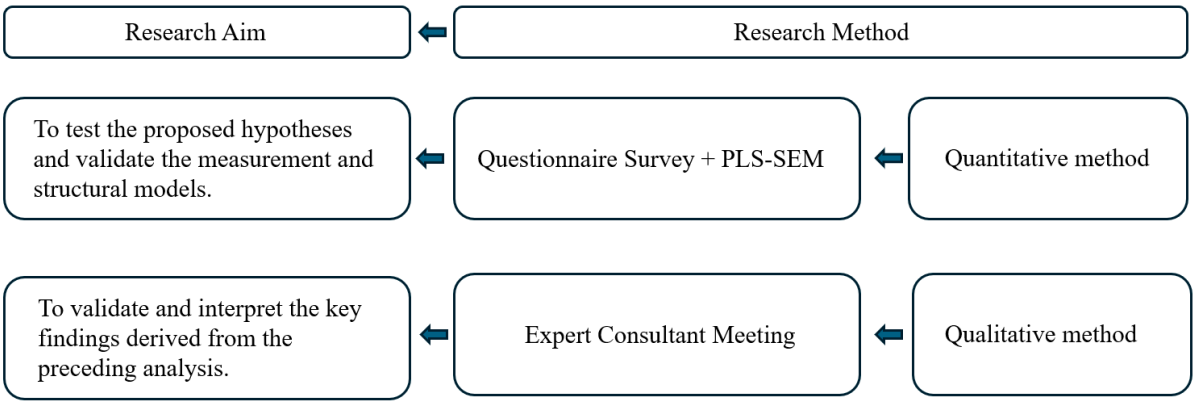

Figure 4. The Research Flow.

3.3. Data Collection and Analysis

3.3.1. Questionnaire Survey

This study employed a structured questionnaire survey to examine heritage-led regeneration in traditional villages in Hebei Province, China. The Section 1 gathered demographic information, including gender, age, education level, and respondent identity. Participants

were classified into key stakeholder groups: local villagers, researchers and designers, government officials, tourism-related personnel, and investors. The core principle for selecting these stakeholders was that any individual who participates in, influences, or is affected by traditional village projects is considered a relevant party in this field.

The Section 2 focused on measuring latent variables related to heritage capacity and village regeneration. These items were adapted from validated studies and further refined through an extensive literature review to align with the specific context of Hebei. To ensure the linguistic and cultural appropriateness of the survey instrument, a preliminary draft was reviewed by a panel of experts with extensive experience in rural development and heritage studies. Based on their feedback, several items were rephrased to better reflect local terminology and avoid ambiguity. The final scale items were evaluated using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), as detailed in Table 3.

Table 3. Measurement items.

Constructs	Items	Sample of Measurement Items	Source
Public Participation (PP)	PP-1	I am interested in participating in the development of traditional villages.	[104,105]
	PP-2	I am willing to participate in work related to traditional villages.	
	PP-3	I am willing to encourage others to participate in the development of traditional villages.	
	PP-4	I will actively participate in the development of traditional villages if opportunities arise.	
Media Platform Construction (MPC)	MPC-1	I believe media platforms can play a pivotal role in strengthening heritage development efforts for traditional villages	[106–108]
	MPC-2	I believe media platforms can provide digital information about traditional village	
	MPC-3	I believe media platforms can provide opportunities for online communication about traditional villages	
	MPC-4	I believe media platforms can effectively promote cultural communication about traditional villages	
	MPC-5	I believe media platforms can develop virtual collaboration in heritage development for traditional villages	
Adaptive Reuse (AR)	AR-1	I believe adaptive reuse is an effective way to promote traditional village development.	[109]
	AR-2	I support traditional villages in promoting the strategy of adaptive reuse.	
	AR-3	I will participate in adaptive reuse projects in traditional villages if opportunities arise.	
	AR-4	I want to contribute to the cause of adaptive reuse in traditional villages in the future.	

Table 3. *Cont.*

Constructs	Items	Sample of Measurement Items	Source
Heritage Industry Development (HID)	HID-1	I believe the development of heritage-related industries is crucial in traditional villages.	[110–112]
	HID-2	I support the development of heritage-related industries in traditional villages	
	HID-3	I believe heritage-related industries should be further promoted and developed in traditional villages.	
	HID-4	I support the local government's decisions on heritage-related industries in traditional villages	
Landscape maintenance (LM)	LM-1	I think landscape maintenance is vital in traditional villages.	[113–115]
	LM-1	I believe that stakeholders should contribute their efforts to maintaining and preserving the landscape of traditional villages.	
	LM-1	I support traditional village landscape maintenance projects and initiatives.	
	LM-1	I support the policy and action of the government for the traditional village landscape maintenance.	
Economic Sustainability (ES)	ES-1	The availability of job opportunities for local residents reflects the sustainable development of the village economy.	[116]
	ES-2	The quality of jobs for local residents—characterized by stability, high pay, permanence, and full-time opportunities—reflects the sustainable development of the village economy.	
	ES-3	The development and promotion of distinctive industries reflect the sustainable growth of the village economy.	
	ES-4	The local economy's diversity reflects the village economy's sustainable development.	
	ES-5	The overall local income serves as an indicator of the village's sustainable economic development.	
Social Sustainability (SS)	SS-1	The construction of physical infrastructure, such as roads, bridges, and drainage, reflects the sustainable development of village society.	[66]
	SS-2	Improvements in social facilities, such as education support and healthcare, reflect the sustainable development of village society.	
	SS-3	Protecting individual and collective rights in traditional villages reflects the sustainable development of village society.	
	SS-4	Improving social interactions and public relations within the village reflects the sustainable development of village society.	
	SS-5	The harmony of local lifestyles reflects the sustainability of village society.	

Table 3. *Cont.*

Constructs	Items	Sample of Measurement Items	Source
Environmental Sustainability (ENS)	ENS-1	The balance between development and environmental preservation reflects the sustainability of the village environment.	[116]
	ENS-2	Resource and energy consumption serve as indicators of the village's environmental sustainability.	
	ENS-3	The implementation of pollution reduction measures indicates the village's commitment to environmental sustainability.	
	ENS-4	The village's recycling of renewable resources reflects its commitment to environmental sustainability.	
	ENS-5	The implementation of environmental protection actions in the village reflects its commitment to environmental sustainability.	

Snowball sampling, with the individual as the sampling unit, was adopted as the most feasible approach, given the dispersed population and lack of a comprehensive sampling frame. This study does not focus on any single traditional village but explores the broader perspective of heritage-led regeneration across the province, with an effort to include as many traditional villages as possible. By leveraging social networks, it reached hidden groups such as investors and researchers. Although it may introduce bias and limit generalizability, it provided the most practical way to obtain diverse responses. Data were collected between December and November 2024, resulting in 410 responses. After excluding invalid entries (e.g., incomplete, patterned, or careless answers), 332 valid questionnaires were retained.

3.3.2. PLS-SEM Analysis

The proposed relationships in this study were tested using structural equation modeling (SEM) performed via PLS-SEM. Compared to covariance-based SEM (CB-SEM), PLS-SEM offers advantages in theory building, allows for the simultaneous analysis of measurement and structural models, and provides a more user-friendly software interface [117,118]. For PLS-SEM, previous studies have identified a threshold of 100 samples as sufficient [119,120]. Additionally, the 'ten times rule' is commonly used as a guideline, which states that the minimum sample size should be ten times the largest number of paths in either the structural or formative measurement models [118,121]. Another method is to use GPower to estimate the sample size precisely. Based on the GPower analysis, with an effect size set to 0.15 and an α error probability of 0.05, the minimum required sample size is 199. Based on these criteria, the sample size of 332 for this study can be considered acceptable.

3.3.3. Expert Consultant Meeting

After testing the hypotheses related to heritage-led regeneration in traditional villages, further validation was deemed necessary to enhance the accuracy and generalizability of the findings. To this end, Expert Consultant Meetings were employed as a supplementary step, designed to cross-verify the SEM results and generate deeper contextual insights. Expert Consultant Meetings facilitate the integration of diverse perspectives by fostering interaction among participants with varied professional backgrounds and expertise, thereby enriching the analysis and promoting consensus [122]. An effective Expert Consultant

Meeting generally includes 4 to 8 participants, and conducting at least two independent sessions helps capture a wider range of perspectives [123].

In line with these recommendations, this study organized two rounds of Expert Consultant Meetings in February 2025. A total of 14 experts participated, with seven individuals assigned to each group. Each group included local villagers, researchers and designers, government officials, tourism-related personnel, and investors. Participants were purposively selected based on their substantial professional experience, each possessing more than 20 years of involvement in domains related to traditional village development. This ensured both the credibility of their contributions and the contextual relevance of the insights generated.

4. Data Analysis and Results

4.1. Descriptive Statistical Analysis

Table 4 presents the respondents' demographic data. The respondents' male-to-female ratio was 43.1% to 56.9%, indicating an approximate balance. This balance helps minimize potential gender bias, thereby enhancing the reliability of the results. Among all participants, 97% were over 18 years old, and 95.6% had attained at least an upper secondary education or higher, ensuring their expertise and adequate comprehension of the survey content. In addition, all respondents were stakeholders of the traditional villages, comprising 45.3% of villages, 14.7% researchers and designers, 16.7% government officials, 21.9% tourism-related personnel, and 1.4% investors.

Table 4. Demographic information of respondents.

Description	Frequency	%
Gender		
Male	143	43.1
Female	189	56.9
Age groups		
<18	10	3.00
18–30	197	59.4
30–35	96	28.9
45–60	25	7.50
>60	4	1.20
Education Background		
Lower secondary education or below	15	4.40
Upper secondary and post-secondary non-tertiary	22	6.60
Undergraduate degree (bachelor's degree)	206	62.0
Postgraduate degree (Master's and Doctoral degrees)	89	27.0
Identity of the respondent		
villagers	150	45.3
researchers and designers	49	14.7
government officials	55	16.7
tourism-related personnel	73	21.9
investors	5	1.40

4.2. Evaluation of the Measurement Model

The first step in SEM analysis is to assess the measurement models. Reflective constructs, as defined by Hair et al., are latent variables that cause changes in highly correlated and interchangeable observed indicators [124]. All constructs in this study were reflective.

Reliability was evaluated through indicator reliability (outer loadings) and internal consistency (Cronbach's α and composite reliability) [118,124]. Following Hair's guidelines,

outer loadings should exceed 0.7, and both Cronbach's α and composite reliability should be above 0.7 [118,125]. All constructs in this study met these criteria, as detailed in Table 5.

Table 5. Construct reliability and validity.

Constructs	Items	Loading	Composite Reliability (CR)	Cronbach's Alpha	AVE
Public Participation (PP)	PP-1	0.835	0.880	0.820	0.648
	PP-2	0.792			
	PP-3	0.772			
	PP-4	0.820			
Media Platform Construction (MPC)	MPC-1	0.806	0.868	0.812	0.568
	MPC-2	0.765			
	MPC-3	0.758			
	MPC-4	0.711			
	MPC-5	0.725			
Adaptive Reuse (AR)	AR-1	0.723	0.839	0.745	0.565
	AR-2	0.770			
	AR-3	0.770			
	AR-4	0.744			
Heritage Industry Development (HID)	HID-1	0.748	0.846	0.758	0.579
	HID-2	0.775			
	HID-3	0.782			
	HID-4	0.738			
Landscape maintenance (LM)	LM-1	0.768	0.847	0.761	0.582
	LM-1	0.829			
	LM-1	0.701			
	LM-1	0.748			
Economy Sustainability (ES)	ES-1	0.744	0.863	0.803	0.558
	ES-2	0.805			
	ES-3	0.734			
	ES-4	0.722			
	ES-5	0.727			
Social Sustainability (SS)	SS-1	0.774	0.879	0.827	0.592
	SS-2	0.827			
	SS-3	0.740			
	SS-4	0.772			
	SS-5	0.732			
Environmental Sustainability (ENS)	ENS-1	0.753	0.889	0.845	0.616
	ENS-2	0.751			
	ENS-3	0.791			
	ENS-4	0.825			
	ENS-5	0.803			

The measurement model is validated through convergent and discriminant validity. The average variance extracted (AVE) is a measure of convergent validity, calculated as the mean of the squared loadings for the items. The analysis, presented in Table 5, shows that all AVE values exceed the minimum threshold of 0.5, indicating acceptable convergent validity [126].

Discriminant validity refers to the extent to which a construct is empirically distinct from the others [127]. According to Fornell and Larcker, in fulfilling the discriminant validity, the square root of the AVE for each construct should exceed the intercorrelations of the construct with other constructs in the model [124,126,127]. Table 6 presents both the square root of the AVE for each construct and the correlations among the constructs, demonstrating that the model exhibits acceptable discriminant validity.

Table 6. Discriminant validity.

Constructs	PP	MPC	AR	HID	LM	ES	SS	ENS
PP	0.805							
MPC	0.403	0.754						
AR	0.370	0.711	0.752					
HID	0.419	0.603	0.633	0.761				
LM	0.319	0.627	0.732	0.674	0.763			
ES	0.433	0.567	0.590	0.538	0.504	0.747		
SS	0.464	0.604	0.613	0.569	0.586	0.649	0.770	
ENS	0.443	0.551	0.630	0.501	0.594	0.686	0.610	0.785

4.3. Assessment of the Structural Model

Two preliminary criteria for assessing the structural model are the magnitude and significance of the path coefficients. The coefficient of determination (R^2) measures how much variance in the dependent variable is explained by the independent variables.

Following Chin [121], R^2 values of 0.67, 0.33, and 0.19 indicate substantial, moderate, and weak explanatory power, respectively. In this study, the endogenous constructs—three dimensions of village sustainability—had R^2 values of 0.45, 0.51, and 0.48, which are considered acceptable.

Effect size (f^2) assesses the impact of each independent construct on dependent variables [128]. Values of 0.02, 0.15, and 0.35 represent low, moderate, and high effect sizes, respectively [129]. Table 6 shows low effect sizes for MPC-ENS (0.008), HID-ENS (0.000), and LM-ES (0.000), while other paths exceed 0.15, indicating stronger effects.

The final index, Q^2, was used to assess the model's predictive relevance. In this study, the Q^2 values for ES, SS, and ENS were 0.234, 0.292, and 0.288, respectively. These values meet Hair's recommended threshold, with a Q^2 value exceeding 0 indicating significant predictive relevance [124].

To assess the structural model, a bootstrapping procedure with 5000 samples was conducted to evaluate the significance of the path coefficients. A p-value ≤ 0.05 indicates statistical significance, with stronger significance at $p \leq 0.01$ or 0.001. Similarly, a t-value > 1.96 (0.05 level) or >2.58 (0.01 level) suggests statistical significance [124]. Table 7 and Figure 5 present the path coefficients of the hypotheses and significant paths. Except for H6, H12, and H13, all the hypotheses are supported.

Table 7. Results of hypothesis testing.

Hypothesis	Path Coefficient	T-Value	*p*-Value	Effect Size (f^2)	Support
H1: PP-ES	0.182	3.660	0.000	0.047	Yes
H2: PP-SS	0.204	4.940	0.000	0.066	Yes
H3: PP-ENS	0.214	4.530	0.000	0.070	Yes
H4: MPC-ES	0.192	2.898	0.004	0.029	Yes
H5: MPC-SS	0.206	3.114	0.002	0.038	Yes
H6: MPC-ENS	0.099	1.659	0.098	0.008	No
H7: AR-ES	0.270	3.839	0.000	0.046	Yes
H8: AR-SS	0.187	2.966	0.003	0.025	Yes
H9: AR-ENS	0.306	3.782	0.000	0.063	Yes
H10: HID-ES	0.163	2.496	0.013	0.022	Yes
H11: HID-SS	0.127	2.080	0.038	0.015	Yes
H12: HID-ENS	−0.006	4.232	0.934	0.000	No
H13: LM-ES	0.018	0.246	0.806	0.000	No
H14: LM-SS	0.169	2.678	0.008	0.022	Yes
H15: LM-ENS	0.243	0.083	0.000	0.044	Yes

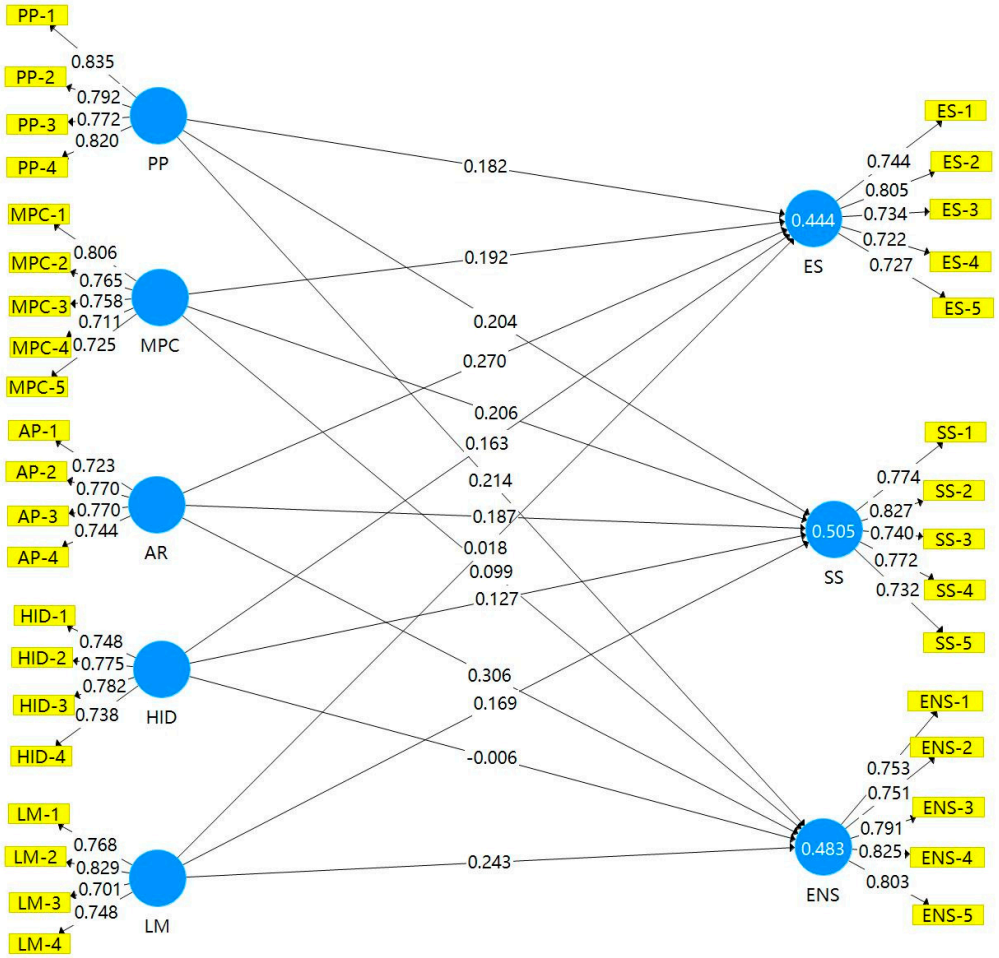

Figure 5. Evaluation of the structural model.

4.4. Validating the Results

To validate the interrelationships among the variables, two sessions of Expert Consultant Meetings were conducted, each comprising seven participants with relevant practical experience. The discussions focused on examining all contested hypotheses, eliciting participants' perceptions and interpretations of the variables and their underlying linkages. Each session lasted approximately 60 to 90 min and was audio-recorded for subsequent transcription and analysis. By the end of the second session, no new disagreements emerged, indicating that all relevant perspectives had been adequately captured. These qualitative insights provided valuable contextual understanding and reinforced the quantitative results by clarifying the mechanisms through which the variables interact. Detailed evidence is presented in Table 8.

Table 8. The Results of the Expert Consultant Meetings.

Group	Dispute	Discussion
Group 1	Hypothesis 3: HID-ES	While LM does not yield immediate economic growth, it plays a key indirect role in fostering long-term sustainability by creating an attractive environment that appeals to tourists and investors.
Group 2		Future research could investigate how landscape conservation generates economic benefits.

Table 8. *Cont.*

Group	Dispute	Discussion
Group 1	The influence on ES follows the order: AR, MPC, PP, and HID.	The economic performance of traditional villages is mainly driven by visible, revenue-oriented initiatives such as AR and MPC, which deliver immediate returns.
Group 2		HID has a limited impact on ES due to its fragmented development and lack of an integrated industrial chain, highlighting the need for strategic enhancement of heritage-based industries.
Group 1	The influence on SS follows the order: MPC, PP, AR, HID, and LM.	Prioritizing MPC, PP, and AR is effective for increasing visibility and engagement in the short term, serving as catalysts for development.
Group 2		Long-term sustainability relies on the reinforcement of HID and LM, as industrial depth and ecological value are essential for sustaining developmental momentum and preventing stagnation.
Group 1	Hypothesis 6: MPC-ENS Hypothesis12: HID-ENS	Although MPC raises awareness of traditional villages, its environmental impact remains limited, as it lacks direct, measurable actions that translate into tangible ecological outcomes. To enhance its effectiveness, MPC should be better integrated with on-the-ground environmental initiatives and community-based actions.
Group 2		HID faces challenges in balancing industrial growth with environmental sustainability due to poor planning, overdevelopment, and short-term economic priorities; however, in the long term, well-managed heritage industries hold potential to contribute positively to ecological preservation.
Group 1	The influence on ENS follows the order: AR, LM, and PP.	AR is seen as more effective for environmental sustainability because it relies on concrete projects that directly address environmental management and promote green energy-saving measures.
Group 2		The impact of LM is less immediate, as it requires sustained effort and long-term commitment to yield visible environmental benefits.

5. Discussion

To better discuss the above results, this study examines the influence of heritage capacity from the perspective of the three dimensions of village regeneration.

5.1. Dimension of Economic Sustainability

As outlined in Section 2.2, five variables were hypothesized to influence Economic Sustainability (ES) in traditional villages: Public Participation (PP, H1), Media Platform Construction (MPC, H4), Adaptive Reuse (AR, H7), Heritage Industry Development (HID, H10), and Landscape Maintenance (LM, H13). The results show that four of these variables—PP, MPC, AR, and HID—have significant positive effects on ES, in line with previous studies [74,81,84,86], whereas LM was not supported. While this confirms the positive role of the first four variables, the true contribution of this study lies in the unexpected disparity in their relative impact, which challenges conventional assumptions. The rank of relative contributions is as follows: AR (0.270), MPC (0.192), PP (0.182), and HID (0.163). Furthermore, the lack of support for LM indicates that an effective linkage between LM and ES in traditional villages has yet to be established.

Among the four supported variables, AR emerges as the most powerful driver of ES, with a contribution of 0.270. This finding is a strong empirical validation of prior studies [86,130,131], suggesting that direct, tangible projects that transform built heritage into new, revenue-generating assets are the most effective way to generate immediate economic returns in these communities. By repurposing historical buildings as homestays, artisanal workshops, or exhibition spaces, AR creates a clear and direct link between heritage and economic activity, providing jobs and attracting investment.

The roles of MPC and PP also proved substantial, with contributions of 0.192 and 0.182, respectively. These variables serve as crucial enablers. MPC broadens market access beyond the physical village, while PP fosters local entrepreneurship and a sense of ownership, which are essential for the long-term viability of place-based economic models [48,132–137].

In contrast, HID—which, by definition, is directly associated with the economy—produces the least significant positive effect (0.163). This finding is particularly noteworthy as it contradicts the prevailing assumption in much of the literature that heritage-based tourism and industries naturally serve as engines of economic growth [138,139]. Insights from expert consultant meetings suggest that this outcome does not diminish the importance of HID; rather, it reflects the underdeveloped industrial ecosystem present in many traditional villages. In the absence of a comprehensive industrial chain encompassing product manufacturing, branding, and marketing, the economic potential of heritage-related industries remains largely unrealized. This underscores a critical policy gap: the priority should shift from merely promoting "heritage industries" to establishing the foundational infrastructure necessary to sustain and scale them.

The non-significant economic effect of LM, despite strong policy advocacy in China, highlights a key challenge in translating landscape development into immediate economic returns [140]. As emphasized in expert meetings, the value of LM lies primarily in its enhancement of environmental quality and aesthetic appeal. These improvements indirectly stimulate tourism and attract investment over the longer term. This suggests that LM should not be viewed as a direct economic driver. Instead, its economic impact is a long-term process that requires consistent, sustained maintenance to build and preserve a more attractive and sustainable environment for other economic activities to flourish.

5.2. Dimension of Social Sustainability

The analysis of social sustainability (SS) reveals a positive impact from all five variables—Public Participation (PP, H2), Media Platform Construction (MPC, H5), Adaptive Reuse (AR, H8), Heritage Industry Development (HID, H11), and Landscape Maintenance (LM, H14). While this finding aligns with existing literature [71,78,84,89,97], the ranking of their relative contributions offers a critical new perspective, challenging the conventional wisdom that economic activity is the primary driver of community well-being. Their relative contributions are ranked as follows: MPC (0.206), PP (0.204), AR (0.187), LM (0.169), and HID (0.127).

The most striking discovery is the dominant role of MPC and PP, which are the top two contributors to SS. Their high scores suggest that the process of engagement and connectivity is more fundamental to a community's social health than tangible development outcomes. MPC goes beyond simple marketing; it serves as a vital tool for sharing information and cultural narratives, fostering a shared identity, and linking the community with the outside world [48,141]. Likewise, PP's strong contribution validates the idea that true social sustainability comes from empowering residents, giving them a sense of ownership over their heritage and future.

The roles of AR and LM, while important, are more complementary. AR contributes to SS by creating tangible community spaces, like cultural centers and libraries, that act

as physical hubs for social interaction and the preservation of cultural memory [142]. LM enhances well-being by creating aesthetically pleasing public spaces that encourage social gathering and a sense of collective pride [143,144].

In contrast, HID ranks last among all variables. While generating jobs and income through heritage industries can undoubtedly enhance social cohesion, this finding indicates that the direct social benefits of such activities are less pronounced than those of community engagement and digital connectivity [88]. The study suggests that for social well-being to flourish, the focus shouldn't be solely on economic outcomes, but on the communal processes that build trust and collaboration.

Finally, the expert consultant meetings also revealed the critical interdependence among all five variables. While MPC and PP can generate initial momentum and attract attention, they cannot sustain it in isolation. Without the cultural and industrial substance provided by AR, HID, and LM, this emerging interest is likely to dissipate, leading to stagnation. Therefore, a balanced and integrated approach is essential.

5.3. Dimension of Environmental Sustainability

The analysis of Environmental Sustainability (ENS) presents a nuanced picture, with three variables—Public Participation (PP, H3), Adaptive Reuse (AR, H9), and Landscape Maintenance (LM, H15)—showing a significant positive influence, consistent with and reinforcing previous studies [75,84,89,97]. However, the most critical insights of this study emerge in two areas: the non-support for Media Platform Construction (MPC, H6) and Heritage Industry Development (HID, H12), and the order of the supported variables' relative contributions. Specifically, the ranking was as follows: AR (0.306), LM (0.243), and PP (0.214).

Among the variables with a significant positive effect, the most striking result is the dominance of AR, with a contribution of 0.306. This is particularly noteworthy because, although the environmental benefits of AR are increasingly acknowledged, its superiority over LM and PP in this context has rarely been documented [145,146]. Insights from the expert consultant meetings offer a compelling explanation: AR is regarded as more effective because its environmental benefits—such as reducing waste and conserving embodied energy through the repurposing of existing structures—are both immediate and visible. As a project-based approach, AR directly addresses pressing environmental challenges.

Conversely, LM, despite its direct association with ENS, ranks second (0.243), while PP ranks third (0.214). Insights from the expert consultant meetings suggest that the benefits of LM—such as enhanced biodiversity and improved long-term soil health [147]—emerge gradually and require sustained effort before becoming tangible. Similarly, although PP is essential for fostering collaborative environmental initiatives, its impact depends on the successful execution of projects, making its contribution more foundational than direct [148,149].

Regarding the non-positive results, neither MPC nor HID shows a significant impact on ENS in traditional villages. Expert consultants' meetings offered valuable insights to help explain why. For MPC, its primary limitation is its intangible nature. While effective at raising awareness, it often fails to translate virtual engagement into tangible environmental action or measurable outcomes. To be more impactful, MPC must be more closely integrated with tangible, on-the-ground community initiatives. The challenges with HID are more fundamental, stemming from a persistent conflict between industrial growth and environmental protection. According to experts, this tension is often driven by inadequate planning, overdevelopment that exceeds the environment's carrying capacity, and a focus on short-term economic gains at the expense of long-term environmental and cultural considerations. Despite these issues, experts agreed that if supported by

comprehensive long-term planning and effective management, heritage industries still hold significant potential to enhance ENS. This highlights the urgent need to balance economic development with ecological preservation to achieve genuinely sustainable outcomes.

6. Conclusions

Heritage-led regeneration has emerged as a promising and contextually appropriate strategy for revitalizing traditional villages in China. This study applies the S–R theoretical lens to conceptualize the interaction between heritage capacity, as the driving stimulus, and village regeneration, as the sustainability-oriented response. Grounded in community-building theory, five key dimensions of heritage capacity were identified: PP, MPC, AR, HID, and LM. These were analyzed about three core sustainability outcomes: ES, SS, and ENS.

Core Findings: The study reveals that the most effective revitalization strategy for traditional villages lies in a combination of "priority focus" and "long-term benefits." Specifically:

For ES, the most effective strategy is to prioritize tangible projects that generate direct economic returns (AR) and digital infrastructure that expands market reach (MPC), as these can rapidly stimulate the village economy. By contrast, HID and LM should be repositioned as foundational investments requiring long-term cultivation and systematic planning.

For SS, the priority lies in building social capital and strengthening interpersonal connections, with PP and MPC as key facilitators.

For ENS, the study highlights the distinction between "perceived" and "actual" impacts. Project-based interventions such as AR emerge as the most effective direct drivers, while LM and PP, though essential, operate as long-term processes whose benefits accumulate gradually over time.

Strategic Implications: Based on these findings, this study proposes a set of strategies to leverage heritage as a catalyst for sustainable regeneration:

Strategic Prioritization: Policymakers should focus initial investments on tangible, economically driven projects (AR and MPC) to generate early returns and build confidence among community members and investors.

Long-Term Foundational Investment: Simultaneously, strategies should cultivate HID and strengthen LM. These investments ensure long-term resilience and authenticity, even if benefits are not immediately visible.

Integrated Planning: Regeneration strategies should be embedded within broader rural development objectives. Coordinated policy frameworks are necessary to align heritage protection with environmental conservation, social equity, and economic diversification.

Limitations and Future Research: While this study provides valuable insights into heritage-led regeneration in traditional villages, it has several limitations that suggest directions for future research. First, the analysis explores heritage capacity through five selected dimensions—PP, MPC, AR, HID, and LM. Although foundational, these dimensions may not fully capture all factors influencing heritage-led regeneration; future studies could consider additional aspects such as governance, education, health, and social inclusion. Second, as a cross-sectional study, the analysis offers a static snapshot of variable relationships and may not reflect the long-term effects of heritage interventions, particularly in social sustainability, which can take years or generations to emerge. Longitudinal or mixed-methods research would be essential to track these changes over time. Finally, the study focuses solely on Hebei Province, limiting the geographic scope. Expanding research to diverse regions with varying cultural, economic, and environmental contexts would enhance the generalizability of the findings.

Ultimately, effective heritage-led regeneration requires integrated policy frameworks that align with broader rural development objectives, supporting coordinated and sustainable outcomes at local and regional levels.

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Abbreviations

The following abbreviations are used in this manuscript:

ES	Economic Sustainability
SS	Social sustainability
ENS	Environmental Sustainability
PP	Public Participation
MPC	Media Platform Construction
AR	Adaptive Reuse
HID	Heritage Industry Development
LM	Landscape Maintenance

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