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Effects of rural revitalization on rural tourism

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ABSTRACT

Rural revitalization is not only a strategy to promote sustainable rural development in developing countries, but also an inevitable trend towards global urbanization. This study used multi-source data, such as remote sensing images, building data, official websites and field survey, to investigate the morphological and social evolution of rural communities from the perspective of touristification and to analyze their drivers. The results showed that from 1988 to 2016, the selected sample case (Jinshitan scenic area, a tourist location situated in the Liaodong Peninsula in China) experienced continuous increases in the average weighted building height, building volume and floor area ratio; the proportion of non-agricultural employment increased by 99.57%; and tourism has become the leading industry in the research site, with a tenfold value of agricultural output value during touristification. These data lend support to that rural revitalization strategy is beneficial to non-urban communities in terms of their economic development and growth in China. Findings provided managerial implications suggesting the local government should implement tourism-related development projects to enhance rural tourism activities to develop the local economy and increase employment.

1. Introduction

With rapid advances and continuous improvement in urbanization, rural urbanization is leading to a worldwide economic, social, and cultural evolution of rural vitalization (Long et al., 2019). Rural tourism combines the economic, social and environmental components of rural areas. It is closely linked to people, space and products and has unique effects on the environment and on economic growth (Nepal, 2007; Wang et al., 2016; Xia et al., 2011). The development of tourism in villages can promote rapid economic growth, create more jobs and improve the quality of residents' life. However, its drawbacks include ecological damage, depletion of local resources and overloading of infrastructure (Gao & Zhang, 2019; Liu et al., 2020; Torres & Momsen, 2005). It is therefore particularly important to understand the relationship between the value of tourism output and the promotion of sustainable development of villages.

"The role of rural areas as repositories of both natural and historical heritage in many nations is of commercial importance because rurality is a unique point of sale for holidays in the countryside" (Lane, 1994, pp. 103). At present, rural tourism research focuses on the local government's exploration of the role and rationality of the joint management department in the tourism sector. Some rural tourism studies focus on the impact of over-tourism on the local ecological environment and the dissatisfaction of local residents (Diaz-Parra & Jover, 2020; Fletcher, 2019; Liu et al., 2019). At the same time, rural tourism research is paying more attention to the contribution of tourism income to the alleviation of poverty and to job creation (Carius & Job, 2019; Higgins-Desbiolles et al., 2019).

Sustainability development can only be achieved through economic and environmental balance (Li et al., 2019; Ortega et al., 2020). Rural exploitation and protection must be balanced during the touristification. Carnero's research has shown that the characteristics of rural tourism,

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such as people-to-people contact and a rich traditional environment, are very important (Carneiro et al., 2015). Together, these characteristics create a peaceful tourist environment, as opposed to the noisy and tense landscape of urban areas. At present, sustainable tourism research should focus not only on the sustainability of the ecological environment, but also the social order and sound economic functioning (Aquino et al., 2018; Jaafar & Maideen, 2012).

Existing research on rural tourism has expanded from early national studies to regional, provincial and city-level research (Kaptan et al., 2020; Liu et al., 2018; Wang & Yotsumoto, 2019). The methods of rural tourism research are diverse, but each has its own limitations. At present, the main research methodologies rely on qualitative descriptions, questionnaire surveys, building models and index system assessments (Christou, 2018; Christou & Sharpley, 2019; Lin, 2019; Nematpour & Khodadadi, 2020). No universal index system has been established for the construction of the evaluation index. The main indices selected by researchers include population, economics and social development (Liu & Feng, 2019; Ma et al., 2020). However, there is still a lack of small-scale regional research on tourism-oriented rural communities in townships. There is also a lack of long-term research from the point of view of space-time differentiation and a lack of quantitative research based on multi-source data such as remote sensing data, on-site research and socio-economic data.

The complex and diverse environments of rural communities determine the complexity and diversity of their evolution. The evolutionary path also varies considerably with the type of area and the scale of settlements (Belhassen et al., 2014; Eusébio et al., 2017; Ristić et al., 2019; Zhang et al., 2016). Most research into rural communities is based on the effects of agriculture, industrialization and the peri-urban (Ciolac et al., 2019; He et al., 2018; Liang et al., 2017; Lu, et al., 2020a). Little information is available from the points of view of touristification and its drivers. This study explores the evolution of a selected tourism village to develop a more sophisticated model to boost rural areas' tourism economy.

The aim of this study is to provide new insights into the touristification of rural communities and how to promote sustainable rural development. The results could highlight the contradictions between tourism stakeholders and decision-makers and compare the ways in which local governments, businesses and residents participate in tourism. To achieve the research goal, this study uses remote sensing data from six periods of time in Jinshitan to investigate the morphological and social evolution from the vantage point of touristification. The development indices of rural communities were used to analyze the evolution and driving mechanisms of spatial patterns.

2. Literature review

2.1. Essence of rural revitalization: systematic, hierarchical and regional characteristics

The rural revitalization strategy is a systematic and comprehensive initiative to strengthen the rural economy. In the early stages of the strategy, the government may be in a dominant position. It is presenting a series of policies and offering some financial support. In subsequent phase, businesses use that policy support to promote rural development. With the continuous promotion and development of the rural revitalization strategy, in the late stage of the strategy, rural residents actively engage in production activities to improve the employment structure (Buzinde et al., 2020; Nugroho & Numata, 2020; Xu & Fang, 2019).

The regional pattern of rural revitalization depends on the types of rural communities. For example, in agricultural villages, economic development can be promoted by expanding the sales channels of agricultural products and the processing of auxiliary agricultural products. In contrast, in industrial villages, the transformation of farmers to workers optimizes the employment and economic structure. In tourist villages, local residents become service workers (Dai et al., 2016; Guo & Sun, 2016; Stoddart et al., 2020; Zhang et al., 2019).

Although there is considerable agreement among researchers about the benefit of tourism development, there is no clear understanding of the evolution of tourism, particularly under the guidance of the rural revitalization strategy (Pung et al., 2020). As urbanization continues to progress, many rural residents have moved to urban areas for better working and living conditions. Many rural areas are still underdeveloped and there is a lopsided development between urban and rural areas (Schmidt & Uriely, 2019; Sun et al., 2020). China's government has therefore formulated a rural revitalization strategy to alleviate the long-term problems of job losses and the recession in the agricultural sector.

2.2. Essence of morphological and social evolution, and rural communities from the perspective of tourism

The early concept of sustainable tourism, centered on ecology and economics, has been replaced by the view that social culture is of equal importance (Weaver et al., 2020). The morphological and social evolution and outcome of the tourism destination is an important way to observe the impact of tourism on a community (Lu, et al., 2020b). Social evolution is an integral part of the evolution of the human settlement environment. As social animals, human beings' existence and development will have a social impact and their behavior can be analyzed through their social evolution (Mou et al., 2020; Wang et al., 2020).

Rural communities are regions where rural people live and work (Li et al., 2018). The speed and scale of development in rural communities are closely linked to natural and human evolutionary processes that manifest in the structure of production, human-land relations and social structure (Yang & Chen, 2018). The pattern of construction of rural communities is the morphological representation of the spatial evolution, industrial remodeling and social reorganization of the rural regional system (Yang et al., 2015). The central authority can optimize the spatial distribution, hierarchical relations and governance of counties, key towns, central towns and central villages (communities) in rural areas by establishing a construction pattern (Kubickova & Campbell, 2020; Xue et al., 2017). Thus, the establishment of a pattern of rural human settlement construction can clarify the positioning of different settlements and to promote their development under local conditions.

In their studies of agricultural rural communities, researchers have used traditional methods, such as field visits and questionnaires, as well as modern methods, such as remote sensing-based interpretation of vegetation cover, to investigate the relationship between settlement development and geographic indicators in villages. Previous research has found that the construction of a village service circle with villages as the core could accelerate the development of urban and rural integration (Lozada et al., 2018; Watmough et al., 2016, pp. 188–203; Xia et al., 2019).

In terms of industrial rural communities, previous research compared numerous areas at different stages of industrialization and revealed an evolution in the functioning of rural housing due to industrialization (Jiang et al., 2016; Lai & Zhang, 2016; Ma et al., 2018; Shin & Chae, 2018). Specifically, settlements have changed from a single residential function to a composite function that integrates residence, industrial manufacturing and leisure tourism.

Researchers with an interest in peri-urban rural communities have analyzed peri-urban agriculture and economic activities. They conclude that peri-urban areas are instrumental in alleviating pressure on urban centers, requiring settlements to have complete infrastructure and a good ecological environment (Guo et al., 2018; Li et al., 2020; Pribadi & Pauleit, 2016; Zhou, 2017).

Each type of rural human settlement follows its own evolutionary pathway. Morphological evolution, especially the transformation of tourism buildings and the change of people and economic structure (i.e. social evolution) in the process are usually the signs of this evolution. Government representatives, tour operators and rural residents, each

participant performing his or her own duties, jointly produced the results of the evolution (Duarte & Nyanjom, 2017).

2.3. The relationship between morphological and social evolution and rural transformation development in developing countries: the case of China

The evolution of rural urbanization in China, the world's second largest economy, is representative of the world's largest developing country in the world (Liu, 2018; Quer, 2021). By the end of 2016, China's urbanization rate was 57.35%, higher than the global rate of 54.50% (China Statistics Press (CSP), 2016). China's rapid urbanization since its reform and opening in 1978 has caused widespread concern both in China and abroad (Huang et al., 2019; Wang et al., 2018; Xu & Hou, 2019).

The World Travel and Tourism Council (WTTC) noted that China's share of travel and tourism in GDP was second in the world in 2019, reaching US$ 1585 billion (WTTC, 2020a). The number of people engaged in tourism in China accounted for 10.3% of the total employment and the number of tourism-related jobs reached more than 79 million (WTTC, 2020b). The number of villages in China that have become rural tourism destinations has increased as a result of economic growth, urbanization and higher living standards (Brandão et al., 2019; Li & Wang, 2020; Zhang et al., 2020). Researchers should pay attention to the development of China's tourism industry and provide other developing countries with ideas and experience for the development by studying their development over the past 30 years.

The regional patterns of rural communities are the result of morphological and social evolution. Among these, morphological evolution is the more direct and visible change. After nearly 30 years of development, the seven administrative villages had undergone tremendous changes in appearance as tall buildings rose to the ground. Evolution results were presented using three indexes: average weighted building height, building volume and floor area ratio, to show the most significant changes in morphological evolution. Social evolution, a change that cannot be ignored in the development of rural communities, is both the result and driver of morphological evolution. Based on the historical developments in Jinshitan, this study used the housing structure, employment structure and industrial structure as indicators of social evolution.

3. Materials and methodology

3.1. Study area

The town of Jinshitan is located on the southern peninsula of Liaodong, within the city limits of Dalian, but 50 km east of the downtown (Fig. 1). Its total area is 120 km^2, with a land area of 62 km^2, a sea area of 58 km^2 and a coastline of 30 km^2. The study site is surrounded by the sea on three sides, consisting of the eastern peninsula, the western peninsula, the open hinterland and the beaches between the two peninsulas. Jinshitan is governed by seven administrative villages (Putaogou, Hezui, Longshan, Manjiatan, Shizijie, Chenjia and Miaoshang).

In 1988, Jinshitan was identified as a national scenic spot. In 1992, Jinshitan was approved by the State Council to establish a national tourist resort. In 2002, Jinshitan passed ISO9001 and ISO14001 international quality and environment system certification. In 2010, Jinshitan was rated as a national 5A-level[1] tourist attraction. In 2012, Jinshitan was rated as one of the 40 most beautiful scenic spots in China by CNN. In 2018, Jinshitan National Tourism Resort has a comprehensive tourism income of 3.05 billion yuan, receiving 6.10 million domestic and foreign tourists, including 0.14 million foreign tourists (http://www.dl.gov.cn). Jinshitan in China has grown from a small traditional fishing village to a national 5A-level tourist and resort coastal town; therefore, its construction and development serves as an important reference point for other tourist areas in China (Yang et al., 2016a, 2016b).

3.2. Data sources

The current study used data spanning around 30 years (from 1988 to 2016) to verify the effectiveness of a revitalization strategy for sustainable rural tourism in China's non-urban areas. As the building vector data does not change significantly from one year to the next; hence, six representative years were selected to illustrate the designated area's evolution over time. 1988 and 1998 were selected to examine the evolution of Jinshitan in its early stage with limited growth and change. After Jinshitan's development has expanded at a steady pace, we set 4 years as the central period (2004, 2008, 2012, and 2016). The building vector data of relevant years (1988, 1998, 2004, 2008, 2012 and 2016) are obtained through the combination of remote sensing images and a field survey (Table 1). Meanwhile, according to the Jinshitan housing survey of 5–6 May 2019, the attributes of the building height and story

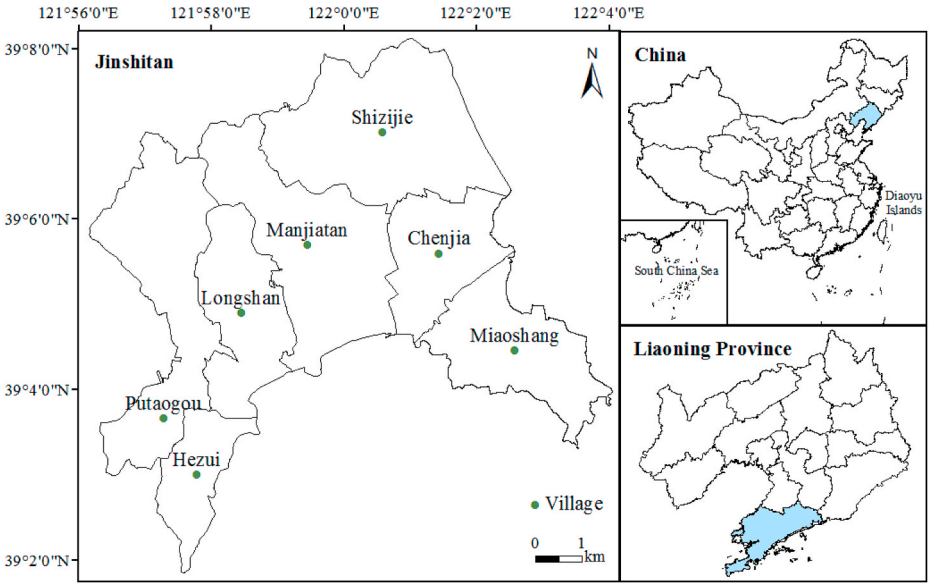


Fig. 1. Location of the study area.

Table 1
Data sources and descriptions.

Data types	Time	Data	Data sources
Remote sensing image data	1988, 1998	Landsat5 resolution:30m	http://www.gscloud.cn
	2004, 2008, 2012	Landsat7 resolution:30m	http://www.gscloud.cn
	2016	Landsat8 resolution:30m	http://www.gscloud.cn
Building vector data	1988, 1998, 2004, 2008, 2012	Based on the 2016 building vector data, through the combination of remote sensing image and field survey, the building vector data of relevant years are obtained	Remote sensing interpretation and field survey
	2016	Building vector data resolution:30m	https://map.baidu.com
Building image data	5–6 May 2019	Photos of representative buildings built in corresponding years of 1988, 1998, 2004, 2008, 2012 and 2016	Field survey
Social economy data	1988, 1998, 2004, 2008, 2012, 2016	Population, agricultural income, tourism income, etc.	Data of Jinpu Statistical Yearbook and Bureau of Statistics
Administrative division data	2009	Country, province, city, county(region), village (town, street) data	Dalian Municipal Planning Bureau

number of the building are supplemented. Over the past 30 years, changes in the number of stories and in the heights of buildings in the seven villages of Jinshitan have been used to depict the evolution of the town's spatial morphology. During the field investigation, we took representative architectural photos of buildings in corresponding years. In addition, by consulting 30 years of Jinpu statistical yearbooks, we obtained the employment rates and output values for the agricultural and tourism industries that were used to trace the social evolution of Jinshitan.

3.3. Methods

The form and function from village to modern city is defined by the three-dimensional outline of the building environment, and the landscape form of the building is of great significance to the sustainability, efficiency and toughness of human settlements (Bonczak & Kontokosta, 2019). The building data is the key to reflect the evolution process, the average weighted building height, building volume and floor area ratio were used to represent the spatial differentiation of the three-dimensional landscapes of the buildings in the study area from 1988 to 2016.

As early as 1996, Wall took Bali as an example and pointed out that with the development of tourism, indigenous people's awareness and attitude towards tourism related employment have become positive (Wall, 1996). So agricultural and non-agricultural employment rates have been used to represent the evolution of the employment structure in the villages. The output values of the agricultural and tourism industries have been used to represent the evolution of the industrial structure in Jinshitan.

To gain a complete understanding of the morphological and social evolution of Jinshitan, several indexes were involved in a comparative analysis (Table 2). The average weighted building height, building volume, floor area ratio were selected as the building indexes (Bao & Li, 2010; Benguigui et al., 2008; Qiao et al., 2015); the proportion of agricultural employed population and proportion of non-agricultural employed population were used as indexes to measure the change of social employment structure (Knight & Song, 1995; Solinger, 1999); the agricultural output value and the tourism output value were used as the indicators of economic growth of study area (Shi, 1999; Zhang & Zhang, 2004) (see Fig. 2).

4. Results and discussion

4.1. Evolution of morphology

4.1.1. Morphology change in the average weighted building height

This study used ArcGIS to carry out a statistical analysis of the seven villages in the study area. In 1988, all seven villages had only one-story bungalows; all of them had an increase in the average weighted building height over the next 30 years. By 2016, the average weighted building height of Jinshitan had risen to 9.71 m.

Among the individual villages, the average weighted building height of Chenjia had risen to 13.81 m, the highest in Jinshitan. Putaogou developed slowly over the first 20 years, and its average weighted building height increased from 8.19 m in 2012 to 11.67 m in 2016. Longshan began to develop rapidly around 2004 and its average weighted building height increased from 3.00 m to 12.67 m in 2004 before reaching the plateau. The average weighted building height of Manjiatan increased to 10.61 m by 2008 and hovered around that value. The average weighted building heights of Hezui, Miaoshang and Shizijie showed a slow increase between 1988 and 2016, with values rising from 5.30 to 7.60 m (Table 3). The data show that, with the economic

Table 2
Calculation and description of rural communities evolution indexes.

Index types	Rural communities evolution indexes	Equations	Variable description
Building	Average weighted building height (H)	$H = \frac{\sum_{i=1}^{n} A_i H_i}{\sum_{i=1}^{n} A_i}$	Where A_i is the base area of building i, H_i is the height of building i, n is the number of buildings in the region
	Building volume (V)	$V = \sum_{i=1}^{n} A_i H_i$	Where A_i is the base area of building i, H_i is the height of building i, n is the number of buildings in the region
	Floor area ratio (FAR)	$FAR = \frac{\sum_{i=1}^{n} A_i F_i}{P_a}$	Where A_i is the base area of building i, F_i is the number of floors of the building, P_a is the land area of the plot, n is the number of buildings in the region
Population	Proportion of agricultural employed population (P_A)	$P_A = \frac{E_A}{P}$	Where E_A is the agriculturally employed population, P is the total population
	Proportion of non-agricultural employed population (P_T)	$P_T = \frac{E_T}{P}$	Where E_T is the non-agriculturally employed population, P is the total population
Economy	Agricultural output value (V_A)	$V_A = \frac{I_A}{A_A}$	Where I_A is the comprehensive agricultural income, A_A is the agricultural land area
	Tourism output value (V_T)	$V_T = \frac{I_T}{A_T}$	Where I_T is the comprehensive tourism income, A_T is the tourism land area

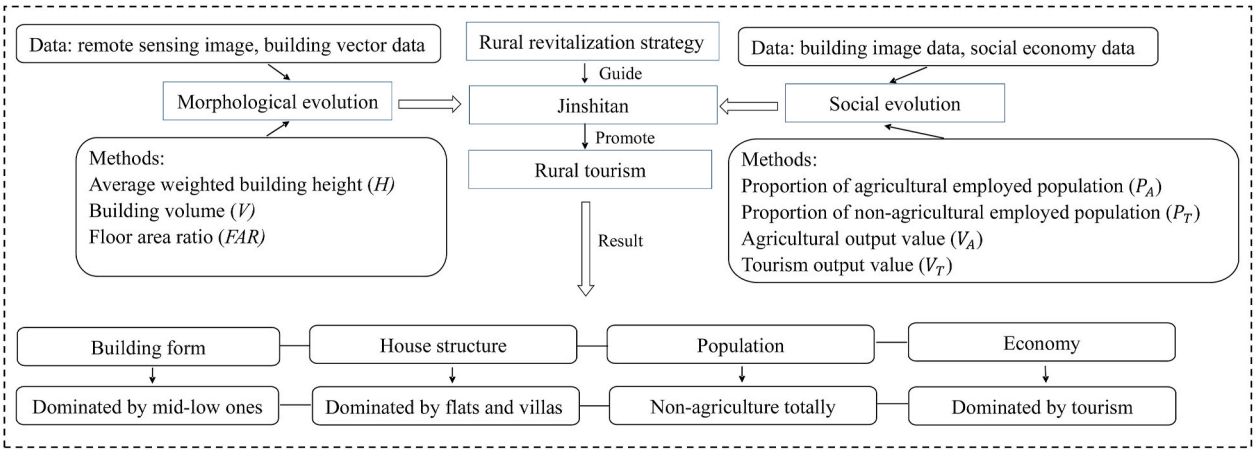


Fig. 2. Roadmap of research design.

Table 3
Morphological evolution of Jinshitan from 1988 to 2016.

Indexes	Villages	1988	1998	2004	2008	2012	2016
Average weighted building height (H)	Putaogou	3.00	3.00	3.15	5.48	8.19	11.67
	Hezui	3.00	3.91	4.12	4.86	5.20	5.85
	Longshan	3.00	3.26	12.67	12.30	12.67	12.86
	Manjiatan	3.00	6.46	8.99	10.61	10.12	10.85
	Shizijie	3.00	3.00	3.89	3.89	6.48	5.35
	Chenjia	3.00	4.24	6.04	10.30	11.17	13.81
	Miaoshang	3.00	3.00	6.37	4.99	7.12	7.57
	Average	3.00	3.84	6.46	7.49	8.70	9.71
Building volume (V)	Putaogou	8.41E+04	1.33E+05	2.36E+05	4.73E+05	1.43E+06	2.92E+06
	Hezui	2.03E+04	4.43E+04	1.54E+05	3.21E+05	3.43E+05	3.64E+05
	Longshan	1.06E+05	1.30E+05	2.70E+06	3.17E+06	4.92E+06	5.47E+06
	Manjiatan	2.19E+05	1.22E+06	3.82E+06	4.79E+06	5.12E+06	8.76E+06
	Shizijie	1.39E+05	1.90E+05	5.47E+05	5.47E+05	9.09E+05	1.20E+06
	Chenjia	1.32E+05	3.47E+05	7.56E+05	2.41E+06	2.88E+06	5.89E+06
	Miaoshang	2.49E+04	8.51E+04	8.21E+05	1.05E+06	1.20E+06	1.77E+06
	Sum	7.25E+05	2.15E+06	9.03E+06	1.28E+07	1.68E+07	2.64E+07
Floor area ratio (FAR)	Putaogou	0.01	0.01	0.05	0.05	0.10	0.44
	Hezui	0.02	0.02	0.04	0.08	0.08	0.03
	Longshan	0.01	0.01	0.18	0.19	0.37	0.43
	Manjiatan	0.03	0.05	0.18	0.20	0.23	0.51
	Shizijie	0.03	0.03	0.04	0.05	0.07	0.09
	Chenjia	0.08	0.09	0.10	0.17	0.30	0.48
	Miaoshang	0.01	0.02	0.30	0.30	0.31	0.22
	Average	0.03	0.03	0.13	0.15	0.21	0.31

development of Jinshitan over the last 30 years, bungalows have given way to high-rise buildings. As the average building height increased, centralized land management and a more rational use of land became necessary.

4.1.2. Morphology change in the volume of building

The building volumes of the seven villages increased continuously from 1988 to 2016, reaching a total volume of 2.64E+07m^3 in 2016. However, the increase in the volume of buildings differed greatly from one village to another. By 2016, Hezui's building volume was only 3.64E+05m^3, with slow growth over the 30-year period. However, Manjiatan's building volume reached 8.76E+06 m^3 in 2016; it increased from 2.19E+05 m^3 to 1.22E+06m^3 between 1988 and 1998 and then expanded rapidly.

Shizijie saw an increase in its building volume approximately every 10 years; its building volume was less than 2.00E+05m^3 between 1988 and 1998, stabilized at 5.47E+05m^3 between 2004 and 2008 and then exceeded 9.00E+05m^3 after 2012. Building volumes of other villages increased significantly at different times after 2000 (Table 3). Manjiatan, which had the fastest growth rate in building volume, is located in the center of Jinshitan, the most densely populated area in terms of tourist attractions. At present, Hezui, which has the smallest building volume, is the farthest away from the town center and has the fewest tourist attractions (Fig. 1).

4.1.3. Morphology change in the ratio of floor area

This study divided the study area into 1101 patches based on village borders, major traffic arteries and land use data. The floor area ratio of each patch was calculated and divided into five equal range levels: extremely low (≤0.20), low (0.20–0.80), medium (0.80–1.40), high (1.40–2.00), and extremely high (≥2.00). Between 1988 and 2016, the average floor area ratio of Jinshitan increased from 0.03 to 0.31. The floor area ratios of the seven villages increased slowly and remained small overall.

The floor area ratio of Manjiatan increased most from 0.03 to 0.51 during the study period and peaked in 2016. Shizijie's floor area ratio showed the smallest increase, from 0.03 to 0.09. The floor area ratios of Putaogou and Chenjia increased slowly in the early years, then acccelerated from 2012 to 2016, with increases of 0.34 and 0.18, respectively. The floor area ratios of Longshan and Miaoshang increased significantly from 1998 to 2004 by 0.17 and 0.28, respectively, and then rose slowly. The Hezui floor area ratio increased slowly in the early years, but then

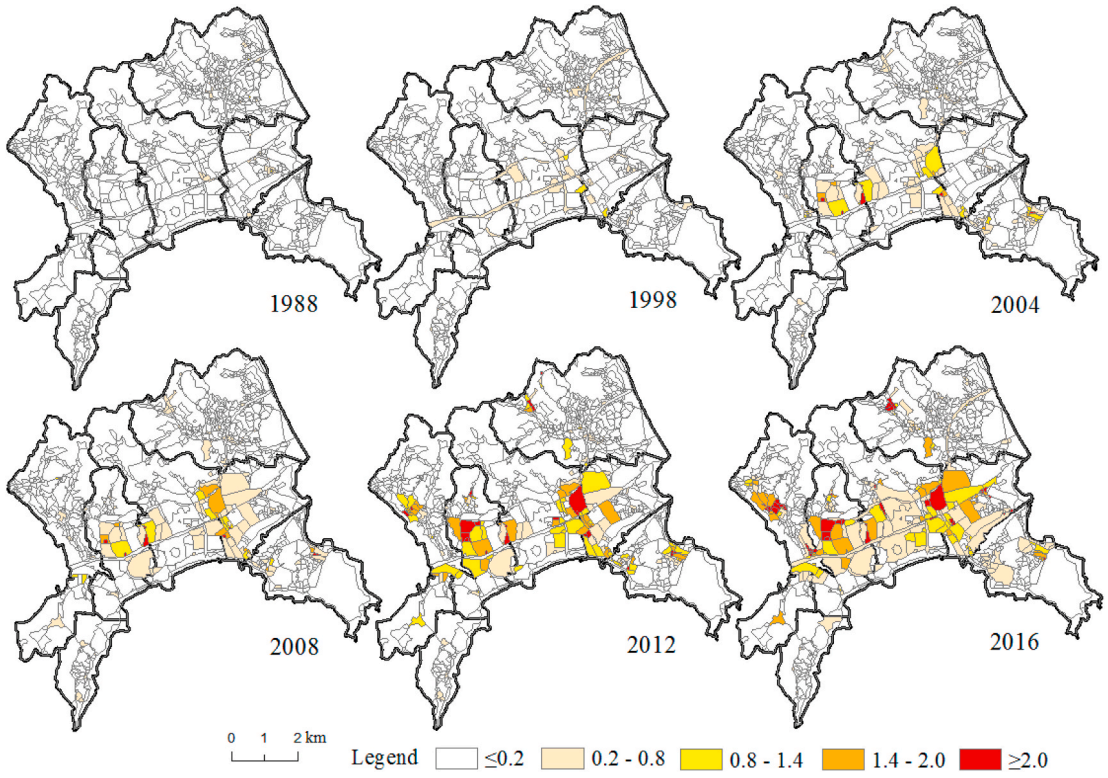


Fig. 3. The spatial distribution of building floor area ratios in Jinshitan from 1988 to 2016.

decreased from 0.08 to 0.03 between 2012 and 2016 with the demolition of unusable buildings (Table 3).

According to their spatial distribution (Fig. 3), the building floor area ratios in Jinshitan were either low or extremely low prior to 1988, with higher levels appearing after 2004. Typically, the floor area ratio was high in central areas and low in northern and southern areas. Although the average floor area ratio of each village was low (below 0.51), a small number of patches had extremely high floor area ratios. By 2016, patches with high and extremely high floor area ratios were concentrated mainly in the central and southern areas of Longshan and Manjiatan. Low and medium floor area patches were mainly distributed in the central area of Jinshitan. Patches with extremely low floor area ratios were concentrated in the villages in the north and south of Jinshitan.

4.2. Social evolution

4.2.1. Evolution of housing structure

Based on the housing data and structural characteristics surveyed in Jinshitan and a comparative analysis of their evolution over six periods from 1988 to 2016 (Table 4), all the houses in the settlement were one-story bungalows prior to the development of Jinshitan; the subsequent transformation from adobe dwellings with grass roofs to red brick houses with tiled roofs reflects the residents' improvement in economic status. At the beginning of the 21st century, wealthy villagers had begun to transform their own homes, with some building two-story dwellings using the government's rural subsidies.

After 2008, the desire for clean air and a good living environment encouraged the construction of detached villas and townhouses, with some companies developing five- and six-story residential buildings. The housing structures of the villages became diversified. After several years of development in town centers, suburban villages started to follow suit. Putaogou and Miaoshang have converted one-story bungalows into multi-story buildings through village collective construction, government subsidies and self-sustaining funds. Most of the newly built houses had six to eight stories.

Since 2016, only a few single-story bungalows have remained. They are used for cultivating flowers and aqua-farming, while some factories have been used to store machinery. Residential buildings have either more than five stories or are situated in picturesque areas. Over the last 30 years of tourism-driven economic development, not only have typical housing structures undergone significant changes, but the composition and structure of the building funding sources have also changed. Government-sponsored business development and self-constructed residential development required coordination to ensure orderly and sustainable construction.

4.2.2. Evolution of the employment structure

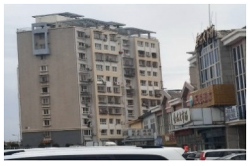
From 1988 to 2016, Jinshitan's rate of agricultural employment declined and the rate of non-agricultural employment increased, reflecting a dramatic change in the employment structure. From 1988 to 1998, employment was based on agriculture and the employment rate for agriculture was 94.14% and 86.14%, respectively.

The non-agriculturally employed population has increased rapidly since 2004. By 2016, the proportion of non-agricultural employment in Jinshitan was 99.57%, with the largest number of jobs supporting the tourism industry (Fig. 4). The talent skills required by the tourism industry are diverse. Most employees have low technical requirements; as such, the industry can provide jobs for previously unemployed people with limited education. As a result, the tourism sector has improved social stability.

4.2.3. Evolution of industrial structure

According to the distribution of agricultural and tourism output values in Jinshitan (Fig. 4), the value of agricultural output increased from 3.00E+04 yuan/km^2 in 1988 to 8.80E+05 yuan/km^2 in 2004 and to 2.36E+05 yuan km^2 in 2016, a moderate upward trend. Since 1992, Jinshitan has focused on tourism development; as such, the output value of tourism in 1988 was zero. However, Jinshitan reached 1.68E+06 yuan/km^2 within 12 years (from 1992 to 2004), well above the value of agricultural output in 2004. In 2016, the output value of the tourism

Table 4
Temporal evolution of the housing structure in Jinshitan.

Year	Types	Materials and structure	Origin of building funds	Layers	Height (m)	Pictures
1988	Thatched cottages	Adobe and grass roof: combined structure of deadwoods and stones	Villagers themselves	1	3	
1998	20st century residences	Red brick roof: combineds structure of woods and bricks	Villagers themselves	1	3	
2004	21st century residences	Reinforced concrete structure	Rich villagers remould personally, government subsidies	1–3	3–10	
2008	Villas	Advanced construction materials, application of new construction technologies	Funds owned by enterprises, bank loans, raised by residents	1–6	1–18	
2012	Towner residences	Traditional or advanced construction materials	Village collective construction intensively, government pays, raised by residents, funds owned by enterprises	1–8	3–24	
2016	High buildings	Advanced materials and contrastive analysis of materials' function	Funds owned by enterprises, bank loans, raised by residents	1–16	3–48	

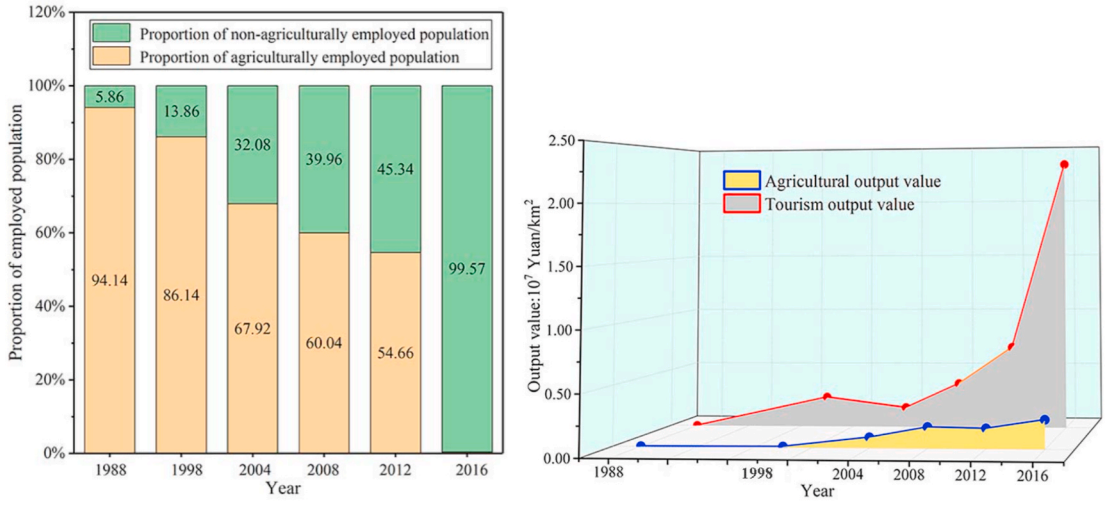


Fig. 4. The agricultural and non-agricultural distribution of Jinshitan from 1988 to 2016. (Fig. 4a. Proportion of agricultural and non-agricultural population; Fig. 4b. Output value of agriculture and tourism).

industry was 2.32E+07 yuan/km^2, which was almost 10 times the agricultural output value of 2.36E+06 yuan/km^2 in the same year.

The rapid development of regional tourism tends to increase the income of local residents. Domestic tourism moves some wealth from tourism source areas to tourism reception areas; on a national scale it redistributes domestic wealth and achieved the goal of more widespread prosperity than is found in an agrarian social structure.

Between 1988 and 2016, both agricultural and tourism output values

increased in Jinshitan; however, their growth rates and momentum varied considerably. As technology developed, even as the number of people engaged in agricultural employment decreased, the value of production rose steadily. However, high levels of agricultural emissions and pollution (e.g., the use of fertilizers and pesticides) pose a threat to environmental safety and are incompatible with green and sustainable development. Since the introduction of high-speed rail transport in 2002, low-carbon tourism and the concern of tourists for the environment have led to green and low-polluting forms of economic development. Tourism, which is part of a small land area but has a high output value, is consistent with global principles of sustainable development.

4.3. Development of rural human settlement mechanisms

Jinshitan, surrounded by the sea on three sides, has abundant marine resources, vast forest areas, scenic surroundings and a variety of natural tourism resources. In addition to social and economic development, improving living standards for residents and changing lifestyles and cultural concepts for residents, the tourism industry in Jinshitan has gradually developed. Increasing demand for tourism and related industries has led to the integration of all seven villages into one town administrative unit. Government, businesses and residents have been the main actors in promoting the spatiotemporal evolution of rural communities, each with its own role in each stage of the evolution of Jinshitan (Fig. 5).

(1) Initial stage (1988–1998): Jinshitan was dominated by one-story bungalows and the output value of agriculture, as the main economic generator, increased from 3.00E+04yuan/km^2 in 1988 to 9.00E+04yuan/km^2 in 1998.

The role of the government has been particularly important. Laws, policies and plans related to the development of tourism were formulated under the guidance of the government. At this stage of infrastructure construction, the government promoted policies on natural resources and gave priority to protection, with use as a secondary al objective.

(2) Rapid growth (1998–2004): The average weighted building height in Jinshitan increased to 6.46m and the building volume increased from 2.15E+06m^3 to 9.03E+06m^3. Longshan and Miaoshang's floor area ratios increased significantly (0.17 and 0.28, respectively).

These data show the rapid morphological evolution of Jinshitan. Infrastructure was well developed after the initial stage and the tourism market mechanism emerged. The development of the tourism industry has become increasingly important for the spatiotemporal evolution of Jinshitan. Tourism-related enterprises have led to further developments in human settlements, and policies have been formulated to support the development of tourism.

(3) Fixed growth (2004–2012): The number of tourists has gradually increased and the government and residents have begun to offer comprehensive formal tourism services. Residential buildings and tourist accommodation quickly expanded. Between 2004 and 2012, the building volume increased from 9.03E+06m^3 to 1.68E+07m^3 and the tourism services industry began to develop. In 2012, the output value of the tourism industry was 7.02E+06yuan/km^2, more than four times the value of agricultural output for the same period.

At this stage, the economic value of tourism in Jinshitan has steadily increased, and the appearance of the villages has changed significantly. This stage has given priority to economic development, with cultural development an additional objective. In addition, markets began to be regulated.

(4) Mature stage (2012–2016): The evolution of Jinshitan was almost complete. Tourism was the leading industry with an output value of 2.32E+07yuan/km^2 and the proportion of non-agricultural employment in Jinshitan was 99.57%. All residents lived in more than five-story residential buildings or in picturesque villa areas. Residents were an important part of the human settlements of the village and town, and their activities had a key impact on the spatiotemporal evolution of Jinshitan.

As rural communities matured, the role of the government diminished, business and market regulation became more stable, and compromises between the interests of residents and tourists were the key drivers behind Jinshitan's evolution. At this stage, the government has formulated service-oriented policies to regulate the development of tourism, which are needed to meet the key interests of residents while protecting natural resources.

After analyzing the results, the present study compares the findings to the product life cycle theory (PLC). The PLC model was first introduced by Vernon and Wells (Vernon & Wells, 1996) and describes four stages of the product life cycle (introduction, growth, maturity, and decline) associated with marketing and management decisions of a product. We found that Jinshitan's tourism development over time can

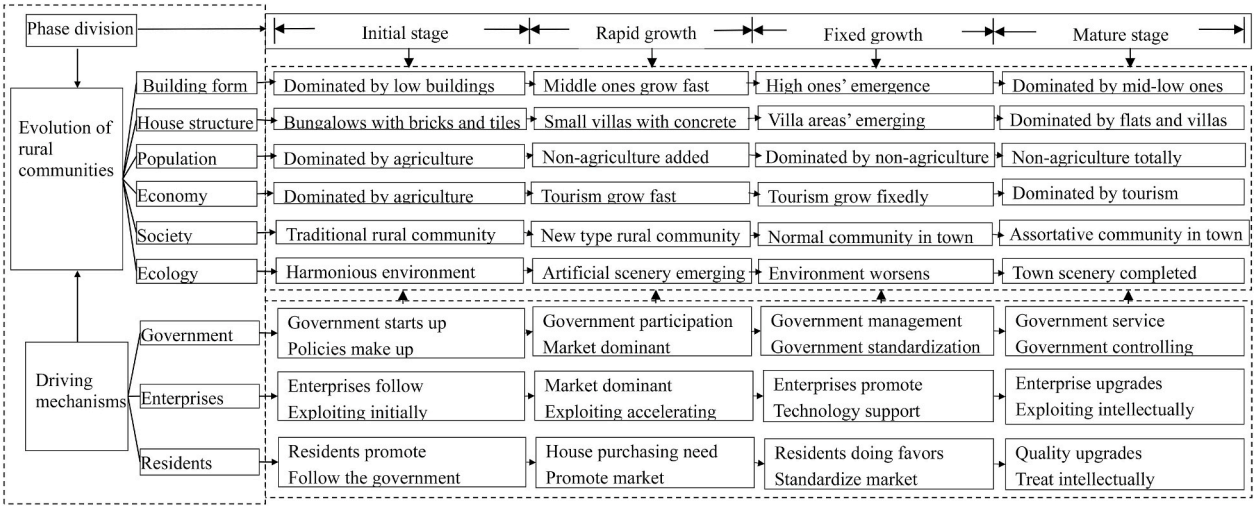


Fig. 5. Driving mechanisms of rural communities evolution.

be broken down into four distinct phases: introduction, rapid growth, fixed growth, and maturity. These findings align with the PLC without the declining stage of the case showing that sustainable development can be promoted in rural communities by revitalizing a destination.

5. Implications and conclusion

Under the background of the rapid development of China's tourism industry and the rural revitalization strategy, this study used remote sensing images from six periods as well as several building vectors (average weighted building height, building volume and floor area ratio) to represent morphological evolution in developing countries, using f the town of Jinshitan as a sample. We used data on housing structures, employment structures and industrial structures to represent the town's social evolution.

As an academic research, this research has some innovative contributions. First of all, our study complements the findings reported by Liu (Liu, 2018) and Wang and Yotsumoto (Wang & Yotsumoto, 2019). Liu (2018) and Wang and Yotsumoto (2019) used an extensive-area-frame sampling technique to present macro-ideologies; their findings do not apply to smaller and rural areas within the resource limits. Our research object is the micro-scale of village and town level, which can be analyzed more accurately. Secondly, this study combines the perspective of human settlements and touristification and applies it to rural areas that previous studies have not investigated (Bonczak & Kontokosta, 2019; Weaver et al., 2020). The findings provide new insights from interdisciplinary perspective into the tourism field of rural communities. Third, in this study, there are more types of data available than other studies (Fletcher, 2019; Stoddart et al., 2020; Nugroho & Numata, 2020). The data (Table 1) used in this study are not only rich in variety and wide in coverage, but also multi-source, including various official websites, remote sensing interpretation and field survey. Moreover, the accuracy is high and refined to every building, with a time span as long as 30 years. Fourth, this paper provides an in-depth assessment of the case area. Unlike Watmough (Watmough et al., 2016, pp. 188–203) only examined the evolution process in one dimension, our analysis focuses on the spatial form of buildings to the social evolution with the external performance of employment structure, economic structure and housing structure, showing the changes of the case area in a comprehensive and multi-level way in six time periods. Finally, this study selects Jinshitan, China's 5A National Tourism Resort, as a case study. Because China is a big tourism country and the largest developing country in the world, the development and evolution process of the case area can provide experience and reference model for countries and regions that want to use tourism to promote the sustainable development of villages. The results reported in this study demonstrate that China is a suitable study sample (Quer, 2021; Long et al., 2019).

This paper reaches the following conclusion: the average weighted building height, building volume and floor area ratio of Jinshitan increased from 1988 to 2016. In 1988, all of the houses in Jinshitan were one-story bungalows, but by 2016 the average weighted building height in Jinshitan had reached 9.71 m. Since 1992, when Jinshitan began to focus on the development of tourism, affluent villagers have built small second-story buildings, ending the uniformity of one-story houses. After 2008, residents' demand for a better living environment stimulated the development of the villa market, and some companies developed five- and six-story residential buildings, further diversifying the housing structures of the villages. By 2016, few one-story bungalows remained and these were converted to flower shops and aquafarms. Some factories have been used to store machinery.

Agriculture has consistently been one of Jinshitan's most important industries. The value of agricultural output has steadily increased from 1988 to 2016, with an early share of agricultural employment as high as 94.14%. However, the value of the tourism industry's output has grown rapidly in Jinshitan since 1992. By 2004, the output value of the tourism industry had reached 1.68E+06yuan/km^2, far exceeding that of agriculture in the same period (8.80E+05yuan/km^2). Meanwhile, the proportion of non-agricultural employment has also increased. In 2016, the proportion of people engaged in non-agricultural employment was as high as 99.57%, in sharp contrast to the proportion of the remaining agricultural employment population. The output value of the tourism industry was 2.32E+07yuan/km^2, almost ten times the agricultural output value of 2.36E+06yuan/km^2 for the same period. The employment structure and economic structure of the case area have undergone earth shaking changes in the past 30 years.

In the initial stage of the development of the case area, the government plays a leading role in guiding enterprises and residents to find ways to promote tourism development. With the development of rural communities' tourism, tourism market mechanism appeared. The compromise between the interests of businesses, residents and tourists is the main driving force for the development of the research area. The leading role of the government is gradually weakened, but the role of policy regulation is strengthening. local governments, businesses and residents have always been the main participants in promoting the spatiotemporal evolution of rural communities.

6. Limitations and future research

This study may not be applicable to the evolution of all rural communities, as complex human settlements determine the evolutionary path and the results of different types of rural communities. In the future, a comparative study of agricultural, industrial, urban and other rural communities can be carried out, the rules on the evolution of types of rural communities can be summarized, and a universal research outcome can be sought.

This study encountered several unsolved theoretical and empirical problems, with the smallest administrative unit available for employment and industrial statistical data at town level. No economic data were available for the seven villages in Jinshitan, which prevented a more accurate analysis of the changes in each village. In future research, socio-economic data at the village level should be obtained to improve accuracy and allow a comparison of advantages and disadvantages in the developmental paths of the seven villages.

The seven rural variables (Table 2) selected in this research method may cover the evolution of the study area, but if more variables are selected, the results will be more accurate. For example, adding nighttime lights data to form evolution can not only produce the results of building evolution, but also the results of population flow evolution. Adding population structure to social evolution, age composition and educational level are also important ways of reflecting the evolution of rural communities.

The experimental accuracy was limited by the capacity of the remote sensing images, the precision of measuring the building heights and flooring obtained from the Dalian Land Resources and Housing Bureau and field surveys, and the rounding of values during calculations. However, research data are accurate to two decimal places, which, although limited, is more accurate than the data in previous studies. The next step will be the quantitative analysis of the driving factors, based on a qualitative analysis of the driving mechanisms, and the identification of the factors that have had the greatest impact on Jinshitan's temporal and spatial evolution.

Future studies should focus on local government contributions to local tourism-related economic development. The government oversees rural tourism, ensuring that it follows the desired direction. Exploring the link between local government autonomy and rural tourism can shed light on the driving factors for rural tourism development.

Declaration of competing interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, or publication of this article.

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