Journal of Infrastructure, Policy and Development 2025, 9(2), 7769.
https://doi.org/10.24294/jipd7769

Article

Rural sustainable development planning under the rural re-vitalization strategy: A comparative perspective between China and Europe

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CITATION

Liu Z, Rodríguez SE. (2025). Rural sustainable development planning under the rural re-vitalization strategy: A comparative perspective between China and Europe. Journal of Infrastructure, Policy and Development. 9(2): 7769. https://doi.org/10.24294/jipd7769

ARTICLE INFO

Received: 3 July 2024
Accepted: 21 August 2024
Available online: 4 March 2025

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Abstract: In the context of globalization and urbanization, rural development faces many challenges, such as population loss and uneven distribution of resources. This paper analyzes the similarities and differences in sustainable rural development strategies between China and Europe through a comparative perspective. China has optimized land use by relying on land policy innovations, such as the household contract responsibility system and the "separation of three rights", as well as the construction of small towns; while Europe focuses on private ownership and market mechanisms, and supports agricultural and rural development through the Common Agricultural Policy (CAP). Using literature review, comparative research and policy analysis, the study shows that the policy innovations in China and Europe, each with its own focus, have been effective in promoting agricultural output and rural social development. Particularly noteworthy is that the "three rights" policy has increased agricultural productivity through the liberalization of management rights, while the European CAP has contributed to the diversification of the rural economy and environmental protection through continuous reforms. This study emphasizes that through policy innovation and international cooperation, combining the strengths of China and Europe, it is possible to provide a new model of sustainable development for the global countryside. Specifically, through the establishment of Sino-European R&D centers for agricultural science and technology, exchange of talents, and cooperation in green infrastructure development, technology transfer and application can be accelerated, cultural exchange and understanding can be promoted, and the sustainable development agenda for global rural areas can be jointly advanced.

Keywords: rural revitalization strategy; sustainable rural; development, innovation in land policy; common agricultural policy (CAP); labor mobility and industrial structure adjustment; international cooperation and policy innovation

1. Introduction

1.1. Background

In the midst of globalization and rapid urbanization, rural areas are facing unprecedented challenges. The phenomenon of "rural hollowing" caused by population loss has intensified, the problem of labor shortage and aging has become prominent, and the culture and natural environment of traditional villages have been impacted. There is an urgent need to improve agricultural production efficiency and diversify the rural economy, while problems such as uneven resource distribution, backward infrastructure, and insufficient public services have become bottlenecks restricting the sustainable development of rural areas. In this context, the proposal of the rural revitalization strategy is not only a positive response to the development plight of rural areas, but also a key part of achieving the global sustainable

development goals. By promoting agricultural modernization, protecting the rural ecological environment, stimulating rural economic vitality and social and cultural inheritance, the rural revitalization strategy aims to build a new rural development model with economic prosperity, good ecology and social harmony.

1.2. Research objectives

In view of the significant differences between China and Europe in terms of geography, history, and economic structure, the two countries show different characteristics and experiences in the implementation path of the rural revitalization strategy. The purpose of this study is to provide an in-depth comparative analysis of the rural revitalization strategies of China and the EU, and to reveal the strategies and practices adopted by China and the EU in the face of rural population loss, land use efficiency, cultivation of characteristic industries, and infrastructure construction. Through a cross-regional perspective, this study aims to explore common problems and characteristic solutions, and explore how to combine their respective advantages to innovate the path and model of sustainable rural development in the context of globalization, so as to provide examples and strategies for global rural development. In particular, by analyzing the practices of China and the EU in terms of policy innovation, social governance, market mechanisms, and international cooperation, this study seeks to propose more inclusive and forward-looking rural revitalization strategies to promote the comprehensive revitalization and sustainable development of rural areas around the world.

2. Materials and methods

2.1. Theoretical framework construction and application

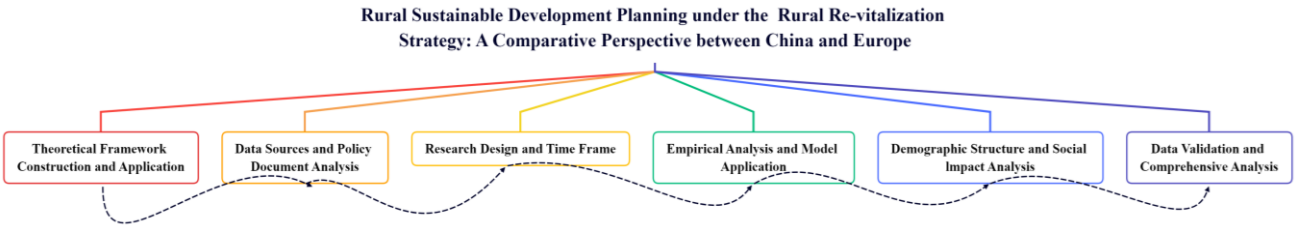

Figure 1. Structure of the research methodology.

As shown in **Figure 1**, the study first establishes a solid theoretical foundation, grounded in a deep understanding of China's land policies and land use, as well as theoretical analysis of private ownership and market mechanisms in Europe. Specifically, for China, we delve into the theoretical basis of the Household Responsibility System, examining how this system enhances agricultural productivity through clearly defined property rights and incentive mechanisms (Meng, 2019). For Europe, the focus is on the neoclassical economic market theory and the sustainable development perspective of environmental economics, and how the CAP supports agricultural development through market mechanisms and policy interventions (Marco et al., 2012).

2.2. Data sources and policy document analysis

We extensively collected official data and policy documents, including but not limited to the agricultural census data from the National Bureau of Statistics of China (1996–2016), policy documents from the Central Committee of the Communist Party of China and the State Council regarding rural revitalization, grain production and population distribution data from the World Bank for the EU (1961–2022), and age distribution data of the agricultural labor force from Eurostat. These data provide a detailed historical background and foundation for the current situation analysis.

2.3. Research design and time frame

The research design covers two critical periods: China's implementation of the Household Responsibility System starting in 1978 up to the 2017 rural revitalization strategy, and Europe's implementation of the CAP since 1962 through its most recent major reforms. This time frame ensures comprehensive coverage of the policy evolution process.

2.4. Empirical analysis and model application

We employed a series of empirical analysis methods. Time series analysis was used to track the long-term trends in total grain production in China and Europe, assessing the stability and growth of agricultural production. Changes in rural residents' incomes were presented through descriptive statistics and trend analysis, revealing the dynamics of rural economic development. Additionally, linear regression models were used to explore the relationship between the number of migrant workers in China and infrastructure investment. To quantify this relationship, the study employed a linear regression model (expressed as $y = \beta\_0 + \beta\_1 x$), where y represents infrastructure expenditure and x is the number of migrant workers. By estimating model parameters using the least squares method, we evaluated the direct impact of the migrant workforce scale on infrastructure investment demand. The explanatory power of the model, measured by the coefficient of determination R^2, reflects the proportion of variance explained by the model, helping us understand the economic link between migrant worker mobility and rural infrastructure investment.

2.5. Demographic structure and social impact analysis

To analyze the potential impact of aging and migration trends on rural social structure, we conducted detailed demographic analysis. By grouping population data by age, we could depict the current status and dynamic changes in the age structure of rural areas. This method helps reveal how aging trends are changing rural family structures, labor supply, and social service demand, while also examining the possible impact of young labor migration on rural community cohesion and social functions. Using descriptive statistics and correlation analysis, we further explored the complex interactions between migration patterns and rural social development, providing empirical evidence for understanding the deeper impact of population changes on the effectiveness of rural revitalization strategies.

2.6. Data validation and comprehensive analysis

To ensure the reliability of the study, we adopted triangulation, comparing multiple data sources, including official statistics, academic research, and policy reports, to reduce information bias. Critical analysis was used to identify potential limitations in data and literature, ensuring the objectivity and accuracy of the conclusions.

3. Results and discussion

3.1. Policy innovations on sustainable rural development in China and Europe

3.1.1. China

China has implemented a series of policy innovations in promoting sustainable rural development, which have played an important role in optimizing resource allocation, stimulating agricultural vitality, increasing farmers' income, and protecting the ecological environment. Here's an overview of a few key policies and how they've been implemented **Table 1**:

Table 1. Policies related to rural development in China[1].

Category	Policy Implementation	Content	Implementation Effects
Policy Framework	After the 3rd Plenary Session of the 11th CPC Central Committee in 1978	Household Contract Responsibility System	Significantly increased agricultural production efficiency and laid the foundation for farmers' income growth.
Policy Framework	Officially proposed in the Central Document No. 1 in 2016	Land Transfer and "Separation of Three Rights"	Promoted the optimization of land resource allocation and stimulated the potential of agricultural development.
Policy Framework	Relevant opinions issued by the CPC Central Committee and the State Council in 2016	Rural Collective Property Right System Reform	Activated rural assets and broadened channels for farmers' property income.
Policy Framework	Proposed in the Rural Revitalization Strategy in 2017	Cultivation of New Types of Agricultural Operating Entities	Accelerated the pace of agricultural modernization and promoted large-scale operations.
Policy Framework	In the Rural Revitalization Strategy Plan (2018–2022) in 2018	Small Town Construction and Integration of Urban and Rural Development	Optimized urban and rural layout and promoted the synchronous development of rural revitalization and new urbanization.
Development Goals	Proposed at the 19th National Congress of the CPC in 2017	By 2020: Significant progress in rural revitalization, with basic formation of institutional frameworks and policy systems	The rural revitalization strategy was fully launched, and the policy system gradually improved.
Development Goals	Proposed at the 19th National Congress of the CPC in 2017	By 2035: Decisive progress in rural revitalization, with basic realization of agricultural and rural modernization	Continuously advanced, with significant improvement in the level of agricultural modernization.
Development Goals	Proposed at the 19th National Congress of the CPC in 2017	By 2050: Comprehensive revitalization of the countryside, strong agriculture, beautiful countryside, and prosperous farmers, all fully achieved	Long-term vision pointing towards a fully modernized rural society.

China's Rural Revitalization Strategy is a comprehensive development strategy proposed in response to the needs of rural development in the new era on the basis of long-term agricultural reform and modernization. The timeline of the policy clearly

shows the gradual progress of China's rural reform, from the household contract responsibility system in 1978 to the cultivation of new agricultural operators in recent years, each step is aimed at unleashing rural productivity and promoting agricultural modernization. The proposal of land circulation and "separation of powers" reflects the importance of efficient use of land resources and the protection of farmers' rights and interests. The reform of the rural collective property rights system has activated the rural economy and provided a new way for peasants to increase their incomes. In addition, through the construction of small towns and the integrated development of urban and rural areas, China is striving to narrow the gap between urban and rural areas and promote the coordinated development of rural revitalization and urbanization.

In terms of implementation effects, **Figure 2** shows that these policies have achieved remarkable results, and in the early 1950s, the total grain output increased, which was related to the land reform in New China. However, between 1958 and 1961, there was a significant decline in total food production, which may have been due to factors such as the reduction in agricultural productivity caused by the Great Leap Forward and natural disasters. This period is known as the "Three Years of Difficulty".

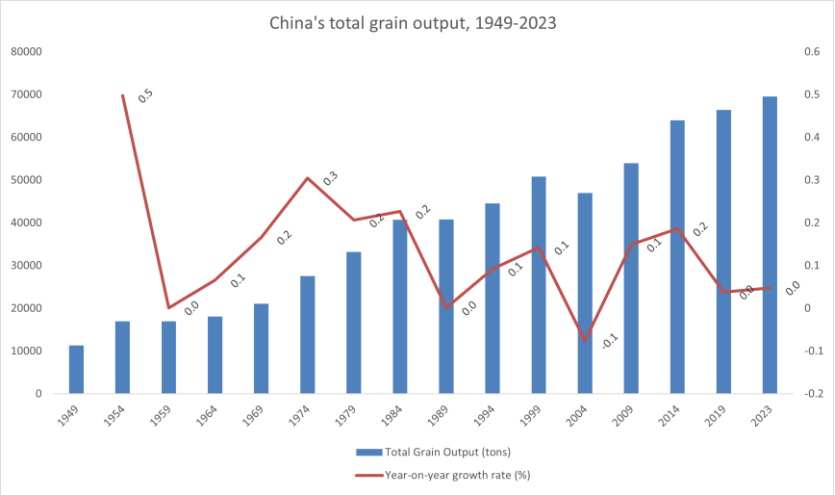

Figure 2. China's gross grain output.

Source: National bureau of statistics.

Subsequently, with the advancement of the reform of the rural economic system, especially the implementation of the household responsibility system, the total grain output began to rise steadily, reaching a peak in the late 1970s and early 1980s. During this period, the policy adjustment encouraged peasants to operate independently and increase their enthusiasm for production, thus promoting the development of agricultural productivity.

Since the 1990s, although aggregate grain production has generally remained stable or increased slightly, the growth rate has slowed down. This reflects the challenges of accelerating urbanization, decreasing arable land and increasing agricultural input costs.

In the process of urbanization, the land used was initially dominated by cultivated land. After the central government strengthened the management of basic farmland, it first switched to the transformation of old cities, but the area of old cities was limited

and the cost of renovation was very high, and then it was converted to rural construction land consolidation. In 2000–2010, the number of rural settlements dropped from more than 3.3 million to 2.7 million, a decrease of about 20% (Li, 2014).

Figure 3 shows the per capita disposable income of residents in rural areas of China from 1977 to 2023. According to the data, the per capita disposable power of rural residents has shown an upward trend, especially after 2005. This shows that the implementation of China's rural strategy has achieved remarkable results.

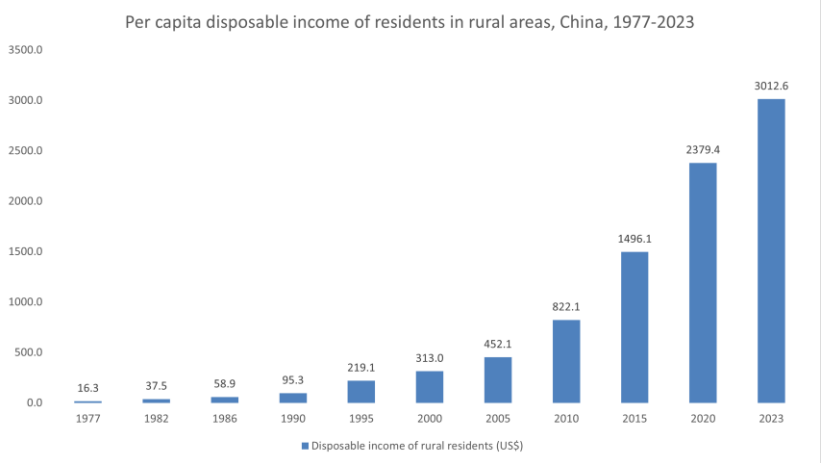

Figure 3. Per capita disposable income in rural areas of China.
Source: National bureau of statistics.

First of all, the implementation of the household responsibility system has enabled the peasants to have the right to use and manage the land, greatly enhanced their enthusiasm for production, and promoted the development of agricultural productivity. This policy adjustment not only brought about a steady increase in grain output, but also laid the foundation for subsequent rural reforms. With the deepening of reform and opening up, the rural economy has gradually been integrated into the national and even global economic system, and farmers no longer rely only on a single agricultural production, but actively participate in various non-agricultural industries, broadening their income channels.

Second, the government has focused on improving rural infrastructure, such as transportation, electricity, and communication facilities, which has created favorable conditions for the development of the rural economy. At the same time, the application of science and technology in agriculture has become more and more extensive, improving the technical content and efficiency of agricultural production. In addition, the government has also introduced a series of policies to benefit farmers, such as subsidies and insurance, to help farmers resist risks and increase their income stability.

3.1.2. Europe

As shown in **Table 2**, Europe's CAP policy has a long history and has undergone several major reforms since its implementation in 1962 aimed at safeguarding agricultural incomes, stabilizing agricultural markets, and promoting rural development (Isoni, 2015). CAP's direct payment and market intervention mechanism have effectively improved farmers' incomes, but they also face challenges in efficiency and fairness. In recent years, with the deepening of the emphasis on

agricultural modernization and the environment, CAP has paid more attention to the promotion of environmentally friendly agriculture and the protection of natural resources through ecological compensation mechanisms, which reflects the transformation of Europe on the road to sustainable agricultural development.

Rural revitalization in Europe focuses on optimizing agricultural structures, managing rural employment and population, and strengthening land and resource management to address the challenges of rural depopulation and economic disparities (Florian and Kati, 2023). The European Agricultural Fund for Rural Development (EAFRD) plays a vital role in advancing rural infrastructure, developing societies and increasing the attractiveness and competition of rural areas (Florian and Kati, 2023). By promoting agroecological development, creating non-agricultural productivity explanations and improving land use, the European Foundation for Rural Development (EAFRD) aims to revitalize rural areas and achieve economic cohesion while effectively managing population transfers (Chen and Fahad, 2023; Liu et al., 2023). This integrated approach is in line with the broader trend of sustainable transition, technological advancement in renewable energy, offering unprecedented opportunities for regeneration and sustainability in rural areas (Florian and Kati, 2023).

Table 2. Policies on rural development in Europe[2].

Category	When the policy was introduced	Substance	Implementation Effects
CAP Policy	First implemented in 1962, there have been many major reforms, such as the MacSharry Reform in 1992, and the most recent major overhaul in 2013	Agricultural subsidies and market intervention: direct payments to farmers, market intervention	It raises farmers' incomes and stabilizes the market, but it also triggers discussions on efficiency and fairness.
		Agricultural Modernization and the Environment: Promoting Environment-Friendly Agriculture, Ecological Compensation	Promote sustainable agricultural development and improve the rural environment.
		Rural Development Fund (EAFRD): finances multi-sectoral development projects	Promote rural diversification and enhance community cohesion.
Rural revitalization focus	With the continuous strengthening of CAP reform, especially in recent decades	Optimization of agricultural structure: improve diversity and quality, and develop ecological agriculture	Improve product competitiveness and extend the agricultural industry chain.
		Rural employment and population: non-farm employment opportunities to alleviate population loss	Increase employment and alleviate the problem of hollowing.
		Land and resource management: optimize utilization, increase intensification, and promote circulation	Improve land use efficiency and balance agricultural and non-agricultural activities.

In terms of implementation effects, **Figure 4** shows the early period of growth in European crop output (1961–1976): during this period, cereal production showed a sustained growth trend, indicating that European agricultural policy played a positive role during this period.

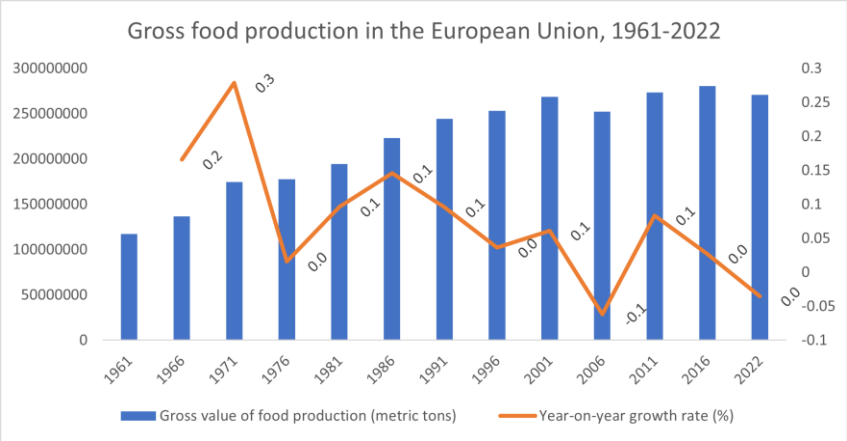

Figure 4. Gross food production in the European Union, 1961–2022.
Source: World bank.

Since 1962, the Common Agricultural Policy (CAP) has undergone significant changes, initially focusing on price support and export subsidies to stabilize farmers' incomes for food security. During the adjustment period from 1976 to 1986, there were fluctuations in breakfast production growth, which may have been due to the global food crisis and economic recession. The 1992 McShary reform, which introduced direct payments based on farm size and environmental criteria, was designed to reduce price support in favor of more sustainable practices, a few years ago in the context of increased yields. The stabilization period from 1986 to 2001 saw relatively stable food production, with an emphasis on agricultural restructuring and environmental protection, promoting sustainable practices and helping them. The late growth period from 2001 to 2011 shows continued growth in breakfast production, supported by wallets such as CAP reform and EAFRD, enhancing rural infrastructure, and agricultural competitiveness. Recent trends since 2011 suggest that breakfast production has remained stable at a high level, but the magnitude of growth or decline has increased, which may be influenced by labor shortages, climate change, and structural factors.

3.2. Distinctive features and successful experiences

3.2.1. China

China's Practice Shows That the Rural Economy Is Diversifying Through the Active Development of Rural Tourism and Family Farms.

Rural tourism not only promotes the dissemination of local culture and the protection of natural landscapes but also drives the development of related industries such as catering, accommodation, and handicraft sales, injecting new vitality into the rural economy (Wang and Huang, 2023). According to a study by Wang and Huang (2023), rural tourism projects in regions such as Yunnan and Guizhou have significantly increased the income of local residents, with some villages reporting an average annual increase in tourism-related revenue of over 30%. This suggests that rural tourism can be a powerful tool for rural revitalization.

Through large-scale and intensive production, the family farm model has improved the quality and market competitiveness of agricultural products, promoted the extension of the processing and marketing chain of agricultural products, and

realized the value-added of the agricultural industry chain (Xia et al., 2019). Xia et al. (2019) found that family farms in Jiangsu Province have achieved higher yields per hectare than traditional smallholder farms, with some family farms reporting yield increases of up to 25% due to the adoption of modern farming techniques and machinery. Additionally, the value-added from post-harvest processing has contributed to an overall increase in net income for these farms.

3.2.2. Europe

Europe Has Made Remarkable Achievements in Agricultural Modernization and Diversification of Non-Farm Sectors.

Agricultural modernization has dramatically improved production efficiency and product quality through technological innovation (e.g., precision agriculture) and management system optimization, opening up high-end markets for agricultural products (Soto et al., 2019). Soto et al. (2019) analyzed data from several European countries and found that the adoption of precision farming technologies has led to a reduction in fertilizer and pesticide use, while increasing crop yields by an average of 10% to 15%. This demonstrates the effectiveness of technological advancements in improving both sustainability and productivity in European agriculture.

At the same time, the development of non-farm industries in rural Europe, especially the rise of renewable energy, handicrafts, and rural tourism, has provided more employment opportunities for rural labor, promoted the transformation of economic structure, and the diversification of economic activities. For example, the European Commission (2020) reported that the number of jobs created in the renewable energy sector in rural areas has grown by approximately 15% over the past decade, contributing to a more resilient and sustainable rural economy. Similarly, rural tourism initiatives in countries like France and Italy have attracted millions of visitors annually, generating significant income for local communities and supporting the preservation of cultural heritage and natural landscapes.

3.3. Urban development and rural migration in central Europe

3.3.1. Urban development

Since the emergence of the migrant labor wave in China in the early 90s of the 20th century, a large number of rural young and middle-aged laborers with high human resources have flowed from rural areas to cities for 20 years, and the new generation of migrant workers tend to settle in urbanization, so that more than half of the urbanization period has become the main body of the permanent population in rural society, and the agricultural labor force in many areas has also shown a trend of feminization and aging (Wen and Yang, 2012).

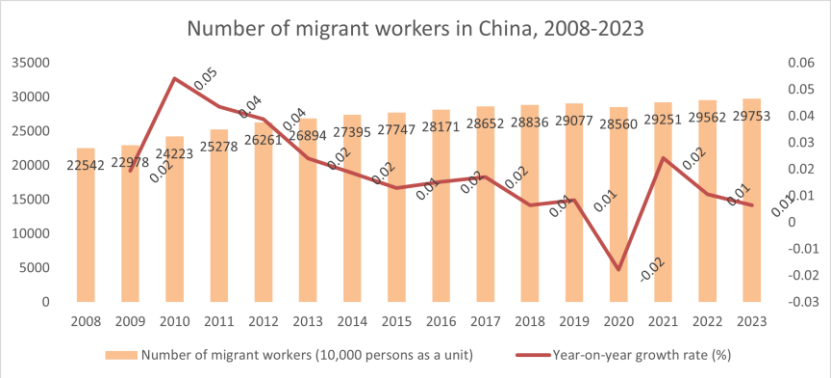

Figure 5. Number of migrant workers in China.

Source: National bureau of statistics.

In response to the flow of migrant workers and the construction of small towns, China has effectively promoted the rapid development of small towns through policy guidance and infrastructure construction, provided nearby employment and housing opportunities for rural surplus labor, and alleviated the population pressure of large cities (Li et al., 2018). Small towns have become an important link between urban and rural areas, promoting the process of urban-rural integration (as shown in **Figure 5**), with the number of migrant workers growing by 0.054% between 2009 and 2010, and falling to 0.06% between 2017 and 2018. Despite this, the number of migrant workers has maintained a certain growth rate, from 225.42 million in 2008 to 292.51 million in 2021.

Table 3. Policies related to the construction of small towns in China[3].

The name of the policy	Approximate timing of enactment	Overview of specific implementation measures
New urbanization planning	Around 2014	Optimize the scale structure of cities and towns, and develop small and medium-sized cities and towns. Promote the urbanization of the rural migrant population and reform the household registration system. Improve urban public services and infrastructure, and improve livability.
National Strategic Plan for Rural Revitalization	2018	Strengthen the comprehensive service capacity of county towns and towns, and build towns and towns into regional centers serving farmers. Carry out rural construction actions to improve the living environment in rural areas. Develop characteristic industries and promote the integrated development of primary, secondary and tertiary industries in rural areas.
Amendments to the Land Administration Act	1 January 2020	Strictly protect cultivated land and standardize land acquisition procedures. Promote the entry of collectively operated construction land into the market, and broaden the channels for rural collective economic organizations and farmers to increase their income.
Several opinions on the establishment of a territorial spatial planning system and the supervision of its implementation	2019	Coordinate and plan all kinds of spatial layouts, and build a land space development and protection system. Strengthen the authority of planning, and implement the control of all types of land and space use in the whole region.
Guiding Opinions on the Coordinated Development of Small and Medium-sized Cities and Small Towns	Around 2017	Optimize the planning and layout of small towns and avoid blind expansion. Improve the level of infrastructure and public services, and promote the integration of industry and city. Deepen the reform of the administrative management system and enhance the governance capacity of small towns.
Several Opinions on Deepening the Construction of New Urbanization	2016	Promote the settlement of non-hukou population in cities and improve urban inclusiveness. Improve the urban housing system and promote the steady and healthy development of the real estate market. Strengthen the construction of urban infrastructure and enhance urban functions.

In addition, the development of small towns has also promoted the process of urban-rural integration, which has led to the gradual narrowing of the gap between urban and rural areas (Huang et al., 2009). As shown in **Table 3**, in general, the government's policy guidance and infrastructure construction have played a positive role in solving the problem of rural population migration and pro-moting the development of small towns.

Figure 6 shows the results of a linear regression analysis between the number of rural migrant workers and national infrastructure expenditure. In the scatter plot, each dot represents the corresponding value of the number of migrant workers in a certain period and the infrastructure expenditure in the same period, while the blue dotted line represents the best-fitting straight line fitted according to the data points, and its mathematical expression is

$$y = \beta\_0 + \beta\_1 x,$$

where x represents the number of rural migrant workers, y represents infrastructure expenditure, and the slope of 0.4672 indicates that for every 1 unit increase in the number of migrant workers, the infrastructure expenditure increases by 0.4672 units on average. The R^2 value of the line is 0.7964, indicating that the change in the number of migrant workers can explain about 79.64% of the change in infrastructure expenditure, which reflects a strong positive correlation between the two, which further proves that the migrant worker group is not only the main body of the urbanization labor force, but also the key driving force to promote the investment and upgrading of urbanization infrastructure. Therefore, it is crucial for policymakers to understand and adapt to this "two-speed effect" between migration and urbanization in order to better plan urban development strategies and allocate resources efficiently, while ensuring the socio-economic inclusion and well-being of migrant workers.

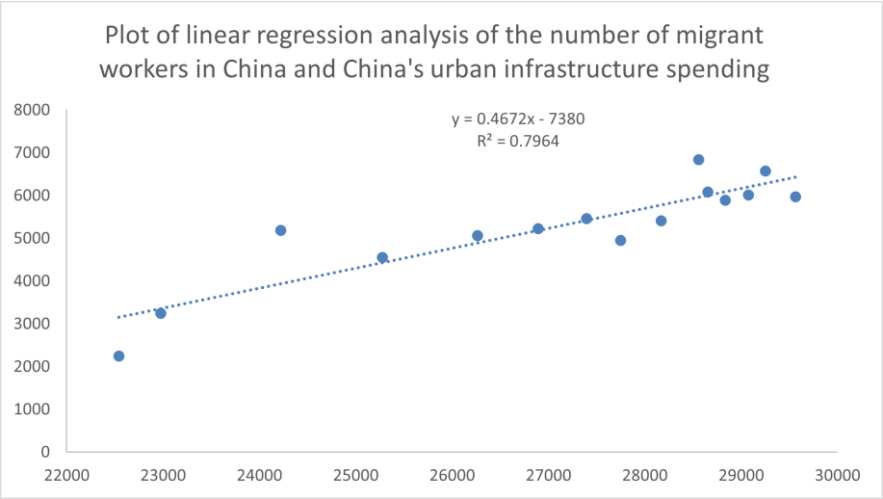

Figure 6. Linear regression analysis of the number of migrant workers in China and China's solicitation of infrastructure expenditure.
Source: National bureau of statistics.

Europe faces the challenge of an aging population, attracting a young population to return by increasing non-farm employment opportunities and improving the rural living environment (Dwyer et al., 2019), and at the same time, Europe's urbanization

strategy focuses more on balanced development and maintaining the vitality of small towns and villages. Respond to the economic and social impacts of demographic change by ensuring that rural areas also have access to quality public services and social benefits.

Since the eastward expansion of Europe in 2004 and 2007, there have been massive population movements, with the alleged migration of Eastern European citizens to Western European countries. Ondrej Schneider's study data (Schneider, 2022). It shows that after the expansion of 2004–2007, about 100 million citizens from Central and Eastern European countries joined the EU, which led to a massive depletion of the labor force in the new EU. The positive impact of this migration trend on regional convergence is that for every percentage point increase in net migration, per capita GDP increases by about 0.01 per cent and unemployment decreases by 0.1–0.2 percentage points. Such as Germany, the United Kingdom, Ireland, etc., looking for better-paying jobs and better living conditions. This large-scale migration not only alleviated the labor shortage caused by the aging population and declining birth rate in Western Europe, but also provided a broad job market and high-income potential for the labor force of Eastern European countries, promoting the increase of household income and the growth of domestic consumption. For example, the export of labor from countries such as Poland, Romania and Bulgaria have significantly increased the foreign exchange earnings of their nationals and promoted the export-oriented development of their economies.

3.3.2. Changes in rural demographics

Rural areas are facing the problem of "hollowing out" caused by an aging population and a large number of young and middle-aged laborers going out to work (as shown in **Figure 7**). According to the Ministry of Civil Affairs, there are currently 47 million left-behind women in the country, and statistics from the All-China Women's Federation show that women already account for more than 60 percent of China's rural labor force. According to the data of the second national agricultural census, at the end of 2006, there were 349 million people employed in agriculture in the country, of which 53.2% were women and 46.8% were men, and the gender ratio of the labor force was 87.97%. At the end of 2006, the gender ratio of the national population was 106.27%, and the sex ratio of men and women at birth was 18.3% higher than that of the labor force. Ye (2009) pointed out that the elderly population has become the main maintainer of agricultural production due to the migration of young and middle-aged laborers in rural areas, and 80.6% of the left-behind elderly are still engaged in agricultural production. The number of operators over the age of 50 in the central and western regions has risen from 17 to 18 percent in 1996 to 32 to 33 percent now, and in provinces with a large labor outflow, the proportion has even reached 46 percent. Some local field surveys have shown that people over the age of 50 in rural areas account for more than 60 per cent of the rural left-behind population. As we can see from the above, the main body of business is becoming more feminine and aging, and at the same time, many children are also an important part of the rural family labor force and are directly involved in agricultural production. This not only affects the vitality of rural society and the family structure, but also poses new challenges to agricultural production, rural governance and social services. How to

attract and retain talents, and promote the rational flow and structural optimization of rural population has become a key link in rural revitalization.

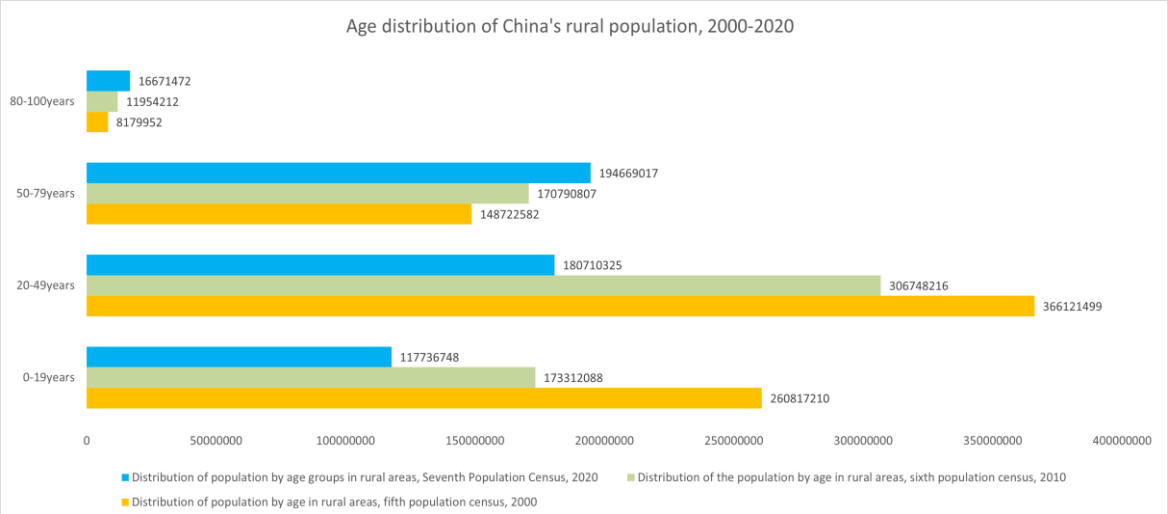

Figure 7. Population distribution by age group in rural areas of China from 2000 to 2020.
Source: National bureau of statistics.

Similarly, Europe is facing severe demographic changes, with rural areas facing an ageing population and a young population moving to cities, leading to labor shortages, reduced community vitality and increased pressure on social services. Rural areas struggle to attract and retain young families and talent, which poses a severe challenge to the agricultural labor supply, elderly care services, and education systems.

Figure 8 shows the distribution of the population in Europe by age group in 2000, 2010 and 2020, divided into three groups: children aged 0–14 years, adults aged 15–64 years, and older people aged 65 years and over. As can be seen from the data, the de-myographic structure of Europe has changed significantly over time: the proportion of children aged 0–14 has gradually decreased over the past two decades, from about 15% in 2000 to about 10% in 2020. This suggests that the birth rate may have declined or the cost of raising children has risen, leading families to choose to have fewer children or no children. Conversely, the proportion of adults aged 15–64 remained largely stable between 2000 and 2010, but declined slightly in 2020, from about 70% to about 65%. This may be due to the migration of some young and middle-aged people to cities in search of better job opportunities and living conditions, and it also reflects the competitive pressures of the labor market. The most significant change is in the proportion of people aged 65 and over, which increased from about 15% in 2000 to about 25% in 2020. This means that Europe is experiencing a rapid aging process, which will put significant pressure on the social security system and may lead to an imbalance be-tween supply and demand in the labor market.

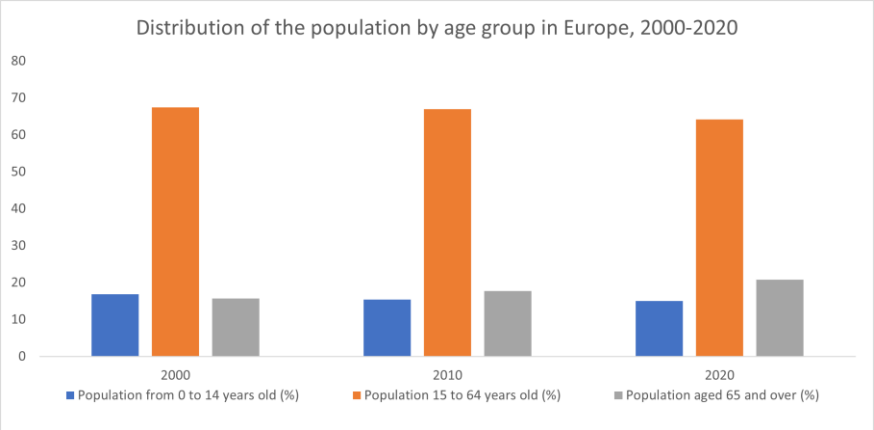

Figure 8. Distribution of the population by age group in Europe, 2000–2020.
Source: World bank.

The data in **Figure 9** illustrate the demographic challenges that are common in rural areas of Europe, namely population ageing and the migration of young people to cities. With the loss of young families and talent, the supply of labor in rural areas is decreasing, the vitality of communities is declining, and the demand for social services is increasing. This not only has a negative impact on the supply of agricultural labor, but also poses a severe test to the pension service and education systems, and at the same time, this flow is accompanied by the "brain drain" problem faced by European countries, especially the loss of highly educated professional and technical personnel, which poses a threat to the scientific and technological innovation capacity and long-term economic development of these countries. Between 1995 and 2017, it is estimated that nearly 7% of the labor force in Central, Eastern and South-Eastern Europe (CESEE)[4] countries lost their population, with a large proportion of them young and well-educated workers. This "talent funnel" effect exacerbates the country's aging population, reduces the supply of young labor, and affects the sustainability of key sectors such as education and healthcare, as well as the overall economic growth potential. Poland, for example, lost 268,000 young people between the ages of 20 and 34 between 2013 and 2017, posing a challenge to the country's long-term competitiveness.

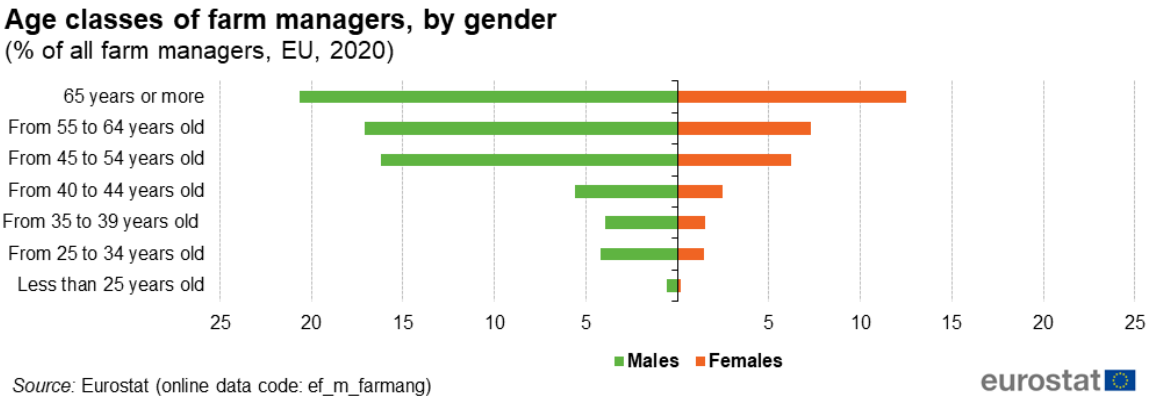

Figure 9. Distribution of agricultural workers in the EU by age group, 2020.
Source: https://ec.europa.eu/eurostat/databrowser/view/ef_m_farmang/default/table?lang=en.

4. Discussion

4.1. Policy improvements to attract talent back

The findings indicate that attracting young talent back to rural areas is crucial for sustainable development. Implementing the talent return incentive plan, which includes tax exemptions, entrepreneurship funds, and housing subsidies, can be effective in encouraging young people to return to their hometowns. This approach aligns with theories of human capital development, where incentives play a key role in reversing brain drain (Borjas, 1987). Additionally, strengthening vocational education and training enhances the skills of the rural workforce, making them more competitive in the job market. This strategy supports the concept of lifelong learning and skill development, which is essential for adapting to changing economic conditions.

Developing rural elderly care services based on European models could help retain older populations in rural areas, who might otherwise migrate to cities for better services. This aligns with the demographic transition theory, which emphasizes the importance of addressing the needs of aging societies (Lee and Carter, 2008). By building a multi-level rural elderly care service system, rural areas can become more attractive for older generations, thereby stabilizing the rural population.

Promoting the deep integration of the education industry through school-enterprise cooperation and internship training bases addresses the mismatch between education and employment, a common issue in rural areas. This approach supports the concept of education for sustainable development, which aims to prepare students for the workforce and contribute to community well-being.

Implementing flexible household registration and land registration policies simplifies the process for rural labor to move to cities while protecting their land rights. This aligns with the theory of rural-urban migration, which suggests that flexible policies can help manage the flow of labor and prevent the depletion of rural resources (Harris and Todaro, 1970).

4.2. Economic diversification

The research highlights the importance of developing rural tourism and organic agriculture as a means to diversify the rural economy. This approach leverages the unique cultural and natural assets of rural areas, aligning with the theory of comparative advantage, which suggests that regions benefit from specializing in activities where they have a competitive edge (Smith, 1776).

Science, technology, and international cooperation through the establishment of the EU-China Agricultural Science and Technology R&D Center can accelerate the adoption of advanced technologies in rural areas. This aligns with the theory of technological diffusion, which posits that innovations spread through social networks and are adopted over time (Rogers, 2003). By focusing on smart agriculture and precision agriculture, rural areas can improve their agricultural productivity and compete more effectively in global markets.

4.3. Comparative analysis of policy approaches

Both China and Europe have taken proactive steps to address the challenges facing rural areas, but their approaches differ in several ways:

China's Focus on Institutional Innovation:

Strengths: The "three rights separation" and the family contract responsibility system have successfully increased agricultural productivity and rural incomes.

Weaknesses: There is a need for further reforms in the agricultural education system and social welfare systems to address issues like the aging rural population and the lack of skilled labor.

Europe's Emphasis on Market Mechanisms and Environmental Sustainability:

Strengths: The Common Agricultural Policy (CAP) and other funding mechanisms have supported agricultural innovation and environmental conservation.

Weaknesses: The CAP has faced criticism for inefficiency and the need to address the "brain drain" of skilled workers from rural areas.

In conclusion, the comparative analysis of China and Europe's rural development strategies highlights the importance of combining institutional innovation with market mechanisms and environmental sustainability. By examining the unique features and challenges faced by China and Europe, this study identifies areas for mutual learning and collaboration. For instance, China can benefit from Europe's expertise in agricultural education and social welfare, while Europe can learn from China's dynamic approach to digitalization and large-scale agricultural innovation.

Future directions for enhancing rural revitalization and achieving sustainable development goals include closer cooperation between China and Europe. This includes joint research and development projects, exchange programs for agricultural technologies and sustainable practices, and collaborative efforts in green infrastructure and tourism development. Such collaborations can accelerate technology transfer, foster innovative applications, and promote cultural exchange and understanding, ultimately contributing to the global agenda of rural sustainability.

By sharing experiences and collaborating on solutions, both regions can make significant contributions to the sustainable development of rural communities worldwide. Future efforts to strengthen China-Europe rural development cooperation will be crucial in realizing the vision of rural revitalization and global sustainability.

5. Conclusion

Through an in-depth discussion and comparative analysis of sustainable rural development in China and Europe, it is evident that while rural areas in both regions face similar challenges such as population aging, labor outflow, and the pursuit of sustainable development, they also exhibit distinct characteristics and advantages in their coping strategies, policy measures, technology applications, and socio-economic development models. Both regions place great importance on agricultural science and technological innovation, committing to promoting smart agriculture and precision agriculture technologies to improve production efficiency and product quality. Additionally, both emphasize diversifying economic development paths, striving to enhance the endogenous strength of the rural economy through the development of emerging industries such as rural tourism and organic agriculture. In response to

population aging, both regions are strengthening their social security systems, particularly improving pension services to alleviate the retirement pressures on rural families.

In terms of differences and complementarities, Europe has a relatively mature agricultural education system, social security system, and green infrastructure, providing China with many exemplary experiences. Conversely, China's unique advantages and dynamism in rapidly advancing digital village construction, large-scale agricultural technologies, and policy-driven economic transformation and modernization offer Europe new avenues for innovation. By establishing closer cooperation mechanisms, China and the EU can deepen collaboration in areas such as agricultural science and technology R&D, talent exchange, green infrastructure construction, and rural tourism development. Joint R&D projects, mutual learning of elderly care and education models, and the promotion of green technologies and digital solutions can not only accelerate technology transfer and innovative applications but also foster cultural exchange and understanding, thereby advancing the sustainable development agenda in rural areas globally. Despite having their own distinct characteristics and challenges, China and the EU, through mutual learning, experience exchange, cooperation, and innovation, can effectively promote the prosperity and progress of rural areas on both sides, providing valuable practical experience and wisdom for the sustainable development of rural areas worldwide.

Author contributions: Proposed the research topic, ZL; completed the manuscript of the article, ZL; refined the methodology section of the article, SER; supervised the article as a whole, SER. All authors have read and agreed to the published version of the manuscript.

Acknowledgments: We would like to express our sincerest gratitude to Wang Shiyuan for proofreading the article in English.

Conflict of interest: The authors declare no conflict of interest.

Notes

[1] Compiled by the author, sources: "September 1980, the Central Committee of the Communist Party of China, "Several Issues on Further Strengthening and Improving the Responsibility System for Agricultural Production", "On January 1, 1982, the Central Committee of the Communist Party of China approved and forwarded the "Minutes of the National Rural Work Conference", "The Central Committee of the Communist Party of China Several Opinions of the State Council on Implementing the New Concept of Development, Accelerating Agricultural Modernization, and Achieving the Goal of Achieving a Moderately Prosperous Prosperity in All Respects", "Opinions of the Central Committee of the Communist Party of China and the State Council on Steadily Promoting the Reform of the Rural Collective Property Rights System", "National Strategic Plan for Rural Revitalization (2018–2022)", "The Central Committee of the Communist Party of China Opinions of the State Council on Comprehensively Promoting Rural Revitalization and Accelerating the Modernization of Agriculture and Rural Areas".

[2] Sources: Resolutions of the European Parliament and the Council of the European Union, official communications of the European Commission, "Science and Society", "Asian Economic Journal".

[3] Sources: "National New-type Urbanization Plan (2014–2020)", "Amendment to the Land Management Law", "Several Opinions on Establishing a Territorial Spatial Planning System and Supervising its Implementation", "Issued by the Central Committee of the Communist Party of China and the State Council, Rural Revitalization Strategic Plan (2018–2022)", Guiding

Opinions on the Coordinated Development of Small and Medium-sized Cities and Small Towns, and Several Opinions on Deepening the Construction of New-type Urbanization.

[4] CESEE stands for "Central, Eastern, and Southeastern Europe". The abbreviation is often used to describe a group of countries that are geographically and economically connected, covering a vast area from eastern Germany and Austria, through the countries of Central and Eastern Europe, to the Balkans and parts of the former Soviet republics.

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