

Rural vitalization in China: A perspective of land consolidation

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Abstract: The core objective of rural vitalization is to systemically establish a coupling pattern of various rural development elements including population, land and industry. As one of the prerequisites, land resources is required to be optimally allocated via land consolidation. Consequently, land consolidation contributes greatly to population agglomeration, industrial development and resources support under the context of combating rural decline. Based on the key elements affecting rural development, this paper elaborates the connotation of rural vitalization and land consolidation in the new era as well as their relationships. Furthermore, the paper analyzes the alternative paths for achieving rural vitalization via land consolidation, and discusses the future directions of land consolidation and rural vitalization. The conclusions are drawn as follows: (1) To cope with the loss and decline of the intrinsic elements in rural areas, rural vitalization is a development strategy aimed at realizing economic, political, cultural and ecological rejuvenation in rural area by reshaping socio-economic morphology and spatial pattern in rural territory. (2) From the perspective of rural vitalization, land consolidation is endowed with new connotation, which should not only target at activating the key elements of rural development, but also place emphasis on coordinating material space and spirit core as well as integrating the restructuring of the physical space and the rural governance system. (3) Land consolidation should be compatible with regional natural conditions and the current stage of socio-economic development. According to the principle of regional planning and classification strategy, the appropriate models and paths should be adopted to promote the benign interactions of population, land and industry based on engineering techniques and ecological means. (4) Under the background of national strategy of rural vitalization, it is necessary to reshape the value orientation of land consolidation based on a scientific understanding of urban-rural relations and rural territorial functions, coordinate land consolidation planning and rural vitalization planning under the unified spatial planning system, and explore the new model combining land consolidation and multifunctional agriculture.

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1 Introduction

The long-term isolation of urban-rural relations and the unfair positioning of rural values under the dual management system have caused the weakening of rural population, land abandonment, industrial lag and other rural recession problems during the process of urbanization in contemporary China (Long *et al.*, 2016; Liu and Li, 2017; Tu and Long, 2017). Three new rural issues—namely, “rural hollowing”, “agricultural marginalization”, and “population aging”—have undermined the promotion of urban-rural integration and the building of a well-off society in all-round way (Long, 2014; Yang *et al.*, 2015; Long and Tu, 2018). In response to the conflict between the people’s ever-growing need for a better life and current unbalanced and insufficient development, the 19th National Congress of the Communist Party of China (CPC) puts forward the “rural vitalization” strategy to alleviate issues of the uncoordinated urban-rural development. Rural vitalization is the construction of economy, politics, culture, ecology, and people’s well-being aiming at realizing the comprehensive rejuvenation in rural areas by systematically allocating and efficiently managing various developmental elements, such as population, land, and industry (Hillman, 2004; Li *et al.*, 2016; Liu, 2018).

Land is the material foundation and spatial carrier for human socio-economic activities (Long, 2014; Li and Li, 2017; Long and Qu, 2018; Qu and Long, 2018). China’s Land Administration Law, implemented in 1999, stipulated that “the state encourages land consolidation”, and the National Land Consolidation Program (2011–2015) further defined the term of “land consolidation”. As a means of coordinating man-land interrelations, land consolidation possesses multiple vital functions such as reconstructing urban and rural space, ensuring food security, coordinating urban-rural development, ensuring intensive and scientific use of resources, and improving the living environment, which are compatible with the multiple goals of rural vitalization (Li *et al.*, 2017; Long *et al.*, 2010, 2012; Long, 2014; Long and Tu, 2018). Since 2000, China has added 64.5 million mu (1 mu=1/15 ha) of cultivated land and built 600 million mu of farmland with high yields and stability through land consolidation, thereby effectively promoting the vitalization and intensive use of land resources in rural areas (Jiang *et al.*, 2017). In recent years, research on land consolidation has focused on the aspects such as the related theory (Long, 2014; Yan *et al.*, 2015), potential and performance evaluations (Tu *et al.*, 2015; Zhang *et al.*, 2017), planning and designing model (Yan *et al.*, 2016), project types and measures (Liu, 2011), landscape ecological benefits (Wang and Zhong, 2017), and operational supervision mechanisms (Liu *et al.*, 2012), while barely addressing the multi-functionality of land consolidation (Zhang *et al.*, 2018) and its relationship with rural transformation development (Long, 2012; Yu *et al.*, 2018). Based on the key elements affecting rural development, this paper illustrates the essence of and reciprocity between rural vitalization and land consolidation in the new era, analyzes the regional implementation of land consolidation within the context of rural vitalization, and renders vital suggestions towards land consolidation in the future in order to provide a solid theoretical basis for the comprehensive vitalization of the rural population, land, and industry.

2 Essence of rural vitalization and land consolidation

2.1 Connotation of rural vitalization

The rural territorial system, an interactive formation of various key elements, is an open, dynamic system with comprehensive multidimensionality. Population, land, and industry are the core elements that affect rural socio-economic development (Ge *et al.*, 2018a, 2018b; Long *et al.*, 2018; Tu and Long, 2017). Among them, population as the main body of development in rural areas creates economic, social, and ecological values for rural areas through the exploitation and utilization of resources, the operation and management of businesses and other production and daily living activities. Population is the momentum driving rural vitalization. Land resources shoulders the basic role of providing resources support in rural vitalization, it not only has multi-functional value in meeting the needs of production, living and ecological space, but also spawns different rural industrial development modes. Industrial development forms the main driving force for rural vitalization, which combines population and land organically through land resources utilization and employment of the population, and affects farmers' incomes and even determines the rural socio-economic sustainable development. Boosting the integration of "resources, capital, and assets" by coordinating the elements of "population, land, and industry" is the key to fostering development momentum and enhancing vitality in rural areas.

Rural vitalization is the opposite of rural decline (Liu, 2018). The large-scale outflow of the rural population during urbanization and industrialization is the root cause for rural decline (Long *et al.*, 2012; Tu *et al.*, 2018), which has led to "aging or weakening" management mainstream and eventually caused the following issues: (1) lag in industrial development, such as low agricultural efficiency and underdeveloped non-agricultural industries; (2) inefficient use of land resources, such as the abandoning of arable land and the idling of homesteads; and (3) a series of social problems, such as landscape devastation, disordered governance, dilapidated infrastructure, and weak local culture (Long *et al.*, 2016).

To cope with the loss and decline of the intrinsic elements in rural areas, rural vitalization is a development strategy aimed at realizing economic, political, cultural and ecological rejuvenation in rural areas by reshaping socio-economic morphology and spatial pattern in rural territory (Tu and Long, 2017; Zhang, 2018), which is intended to address the conflict between the people's ever-growing need for a better life and unbalanced, inadequate development during the mid-term urbanization in China. Besides, the value orientation of rural vitalization is to narrow the gap between urban and rural development, initiate sharing of development achievements and build a balanced urban-rural development pattern to create equal development opportunities. The complexity of rural territorial system determines the implementation process of rural vitalization strategy with the systematized, hierarchical, and regional characteristics.

(1) Systematized: Rural vitalization is the coordinated symbiosis of various elements that are interconnected and mutually constrained. "Thriving industry, pleasant living environment, refined rural civilization, effective governance, and prosperous life" are the basic principles for rural vitalization, covering economic, social, ecological, and cultural aspects. As a comprehensive humanistic process, on the one hand, rural vitalization requires the multidisciplinary integration of various subjects such as economics, sociology, management,

engineering technology, and geography in order to make scientific development planning with clear objectives, reasonable positioning, and functional optimization. On the other hand, rural vitalization requires multi-departmental coordination to promote developing a mutually complementary governance system with clear responsibilities and standardized management.

(2) Hierarchical: Considering the different rules and characteristics of rural development at different spatial scales, rural vitalization should adopt differentiated goal orientation and strategic positioning. At the regional level, rural vitalization should cover whole regions and form an overall vitalization pattern, while at the village level, it is crucial to selectively support according to the law of economic development. For some villages with unfavorable natural environments, poor geographical locations or difficult supplies of basic public services, it is necessary to guide villagers to relocate and allow the original villages to dissipate naturally. On the contrary, the villages with excellent resource endowments, strong industrial bases, and better locations should be given priority support.

(3) Regional: Influenced by various factors, such as resource endowments, location conditions, industrial bases, policies, urban-rural relationships, market environments, central-city leading forces, and cultural heritages, rural socio-economic development differs significantly among regions of China. Therefore, excavating local rural values, cultivating diverse industrial structures locally, and scientifically formulating strategies and paths for rural transformation and rejuvenation are the keys to promoting rural sustainable vitalization.

2.2 Connotation of land consolidation from the perspective of rural vitalization

Traditionally, rural land consolidation has been limited to engineering and technical aspects. Its core objectives are mainly to expand the scale of farmland, improve the quality of cultivated land, and optimize the village's layout, and even in some areas, land consolidation is considered merely a means of providing more space for urban development. Currently, rural vitalization is reflected not only in the upgrading of the living environment and public services and other material aspects but also in the in-depth revival of a vibrant industry, a unique culture, and an orderly governance system. Comprehensive rural vitalization should be based on the distinctions between urban and rural territorial system and the multifunctional values of rural areas. Land consolidation is endowed with the following new connotation and multi-functions from the perspective of rural vitalization:

(1) Activating the key elements of rural development such as population, land, and industry. Beginning with comprehensive land consolidation, it is better to restructure production, living, and ecological spaces, strengthen the integration of modern agriculture and multi-industrial forms such as Bed and Breakfast (B&B) industry, pension industry and ecological tourism etc., and it is necessary to promote the non-agricultural transfer of the rural population and the transformation of land use patterns.

(2) Coordinating the vitalization of the physical space and the promotion of the spiritual core. Comprehensive land consolidation aims at changing the quantity and quality of the cultivated land and the rural construction land as well as vitalizing rural land resources. Meanwhile, it should take into account the inheritance of rural characteristic culture, the maintenance of the architectural appearance and settlement texture in order to preserve the unique charm of the countryside and enhance the rural ecological and cultural functions.

(3) Integrating the restructuring of the actual physical space and the rural governance

system. With the aggregating of rural living spaces, it is of vital important to establish mul-tilayer rural governance modes through combining grassroots autonomous organizations and communities, as well as cultivating skilled manpower capable of appropriately scaled opera-tions for the purpose of realizing a smooth linkage between the rural spatial system and the governance system.

3 Relationship between land consolidation and rural vitalization

3.1 Coupling relationship between land consolidation evolution and rural transfor-mation development in China

The evolution process of land consolidation in China can be roughly divided into three stages (Figure 1):

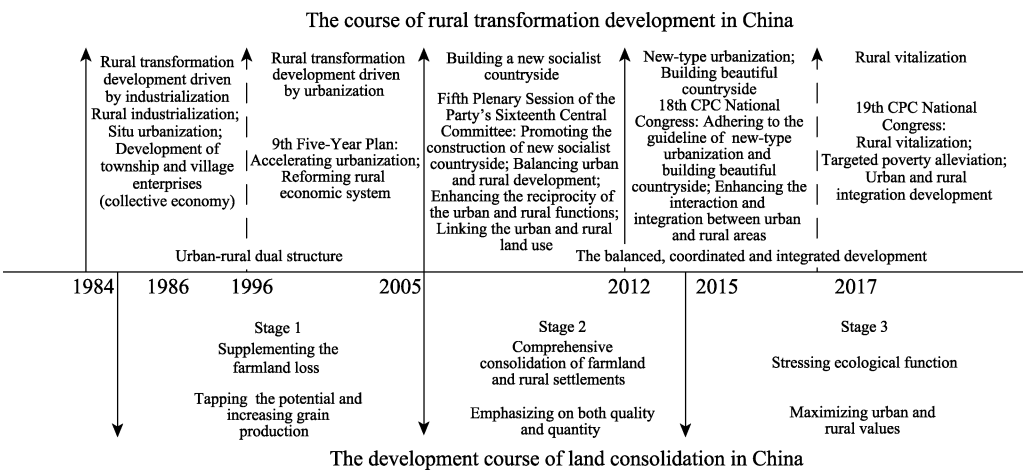


Figure 1 Phase characteristics of land consolidation and rural transformation development in China

(1) The stage of tapping the quantitative potential: The development of township and vil-lage enterprises and the rapid expansion of urban construction land resulted in a sharp shrinkage of cultivated land and increasing pressure on food security (Long *et al.*, 2018). To tackle these issues, land consolidation aimed at supplementing farmland loss was widely carried out in China’s rural areas (Long, 2014), among which some successful models emerged including the “three concentrated” consolidation model in Shanghai (the concentra-tion of farmers’ houses to central villages and small towns, township and village enterprises to industrial zones, and farmland to large-scale operations). From 1998 to 2005, China wit-nessed a rapid increase in the number of funds, projects and scale for land consolidation, and more than 4 million mu of cultivated land was replenished annually through land consolida-tion. During this period, land consolidation focused on increasing the amount of cultivated land and providing space for urbanization and industrialization, which has guaranteed agri-cultural production, increased farmers’ income and ensured food security to a certain extent.

(2) The stage of emphasizing on both quantity and quality: In 2006, the establishment of 116 national prime farmland protection demonstration zones marked the transformation of China’s land consolidation from emphasis on a quantitative increase to a comprehensive consideration of both quantity and quality of newly-added cultivated land. In the same year,

the former Ministry of Land and Resources deployed the first batch of pilot projects of “Linking up Increased Urban Construction Land with Decreased Rural Construction Land”, which indicated that rural construction land consolidation has been an important part of land consolidation (Long *et al.*, 2012). In 2005, the State proposed the strategy of “Building New Countryside” aiming to form a new pattern of coordinated urban-rural development (Long *et al.*, 2010), and land consolidation laid a solid material foundation for the building of the “new countryside” through improving the production and living conditions as well as ecological environments in rural areas.

(3) The stage of stressing ecological functions and maximizing urban-rural values: The “13th Five-Year Plan” of land consolidation highlights the construction, utilization, and protection of ecologically beneficial fields and advocates “green” land consolidation, which shows that China’s land consolidation is shifting to paying more attention to ecological function of land use. In 2017, the 19th CPC National Congress proposed the strategy of rural vitalization to promote the integration of urban and rural development. Meanwhile, land management departments at all levels have successively issued a series of comprehensive rural land consolidation policies to accelerate the supply-side reform in the agricultural sector, optimize the space of urban and rural development and lay a solid foundation for rural vitalization.

Different socio-economic development stages have different requirements for land use morphology patterns. The process of rural transformation development prompts land users to optimize land use morphology patterns through land consolidation projects, and the transition of land use morphology in turn acts on rural development and vitalization (Long, 2012; Long and Tu, 2018). Chronologically, the modernization of a region or a county usually undergoes the periods of the “urban bred by countryside, urban-rural separation, urban-rural opposition, and urban-rural integration” (Ye and Chen, 2008), as is the case with China’s rural transformation development (Figure 1). With the advancement of socio-economic development in different periods, the objectives of land consolidation in China have changed from the emphasis on exploitation of unused land, the increase of cultivated land and the provision of space for urbanization to focusing on the comprehensive improvement of farmland and villages, the equal emphasis on “quantity” and “quality”, and eventually the multi-functionality of land use and the maximization of urban-rural values. Apparently, the orientation and effectiveness of land consolidation have been highly consistent and intrinsically coupled with the needs of socio-economic development and transition in China.

3.2 Reciprocity between land consolidation and rural vitalization from the perspective of “population-land-industry”

The advanced or lagging transformation of the urban-rural socio-economic development elements could cause different feedbacks and responses to the rural territorial system, which could affect the sustainable development of regional agriculture and rural areas. The common point of rural land consolidation and rural vitalization is to adjust key development elements and promote coupling and coordination among various elements. Rural land consolidation mainly includes farmland and rural construction land consolidation, both of which are land use behaviors interfering with rural production, living, and ecological spaces through engineering and technical means (Long, 2014) (Figure 2).

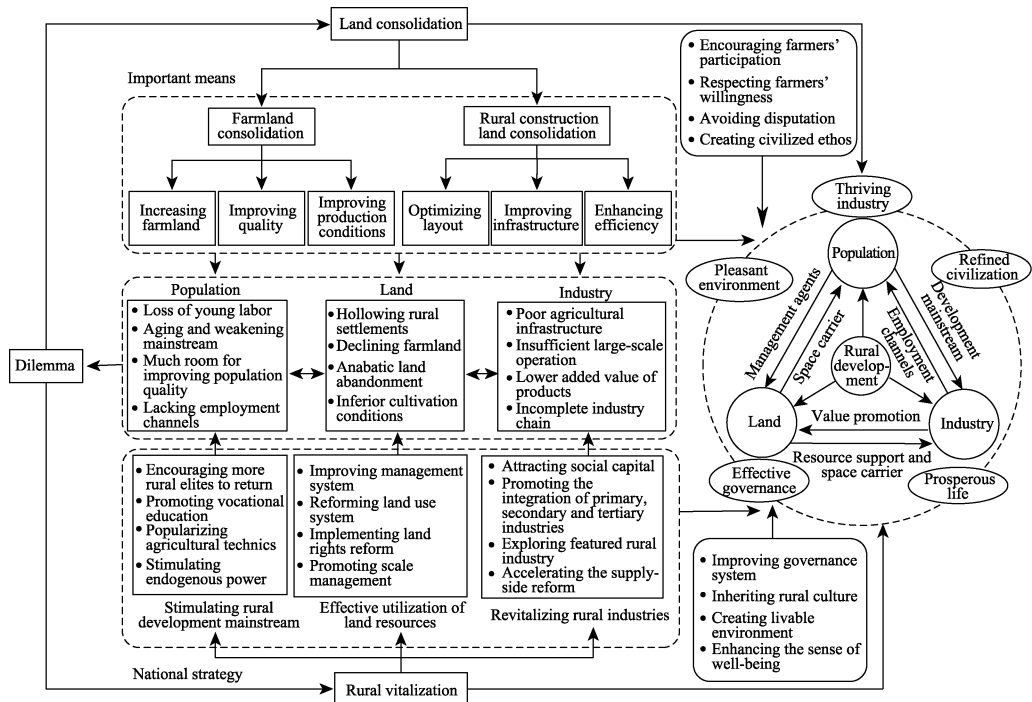


Figure 2 The relationship between land consolidation and rural vitalization in China

As the space carrier of major socio-economic activities, the optimization of inner structure and the improvement of quality for land resources directly affect the economic benefits of agricultural production and the cultivation of non-agricultural industries, thus exert an important influences on the income of local residents, the transformation of industrial structure and the allocation of human resources. Compared with the objectives of agricultural land consolidation to increase the amount of cultivated land, improve agricultural production conditions and promote the scale of agricultural management (Jiang *et al.*, 2017), the goal of rural construction land consolidation is to achieve a positive interaction between urban capital and rural idle land by guiding rural population agglomeration and industrial concentration, and eventually build up the channels of elements flows between urban and rural areas.

The essence of land consolidation is to adjust land ownership and supervise land use, and the multi-functionality of land resources also extends their derivative values such as coordinating urban and rural development, preserving the cultural landscape, and maintaining social stability. Confronted with various problems, such as the inefficient utilization of land resources, the poor infrastructure, the rapid loss of development elements, the weakening of the manpower etc., in rural areas, land consolidation within the context of rural vitalization should be gradually transformed from merely increasing land to prospering rural economy, improving farmers' income, and protecting the ecological environment etc., as well as from the single-factor regulation of "land-based" to the comprehensive regulation towards coordinating the multiple elements of "population, land and industry" through the organic integration of new enterprises, advanced technologies, and skilled manpower.

4 Regional implementation paths of rural vitalization through comprehensive land consolidation

Considering the regional natural and humanistic factors as well as socio-environmental features, the main functional zoning divides China's land space into optimized development zones, key development zones, major agricultural production zones, and key ecological function zones (Fan, 2015). As an important means of coordinating man-land interrelations, land consolidation also needs to be adapted to the natural conditions and socio-economic development within the region, and adopt appropriate models and paths to promote the benign interactions of population, land and industry through engineering techniques and ecological means.

4.1 Optimized development zones

As the core area leading economic growth, the optimized development zones are characterized by a strong central-city leading force, rapid population growth, and a high demand for land use. Carrying out comprehensive land consolidation based on the diffusion of urban economic energy is not only the key to alleviating the increasing contradiction between strong demand and limited supply of land resources, but also has an important influence on coordinating rural development elements and realizing rural vitalization in the region.

Population: Rural employment channels should be broadened through the integration of the primary, secondary and tertiary industries. In particular, more attention should be paid to the development of modern service industries such as rural tourism and Bed & Breakfast, so as to stimulate some rural migrants to return to the countryside and attract urban dwellers to the rural area for leisure stays or investment, eventually promote the two-way flow of urban and rural human resources.

Land: It is crucial to speed up the exploration of land use management system accustomed to the new types of rural economy, and actively carry out consolidation of agricultural land and rural construction land as well as remediation of contaminated farmland for the purpose of improving farmland landscape, effectively utilizing vacant and abandoned land, restoring the productive capacity and ecological value of polluted land, and providing a space carrier for the industrial development.

Industry: For villages with location advantages, distinctive landscape features, or unique historical culture, the development of modern service industries such as rural tourism, agricultural exhibition etc. should be encouraged through improving rural infrastructure as well as the aesthetic values of rural farmland and housing.

4.2 Key development zones

Key development zones, possessing a good economic foundation and rich resources as well as higher carrying capacity, are important areas supporting China's economic development and population agglomeration in the future. Based on implementing the policy of "Linking up Increased Urban Construction Land with Decreased Rural Construction Land", the rational, efficient and harmonious layout of production, living and ecological spaces as well as the development of new types of rural economy are the key points for rural vitalization pushed forward by land consolidation in these zones.

Population: Seizing the opportunity of spatial restructuring and industrial transformation, it is better to vigorously promote the orderly transfer of rural surplus labor, explore the implementation of differentiated citizenization policies of rural migrant population with different level of urbanization, and encourage out-flowing rural talents to return hometown to start their business.

Land: First of all, with the guidance of “quantity control, quality management and ecological protection”, it is necessary to conduct a comprehensive consolidation planning regarding farmlands, water, roads, forests, and homesteads in order to establish a rural complex. Secondly, building an orderly rural settlements system and implementing rural residential renovation are effective ways to tap the potential of stock land, promote the orderly transfer of collective construction land and awaken “dormant” land assets in rural areas.

Industry: Relying on intensified arable land resources through land consolidation, it is urgent to promote agricultural mechanization and large-scale operation, and encourage the development of ecological agriculture, urban agriculture, and rural tourism in the areas surrounding the city. Meanwhile, it is necessary to develop rural e-commerce industry and open up the marketing channels of agricultural product sales.

4.3 Major agricultural production zones

As the strategical core areas of modern agriculture and food production, major agricultural production zones shoulder the responsibility for national food security and farmland protection. In recent years, the rapid industrialization and urbanization have led to tremendous changes of the man-land interrelations in these areas, and rural development faces a series of problems such as low efficiency of grain production, rural population aging, vacant or deserted houses, and extensive use of rural land. Therefore, land consolidation in these zones should aim at limiting high-intensity industrialization and urbanization, especially focusing on improving cultivated land quality, upgrading farmland facilities and solving the problems of inefficient use of rural construction land.

Population: A dense agricultural population is one of the main characteristics in the region. Human resources aging caused by the migration of rural youth labor during urbanization has seriously hindered the process of agricultural modernization. Beginning with farmland consolidation and agricultural moderate scale operation, establishing a new type of professional peasant team and strengthening skills training are crucial for modern agricultural production and rural vitalization in these areas.

Land: Oriented by ensuring a high standard for basic farmlands, addressing water-related hazards, improving farmland irrigation facilities and reducing soil pollution, it is necessary to focus on agricultural land consolidation by promoting the transformation of low- and medium-yield farmland, improving the irrigation and drainage conditions, and solving farmland fragmentation. In addition, facing the disorderly and decentralized utilization of rural homesteads, the project of “hollowed village consolidation” should be carried out actively and related land use policies accelerating the exit and circulation of homesteads should be explored in the purpose of promoting the intensive use of consolidated land and improving the living, production and the ecological environment in rural areas.

Industry: Besides traditional crop cultivation, the adjustment of the industrial structure should be given more attention, such as actively developing forestry, animal husbandry,

fishery, agricultural product processing and manufacturing etc., especially emphasizing on the organic integration of agricultural planting and rural tourism based on the appropriate design of farmland landscape. And the new mode of rural economic operation with online and offline interaction should be explored by relying on the internet platform for propaganda and sales.

4.4 Key ecological function zones

Key ecological function zones exert their ecological protective functions such as protecting biodiversity, conserving water sources, breaking wind, and fixing sand. China's key ecological function zones are mainly located in poverty-stricken areas with complex climatic conditions, fragile ecological environments and lagging economic development, which constitute 76.52% of the national poverty-stricken areas (Liu, 2016). It is necessary to conduct ecological land consolidation tailored to regional natural conditions and local humanistic features, which is the only wise option towards sustaining ecological balance and promoting rural vitalization.

Population: Aiming to uproot the intellectual disadvantage hindering regional rural development, relevant measures should be carried out, such as increasing investment in basic education, vocational education, and skills training, and so on.

Land: Targeting areas with frequent soil erosions (the Loess Plateau), stony and rocky deserts (Yunnan and Guizhou provinces and the Guangxi region), and frequent geological disasters (the Qiangtang Plateau and Hengduan Mountains) as well as high-altitude terrains (the Wuling Mountain Area), it is of great significance to introduce the concept of "ecologization" into the design of remediation engineering and explore ecological land consolidation model based on local water and soil conditions. For example, restoring the production capacity of cultivated land with a focus on "cultivation" and "protection", improving the ecological compensation mechanism, and orderly guiding villages in areas with poor living conditions to carry out relocation and combination.

Industry: Taking into account the ecological value of these regions, it should highlight the adjustment of agricultural structure so as to developing characteristic and ecological products such as green food and organic food, and using the network platform to broaden sales channels. For the old revolutionary areas, it should emphasize the significance of promoting cultural and tourism industries by taking advantage of characteristic 'Red culture' on the basis of improving support ability of infrastructure construction and public service.

5 Prospects for land consolidation and rural vitalization

5.1 Reshaping the value orientation of land consolidation

Traditional land consolidation measures mainly focused on supplementing cultivated land, improving land quality, and increasing transactional construction land for the purpose of the maximization of economic benefits. However, from the perspective of rural vitalization, the value orientation of land consolidation must be reshaped based on a scientific understanding of urban-rural relations and rural territorial functions. Firstly, urban and rural areas constitute an integrated mutually beneficial system, in which the city's development is inseparable from the countryside's support because the newly added population, land, and agricultural

products all come from the countryside. The development of the countryside is also inseparable from the leading influential force of the city because the city's capital, technology, and management system are crucial for rural development. Therefore, based on the principle of urban-rural structural coordination and complementary functions, rural restructuring and vitalization should make full use of urban capital to innovate the financing mechanism of land consolidation, absorb advanced technology and talents to participate in the planning of land consolidation, which is an effective way to realize the vitalization of rural resources while providing space for urban development.

Besides, rural territorial system have multiple functions such as economy, society, ecology and culture etc., and ecological value and cultural value are the unique charms that are different from city. Accordingly, guided by the concept of harmonious coexistence with nature, it needs to actively probe the organic integration of land consolidation and ecological construction, and create multi-level and multi-functional pastoral organisms via establishing ecological networks and green infrastructure. At the same time, it is necessary to coordinate "material vitalization" and "humanistic rejuvenation" in the process of land consolidation, on the basis of rational layout of rural development physical space. More attention should be paid to the inheritance of rural traditional culture, and make the countryside become a carrier with local culture and a homesickness.

5.2 Coordinating land consolidation planning and rural vitalization planning under the unified spatial planning system

The rural territorial system is a natural, ecological, social, and economic complex composed of multiple elements, and the spatial heterogeneity and the diversified development goals of rural territory require that rural vitalization planning should be scientifically formulated to make forward-looking arrangement for spatial morphology, infrastructure, industry etc., based on the identification of regional characteristics. Generally speaking, land consolidation planning makes overall layout for the priority and key areas carrying out land consolidation according to the natural and human factors. Currently, China's land consolidation planning has been implemented at four levels including national, provincial, municipal, and county, and rural vitalization planning at national level has just been introduced. In the future, based on a top-level design and an institutional guarantee, it is necessary to coordinate land consolidation and rural vitalization to ensure the positive interactions of land, industry and infrastructure under the unified spatial planning system including socio-economic development planning, urban-rural planning, land use planning, and ecological environmental protection planning. In addition, the village-level land consolidation planning has not yet been included in the overall planning system. Village is the basic unit of rural vitalization, and the lack of village planning could inevitably hinder the coordinated development of rural elements. Therefore, it is equally important to explore the synergy between village-level land consolidation planning and rural vitalization planning.

5.3 Exploring the new model combining land consolidation and multifunctional agriculture

At present, China's agriculture is still dominated by traditional large-scale crop cultivation. Affected by price increases in production factors such as labor, agricultural materials, and

land leases, the benefits of grain production are relatively low, and it further leads to a series of problems ensues such as the lack of labor force, insufficient agricultural production materials, extensive agricultural production, and difficulties in promulgating agricultural science and technology, which has become the keys and difficulties to coordinating rural man-land interrelations. Agriculture is the foundation of rural development, which bears multiple functions such as agricultural production, landscape aesthetics, recreation, maintenance of biodiversity, and inheritance of local culture. The connection between land resources and agriculture is significant for the sustainable development of the rural economy and the efficient use of resources. Therefore, in the process of rural production, living and ecological spatial restructuring, land consolidation should be combined with developing new agricultural production and operation forms such as organic agriculture, ecological agriculture, energy agriculture, tourism agriculture, cultural agriculture, so as to increase the added value of agricultural production, solve the shortcomings of low output of traditional crop production and effectively absorb the rural surplus labor force.

6 Discussion and conclusions

(1) Activating rural developmental elements, such as population, land, and industry, is the key to cultivating development momentum and solving the problems of agriculture, rural areas, and farmers. Rural vitalization copes with the loss and decline of the intrinsic elements in rural areas, and it is a development strategy aimed at realizing economic, political, cultural and ecological rejuvenation in rural area by reshaping socio-economic morphology and spatial pattern in rural territory. The complexity of rural territory system determines the implementation process of rural vitalization strategy with the systematized, hierarchical, and regional characteristics.

(2) Comprehensive rural vitalization should be based on the distinctions between urban and rural territorial system and the multi-functional values of rural areas. As a crucial means of promoting rural vitalization, land consolidation is endowed with new connotations such as activating the key elements of rural development, coordinating the vitalization of the physical space and the promotion of the spiritual core, integrating the restructuring of the actual physical space and the rural governance system.

(3) Different socio-economic development stages have different requirements for land use morphology patterns. The process of rural transformation development prompts land users to optimize land use patterns through land consolidation projects, and the transition of land use morphology in turn acts on rural development and vitalization. The orientation and effectiveness of land consolidation has been highly consistent and intrinsically coupled with the needs of socio-economic development and transition in China.

(4) As an important means of regulating man-land interrelations, land consolidation needs to be adapted to the natural conditions and socio-economic development within the region, and adopt appropriate models and paths to promote the benign interactions of population, land and industry through engineering techniques and ecological means.

(5) Under the background of national strategy of rural vitalization, it is necessary to reshape the value orientation of land consolidation based on a scientific understanding of urban-rural relations and rural territorial functions, coordinate land consolidation planning and rural vitalization planning under the unified spatial planning system and explore the new

model combining land consolidation and multi-functional agriculture.

As the rural is a complex and comprehensive system, integrating multidisciplinary knowledge, coordinating various development elements and absorbing more skilled manpower are of far-reaching importance for solving rural problems. At present, the relevant theoretical cognition, institutional mechanisms, vitalization models, and implementation paths for advancing rural vitalization are still being explored preliminarily, and land consolidation is also confronted with prominent problems such as an outdated theoretical basis and an obsolete ideology. Consequently, it is imperative to promote scientific, standardized, and regulated land consolidation through theoretical, technological and institutional innovations, so as to achieve a comprehensive vitalization of rural economy, society and ecology, and develop a new pattern of urban-rural integration development.

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