Land use Transition and Rural Spatial Governance: Mechanism, Framework and Perspectives

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Abstract

Rural space utilization is an important manifestation of the uncoordinated relationship between land use patterns and rural development status during a transformation period. Consequently, this article analyzed the interaction mechanisms between land use transition (LUT) and rural spatial governance and then build a rural spatial governance analysis framework based on LUT. Also, the paper explores the internal relationship between rural spatial governance and rural vitalization and discusses the research prospective of the interaction. The study found that: (1) Rural space utilization has systemic problems such as limited development space, ill-defined ownership and poor organization, which have become important obstacles for rural development. (2) The uncoordinated relationship between LUT and rural transformation development RTD is an important reason for the dilemma surrounding rural space utilization. (3) The LUT provides a basis for determining the timing of rural spatial governance, specifying spatial governance objectives, and clarifying rural spatial governance methods. (4) The construction of a comprehensive analysis framework of "matter-ownership-organization" of rural space based on the LUT has created conditions for the orderly promotion of rural spatial governance. (5) Rural spatial governance which facilitates the integration of urban-rural development is an important foundation for rural vitalization. (6) Interaction analysis of LUT, RTD and rural spatial governance is conducive to facilitating research on the operational mechanism of rural regional systems and to expanding the research field of rural geography.

Keywords: Rural spatial governance; land use transition; rural vitalization; urban-rural integrated development; rural transformation development

Introduction

Against a new round of spatial planning for territories, space governance has become an important analysis element for human geographers (Fan, 2017). Rural spatial governance is an important part of China's modern governance system (Long, 2014), providing a key mechanism for promoting the efficient use of rural space and the sustainable development of rural areas (Liu, 2018; Long et al., 2019b). Currently, geographers, especially rural geographers, focus on the impact of rural space development and its utilization in urban-rural integration development (Liu, 2014; Long et al., 2017). Researchers seek to explore the spatial mechanism and cultural inheritance of rural governance (Cheng et al., 2017; Sun, 2019), rural spatial planning and restructuring (Long, 2013a; Tu and Long, 2017) in order to expand the scope for research on rural spatial governance.

Unreasonable use of rural space, as a basis for rural development, is an important factor that restricts rural development and hinders the development of urban-rural integration. The current consolidation of rural "production-living-ecology" spaces requires comprehensive consideration of rural development goals (Long, 2014; Long et al., 2018). The consolidation of rural multi-dimensional spaces provides a powerful tool for optimizing the structure and maximizing the function of rural space. Therefore, restructuring the rural space system based

on rural spatial governance is an important strategy for promoting urban-rural integration and rural vitalization in the new era (Liu and Li, 2017; Liu, 2018; Ge and Long, 2020).

Land use transition (LUT) research, with the trend for studying the pattern of land use morphologies at its core, has gradually become an important branch of land use change research (Barbier et al., 2010; Mey froidt et al., 2018; Long et al., 2019; Long, 2020), and also an important window to explore the status of rural development. At present, the existence of an imbalanced relationship between LUT and rural transformation development (RTD) is an important cause of recession in rural regions (Long et al., 2019; Long, 2020), and the coupling and coordination processes between the two provide a key to achieving rural vitalization (Long et al., 2019a; 2019b), which clearly has great significance in the context of optimizing the rural development process and building a harmonious and orderly urban-rural transformation development process (Tu et al., 2018).

At present, rural spatial governance focuses mostly on rural physical space, however, there is a lack of research on non-physical fields such as the social relationships underpinned by rural physical space, organization and ownership of rural space (Ge and Long, 2020). Land use transition provides a guidance target, a timing mechanism and a means to support rural spatial governance. The undertaking of research on LUT and rural spatial governance facilitates the potential value of rural territorial space, and this helps to promote the efficient and sustainable use of rural space, to optimize rural regional structures and functions, and benefits the strategic objectives of rural vitalization. This article seeks to clarify the problems of rural space utilization in the transformation period, analyze such problems from the perspective of LUT, and discuss the interaction mechanisms and the effects of LUT and rural spatial governance. Besides, the paper also seeks to construct the "matter-ownership- organization" governance system of rural space based on the perspective of LUT and explores possible ways whereby rural spatial governance can promote rural vitalization. Finally, this research tries to highlight the internal relationships and interaction tendencies of LUT, RTD and rural spatial governance.

Rural space utilization problems in the transformation period

Limited space for rural development

The characteristics of disorder, inefficiency and depopulation associated with rural space utilization led to a situation where there is limited space for rural development. Limited "production-living-ecology" spaces in rural areas have become the core factor that inhibits RTD. The marginalization of rural production space presents phenomena such as abandoned farmland, extensive management, and disorderly occupation (Bren d'Amour, 2017; Ge et al., 2018; Yang et al., 2019), which further squeezes the originally limited agricultural production space in quantity and quality, threatens national food security, goes against agricultural scale operations, and hinders the industrialization and modernization of agriculture (Chen et al., 2019). The neglected and abandoned rural living space centered on the utilization of the rural homestead has spawned phenomena such as "building a new house but not demolishing old one" and "one household with multiple houses" (Liu et al., 2010), which seriously restricts the process of optimization and reorganization of rural living space (Liu et al., 2014; Ge and Long, 2020).

The efficient combination of rural "production-living-ecology" space is an important pre- requisite for improving the structure and function of the rural regional system (Liu, 2018; Long et al., 2019b). The pollution of rural ecological space is an important manifestation of the limited rural space during the transformation period. Excessive application of fertilizers and pesticides seriously threatens the continuous supply of rural ecological products and results in pollution from rural non-point sources (Long, 2014; Wang et al., 2018). Problems such as an absence of environmental protection supervision, livestock breeding and industrial pollution

have brought serious challenges to the protection of rural ecological space (Wang et al., 2018). A lack of not using available (i.e., unused) rural space, an extensive and excessive utilization of used space, and disordered organization of "production-living-eco- logy" space have become important obstacles to the promotion of RTD.

Unclear ownership of rural space

Rural spatial ownership is a concentrated embodiment of the rural spatial value attribute. Spatial ownership and the benefit of the distribution mechanism are the core elements that determine the flow direction of the rural spatial value. At present, rural space ownership in China has problems such as the unclear relationships between (1) short-term ownership and long-term ownership (Liu et al., 2014; Huang, 2017; Ge and Long, 2020), (2) public and private space, and (3) group and national interests. These situations lead to deep structural problems such as disputes over the distribution of rural space rights and interests ("public" versus "private" ownership), and the uncoordinated short-term and long-term goals of rural spatial restructuring (Yan et al., 2016). For rural space represented by housing land and farm- land, the "three-rights separation" scheme temporarily solved the issue concerning the difficulty to organize effectively the current physical space, but this also implies that it is difficult to effectively link short-term ownership to long-term ownership, and to coordinate physical space ownership with economic ownership (Liu et al., 2010; Qiao and Liu, 2019). At present, the lack of clarity regarding ownership of rural space has become an important problem that restricts rural resource development, power distribution and the sharing of benefits.

The unclear ownership of rural public space is likely to impact negatively on responsibilities and rights, and to hinder the rehabilitation of the rural residential environment. Rural public space has the risk of being dominated by a limited number of rights or falling into "the tragedy of the commons," which will cause a waste of rural public resources and social relationship conflicts. The unclear ownership of rural space on the farmers' contracted land is mainly manifested by the uncoordinated relationship between the short-term and long-term ownership. The unclear ownership affects the psychological expectations of the farmers' additional investment in farmland, which will become an important obstacle to the sustainable transition of farmland and the cultivation of new agricultural business entities (Ge et al., 2019; Long et al., 2019a). Such unclear ownership is not conducive to the establishment of a rural land property trading system, which hinders the transformation of rural space from resources to assets and capital.

Inefficient organization of rural space

Organization of rural space is an important component to consider for modernization of the rural governance system in the new era (Liu, 2018; Ge and Long, 2020). The spatial organization in rural areas has witnessed a lack of an organizational core, and tends to have a chaotic network structure, and a weakened self-organizational capability. At present, "fragmentation" and "hollowing" of rural spatial organization have become important obstacles to the modernization of rural spatial governance (Liu et al., 2010; Yang et al., 2015). At the core of rural spatial organization fragmentation is the haphazard organization of people, land and industry, which is manifested by a disorder in living space organization, confusion of ownership organization and absence of public space organization. The hollowing of rural spatial organizations is mainly manifested by a hollowing of the subjects of the organizations (e.g., the ability of government administrative agencies to penetrate the countryside) and the objects of the organizations (e.g., rural migrations away from original residences).

The spatial organization system for towns and villages represents the core for constructing the urban-rural settlement system. An efficient and reasonable settlement system for towns and villages is an important guarantor for optimization of the rural regional function

(Liu, 2018; Lu et al., 2020). In the process of urban-rural transformation and development, the disorderly expansion of rural settlements and the poor scale coordination between town settlements have caused the disorder and disharmony in village and town settlement systems, resulting in inefficient rural spatial organization. Disharmony resulting from transformation in farmland utilization and rural population change leads to marginalization, abandonment and fragmentation of farmland use morphologies (Ge et al., 2018b, 2019b), which, in turn, leads to the fragmentation of the spatial organization of farmland utilization that cannot meet the development needs of modern and efficient agriculture.

The disorder of social organization is also an important manifestation of the lack of efficient organization in rural space. At present, the migration of rural laborers has further accelerated the disintegration of traditional rural societies (Caulfield et al., 2019; Ge et al., 2020). Rural spatial organizations have suffered from institutional and practical problems such as weak organizational capabilities, lack of organizational subjects, and inadequate organizational systems. These problems also directly lead to ineffective measures to strengthen socio-economic development by relying on rural spatial organization. From traditional physical space to spatial relationships, spatial organization to social relationship organization, and spatial relationship organization to rural regional system structure and function organization, the premise of efficient rural spatial organization is required.

Analysis of the rural space utilization problem from the perspective of land use transition. The uncoordinated coupling relationship between LUT and RTD intensifies the problem of rural space utilization

The LUT provides a new perspective for the study of regional human-land interaction and the laws of socio-economic development. Research on LUT can reflect the trend of regional land use patterns and summarize the trends in regularity from drawing on land use change (Grainger, 1995; Lambin et al., 2010; Long et al., 2018). The research can also provide a reference for revealing the future direction of land use change, solving the existing problems of land use, and coordinating the contradiction between land use and socio-economic development. It is worth mentioning that Foley revealed the phased feature of LUT with the development of human society and economy (Foley et al., 2005), which perfectly explains the core meaning of land use morphology corresponding to the regional socio-economic development stage in a certain period of time (Long, 2014; Grainger, 1995). The Chinese researcher Long analyzed the connotation of regional land use morphology from the perspective of dominant and recessive morphology, and systematically constructed a theoretical analysis framework for LUT (Long et al., 2018; Long and Qu, 2018; Long, 2020; Long et al., 2020).

The problem of rural space utilization can be analyzed at depth from consideration of the uncoordinated coupling between land use morphologies and rural development status. The change process associated with conflicts in regional land use morphology is an internal mechanism that drives the evolution of land use morphologies (Song, 2017; Long et al., 2018). By analyzing regional land use morphology and the associated internal conflicts, the problem of rural space utilization in the process of rural development can be understood (Liu et al., 2014; Li et al., 2018; Long et al., 2019a). The problem of rural space utilization is an important manifestation of the uncoordinated coupling effect between LUT and RTD. Rural space serves as the spatial carrier of rural development, and land use serves as the spatial projection of socio-economic development (Ge et al., 2019; Long et al., 2019a). The mechanism and mode of the impact of land use change on rural development provide an important window for revealing the problems of rural space utilization. Therefore, the problem of rural space utilization is the spatial manifestation of structural problems as presented in rural development.

Analysis of the rural space utilization conflict based on LUT

It is difficult for rural space to support the spatial needs of RTD, mainly due to the limited amount of land and the unreasonable structure. The dominant morphology of land use can more readily present the characteristics of the land use pattern. The limited per capita farm-land area has caused a tension in human-land relations, indicating that the rural agricultural production space is tightly constrained by the pattern of farmland use (Van Vliet et al., 2015; Ge et al., 2018, 2019). Expansion of the rural housing land area is an important manifestation of the evolution of rural land use structure, and the hollowing of homestead utilization is the result of the differentiation of its internal structure (Liu et al., 2010, 2014; Long and Li, 2012), which has become an important manifestation for extensive use of rural space. The evolution of the quantity and structure of rural land use has further affected the structural and functional characteristics of rural "production-living-ecology" space and limited the potential development and utilization of rural space. The characteristics of the rural spatial function are derived from the spatial characterization of land use function. The unreasonable structure and the unrealized implementation methods of land use function are important factors restricting the development and utilization of rural space.

The unclear ownership of rural space is an important manifestation of the lagging of rural LUT behind the RTD. Rural spatial ownership can be clarified by the ownership pattern of land use. The ownership problem of rural farmland use morphology provides important evidence of the change of the recessive morphology of farmland use lagging behind the RTD (Ge et al., 2019; Long et al., 2019a). The reform and implementation of the separation of the three rights (ownership rights, contract rights and use rights) of farmland has not kept up with the evolution of the relationship between rural people and farmland. The lagging of rural homestead ownership, qualification and use rights reform are the core reasons for the hollowing out of rural homestead utilization (Liu et al., 2010). It is difficult to establish at the institutional level the boundary between rural and public space, which has become a bottleneck for restricting the development and utilization of rural public space. Therefore, changing the ownership of rural land use provides a way to create great potential for stimulating the vitality of rural development.

The inefficient organization of rural space directly results in the inefficient use of rural land. As one of the important elements of land use morphologies, land use efficiency pro- vides a breakthrough for analyzing rural spatial organization problems by determining the efficiency of different land types in rural areas (Long and Qu, 2018; Long, 2020). The per capita farmland area in rural areas is small, and a large amount of farmland is used inefficiently or left uncultivated, which is mainly caused by the mismatch between the farmland use transition and the population transformation, resulting in a low efficiency of farmland use (Ge et al., 2018; Li and Li, 2018). The inefficient utilization of rural homesteads is mainly manifested in the mismatch between the evolution of the village settlement system and rural development, and it is difficult for different types of settlements to be efficiently organized, developed and utilized. In addition to the above land use issues in terms of efficiency, the rural land use organization system is also an important factor that makes it difficult to use rural space efficiently. The fragmentation of farmland, the decentralization of homesteads, and the fragmentation of ecological land are all important manifestations of the inefficient use of rural space.

The interaction between land use transition and rural spatial governance

The interaction mechanism between LUT and rural spatial governance

Compared with the uncertainty of the trend of land use change, the study of LUT pays more attention to the tendency and regular change processing of regional land use morphology. Land use transition corresponds to a change of land use morphology with the succession process, in the stage of socio-economic development, highlighting the coupling characteristics

of land use change and rural development (Long and Qu, 2018; Long, 2020). Through analysis of the evolution process of land use morphology, LUT provides an index for the analysis of the evolution process within the rural space, and provides an effective connection for a study on the coupling of LUT and RTD; it also provides additional support for solving the problem of rural space utilization during the transformation period.

Land use transition is an important symbol for identifying the characteristics of the RTD stage and provides a time reference for implementing precise policies for rural spatial governance (Figure 1). Given the current rural space utilization process, we can carry out targeted comprehensive remediation, take land use features such as function, ownership and efficiency in the recessive morphology as the core objective of governance, and expand the field and scope of comprehensive land consolidation, which is conducive to strengthening the ability of comprehensive land consolidation to resolve rural space utilization problems (Long, 2014; Long et al., 2019a, 2019b; Ge and Long, 2020). Land use transition provides strategic guidance and a starting point for rural spatial governance; that is, the timing determination and means (appropriate land use types) of rural spatial governance are closely related to the evolution process of land use morphology. Through rural spatial governance, it will be possible to further change the rural land use morphology, coordinate the coupling relationship between the rural land use morphology and RTD, and further optimize the rural regional structure and function.

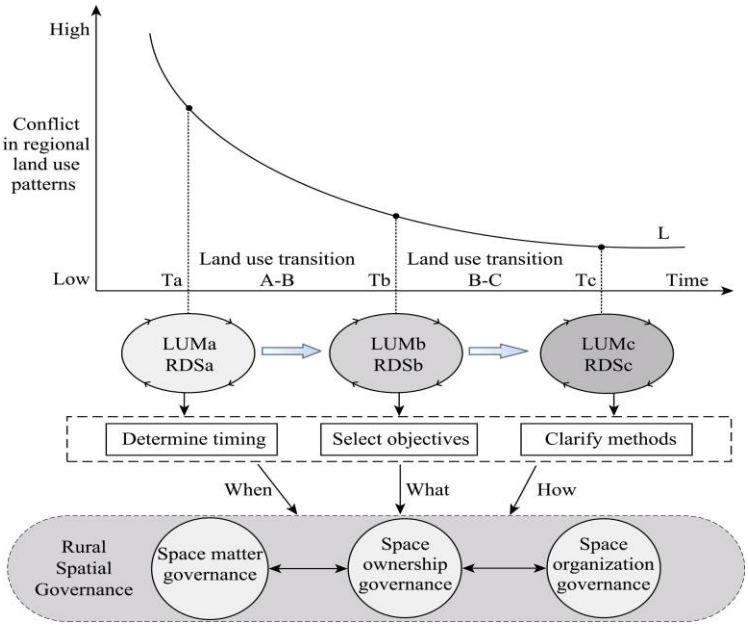


Figure 1 The interaction between LUT and rural spatial governance
Source: Long and Qu, 2018

Consolidation of unreasonable use of land can provide an important starting point for optimizing the structure of rural space and for improving the function of rural space. To meet the practical needs of constructing a modern rural governance system and solve the new situation and the problems that occur in the utilization, development, organization and management of rural space, it is necessary to strengthen comprehensive land use management methods such as beginning from the dominant and recessive morphologies of land use, and to incorporate the issues of physical space utilization, ownership and organizational efficiency into the field of the comprehensive land consolidation.

We need to expand the traditional rural land consolidation fields, to focus on the goals for comprehensive management of rural space, to start from the management of rural physical space and build a modern comprehensive management system for rural space. The governance of the land use physical structure, ownership and the organizational system can be taken as the starting point for the construction of the "matter-ownership-organization" trinity for comprehensive governance of rural space, and this is beneficial for discussing the direction for rural governance based on LUT. Besides, we also need to probe into a comprehensive governance path based on rural LUT, and to further the process of interaction between LUT and the management of rural space, and its profound impact on RTD, and highlight the goal of sustainable rural development.

The effect of interactions between LUT and rural spatial governance

The evolution pattern of rural land use morphology is the bridge connecting LUT and rural spatial governance. The recessive morphology of land use is the key to rural spatial governance. The recessive morphology of land use is beneficial to further enrich the connotation system of rural spatial governance. Aimed at various kinds of problems in the current rural space utilization, the transition of land use morphology is used as a breakthrough to provide a better solution for the comprehensive management of rural space. This is conducive to re- structuring the rural spatial system, optimizing the rural land use pattern, and promoting the rural LUT into a virtuous circle (Long et al., 2019a). In the process of the interaction between LUT and rural spatial governance, it is important to coordinate the coupling relationship be- tween rural land use morphologies and RTD, optimize the structure and function of rural space, and thereby promote the benign development of rural space (Ge and Long, 2020).

Based on the LUT process, the characteristics of the RTD stage are identified, which determines the starting node and timing relationships for rural spatial governance. In the process of LUT, conflicts and contradictions in regional land use patterns arise which prompt villages to select and consolidate the land use types (Long and Qu, 2018; Long et al., 2019b). An in-depth analysis of the contradictions behind the misused land types from the perspective of LUT is helpful for distinguishing the shortcomings of the rural land use pattern. Such an analysis can also help identify accurately the needs of rural spatial governance, clarify the objectives and goals of rural spatial governance, and provide strategic guidance for rural spatial governance. Conflicts regarding the intensity of rural land use patterns at different stages become a key factor driving the process of LUT, thus forming the regional LUT curve (Figure 1 line L). Correspondingly, the conflict between land use patterns and rural development dynamics leads to the differential types of couplings between land use morphology (LUM) and rural development status (RDS) in different periods. The succession process of the coupling relationships between land use morphologies and rural development status has become an internal factor driving the evolution of rural space utilization patterns. Therefore, the coupling relationship between LUT and RTD has become a key reference for clarifying the practice of rural spatial governance, which accordingly helps clarify the timing of governance and helps establish governance goals based on the differences in the coupling relationships during different periods (Long et al., 2019a).

According to the different types of coupling patterns in different regions, we can further establish acceptable governance measures according to local conditions, and then form a rural spatial governance path of "when to govern, what to govern and how to govern." The goal of rural spatial governance based on LUT is determined, so that the physical structure, ownership and organizational system of rural space are included in the scope of comprehensive governance. As a result, rural spatial governance has shifted from a previous focus on physical space governance to comprehensive governance that takes into account physical aspects,

ownership and organization, such that the capacity and efficiency of rural spatial governance are enhanced. The successful implementation of rural spatial governance will aid to optimize and adjust the pattern of rural land use morphologies, which constitutes the interactive process of LUT and rural spatial governance.

Construction of the "matter-ownership-organization" governance system

The relationship between rural space "matter-ownership-organization" governance and LUT

A comprehensive governance system comprising "matter-ownership-organization" in rural space provides feasible solutions to the structural problems of the rural regional system. Starting from the optimization of physical space, rural spatial governance attempts to solve the structural imbalances and functional deficiencies in rural space and provides strategic support for breaking through the space constraints in the process of RTD. Based on rural physical space governance, supported by rural space ownership governance and organizational governance, rural spatial governance provides an effective way to build a comprehensive rural spatial governance system.

The governance of rural physical space is closely related to the ownership and organizational governance of rural space. Promoting multidimensional governance of rural space on a collaborative basis will be an important breakthrough to solve the current problem of rural space utilization. The construction of a comprehensive governance system of "matter-ownership- organization" based on LUT has created conditions for the orderly promotion of rural spatial governance. The optimization of land use structure and quantity adjustment are the core elements for promoting rural physical space governance. Also, the key to ensuring the effectiveness of rural physical space governance is to carry out targeted "production-living-ecology" land improvements based on local conditions. The objective for rural space ownership and organizational governance is to solve the socio-economic relationship problems brought by rural space. This is closely related to the recessive morphology of land use, which has also become a determinant of whether the rural spatial governance can play a central role. Therefore, the development of rural spatial ownership and organizational governance re- quires a scientific evaluation of the transition trend of rural land use patterns (Long et al., 2019a). In addition, combined with the goal for orientating rural space development and utilization, rural spatial governance ensures effective management of rural space, and pro- motes an improvement in the rural regional system structure and function. Through comprehensive governance of the "matter-ownership-organization" of rural space, this approach can help facilitate the restructuring of rural space (Long, 2014; Long et al., 2019b), the re- shaping of ownership relations and the reconstructing of the organizational system. The construction of a modern rural spatial governance system featuring efficient rural spatial organization and clear and fair rural space ownership, and which provides a strategic fulcrum for promoting the modernization of rural governance, can also be explored.

The governance of rural physical space

The governance of rural physical space can help to exploit the potential of rural space development, improve the level of supporting rural infrastructure, reverse the defilement and degradation trends of rural space, and expand the capacity of rural space utilization (Long, 2014; Liu and Wang, 2019). The focus of rural physical space governance is to solve the practical problem of uncoordinated spatial structure and function of "production-living-ecology" spaces. The rural physical space governance should focus on the optimization of the structure and function of the "production-living-ecology" lands, and then promote the efficient operation of the rural physical space through farmland management. Agricultural land can be improved through agricultural land consolidation, land leveling, high-standard farm- land

construction, water conservancy, transportation, and introduction of land protection measures, which improve the quality, increase the area, and optimize the internal structure of rural production space (Liu and Wang, 2019; Long et al., 2019b).

In terms of living space, we should focus on the consolidation of "hollow villages", renovate empty rural homesteads and other empty lands, strictly control the area of homesteads and coordinate the planning and design of new housing. It is also important to improve rural infrastructure and public service facilities to optimize the spatial pattern of rural living space (Tang et al., 2014; Zhou et al., 2018). For the management of ecological space, we should focus on the industrialization and the intensive and efficient use of industrial and mining land, the renovation of rural polluted space, and the optimization of rural ecological space (Liu et al., 2010; Long, 2014; Long et al., 2019b). Aiming at the degraded, unused and marginalized "production-living-ecology" lands in rural areas, we can implement measures to protect rural land space and develop planning measures to establish comprehensive improvement of rural land and a unified approach to protection awareness.

The governance of rural space ownership

By clarifying the relationships between property rights and ownership rights for people in the rural space, the distribution mechanism for the rights for development and utilization of the rural space is established. Defining the boundary between public and private spaces and establishing a clear ownership system for rural spaces can create opportunities for optimizing the social relations for rural spaces, stimulating rural innovation and mobilizing rural development momentum. The governance of rural space ownership needs to be based on the current land management system, such that we can try to establish an innovative way to realize ownership, and promote the participation of multiple rural subjects into the governance of rural space ownership (Huang, 2017). To solve the problem of the unclear ownership among "production-living-ecology" spaces, an evaluation of land use morphology can be used to provide a scientific basis for the measure. Ownership is an important recessive morphology of land use, whose evolution process and the driving mechanism is an important basis for promoting the governance of rural ownership.

It is necessary to earnestly promote reform of the rural land regime, optimize the regime of rural land property and management, implement the "three separated rights" regime of rural contracted land and homesteads, and facilitate the confirmation, registration, and certification of rural contracted land and homesteads to stabilize and clarify land rights (Huang, 2017; Qiao and Liu, 2019). In addition, it is important to innovate and improve the user rights transfer mechanism and income distribution mechanism of rural construction land and improve the integrity of usufructuary rights of homesteads and housing. A cohesive mechanism of short-term and long-term land use rights should be set up and a plan for flexible land use ownership should be made. Other important measures include the need to emphasize the public-welfare attribute of public land from the perspective of space justice, highlighting a sharing mechanism for the distribution of the interests of rural public space, establishing rural spatial accrual integrated management thinking, preventing rural public space from being occupied, and eliminating the inefficient use of rural public space.

The governance of rural spatial organization

Rural spatial organization includes both the physical space and spatial relations. The lack of efficient organization of rural space leads directly to ineffective rural space management and control, and the measures and control methods of rural spatial governance become difficult to implement. Therefore, taking the issue of rural spatial organization as a breakthrough, finding an effective means to strengthen the capacity of rural spatial organization is an indispensable and important step in the construction of a modern rural governance system. An

important means for efficiently organizing rural space is to scientifically formulate the organizational mode and utilization method of each land type based on the rural LUT trend, transform the traditional rural land use organization system, and then realize an effective concentration and efficient use of rural space (Long et al., 2019a). The efficiency system, organizational model and functional characteristics of the recessive land use morphologies in rural areas have become useful tools for carrying out rural spatial organization and governance, and effectively carrying out rural spatial organization governance requires a scientific analysis of the rural land use recessive morphologies and their transition trends.

To solve the problem of ineffective organization in rural areas, an efficient organization scheme for rural space can be constructed based on the perspectives of a farmland, home- stead, industrial and mining land, and village settlement system (Figure 2). Farmland land utilization organizations aim to further guarantee the orderly transition of farmland and promote the concentration of farmland among rural farmers and interested parties. An important direction for farmland organization is to develop a moderate scale management, in- novate the organization mode, and improve agricultural production efficiency. At the same time, the establishment of a rural homestead exit mechanism promotes the centralized distribution of rural living spaces and strengthens the role of traditional culture in rural social organizations. In addition, improving the system of circulation of the right to use collective construction land, impel the reform of the transformation of collective public welfare construction land into collective construction land, and cooperate with the reform of the property rights system to optimize the regional industry development space are key measures.

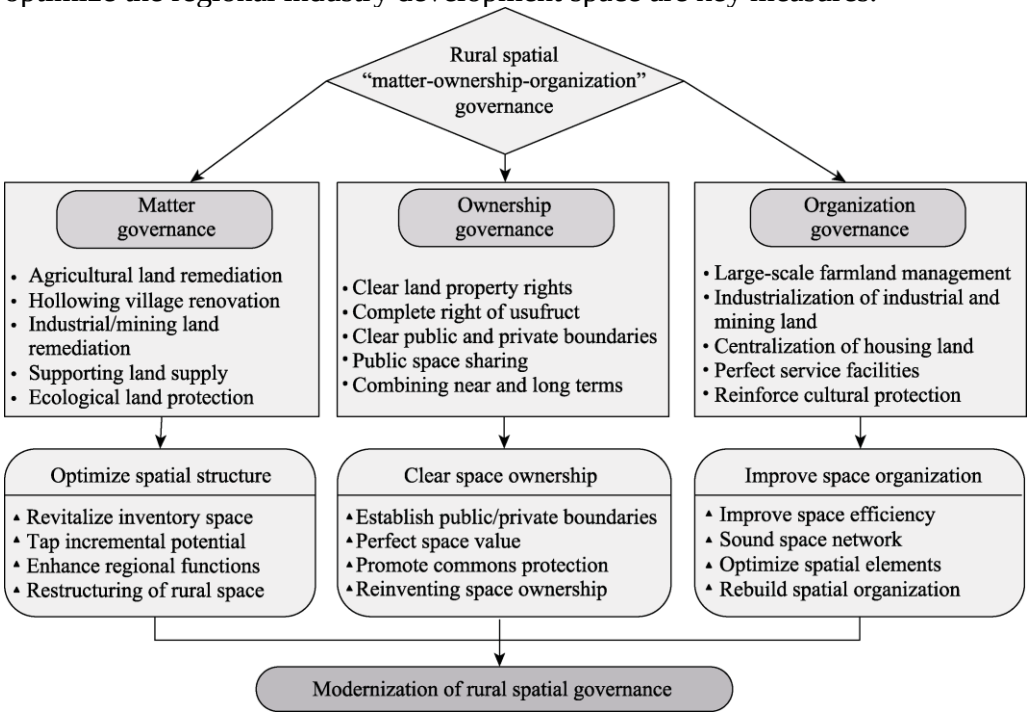


Figure 2 The construction path of a comprehensive rural governance system of "matter-ownership-organization" based on land use transition
Source: Long et al., 2019

Discussion

Rural spatial governance and rural vitalization

Promoting the integration of urban-rural development and rural spatial governance is an important foundation for rural vitalization. The key to the integration of urban-rural development is to break down the systemic obstacles of the flow of elements, structural

integration and functional intercommunication in the existing urban-rural regional system (Wu, 1991; Liu, 2018).

The loss of factors, the lack of structure, and the functional decline in rural areas are the key factors that hinder rural development. The material foundation of the urban-rural integrated development is the rural space problems that need to be solved and these are mostly related to the socio-economy and ownership relationship supported by the rural space. The key to promotion of rural vitalization with rural spatial governance is to change the pattern of elements, structures and functions of the urban-rural regional system, and to create an environment that facilitates the interaction of development elements, structure and function between urban and rural areas. The essential step in rural vitalization is to eliminate barriers between urban and rural areas, and to change the unequal pattern of development element allocation and development rights. Optimizing the urban-rural development pattern through rural spatial governance is an important driver for the construction of urban-rural regional systems and provides solutions for solving the structural problems faced by rural vitalization (Ge et al., 2019; Long et al., 2019a).

The interaction of urban and rural development elements is the sticking point of over-coming the bottleneck of rural development and promoting rural vitalization. Beginning from matter, ownership and organizational governance, rural spatial governance re-establishes the processing capacity and rights distribution of the different elements of rural space and changes the recessive morphological characteristics of the socio-economy carried by rural space. Therefore, from the perspective of the interaction between urban and rural factors, rural spatial governance has changed the spatial configuration of urban and rural development elements, endowing rural development with much-needed resources, which is conducive to ensuring the energy required for rural development (Liu and Li, 2017; Long et al., 2019b). The governance of rural physical space improves the unreasonable problem of rural spatial structure and promotes the optimization of urban and rural spatial structure. The key to delivery of rural space ownership governance is to release the economic value of rural space, thereby providing a basis for promoting the optimization of urban and rural economic structure (Huang, 2017).

In the modern era, in order to construct the spatial linkage mechanism of urban-rural space, we should re-examine the value system of rural space, the complementary function space and the value of the urban-rural linkage system. In the process of urban-rural integrated development, the non-coordination of the urban-rural development pattern and the disharmony of urban-rural relations will further promote a new round of rural spatial governance and RTD (Liu, 2018; Ge et al., 2020). Rural spatial governance is a continuous and systematic project, and the difficulty of rural vitalization also determines the complexity of the project. Constructing a benign interactive relationship between rural spatial governance and the integration of urban and rural development will be helpful to promoting an improvement in the rural vitalization system.

The prospective of the interaction between LUT and rural spatial governance

The interaction between LUT and rural spatial governance provides an effective tool for promoting RTD, and for improving the structure and function of rural regional systems. This section focuses on the analysis of the internal logical relationship between LUT and rural spatial governance, and mainly discusses the internal mechanism and effects of the interaction between rural spatial governance and LUT (Long et al., 2019a). The LUT provides a scientific basis for the orderly development of rural spatial governance, and rural spatial governance reacts to LUT, which provides an important means for optimizing the transformation of rural human-land relations (Figure 3). Carrying out rural spatial governance pro- vides the means to effectively resolve the structural and functional problems that arise in the process of rural space development and utilization and creates conditions for constructing a rural development pattern

with orderly space, clear ownership, and efficient organization. The rational development and utilization of rural space is the material basis for ensuring rural transformation and development (Long, 2014; Long et al., 2019a; Liu and Wang, 2019). The governance of "matter-ownership-organization" of rural space provides support for RTD. Carrying out research on the impact of rural spatial governance on RTD provides effective tools for deepening the rural development mechanisms. Therefore, research on the interaction between rural spatial governance and RTD will provide a basis for rural vitalization.

Under the guidance of LUT research, based on strengthening the "matter-ownership-organization" governance of rural space, strengthening research on the driving mechanism and regional model of RTD will be an important direction for promoting theoretical research to serve practical needs. At present, with regard to the construction of a theoretical analysis framework for the coupling of LUT and RTD, the identification of the coupling nodes of the interaction between the two, and research on the evolution process and interaction mechanism based on the coupling nodes are still at the exploratory stage. This article further demonstrates the internal relationship between LUT and rural spatial governance and its impact on RTD. Orderly RTD has the common purpose of deepening LUT and rural spatial governance. Rural LUT research has become an important basis for revealing the interaction status and predicament of rural spatial governance and RTD. Rural spatial governance is an important means to optimize the coupling relationship between LUT and RTD, and it is conducive to strengthening the internal mechanism of the two. Therefore, the effective integration of LUT, RTD and rural spatial governance under a unified analytical framework will help deepen the study of the operational mechanism of the rural regional system and provide a reference on vitalization practices to rural villages and communities.

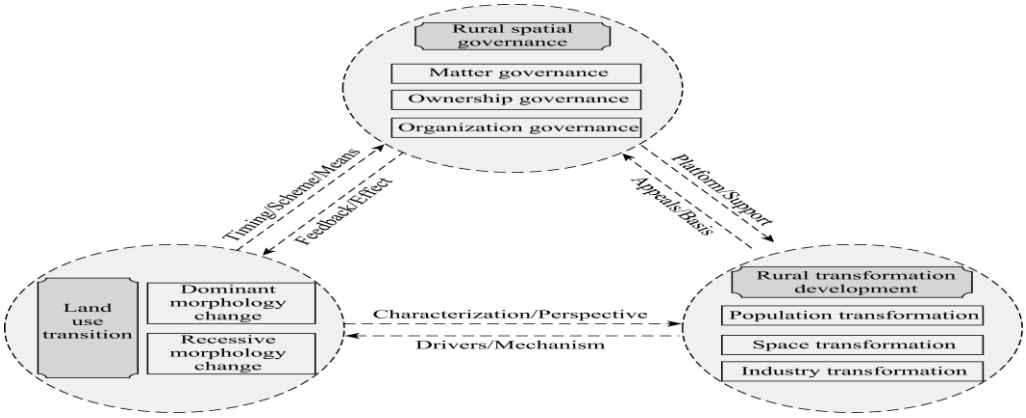


Figure 3 The internal relationship between LUT, rural spatial governance and RTD
Source: Long et al., 2019

Conclusion

The orderly development and utilization of rural space is the material basis for the sustain- able development of rural areas in China. At present, the use of rural space has systemic problems such as limited development space, unclear ownership and poor management, and this has become a significant obstacle to rural development. The dilemma concerning rural space can be explained by analyzing the coupling relationship between LUT and RTD. The LUT focuses on the trend in the change process for the dominant and recessive morphologies of rural land use, which provides a valuable perspective for analyzing rural space utilization problems. The LUT is an important concept for identification of the characteristics of the RTD stage, and provides a basis for determining the timing of rural spatial governance, selecting spatial governance objectives, and clarifying rural spatial governance methods.

The integrated governance system of "matter-ownership-organization" of rural space pro- vides a feasible solution to solving the structural problems of the rural regional system. The construction of a comprehensive governance system for rural space based on the LUT provides conditions for orderly promotion of rural spatial governance. Through rural physical space governance, exploiting the rural space development potential, improving the supporting level of rural space infrastructure, and reversing the trend of pollution and degradation of rural space, all help to expand the utilization capacity of rural space, and break the dilemma of having limited rural development space. Also, by clarifying the property rights relation- ship for rural space, we can define the ownership rights among the inhabitants, establish the mechanism for distribution of rights with respect to the development and utilization of the rural space, establish the boundaries between public and private spaces, and build a clear ownership system for the rural space. An important means for efficiently organizing rural space needs to be based on rural LUT trends with a scientifically based formulation for the various types of organizational models and utilization methods, and reform of the traditional rural land use organization system in order to achieve effective accumulation and efficient use of rural space.

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