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Doctoral Thesis

Modes and mechanisms of land consolidation in promoting rural vitalisation at the village level from a multifunctional perspective — Taking two Chinese villages as case areas

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Abstract

Researchers in rural studies and policymakers have taken interest in relieving and resolving rural issues by balancing the supply-demand of and for rural land use functions (RLUFs). As a multifunctional toolkit for this purpose, rural land consolidation (RLC) has been practised in many places to adjust the supply of RLUFs. However, few studies have analysed the relationship between RLC and rural development and how to formulate a RLC scheme at the micro level from a multifunctional perspective. Given the relatively successful outcomes of Eastern China in RLC, this study set to analyse the RLC in eastern China from a multifunctional perspective. The aim is to advance the understanding on the relationship between RLC and village development to serve as a reference point to advance RLC planning at the village level.

This study first constructs a theoretical model combining qualitative and quantitative aspects. To verify and calibrate this model, it is applied to two typical villages as case studies. These two villages were both directly affected by RLC between 2010 and 2020. One village, Jinzhuang, is far from two nearby major cities; the other, Dongheng, is close to two nearby major cities. Using this theoretical model, this study systematically analysed the spatial restructuring processes of these two villages, as well as comparing and contrasting their modes and mechanisms of RLC in promoting local vitalisation.

The qualitative part of the analyses indicates the implementation of RLC has rearranged land use structures to achieve villages' spatial restructuring that facilitates the industrial transformation of these two villages. The results of quantitative analysis showed RLC has promoted the overall development of vitalisation index values of these two villages with varied effects in aspects evaluated. Moreover, in the supply-demand analysis, both villages showed the strongest demand for economic benefits, and the gap between the RLUFs supply-demand was most evident in their production functions. These analytical results become the base for the customised land use strategies proposed in this

study for facilitating the development of these two villages.

The case studies also revealed the underlying mechanisms of the success and not-so-satisfactory outcomes of RLC in the two villages. In particular, the positive effect of RLC on Dongheng's vitalisation cannot be achieved without policy support, solid industrial foundation, superior resource endowment, and local elites' efforts; while in the Jinzhuang, policy support and the efforts from local elites produced positive yet not as successful results as the geographical location, and market demand may have shaped the direction of the development. By comparing the two cases, it is found accessibility to major cities may have a significant impact on RLC strategies, at least in plain areas.

Overall, the theoretical model constructed from a multifunctional perspective depicting the relationship between RLC and village development for the two selected cases. In this way, the theory and practises of applying RLC to improve villages' sustainability are integrated in this study; from which, insight can be derived for bettering rural vitalisation.

Keywords: land consolidation, land use structure, multifunctionality, effectiveness, supply-demand, mechanism of village vitalisation, China

List of abbreviations

CPC	Communist Party of China
CF	Cultural function
EF	Ecological function
FAO	Food and Agriculture Organisation of the United Nations
FDI	Functional demand intensity (i.e. Demand intensity for rural land use functions)
FSI	Functional supply intensity (i.e. Supply intensity of rural land use functions)
GLP	Global Land Project/Programme
LCS/LSS	Land Change Science/Land System Science
LF	Living function
LUCC	Land use and land cover change
LUFs	Land use functions
LUMF	Land use multifunctionality
LUTs	Land use types
MLU	Multifunctional land use
OECD	Organisation for Economic Co-operation and Development
PF	Production function
RLC	Rural land consolidation
RLUFs	Rural land use functions
RLUS	Rural land use structure
RV	Rural vitalisation
TVEs	Township and village enterprises
UP	Unexploited function
WTO	World Trade Organisation

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Chapter 1 Introduction

1.1 Background and motivation

With the process of global urbanisation accelerating, rural decline has been significant in the past few decades, especially in developing countries such as China (Liu & Li, 2017). The utility of rural land consolidation (RLC) as a multifunctional land use tool has been recognised in combatting rural poverty and promoting rural development (Veršinskas et al., 2020; Zhou, Li & Xu, 2020). The following three aspects offer the direction and incentive for this research presented here.

1.1.1 The rising importance of rural land use multifunctionality in Land Change Science/Land System Science

Rural regions are essential to the growth and development of urban areas, since they supply a wide range of services and resources (Long et al., 2020; Long, Zou & Liu, 2009). Rural development has long been a major issue and plays a vital role in the socio-economic development of regions. As a part of the natural environment and source of resources, land is vital for human survival. Land use is an important human activity that determines the performance of the environmental, economic, and social functions of ecosystems (Mander, Wiggering & Helming, 2007). However, the social and economic productions and services provided by rural land use create pressure on the eco-environment and natural resources even as they create development opportunities for mankind. Since the beginning of the 20th century, the conflict between socio-economic development and the use of rural land resources has been fierce with the rapid growth of the population. Thus, researching how to ease the tense human-land relationship in rural areas has become an area of foremost concern (Liu & Li, 2017).

Land use and land cover change (LUCC), considered as a coupled human-

environment system, has emerged as an essential subfield of Land Change Science/Land System Science (LCS/LSS) for evaluating and analysing global environmental change and sustainable development (Rindfuss et al., 2004; Turner, Lambin & Reenberg, 2007; Turner & Munroe, 2020). In response to the growing intricacy of human-land interaction, the notion of land use multifunctionality has been emphasised as a tool used to comprehend and address rural transformation and sustainability challenges in more depth (Mander, Wiggering & Helming, 2007; Verburg et al., 2009). Land use multifunctionality (LUMF) here refers to different functions (i.e. products and services) provided for human activities in the process of land use in rural areas (Pérez-Soba et al., 2008). It is closely connected to the diversity of ecosystem services, the level of socio-economic development, and the sustainability of rural development. The rural land use system is a dynamic, complex, and sensitive one, which means that the functional supply of land use varies with use pattern, and the demands for rural land use functions (RLUFs) are similarly time- and place-dependent. If RLUFs are altered unreasonably, the resulting short-supply of various functions may disrupt the coordination of the rural land system and lead to lots of issues, such as environmental contamination, wasting of resources, and economic recession (Liu, Li & Yang, 2018). This is why the emergency of rural problems is partly due to the long-term supply-demand mismatch of RLUFs (Ma et al., 2019). It is therefore imperative to mitigate and even attempt to resolve these problems by utilising the developed land resources to balance the supply-demand of and for RLUFs.

Since the 1980s, research on agricultural and rural land use multifunctionality has arisen as a new paradigm to guild the study and practise of agricultural and rural transformation development in the West (Van Huylenbroeck & Durand, 2003). In a similar vein, LUMF has emerged as a major theme of research in the area of LUCC and rural geography in China (Li & Zhang, 2017; Qu et al., 2017; Xie et al., 2010; Zhen et al., 2009; Zhen et al., 2010).

1.1.2 Alleviating increasingly serious rural problems in China

As early as the 1960s and 1970s, developed regions in the West had achieved economic efficiency by mechanising agriculture (Potter, 1998). Since the 1970s, the focus has turned to the natural environment, biological diversity, landscape values, and social equality (Wilson, 2007), which has contributed to the amelioration of rural issues to a great extent throughout the subsequent four decades. However, rural China's growth over the same period has not provided the same bright image. Since the reform and opening-up, the primary objective of the process of the modernisation paradigm in rural China has been that of economic growth (Fang & Liu, 2015). This has contributed to continued socio-economic growth in rural areas (Long & Liu, 2016; Tu & Long, 2017). However, it has also resulted in a number of unresolved rural issues, such as farmland fragmentation, environmental degradation, rural hollowing, rural population ageing, extreme poverty, and massive rural-urban migration (Liu et al., 2014; Liu & Li, 2017; Liu et al., 2010; Long & Liu, 2016; Wu, Zhou & Liu, 2020). In addition, gaps in economic income, education conditions and social welfare between the majority of urban and rural regions have continued to grow (Chen, 2015). Moreover, the degree of farmland fragmentation in China far exceeds that of developed European countries and even Central and Eastern Europe (Jiang et al., 2022b). These rural issues and rural-urban disparities have become significant obstacles to rural China's sustainable development.

Internationally, the study of China's rural problems and the promotion of China's rural development are significant for the following reasons. First, China is the world's most populous and has been the fastest-growing developing country in the past few decades. Analysing and solving China's rural issues may have a valuable reference for other developing countries and regions, especially for Asia, in lifting their own rural areas out of poverty and promoting their vitalisation. The target poverty alleviation of rural China, for instance, has made a significant contribution to poverty reduction in the world (Zhou et al., 2018). Second, the success of the Sustainable Development Goals (SDGs) 2030 Agenda

will be significantly hampered if we do not address the mounting challenges in rural China and work to ameliorate them.

China uses only 8.35% of the world's arable land to feed 18.82% of the Earth's population (FAO, 2019); intensive land use in China is therefore inevitable. Unfortunately, a substantial amount of farmland has been occupied and used inefficiently. Unsustainable farming practises and poor management have led to the degradation of over 40% of the farmland and the contamination of 19.4% of farmland (Zhao et al., 2015). In addition, Liu et al. (2013) have estimated that, by 2020, the consolidation potential of China's hollow villages would amount to 758-992 million hectares. This rural hollowing is accompanied by the expansion of new houses; that is, many rural residents build their new houses on agricultural land, even farmland, without reclaiming the old while spending the majority of their time as migrant workers, resulting in the hollowing out of some rural villages. This has caused a large amount of waste of rural land and serious damage to farmland resources. Furthermore, a large amount of undeveloped land and natural land in rural China has been turned into farmland for food production or developed for residential use to accommodate the burgeoning population. For example, when compared to the 1950s, the amount of natural grassland in China has shrunk by 30–50%; natural forests have shrunk by 61,000 ha annually; the largest swamp region has shrunk from 5 million ha to 1.13 million ha; and the extent of coastal mangrove swampland has shrunk from 50,000 ha in the 1950s to 22,000 ha in 2010 (Bai et al., 2016; Dan et al., 2014). The food insecurity caused by the area reduction and the qualitative decline of farmland, as well as the ecological security issues caused by the reduction of natural land, can be regarded as the two major problems in rural China. As a result, the Chinese government has formulated the 'arable land redline' and 'ecological redline' policies to ensure the quality and quantity of farmland and to protect natural land (Guo et al., 2018; Jiang et al., 2019; Kong, 2014). On the other hand, the differences in social and political environments between China and the West make it necessary to research rural issues based on

the Chinese context to identify solutions in rural development rather than uncritically transferring any internationally-successful practise and experience to China. It is therefore crucial to alleviate and solve China's rural difficulties through the rational and efficient use of rural land resources in order to contribute to the attainment of the SDGs 2030 Agenda and the vitalisation of the rural world.

1.1.3 RLC is increasingly important in promoting rural development

In the process of (re)vitalising rural areas, many developed countries and regions – such as Western European countries (Lambert, 1963; van den Brink & Molema, 2014), Japan (Mihara, 1996), and South Korea (Korthals Altes & Bong Im, 2011) – have adopted land consolidation as an effective measure to facilitate rural development by optimising the structure of local land use and soil and have achieved ideal results. Subsequently, other countries and regions, such as India, Ghana, Central and Eastern Europe, and Vietnam, also launched land consolidation praxes on the basis of Western experience and local conditions in order to cope with rural poverty and facilitate rural development (Asiama, Bennett & Zevenbergen, 2017; Hartvigsen, 2015; Huy & Warr, 2020; Thapa & Niroula, 2008).

As one of the most populous and fastest-urbanising developing countries in the world, rural poverty and decline in China are clearly visible (Guan et al., 2018; Liu & Li, 2017). In response to this rural decline and demand of rural development, the Chinese government has issued No. 1 Central Documents[1] covering agriculture, rural regions, and farmers for 18 years running, starting back in 2004, and has further purposed the 'Rural Vitalisation Strategy' as one of the national policies in 2017. In the process of alleviating poverty and promoting the comprehensive development of rural China, RLC has demonstrated its capabilities in alleviating the increasingly tense human-land relationship and breaking the Matthew effect of unbalanced regional

[1] No.1 Central Document means one of the most important policies in China.

development (i.e. poor get poorer while rich get richer) (Li, Wu & Liu, 2018; Liu & Wang, 2019; Rao, 2022; Zhou, Guo & Liu, 2019). Up until now, many studies and cases have demonstrated that RLC in China is a useful tool to provide socio-economic and technical solutions to ameliorate rural issues in terms of agricultural land quality (Lin et al., 2019; Shi et al., 2020), agricultural and rural modernisation (Wang et al., 2017), human-land relationship (Xin et al., 2015), ecological environment and biodiversity (Wang & Zhong, 2017), rural spatial restructuring (Long, 2014), and farmers' livelihoods (Liu & Zhao, 2018). It has also been proven that RLC activities are profoundly affecting rural land use structures/functions and boosting the development of rural areas (Long, Zhang & Tu, 2019; Rao, 2022). Currently, RLC in China is regarded as one of the most important levers and platforms for resolving rural problems, which can be seen from the political priority given to it. For example, two five-year national land consolidation plans have been developed by the Chinese government since 2011, both of which recognise the comprehensive role RLC plays in terms of its concept, purpose, and content (Zhou, Li & Xu, 2020). In other words, the role of RLC has been expanded from that of a tool used to solve farmland fragmentation to a combination of policy instruments and engineering measures to consolidate farmland, water area, infrastructure, woodland, and villages for rural vitalisation (RV) and even urban-rural integration (Jiang et al., 2022b). Comparatively, China seems to be more successful than most other developing countries in supporting rural development through RLC (Asiama, Bennett & Zevenbergen, 2017; Niroula & Thapa, 2005; Thapa & Niroula, 2008; Zhou, Li & Xu, 2020). China's experience in land consolidation would seem to be worth learning from for other developing regions and countries. Meanwhile, the eastern coastal provinces (e.g. Shandong, Jiangsu, and Zhejiang), as the most economically developed region in China, are the experimental areas and forerunners of China's institutional reforms, especially those involving land and economy. At present, compared with most of the central and western regions, the eastern coastal provinces have achieved greater success in RLC in some aspects,

such as economic development, cultural cultivation, social construction, local governance, and environmental protection (Long, 2020; Wang, 2020; Wang et al., 2017; Xu, Yang & Chen, 2011). For example, as early as 2003, Zhejiang Province took the lead in launching the "Green Rural Revival Programme" (also known as "*Qiancun shifan, Wancun zhengzhi*"), the aim of which was to select roughly 10,000 administrative villages[2] out of the 40,000 in the province for comprehensive consolidation, and to build about 1,000 central villages into demonstration villages for the overall realisation of vitalisation. In September 2018, Zhejiang's "Green Rural Revival Programme" was awarded for "Inspiration and Action"[3] in the United Nations Environment Programme's Champions of the Earth Award[4].

Thus, studying and analysing eastern provinces' experience with land consolidation to spur rural development can serve as a reference point for rural areas in the rest of China and other developing regions and countries.

1.2 Research status, gap, and question

1.2.1 A bibliometric analysis of rural land consolidation

Bibliometrics is an effective method that can be used to generate an intuitive understanding of the research status of a topic (Aria & Cuccurullo, 2017). Based on the Core Collection of CNKI (including PKU Core Journals, CSSCI, and CSCD) and the Core Collection of Web of Science (WOS), VOSviewer (version 1.6.18) (Cui, 2018; Hernández-Torrano & Ibrayeva, 2020; van Eck & Waltman, 2010), a scientometric software, was adopted to analyse the research status of topics concerning rural land consolidation. VOSviewer is a freely available software for constructing and visualising bibliometric

[2] In many provinces, it is common for an administrative village to be made up of a central village and several natural villages (hamlets). The central village is usually the location of the village committee.

[3] https://www.unep.org/championsofearth/all-laureates?field_award_year_value=2018 (Access to the official website of Champions of the Earth Award in 2018)

[4] The UN Environment Programme's Champions of the Earth award is the UN's highest environmental honour. Champions of the Earth are celebrated in four categories: Policy leadership, Inspiration and action, Entrepreneurial vision, and Science and innovation.

networks and maps based on a co-occurrence matrix (see www.vosviewer.com). The main rules of the concept maps that will be generated in this study via VOSviewer are: 1) each node represents a corresponding concept/keyword, while the colours of the nodes represents keyword clusters, which can explain a broad research topics in a field, 2) a closer distance between two words denotes a high degree of similarity/relatedness, while the inverse is true, as well as 3) the more occurrences of a concept, the larger the size of the node indicating the concept (van Eck & Waltman, 2011; van Eck & Waltman, 2010). More elaborate analyses and discussions of VOSviewer are provided elsewhere (van Eck & Waltman, 2017; van Eck & Waltman, 2010; van Eck & Waltman, 2007; Waltman, van Eck & Noyons, 2010). Based on the above-listed literature databases, a total of 1023 articles have been found in WOS[5] and 3149 articles have been found in CNKI[6]. The two types of datasets obtained were then imported into VOSviewer for analysis and presentation, resulting in Fig. 1-1.

As shown in Fig. 1-1a, there are seven clusters, including five large clusters labelled red, green, blue, yellow, and purple, as well as two small clusters labelled cyan and orange. The first five clusters focus on the following topics: land consolidation projects/programs and farmland conservation; village construction and research progress in the discipline of land science; potential, patterns, and influencing factors of rural settlement consolidation; methodology related to the evaluation of the benefits of land consolidation; identification, patterns, and planning of land use. The two small clusters focus on problems and countermeasures in the process of land consolidation and rural development, as well as the impact of land reclamation and development on the ecological environment. As shown in Fig. 1-1c, the presence of five clusters is indicated,

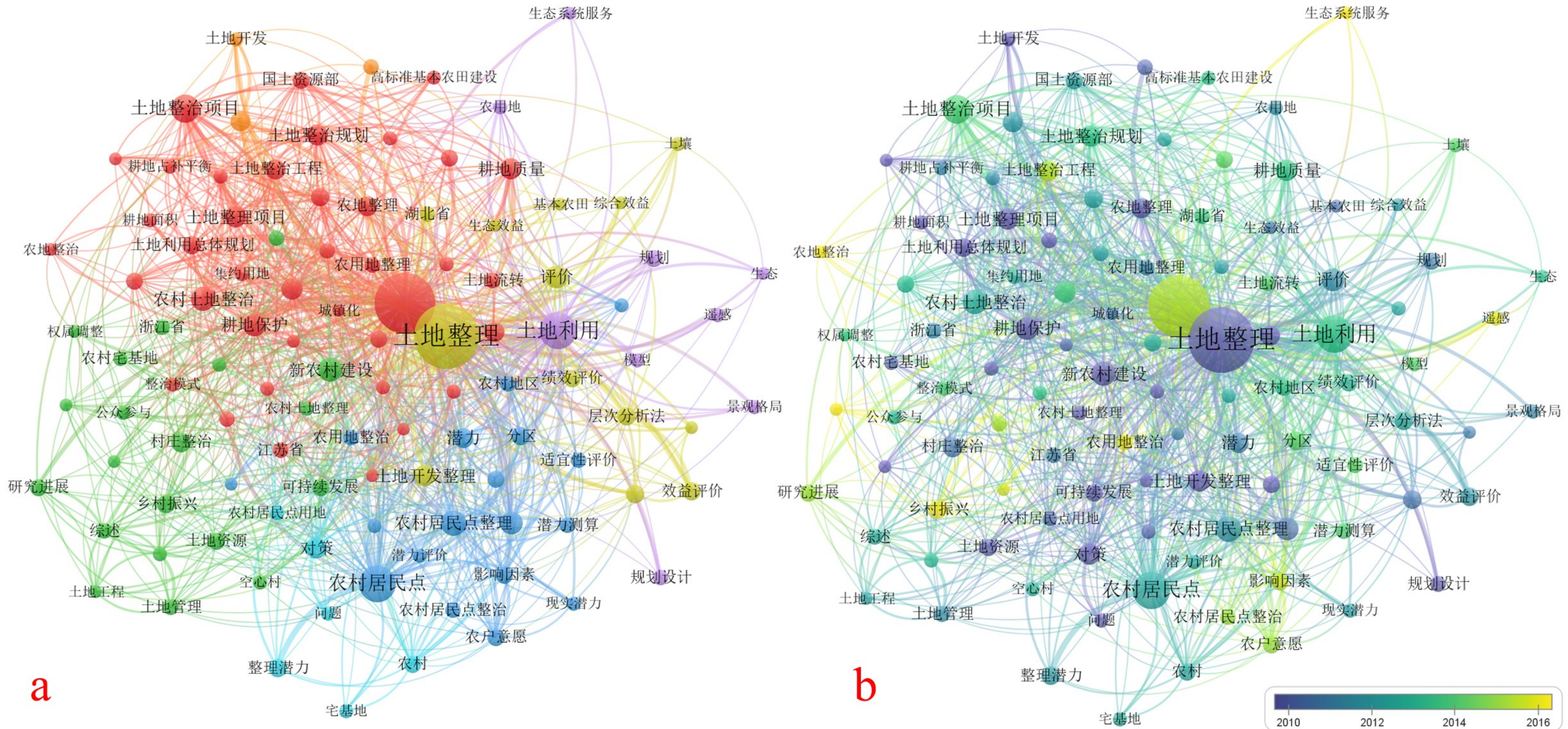
[5] The retrieval mode for LC articles from the Core Collection of WOS, with the publication data from 1900-01-01 to 2021-12-31, is as follows: (TS=(land consolidation) NOT TS="urban land consolidation" AND ALL=("land consolidation"))

[6] The retrieval mode for LC articles from the Core Collection of CNKI, with the publication data from 1915 to 2021, is as follows, where SU is the 'Topic': (SU=土地整治 or SU=土地整理 or SU=村庄整治 or SU=村庄整理 or SU=农用地整治 or SU=农用地整理 or SU=建设用地整治 or SU=建设用地整理 or SU=耕地整治 or SU=耕地整理 or SU=居民点整治 or SU=居民点整理 or SU=工矿整治 or SU=工矿整理 or SU=宅基地整治 or SU=宅基地整理). A total of 3275 Chinese articles were retrieved based on this retrieval mode, leaving 3149 articles after eliminating those without authors.

which are marked red, green, blue, yellow, and purple for clusters one through five, respectively. The first cluster focuses on the patterns, impact and management of land fragmentation and consolidation, in addition to agricultural and rural development. The second cluster focuses on China's issues and the corresponding policies. The third cluster focuses on land use, soil erosion, and the environment in Loess Plateau. The fourth cluster focuses on cultivated land and food security. Finally, the fifth cluster consists of 9 items that mainly focus on the relationship between land consolidation and the natural environment, such as ecosystems, climate, and biodiversity.

In addition, it can be found that there is a close relationship between land consolidation, land reclamation, and land reallocation. Topics such as land use, land fragmentation, and rural development have been repeatedly mentioned in articles on land consolidation. Also, China's land consolidation has received increasing attention. In China, the term use of "land consolidation" has been transformed from "*tu di zheng li*" (*土地整理*) to "*tu di zheng zhi*" (*土地整治*), and it is regarded as a way to achieve rural sustainability in practises. Meanwhile, land use, new village construction, rural residential areas (i.e. homesteads), and agricultural land (especially farmland) protection are the key topics that have attached a lot of attention in land consolidation research.

Moreover, Fig. 1-1 b and d depict the evolution of research hotspots on rural land consolidation over time. Popular keywords over the last three to five years are scattered across different clusters, suggesting that all these broad research themes mentioned above remain of interest to researchers. Specifically, the application of remote sensing technology in land consolidation, the management of land resources using comprehensive land consolidation to promote poverty alleviation, environmental protection and the vitalisation of rural areas, the role of land consolidation in new urbanisation and urban-rural integration, the analysis of land consolidation zoning, and the main influencing factors of land consolidation have become hot topics in rural land consolidation research.


生态系统服务
土地开发
国土资源部
高标准基本农田建设
土地整治项目
农用地
土地整治规划
土壤
耕地占补平衡
土地整治工程
耕地质量
农地整理
湖北省
基本农田
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生态
土地流转
评价
农村土地整治
城镇化
遥感
权属调整
浙江省
耕地保护
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整治模式
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绩效评价
公众参与
农村土地整理
层次分析法
景观格局
村庄整治
农用地整治
潜力
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乡村振兴
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2012
2014
2016

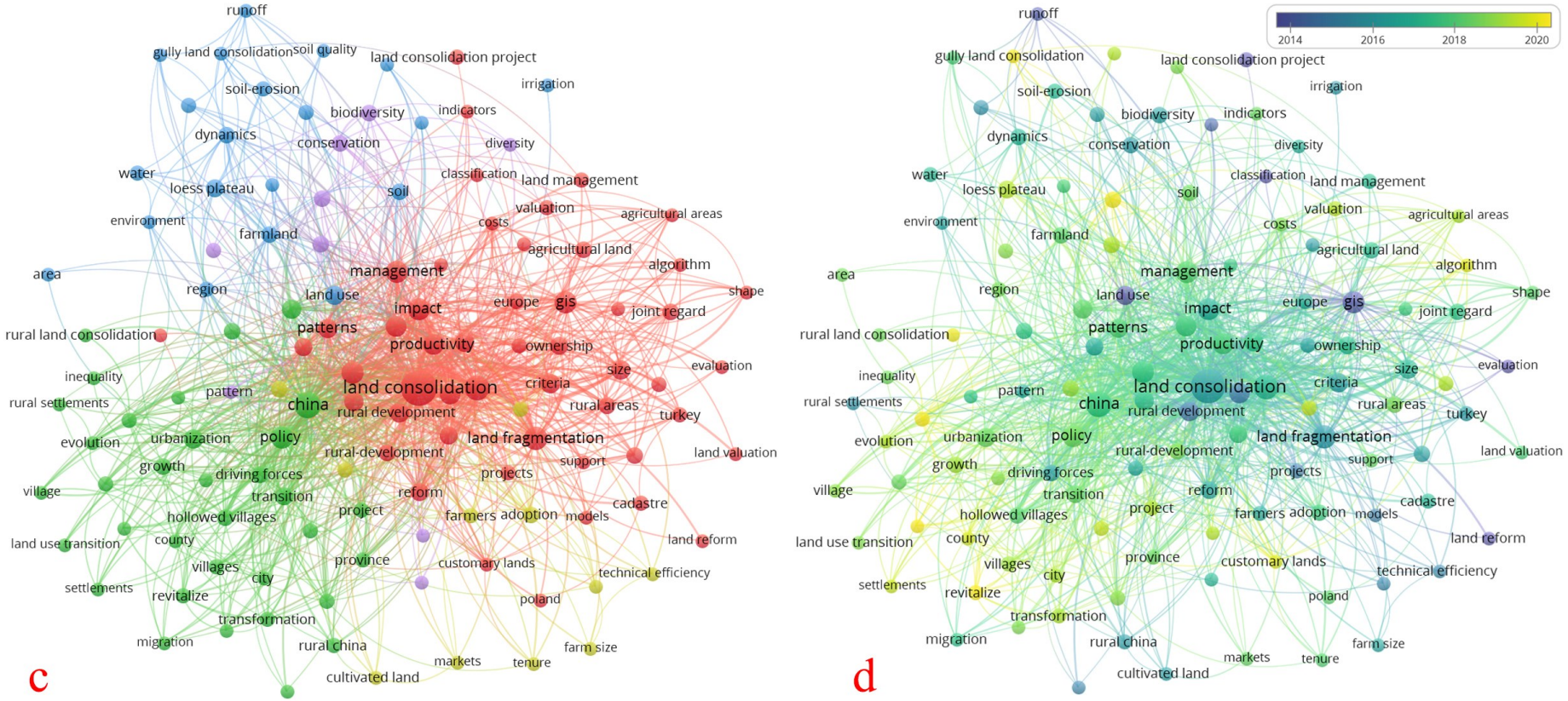

Fig. 1-1. Research status of rural land consolidation

(a: network visualisation of RLC in CNKI, b: overlay visualisation of RLC in CNKI,
c: network visualisation of RLC in WOS, d: overlay visualisation of RLC in WOS)

1.2.2 Research gaps and questions

As mentioned in Sections 1.1.3 and 1.2.1, the role of land consolidation in rural development has received increasing attention as an area of intense focus. Meanwhile, Section 1.1.1 mentions the increasing importance of land use multifunctionality in LCS/LSS, while land consolidation, as a multifunctional toolkit used to change land use structures and systems, has also become an important topic in LCS/LSS (Long et al., 2021). As such, there has been a rise in research on the relationship between land consolidation, rural vitalisation, and multifunctionality. At present, the related research can be summarised from the following four perspectives to explore the gap.

From a theoretical aspect, existing studies have mainly analysed and discussed the relationship between RLC and RV and **the development path of RLC** from macro perspectives such as “regional features”, “urban-rural integration”, “rural development factors” and “the five purposes of rural vitalisation” (Chen & Long, 2020; Jiang et al., 2015; Kong et al., 2019; Long, Zhang & Tu, 2019; Qiao, 2019; Zhou, Li & Xu, 2020). A local development strategy is often developed based on the development measures of various elements. This means that, in addition to the overall analysis of the relationship between different elements, it is also necessary to deeply consider the development measures of different elements. Although the current research on rural development involves various developmental elements, there is a lack of more detailed research on one element. Land is the main spatial carrier of social and economic development in rural China and even in most developing regions and countries, and its mode of utilisation has a direct impact on local development (Long, 2014; Long et al., 2021). So far, **few studies have considered the relationship between RLC and rural development from the standpoint of individual components like land** (Jiang, Long & Tang, 2021).

In terms of the research content and objectives, in light of China's national strategy for rural vitalisation, research into the internal mechanisms, modes, and ways in which land consolidation impacts rural development is

urgently needed (Zhou, Li & Xu, 2020). For this reason, increasing numbers of scholars are taking it upon themselves to consider this field from various perspectives (Liu & Wang, 2019; Long, Zhang & Tu, 2019; Zhou, Li & Xu, 2020). Nevertheless, due to the complexities of development challenges, and the diverse conditions and socio-cultural contexts of rural areas (Tomaney, Krawchenko & McDonald, 2019), the practises of rural vitalisation run a risk of failure, no matter how attractive this strategy may be. Not every village is apt for this strategy, as there is no "one-size-fits-all" rural development method that can be transferred from early adopters to others. Institutional frameworks, socio-economic structures, cultural preferences, and natural conditions are just some of the aspects that can affect the viability of RLC as a technique to assist rural development. Likewise, the direction and priorities of RLC projects also vary regionally due to these same variables (Asiama, Bennett & Zevenbergen, 2017; Ju et al., 2003; Long, 2020; Qu et al., 2017; Thapa & Niroula, 2008; Tong, Hu & Yang, 2015; Veršinskas et al., 2020). However, in the increasingly urbanised and globalised world, different places may share some aspects in common and learn from others' experiences, even though these similarities or experiences did not occur at the same time and place (Jiang et al., 2022a). It therefore **is necessary to compare and contrast the modes and mechanisms of rural development in China that have been largely supported by RLC from various dimensions and scales, from which other developing areas and nations with similar problems and features can learn or benchmark** (Jiang et al., 2022b)**.**

However, while the research content referenced above can assist in the formulation of RLC development strategies, it may not be able to generate more specific recommendations or schemes for RLC planning. One of the primary causes of rural decline is the long-term gap between the supply and demand of and for RLUFs for rural development (Ma et al., 2019). It can contribute to further RLC planning, provided the impact of RLC on different aspects of rural development can be revealed and the supply and demand relationship of different

land use functions/types can be quantitatively described. In addition, land consolidation in some areas is expected to produce multifunctional outputs given that it needs to accommodate a variety of local developmental demands. Meanwhile, the multifunctional use of rural land is an important way to promote sustainable land use and rural development (Mander, Wiggering & Helming, 2007). Therefore, taking multifunctionality as a starting point will help to further the understanding of the relationship between RLC and rural development, and serve to further land consolidation planning. Although multifunctional land use is an important feature of and a hot topic in current agricultural and rural development (Liu et al., 2018; Mander, Wiggering & Helming, 2007; Wilson, 2007; Zou et al., 2020), it is rarely integrated into studies of how land consolidation affects rural vitalisation. For example, a large number of studies have been conducted on multifunctional land use (land use multifunctionality)[7] and rural vitalisation[8]. Only around 100 English- and Chinese- articles published in core journals have discussed the relationship between/among the three topics of land consolidation, multifunctional land use (land use multifunctionality), and rural vitalisation (rural development). Additionally, LCS/LSS emphasises the significance of geographic position for comprehending land use change (Rindfuss et al., 2004). **Therefore, a better measurement of how RLC affects rural development can be achieved through adopting a multifunctional land use perspective on rural development in geographically-different places, which can also help to comprehend, qualitatively and quantitatively, the diversity of the supply and demand relationships between different types of land consolidation projects and rural development over space and time** (Jiang et al., 2021; Ma et al., 2019). This will be conducive to the further formulation of land consolidation schemes to promote local development. Furthermore, although many studies conducted by Chinese scholars have

[7] Articles on the topic of land use multifunctionality, from 1900 to 2021, were retrieved 388 in the Core Collection of CNKI and 218 in the Core Collection of WOS.

[8] Articles on the topic of rural vitalisation, from 1900 to 2021, were retrieved 8372 in the Core Collection of CNKI and 492 in the Core Collection of WOS.

generated insights into rural multifunctional land use, their framework for analysing LUMF remains partial and incomplete. Most focus only on construction land (Ma et al., 2019; Qu et al., 2017; Yuan et al., 2017; Zhu et al., 2014) or farmland (Hu et al., 2014; Wang et al., 2018; Zhang et al., 2018); few studies have placed construction land and agricultural land in the same framework to assess and discuss RLUFs. In a specific area, the interaction between different land use types constitutes the local land use system, which requires that **different land use types in this area be placed in the same framework for overall analysis and further rearrangement.**

From the perspective of research method, some studies have been published using various methods, such as the Gray relation projection method (Wang & Dong, 2015), the Improved TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) (Behzadian et al., 2012; Gao, Zheng & Liu, 2018), and the Gray-TOPSIS model (Liu et al., 2019; Ren et al., 2018), to evaluate or assess the supply and demand of and for RLUFs separately. However, **detailed studies concerning how to balance the supply-demand of and for RLUFs remain rare** (Ma et al., 2019). Meanwhile, considering that different indicators may contribute differently to the overall evaluation indicator system, each indicator is usually given a specific weight. The subjective weighting method and objective weighting method are the two subjective methods that have been widely used for assigning weights to indicators (Peng et al., 2012; Wang & Dong, 2015). The Analytic Hierarchy Process (AHP) (Xiang et al., 2019; Zhen et al., 2009), Delphi Method (Ma et al., 2019; Pérez-Soba et al., 2008), and Participatory Rural Appraisal (Chambers, 1994), and Opinion-based approach (Krueger et al., 2012; Ritz et al., 2009) are the most-commonly adopted subjective weighting methods, while objective weighting involves various methods such as the Entropy Method, PCA (Principal Component Analysis), the Multi-correlation Coefficient Method, as well as the Coefficient of Variation Method (Ni et al., 2014; Yang, 2006). Moreover, some scholars have suggested that land use functions or sub-functions at the same level should be

given similar importance (i.e. that they be equally weighted) in the evaluation of the multifunctionality of rural land use and rural development, because functions or sub-functions differ only in features and form and no one should be held to be superior to others (Gu et al., 2019; Li et al., 2019; Liu et al., 2018). Besides, to alleviate the shortcomings of a single method, some scholars combine two or more different methods to calculate indicator weights (Du, Sun & Wang, 2016; Zhang et al., 2018). However, it is still insufficient to quantitatively analyse the relationship between RLUFs and local development via some indicators that can easily be quantified. There are two main reasons for this. First, dominant attributes of land use (e.g. land use type, area, and location), which are easily observable and used for analysis, are the external representation of land use, whereas some recessive attributes, such as land property rights and operation mode, may be more vital for land use management (Liu et al., 2015; Long et al., 2020; Long et al., 2014). These recessive attributes need to be collected through field investigations and qualitatively analysed. Second, mathematically sound results may not describe the actual situation precisely (Peng et al., 2012). **It is therefore necessary to adopt a combination of quantitative and qualitative methods to generate a deeper understanding of the complex relationship between RLC and local development.**

Regarding the research scale, most studies concerning the multifunctional measurement of and discussion of the relationship between rural development and land use take meso- and macro-level administrative regions, i.e. they take provinces (Du, Sun & Wang, 2016; Gao, Zheng & Liu, 2018), municipalities (Wang & Dong, 2015; Wang et al., 2019) and counties (Qu et al., 2017; Sun et al., 2017; Tan et al., 2018) as evaluation units, but **only a few have focused on the micro-scale** (Duan et al., 2020), such as the town level (Ma et al., 2019), village level (Li, Fan & Zhang, 2017; Zhang et al., 2014; Zhu et al., 2019), and geographical grid level (e.g. 500m*500m) (Li et al., 2011; Liu et al., 2018). However, the success of a system at the macro or meso level is no guarantee of success at the micro level, and the shortcomings of certain communities may be

obscured by the positive statistics collected at the macro or meso level. In addition, some studies have measured the multifunctional development of some villages (Gu et al., 2019; He et al., 2020; Zhang, Li & Xu, 2018), while the effects of RLC on village development have received less attention. In rural China, the village serves as both the fundamental socio-economic unit and the fundamental cell of the rural territorial system (Liu, 2018; Tu et al., 2018). It is in the village that many rural inhabitants carry out their daily activities of production, living, and culture. In practise, peasant households are the direct stakeholders in RLC projects, while the village is the fundamental unit upon which RLC projects are based. Meanwhile, the multifunctionality of rural areas is most often implemented at the village level (Liu et al., 2021; Wilson, 2010). Therefore, **investigating and analysing the relationship between RLC and RV at the micro-level (e.g. village/community level) can be more instructive in easing the challenges that arise in rural China during socio-economic transformation** (Long, Zhang & Tu, 2019).

Based on the aforementioned analysis, the research intends to investigate two questions: ***Can land consolidation promote the vitalisation of rural villages in Eastern China? What factors influence the effectiveness of land consolidation to achieve RV at the village level?***

1.3 Thesis aim and objectives

The ultimate goal of this study is to advance the understanding on the relationship between land consolidation and village development to be used as a reference point to support human-centred RLC planning at the village level. Based on this goal, the main task of this study, based on data collected from various sources, is to answer the proposed questions by combining theoretical analysis with case studies and combining qualitative analysis with quantitative analysis. The main task of the research will be achieved through the following steps to achieve objectives under the overarching goal:

1) Critically reviewing the literature on multifunctional land use, rural vitalisation, and land consolidation to analyse the relationship between the three concepts (Chapters 2, 3, and 4).

2) Constructing a theoretical model to systematically analyse the relationship between RLC and RV from a multifunctional perspective. The theoretical model integrates a conceptual framework and a measurement framework. The conceptual framework qualitatively evaluates how the spatial arrangement of RLC promotes RV. The measurement framework accesses the effectiveness of RLC on RV and the supply and demand balance of and for RLUFs based on the available statistics (Chapters 5 and 6).

3) Comparing and contrasting the impact of land consolidation on two geographically-diverse villages during the period 2010-2020 by applying the qualitative method to analyse the processes and modes of their development (Chapters 7 and 8).

4) Measuring the impact of land consolidation on local development, and the supply-demand of and for RLUFs, in the two cases to further reveal the main influencing mechanisms of RLC on vitalisation via the combination of quantitative and qualitative methods (Chapter 9).

5) The comparison of RLC and rural development in the two villages involves the proposal of land use strategies for their future development from the supply side, and a final section in which lessons learnt are summarised and recommendations made (Chapter 10).

1.4 Expected contributions

This research focuses on and contributes to the patterns of land consolidation development at the village level based on the rural vitalisation strategy both in terms of theory and practise. The pattern of land consolidation has not been fully investigated at this spatial level in China.

From the theoretic perspective, the thesis will contribute an updated model

and a methodology for analysing the relationship between RLC and RV within a multifunctional framework; measuring the effectiveness of RLC on village development and the difference between supply and demand of and for RLUFs; extracting the modes of RLC in promoting villages' development and further revealing its mechanisms.

First, this thesis will establish a conceptual framework focusing on land, one of the elements of rural development, to explain the interactions among multifunctional land use, RLC, and RV. In this framework, the research object will be more concrete than the previous relative Chinese research. In addition, compared with the previous studies by Chinese scholars that focused either on construction land (Ma et al., 2019; Wang & Li, 2011; Yang et al., 2020) or farmland (Hu et al., 2014; Zhang et al., 2018; Zhong et al., 2017), this thesis will comprehensively analyse the functions of rural land use, as well as the relationship between RLC and rural development, by including construction land, agricultural land and undeveloped land in its research scope. Second, the analytical framework in this thesis is distinct from multifunctional assessment frameworks that focus only on the supply side or demand side (Holmes, 2006; McDowell et al., 2018; Zhang et al., 2014), and those that do not consider the role of RLC in the supply and demand of and for land use functions (Hermanns et al., 2017; Ma et al., 2019). As the product of reciprocal relationships among the functional demand of RV, the functional supply of RLC, and RLUFs, land use multifunctionality(Wiggering et al., 2006) is of great importance for understanding how RLC affects RLUFs and how they satisfy the diversified demands of rural development. Thus, a systematic methodology will be introduced in this thesis to measure the multifunctionality of rural land consolidation by combining the functional supply of RLC, the functional demand of RV, and the effectiveness of RLC on RV. The functional supply will be measured by analysing the relationship between land use types and land use functions. In addition, functional demand and the effectiveness of RLC will be assessed through two sets of separate indicators in a case-based and flexible way.

Moreover, through the analysis of different cases, modes and pathways will be extracted for RV promoted by RLC, which are influenced by geographical positions. Furthermore, the influencing mechanisms of land consolidation on village development can be revealed based on a combination of quantitative and qualitative analyses as described above.

The understanding of such mechanisms in this thesis can help to develop new approaches that could be applied to address not only local problems but land use issues in other places in similar geographical situations to the village cases studied. In particular, the theoretical research and the demonstrated feasibility of multifunctional evaluation for rural land use can promote the changing of its evaluation systems focusing on the economic or environmental functions to a multifunctional evaluation system based on ecological, social, economic, and cultural functions. This is of great significance for building a harmonious rural society that is resource-saving, environmentally-friendly, and economically sustainable. In addition, the analytical results from the case studies can provide two patterns that could inform policymakers under different social contexts to identify the improper land use pattern in rural areas thus making location- and quantity-appropriate land use choices at the village level and even town level. Hence, the frameworks designed, methods and data used, and results obtained in this study can make contributions to future research and planning concerning rural land use and development in developing regions, especially in Asia.

1.5 Overview of chapters

The rest of the thesis after Chapter 1[9] is organised into the following four parts. In Part 1 (background and literature review), the background and literature concerning multifunctional land use, RLC, and RV, and the relationship among them are critically reviewed and combed. Part 2 (theoretical model), followed

[9] Parts of Chapter 1 are derived from the articles published by the author of this thesis as the first author in *Progress in Geography* (Chinese), *Habitat International*, and *Journal of Rural Studies* during his doctoral study.

the above analysis, develops the theoretical model of this research based on theories and the general objectives of land consolidation and rural vitalisation, including a conceptual framework and a measurement framework. Then, two cases are selected in Part 3 (model verification via case studies) for quantitative and qualitative analyses to demonstrate the feasibility of the above theoretical model. Finally, Part 4 provides the discussion and conclusion (Fig. 1-2).

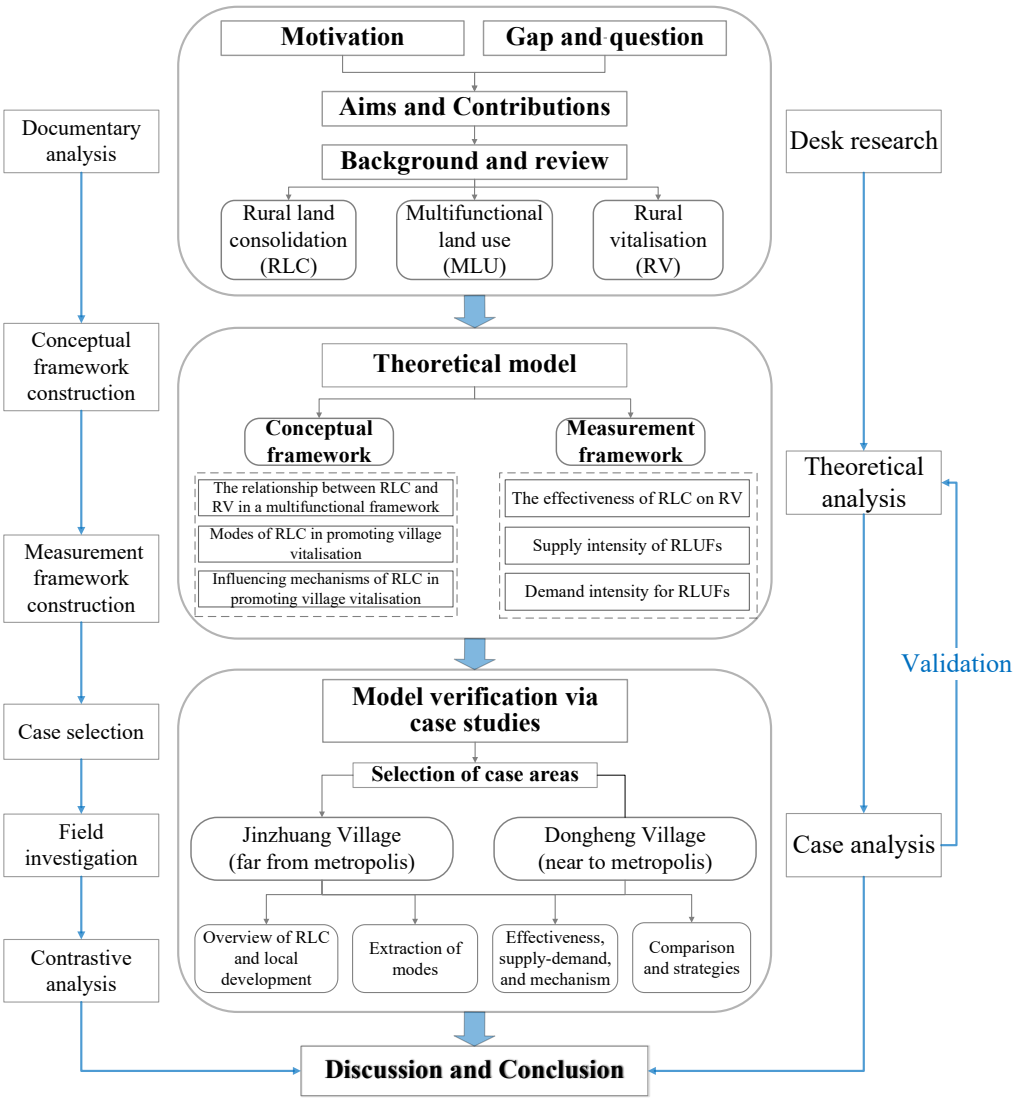

Fig. 1-2. Research flow

Part 1 Background and literature review

Chapter 2 (Multifunctional land use) reviews the concept of multifunctionality, involving the ways to understand it and its development in agricultural and rural fields. Then, the research further examines the studies on the topic of multifunctionality in rural land use. Finally, the concept, categories,

and calculation approaches to rural land use functions are reviewed as the base for developing the measurement framework in this study. Parts of this chapter are derived from the article published by the author of this thesis as the first author in *Progress in Geography* (Chinese) during his doctoral study.

Chapter 3 (Rural vitalisation) first critically discusses the potential of applying the concept of multifunctional rural development to achieve RV worldwide. The following content argues that rural vitalisation is the goal of rural development based on the review of the literature, and outlines this core stage and goal in the process of rural development in China. In particular, the contemporary land system reforms and the rural development process in China are outlined. This is followed by a review of related research that supports the discussion of what is RV, especially village vitalisation, in China (the theoretical basement of Chapter 6). Parts of this chapter are derived from the article published by the author of this thesis as the first author in the *Journal of Rural Studies* during his doctoral study.

The first three sections of **Chapter 4 (Rural land consolidation)** critically discuss the relationship between multifunctional land use and RLC, review the development of RLC and the way it is conceptualised, and classify RLC from different perspectives. Then, it elaborates on the evolution of land consolidation at the policy level in rural China from a functional perspective. Against these backgrounds, the final two sections summarise the contemporaneous influence of RLC in China and the factors influence on the performance of RLC. Parts of this chapter are derived from the articles published by the author of this thesis as the first author in *Progress in Geography* (Chinese) and *Land Use Policy* during his doctoral study.

Part 2 Framework construction

Chapter 5 (Conceptual framework) presents the conceptual framework underpinning this research. Specifically, this chapter uses a theoretical approach under the supply-demand framework of RLUFs to deliberate the relationship between RLC and RV. This framework covers 1) the rural land use structure and

functional supply, 2) the impact of RLC on land use structure and functions, 3) RV's demand for RLUFs that will be used to generate the supply-demand assessment framework in Chapter 6, as well as 4) the evolution of the relationship between the supply of RLUFs, demand for RLUFs, and RLC. The next section puts forward two modes of RV promoted by RLC from a functional perspective. Finally, the mechanisms of RLC in promoting rural development are expounded theoretically. Parts of this chapter are derived from the articles published by the author of this thesis as the first author in *Progress in Geography* (Chinese), *Journal of Rural Studies,* and *Habitat International* during his doctoral study.

Chapter 6 (Measuring supply-demand of and for RLUFs and the effectiveness of RLC) concentrates on the indicators and methods for measurement, in particular the theoretical foundations and logic for indicators selection at the village level. Based on the theoretical analysis in the last chapters, some indicators closely related to land use are selected to measure the effectiveness of RLC on local development to reveal the quality of RLC projects at the village level. Similarly, the calculation methods are developed by combining the selected indicators with the updated mathematical formulas to evaluate functional supply intensity and functional demand intensity. Parts of this chapter are derived from the articles published by the author of this thesis as the first author in *Progress in Geography* (Chinese), *Journal of Rural Studies*, and *Habitat International* during his doctoral study.

Part 3 Case study

Chapter 7 (Case selection and data processing): The two frameworks that comprise the theoretical model are tested and specified by using two real-world case studies (Chapters 8 and 9). Initially, the importance of carrying out case studies is expounded. Moreover, the reasons for conducting typical studies on two selected cases are introduced. Finally, the required data, data acquisition methods, and data processing are elaborated. Parts of this chapter are derived from the articles published by the author of this thesis as the first author in the

Journal of Rural Studies and *Habitat International* during his doctoral study.

Chapter 8 (Modes of local vitalisation promoted by RLC from a multifunctional perspective in the two case areas) summarises the development process observed and recorded from a rural village (Jinzhuang) far from major cities and a rural village (Dongheng) near to major cities, respectively, as well as reveals the RLC-driven spatial restructuring processes in both villages from 2010-2020. The main modes of RV promoted by RLC during 2010-2020 from a functional perspective in the two villages are further extracted (based on Chapter 5). Parts of this chapter are derived from the articles published by the author of this thesis as the first author in the *Journal of Rural Studies* and *Habitat International* during his doctoral study.

Chapter 9 (RLUFs supply-demand and local vitalisation in two villages under the influence of RLC) applies the frameworks established in Chapters 5 and 6 to the case areas. This chapter measures the RLC's effectiveness on the local vitalisation as well as the influence on the supply-demand of and for RLUFs in two villages, followed by analysing the mechanisms of RLC in promoting the development of the two villages. Parts of this chapter are derived from the articles published by the author of this thesis as the first author in the *Journal of Rural Studies* and *Habitat International* during his doctoral study.

Part 4 Discussion and Conclusion

Chapter 10 (Discussion: Comparison, RLC strategies, and Inspiration) deals with the case comparison and corresponding strategies. Initially, the two villages are compared, based on the preceding quantitative and qualitative analyses, in terms of rural development from the perspectives of purposes, main influencing factors, and outcomes of the implementation of RLC. In the comparison of purposes, it analyses and discusses how the geographical position and resource endowment influence the direction in which RLC projects are carried out; in the comparison of influencing factors and results, it is revealed what has driven the relatively successful implementation of RLC projects in the two villages, but what has led to the two villages producing different outcomes.

Corresponding RLC strategies hereafter are proposed for the two villages based on analysis in Chapters 8 and 9. The final section puts forward the lessons learned and inspiration, such as '*Did every instance of RLC bring good results for local development?', 'A comparison of the Chinese and European experiences in RLC'*, and '*How should land consolidation respond to the next potential lockdown?'.* Parts of this chapter are derived from the articles published by the author of this thesis as the first author in the *Land Use Policy, Journal of Rural Studies,* and *Habitat International* during his doctoral study.

Chapter 11 (Conclusion and further research) concludes in three main sections. The first section highlights the research innovations and main outcomes, while the second section discusses the research limitations and provides suggestions for further research concerning RLC and rural development. Ultimately, the whole thesis is finished with a concluding remark. Parts of this chapter are derived from the articles published by the author of this thesis as the first author in the *Journal of Rural Studies* and *Habitat International* during his doctoral study.

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Chapter 2 Multifunctional land use

2.1 Introduction

The core goal of this research is to advance the understanding on the relationship between rural land consolidation (RLC) and rural vitalisation from the perspective of multifunctional land use. Thus, it is considered necessary to first review literature concerning multifunctional land use to show what exactly it is and why it is worth further study. Section 2.2 is concerned with presenting ways in which multifunctionality can be understood. Thereafter, Sections 2.3, 2.4, and 2.5 (concerning the conceptual development of multifunctionality) review multifunctional agriculture, the multifunctional rural transition, and multifunctional land use (MLU), respectively. Finally, Section 2.6 focuses on the definition, categories, and measurement of rural land use functions (RLUFs).

2.2 Understanding 'multifunctionality'

The notion of 'multifunctionality' can be seen as something that exhibits 'multiple functions' (Wilson, 2007). According to the Organisation for Economic Co-operation and Development (OECD), "multifunctionality refers to the fact that an economic activity may have multiple outputs and, by virtue of this, may contribute to several societal objectives at once" (OECD, 2001). This is considered to be the 'definitive recognition' of the concept of multifunctionality at the international level (Delgado et al., 2003).

There are essentially two ways to understand the concept of "multifunctionality" (OECD, 2001). One interprets multifunctionality as an economic activity which has multiple, interconnected outputs or effects. There are numerous ways in which economic activities can be multifunctional. The second perspective uses the term to describe an activity which is expected and assigned to fulfil certain functions in society. Consequently, multifunctionality

is not only a characteristic of an activity but also a kind of value that people assign. These two views can both be termed the "positive" aspects of multifunctionality, although multiple outputs in production can cover both "goods" and "bads" (i.e. positive and negative externalities) (Vejre et al., 2007).

In terms of rural areas, the notion of multifunctionality was first applied in the fields of forestry, agriculture and landscape ecology (Loomis, 1993; Mander, Wiggering & Helming, 2007; Mather, 2001; OECD, 2001; Randall, 2002; Van Huylenbroeck & Durand, 2003; Wilson, 2007). Moreover, multifunctionality-based research and policy have evolved over time: from monofunctional agendas (such as forest protection) to economically-oriented productive outputs, and on to a focus on non-productive needs, such as social, ecological, environmental, and landscape needs (Haripriya Rangan, 2001; Wiggering et al., 2006; Wilson, 2007; Wilson & Memon, 2005).

2.3 Multifunctional agriculture

The emergence of the concept of agricultural multifunctionality can be traced back to the literature and policy documents of some developed European countries in the later 1980s under the influence of the notion of multifunctional forests (Wilson, 2007). The first formal official European initiative to advocate multifunctional agriculture[10] was at the Commission of the European Economic Community (Commission of the European Economic Community, 1988). In the 1990s, the notion of 'multifunctionality' gained increasing importance as a way to achieve sustainable development and a new way to grant fresh insight into the development of agriculture (Noe, Alrøe & Langvad, 2008). The notion of multifunctional agriculture was first proposed at the international level at the 1992 Rio Earth Summit (Delgado et al., 2003). Subsequently, the concept of

[10] Based on the two ways to understand the concept of "multifunctionality", the concept of 'agricultural multifunctionality' focuses on describing various functions of agricultural production, while the concept of 'multifunctional agriculture' pays more attention to making the agricultural production "more" multifunctional. Essentially, there is no difference between the two concepts and they could be used interchangeably to describe the same processes/phenomena of agricultural production.

"multifunctional agriculture" was first used by European Council for Agricultural Law in 1993 to provide legislative support for the development of agricultural sustainability (Pribadi et al., 2017), and was officially introduced by the European Commission to the OECD Agricultural Commission Meeting in 1998 (Gallardo et al., 2003). In 2001, the OECD (2011) officially advanced the concept of multifunctional agriculture and its analytical framework. Since then, this concept has drawn extensive attention from the European Union (EU), Food and Agriculture Organisation (FAO), OECD, and World Trade Organisation (WTO). The outcome of this has been that multifunctional agriculture is mentioned and valued by many developed and some developing countries, such as China (Fang & Liu, 2015; Song & Robinson, 2020), in policy documents since the late 1990s to promote agricultural and rural development.

Fruitful studies have been devoted to agricultural multifunctionality and multifunctional agriculture. In its broadest sense, multifunctional agriculture is considered as a farming method that can provide multi-functions, such as providing environmental benefits and contributing to the socio-economic viability of many rural areas, beyond serving as a fundamental basis for food and fibre production (Commission of the European Economic Community, 1988; Potter & Burney, 2002). It is generally agreed that the key characteristics of multifunctional agriculture are related to the existence of multiple commodities and non-commodity outputs which are jointly produced by agriculture (OECD, 2001). However, some of the non-commodity outputs may show the features of externalities or public goods that do not exist in the market or function poorly (Mander, Wiggering & Helming, 2007). Theoretically, Wilson (2007) anchored the concept of multifunctional agriculture in the productivist and non-productivist transition to describe and explain the contemporary agricultural transition. In terms of functions' classification, Van Huylenbroeck and Durand (2003) stated that, in addition to those relating production, agriculture includes the other three functions: territorial, environmental, and socio-cultural.

In sum, multifunctional agriculture can be seen as the ability of agricultural

production to provide various products and services for the needs of human society, such as food security, environmental benefits, landscape values, cultural heritage, the viability of rural communities, and recreational opportunities. The eventual goal is to establish principles of good policy practice that permit the achievement of multiple food-based and non-food-based objectives to be cost-effective and positive (OECD, 2001). Currently, the notion of 'multifunctional agriculture' has become an almost ubiquitous term used by various actors such as policymakers, academics, and grassroots-level stakeholders (McCarthy, 2005). It has not only steadily entered the political and scholarly debate regarding the role of agriculture in the economy, society, and eco-environment as a whole, but has also become a new paradigm for agriculture and rural development (Fang & Liu, 2015; Mander, Helming & Wiggering, 2007; Song & Robinson, 2020; Song, Robinson & Bardsley, 2022, 2022; Van Huylenbroeck & Durand, 2003). Further, the pursuit of sustainability since the 1980s has enabled the transition of multifunctional research from the agricultural field to those of rural development and land use (Dalgaard et al., 2007; Holmes, 2006; Kates et al., 2001; Mander, Wiggering & Helming, 2007; Mather, Hill & Nijnik, 2006).

2.4 The multifunctional transition of rural development

The 1970s and 1980s saw a fundamental paradigm shift in European rural areas (particularly in Western Europe) from production-oriented policies towards ones focused on rural development; that is, trying to find a benign interrelationship between agriculture and rural economy, society and environment (Dalgaard et al., 2007; Wiggering et al., 2006). In the meantime, the concept of multifunctionality has begun to appear in the forestry and agricultural sectors, and to a certain extent, it fits the idea of sustainable development. The concept of "multifunctionality" was subsequently adopted by rural development studies.

Since the 1970s, with the robust growth of the rural economy, the main

economic structure of rural areas in developed or industrialised regions and countries has shifted from agriculture to a more diversified one that includes primary, secondary and tertiary industries (Ma et al., 2019; Wilson, 2007). Holmes (2006) conceptualised the phenomenon of this shift from monofunctional to multifunctional rural development as the 'multifunctional rural transition'. The emergence of multifunctional resource utilisation and the enhancement of spatio-temporal heterogeneity in rural areas (i.e. multifunctional rural transition) are jointly driven by agricultural overcapacity, the emergence of market-driven amenity values, as well as by growing societal awareness of sustainability and preservation issues (Holmes, 2006). Léon (2008) stated that rural areas are not only spaces traditionally supplying goods from agriculture, forestry, and extractive and artisanal industries, but have also become places for leisure, tourism, living, and nature and resource protection. Similarly, Chen et al. (2018) agreed that, with the acceleration of urbanisation and industrialisation, rural areas have shifted from a territorial system focused solely on the traditional production function of agricultural products to a multifunctional territorial system focused on various functions such as agriculture, industry, leisure, culture, retail, and ecology. Liu et al. (2011) proposed that multifunctional rural development refers to the process in which rural areas integrate their attributes and joint effects with other systems, such as urban systems, to produce effects beneficial to nature and human development, with obvious spatio-temporal heterogeneity. Therefore, it can be concluded that the concept of multifunctional rural transition is helpful in reducing reliance on traditional agriculture while simultaneously achieving multifunctionality via the rural diversification approach, and that it has positive implications for coordinating the development of rural society, economy and environment, as well as bolstering rural communities' resilience in the face of both internal and external challenges (De Rosa, McElwee & Smith, 2019). It has also pointed to novel areas in rural development and rural geography (McCarthy, 2005; Renting et al., 2009).

With the rapid development of urbanisation and industrialisation, most of

China's rural areas have been transformed over recent decades from a territorial system focusing only on traditional agricultural production functions to a multifunctional territorial system with agricultural, industrial, recreational, cultural, retail and ecological objectives (Chen, Huang & Wang, 2018). This is the result of a combination of policy-oriented and market-induced forces (Long et al., 2022). Most areas of rural China have experienced and/or are experiencing the "Rural household contract responsibility system" since the "Reform and Opening-up" (1978), "Rural cooperatives" (i.e. farmer professional cooperatives), and the construction of the "New Socialist Countryside" after the new millennium (Su, 2009; Yang et al., 2021). In 2017, the Chinese government proposed the "Rural Vitalisation Strategy", whose goals cover five aspects: industry, environment, culture, governance and life (Long, Zhang & Tu, 2019). These objectives signal that China's rural development is moving towards a new stage, one in which production, living, environment, and culture are all supposed to advance in conjunction, and rural areas are intended to be vitalised comprehensively (Long, 2020). However, research has shown that, due to regional differences in resource endowments, location and transportation infrastructure, urbanisation processes, as well as economic strength, the multifunctional development of rural China exhibits significant spatial heterogeneity (Long et al., 2022).

2.5 Multifunctional land use (MLU)

Land is a multifunctional resource. It can not only provide food, water, and other necessary things for humans (Xiang et al., 2019), but also is the material foundation and spatial carrier for major human activities (Long, 2014; Long et al., 2021). Land, thus, can be seen as the vital carrier of multifunctional agriculture (Long, Zhang & Tu, 2019; Mander, Helming & Wiggering, 2007). To deepen the theoretical research on multifunctional agriculture, a more generic 'land use multifunctionality' (LUM) concept was proposed and developed in the

late 1990s (Oostindië, Roep & Renting, 2006). This concept is rooted in the concepts of ecosystem goods and services, agriculture, and landscape function (Liu et al., 2016). In 2004, the concept of multifunctional land use (MLU) [11] was formally proposed by the SENSOR project (Sustainability Impact Assessment: Tools for Environmental Social and Economic Effects of Multifunctional Land Use in European Regions) in the European Union's Sixth Framework Programme supported by the Global Land Project (GLP) (Helming, Pérez-Soba & Tabbush, 2008). LUM represents the ability of land use to provide products and services for the various demands set by society on rural territories (Gao, Zheng & Liu, 2018; Paracchini et al., 2011), while MLU is a vital way to achieve the sustainability of land use and rural development (Vejre et al., 2007).

The concept of MLU helps to merge multiple foci (i.e. economy, society and environment) in rural areas by emphasising the rule that economic action is per se accompanied by ecological utility; that is, both commodity output (e.g. yields) and non-commodity output (e.g. landscape aesthetics) should be valued (Wiggering et al., 2006). It can be regarded as a way toward rural sustainability (Pérez-Soba et al., 2008). With the explosive growth of popularity in GLP (changed to Global Land Programme in 2016), the concept of multifunctionality has been given more importance to sustainable land development, making MLU a new concern of LUCC (GLP, 2005; Liu et al., 2018).

2.6 Rural land use functions (RLUFs)

2.6.1 Concept development and differentiation

In its early stages, consideration of land functions was often associated with ecosystem service functions (Marsh, 1864). In the 1980s, with the rise of landscape ecology, Haase & Richter (1983) divided landscape functions into production, human ecology, carrying, and regulation functions, covering some land functions. The concepts of ecosystem services (Costanza et al., 1997) and

[11] As above, there is no essential difference between "land use multifunctionality" and "multifunctional land use", and they could be used interchangeably to describe the same processes of land use.

ecosystem functions (de Groot, Wilson & Boumans, 2002) have been proposed to promote people's understanding of the multi-dimensional impact of land use change on regional sustainability, as well as to advance a methodology for the Millennium Ecosystem Assessment. Meanwhile, the upsurge of the GLP has also promoted the in-depth study of land functions. As early as 1999, the FAO systematically proposed then basic functions of land supporting humans and other terrestrial ecosystems (FAO, 1999).

On the other hand, 'land use function' is also a frequently-used term in some related studies. Land use is an important human activity that determines the performance of the environmental, economic, and social functions of an ecosystem, and the performance of an ecosystem's environmental, social and economic functions is highly dependent on the pattern and intensity of land use (Wiggering et al., 2006). Regarding the relationship between land function and land use function, some scholars believe that 'land function' denotes a description of the function of the land itself, whereas 'land use function' reflects the use and need of human beings relating to land (Liu et al., 2016). However, other scholars argue that it is difficult to distinguish land functions and land use functions thoroughly, or else make no distinction between the two (Liang, Cao & Sun, 2003; Wiggering et al., 2006), because land functions include not only the natural functions of the land but also the functions generated by human needs (FAO, 1999; OECD, 2001). In addition, with human activities permeating almost every part of the earth, there is not much unused, undetected or vacant land in the true sense. Unused land, such as virgin forests and swamps, is also considered to be a human arrangement of land, providing functions such as ecological regulation for human survival and development (Duan et al., 2020). Therefore, the two concepts of land function and land use function will not be strictly distinguished in this study.

LUM and MLU both emphasise the functional diversity of rural land use (Zhen et al., 2010), generally represented by rural land use functions (RLUFs) (Du, Sun & Wang, 2016; Liu et al., 2018; Verburg et al., 2009). The concept of

RLUFs was initially proposed and widely adopted to further promote multifunctional agriculture and even rural development (Kates et al., 2001; Mander, Wiggering & Helming, 2007). It is perceived as the products and services provided by diversified land uses for the various demands set by society on rural territories, the changes of which outline the most relevant social, economic and environmental issues in an area over a given timeframe (Ma et al., 2019; Pérez-Soba et al., 2008). However, some issues, such as environmental contamination and resource wastage, may arise due to the supply-demand imbalances of RLUFs (Liu et al., 2018). Thus, the supply-demand mismatch of RLUFs over the long term is seen to be a significant contributor to the emergency of rural problems (Ma et al., 2019). A particular challenge today in LUCC involves the satisfaction of diverse human demands placed on limited land resources through reasonable/responsible MLU (Liu et al., 2018; Liu, Liu & Chen, 2011; Ma et al., 2019).

2.6.2 Interpretation of RLUFs

Land Change Science/Land System Science (LCS/LSS) suggests that, apart from location, the ways to characterise changes in land use functions are shifts between distinct function types and the shifts in the intensity of individual functions (Rindfuss et al., 2004; Turner, Lambin & Reenberg, 2007; van Diggelen et al., 2005; Verburg et al., 2013). Thus, there are two ways to understand RLUFs, that is, RLUFs consist of different sub-functions such as economic and ecological functions, and the intensity of each function may be different (Jiang et al., 2022). In addition, there is a need to take a look into the relationship between land use functional supply intensity (FSI) and land use intensity. On the one hand, there is a certain difference between them. Land use intensity is generally regarded as the difference between the socio-economic inputs and outputs levels per unit area within a certain period (Erb, 2012; Turner & Doolittle, 1978), while it can also be measured as the sum of the products of the proportion of different land use types and their correlation coefficients (Chen,

Chi & Li, 2019; Li et al., 2018). FSI, similar to ecosystem services intensity (Koschke et al., 2012; Millennium Ecosystem Assessment, 2005), is a comprehensive indicator that includes the various services/functions provided by a land use system. It refers to the comprehensive supply capacity of various functions per unit area in a certain period of time (Costanza et al., 1997; Koschke et al., 2012). And given that, in the case of the same building base area, the higher the number of building floors, the stronger the functional supply capacity (Ming et al., 2018), it is thus more reasonable to measure the functional intensity of construction land use via the ratio of building area (i.e. floor area ratio). On the other hand, there is a certain similarity between land use intensity and land use function intensity. Since the supply intensity of RLUFs is mainly embodied in the internal structure of rural land use, the supply intensity of RLUFs can also be reflected by the corresponding land use type(s) and area (Ma et al., 2019).

In summary, the number of land function *types* denotes the breadth of the supply capability of land use in a given area, while the *intensity* of supply of a function reflects the depth of the supply capacity of the corresponding land use. Effectively promoting the multifunctional output and quality of rural land use may be accomplished by arranging function types and intensities in a rational manner at suitable sites.

2.6.3 How to calculate the RLUFs

In the context of the SENSOR project, the Sustainability Impact Assessment Tool (SIAT) was established to assess the land use functions (LUFs) in Europe and nine sub-functions characterised by a set of economic, environmental and social indicators were identified (Pérez-Soba et al., 2008). This functional classification method provided new insight into the analysis of multifunctional land use. Based on the SIAT, LUFs have been classified into three main functions in much research, i.e. economic, social, and environmental functions (Paracchini et al., 2011; Zhang et al., 2019; Zhen et al., 2009), or else living, production, and ecology functions (De, Xu & Lin, 2017; Liu et al., 2018;

Ma et al., 2019; Qu et al., 2017), representing sustainability dimensions.

Since then, research on the assessment of multifunctionality has obtained increasing attention in scientific and policy debates on the future of sustainable development. For example, Reidsma et al. (2011) applied the concept of LUFs to assess the impact of land use policies on sustainable development in developing countries, and discussed the impacts of these LUFs with stakeholders based on a multi-criteria analysis by taking Taihu Basin in China as an example. Paracchini et al. (2011) designed a framework for the ex-ante sustainability impact assessment of policy scenarios on land use multifunctionality. Purushothaman et al. (2013) adopted LUFs framework in the participatory impact assessment to address multidimensional sustainability in agricultural landscapes. Xie et al. (2010) established a conceptual framework to assess Chinese LUFs by taking policy scenarios into account. Schößer et al. (2010) comparatively reviewed the LUFs framework developed in the SENSOR with other frameworks (i.e. ecosystem services as applied in the Millennium Ecosystem Assessment and landscape functions identified through landscape ecology) to assess their suitability for assessing sustainability impact of land use changes. Moreover, Koschke et al. (2012) employed a benefit transfer method and an expert-based assessment approach to assess the contribution of regional land use to the provision of ecosystem services. While they admitted that they could not fix the problem concerning the representativeness of stakeholders or expert groups in their assessment, they concluded that the expert estimation could be the most suitable method to estimate the provision of ecosystem services by regional land use. Some scholars have adopted and promoted similar methods in studies concerning the ecosystem service supply intensity of land use (Chen, Zeng & Li, 2021; Hu et al., 2015). Finally, some studies are based on the principle that different land use functions have the same status as each other (Pérez-Soba et al., 2008; Paracchini et al., 2011).

Today, with changes in land policies and the social economy in China, some scholars have proposed that the evaluation of LUFs should shift from the

traditional three-dimensional framework to a four-dimensional framework, such as production (economic), living (social), and ecological (environmental) and cultural functions (Jiang et al., 2020; Jiang, Long & Tang, 2021; Meng et al., 2019), or a five-dimensional framework, such as agriculture, non-agriculture, living, eco-environment and social security (He et al., 2020).

In a word, to measure the multifunctionality of land use or the functional intensities of multifunctional land use, the generally accepted approach is to construct an evaluation framework with appropriate indicators based on the classification of land use types and functions.

2.7 Chapter summary

Multifunctionality is the ability of an activity to serve multiple purposes simultaneously. In rural areas, the concept was first applied to forestry. Subsequently, multifunctional agriculture was officially proposed in Europe in the late 1980s. Since then, the role of multifunctionality in the economy, society, and ecological environment has gained more attention and has gradually become a new paradigm for agricultural and rural development. Alongside the multifunctional transformation of agriculture and the development of the concept of sustainable development, the multifunctional transition of rural development could be observed in developed countries. Multifunctional rural development refers to the transformation of rural areas from a territorial system that had been almost exclusively oriented towards traditional agricultural production functions to a territorial system integrating various functions such as agriculture, industry, leisure, culture, and ecology. It can help rural areas to rid themselves of excessive dependence on traditional agriculture, improve the diversity of rural industries, and enhance the resilience of rural development, thus producing a positive influence on local development. At present, many rural areas in China is moving towards a period of multifunctional transition.

Concerning the vital role of rural land in providing necessary things such

as food for humans and holding major human activities, MLU and RLUFs were successively proposed and developed in the late 1990s to deepen the theoretical research on multifunctional agricultural and rural development. RLUFs can be understood by function type and function intensity. The former is manifested in land use types, while the latter is closely connected with corresponding land use structure. Moreover, constructing an evaluation framework with appropriate indicators based on the classification of land use functions is a generally accepted approach for calculating and measuring the multifunctionality of land use or the functional intensities of land use.

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Chapter 3 Rural vitalisation

3.1 Introduction

This chapter focuses on rural vitalisation (RV). It is one of the core goals of rural development in many countries and is also the central focus of this research given that the core objective of RLC in China is to vitalise rural areas. This chapter reviews and explains the concept of RV and how it is related to the key elements in the study. Following the introduction, Section 3.2 provides a critical discussion concerning the relationship between multifunctional rural development and RV in general. Section 3.3 describes the basis of the current land administration system, the history of China's rural development, and related policies. Finally, Section 3.4 sets out the definition, the main content, and the functional demands of rural vitalisation in China. The review and examining of related concepts relating to China forms a meaningful base for the development of theoretical frameworks for this study.

3.2 Multifunctional rural development and rural vitalisation

As mentioned in Chapter 2, with its emphasis on the ability of rural development to generate multiple functions and provide multiple services, multifunctional rural development provides a new research perspective and theoretical paradigm for rural studies (Holmes, 2006; Ma et al., 2019; McCarthy, 2005). Although the status and stages of rural development vary from region to region, rural villages in different regions are expected to develop in a diversified and harmonious manner. In order to achieve the goal of rural (re)vitalisation, many countries and regions have formulated corresponding development strategies. Rural (re)vitalisation, whether as a development strategy or a goal, emphasises not only the multifunctionality of rural development, but also the coordinated development between different functions. This can be reflected in the objectives of rural (re)vitalisation in many places. For example, rural

revitalisation in the European Union aims to improve well-being and quality of life in rural areas by optimising social, economic, and environmental conditions (The European Network for Rural Development Thematic Group on Rural Revitalisation, 2022). In South Africa, rural revitalisation is considered a successful rural development strategy, which requires the integration of the local economy, social environment, human settlements and eco-environment, and governance (Meyer, 2014). In China, the central government has proposed its rural vitalisation strategy (see Section 3.4) involving the economy, environment, society, governance, and well-being, aiming to vitalise rural areas and promote urban-rural integrated development (Long, Zhang & Tu, 2019). Moreover, the tight integration between economic development, cultural industry, social life, and environmental protection is considered to be the key to revitalising Japan's rural areas (Qu & Cheer, 2021; Rausch, 2009)

However, the interrelations among functions created by one human activity include coordination (synergies) and conflict (trade-offs). The former refers to the positive interaction between functions; the latter refers to one function that would restrict the ability of another function (De, Xu & Lin, 2017; Liu et al., 2018). This is because the same function may drive overall development towards "good" or "bad" directions under different contexts (Vejre et al., 2007). This implies that there may be a mutually-reinforcing and inhibiting relationships between multifunctional rural development and RV.

On the one hand, rural multifunctionality and rural vitalisation reinforce each other. First, multifunctional rural development can be of positive significance for rural areas which are moving beyond an over-dependence on traditional agriculture and achieving multi-function through diversified approaches (De Rosa, McElwee & Smith, 2019), thus optimising the internal structures and functions of rural areas (Pribadi et al., 2017). In addition, rural multifunctionality can be seen as a response to the need to address issues of poverty among rural communities and families, especially those in geographic locations inconducive to economic growth, to cope with challenges to survival

through a variety of strategies (Parnwell, 2007). Further, rural multifunctionality helps to establish a network of interconnecting between actors in different sectors. In this way, through the functional connection between rural actors and the combination of competitive but also cooperative business strategies, it can promote the realisation of a diversified combination of public and private products in rural areas to meet the various needs for local development (Bassi, Zaccarin & De Stefano, 2014). This is of positive significance for the enhancement of the resilience of rural communities, enabling them to cope with endogenous changes and external disturbances, as well as laying a solid foundation for the realisation of rural vitalisation (De Rosa, McElwee & Smith, 2019; Wilson, 2010). Meanwhile, the objectives of rural vitalisation also reflect its requirements for the diversified development of villages and rural areas.

On the other hand, multifunctional rural development may conversely have an inhibitory effect on rural vitalisation. With the acceleration of the urbanisation process, some decisions made by rural actors may reduce the quality of multifunctionality, such as the rural-urban migration of massive numbers of young people and environmental pollution caused by urbanisation and industrialisation in rural areas (Wilson, 2010). Additionally, the multifunctional model of rural development may place too much emphasis on environmental capital, which may lead to agricultural cultural areas being occupied by ecological spaces, potentially damaging farmers' incomes as a result, thereby inhibiting rural employment and social security functions (Ma et al., 2019). If policymakers simply pursue the number of rural functions while ignoring the intersection and balance between them, the quality of multifunctionality will be compromised (Wilson, 2010), which in turn will constrain the vitalisation of rural areas. If they are always concerned with the synchronism or interdependence between multiple functions while ignoring the stages of development and the focus of different development periods, the pace of local development may be inhibited. This is because some site-specific characteristics will be predominant in different rural settings and at different spatial scales;

moreover, the “quality” of multifunctionality varies across cultural contexts (Wilson, 2010). Only when factors such as the stage of development, the role of the local area in regional and even global development, regional policies, resource endowment, as well as the socio-economic context are considered as a whole, is it possible to formulate a multifunctional development strategy that will enhance the overall quality of the local area and thus fit the objectives of RV.

Rural multifunctional development and rural vitalisation are therefore complementary. The vitalisation of rural areas must be based on the premise of stimulating the multifunctionality of rural development, but care should be taken to develop a coordinated development between multiple functions within a reasonable range based on geographical characteristics and socio-economic context, rather than the blind pursuit of diversification.

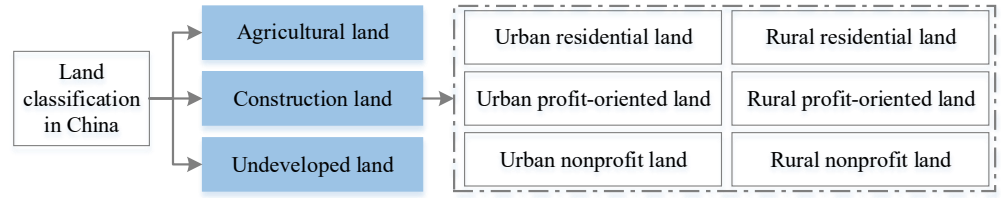
3.3 Rural development and land system reforms in China

Land is the main spatial carrier of socio-economic development and human activities in most developing regions and countries (Asiama et al., 2021; Long, 2014; Long et al., 2021; Pašakarnis & Maliene, 2010). The reform of China’s land system has played and likely will continue to play a pivotal role in the development of its rural areas (Chen et al., 2019; Zhou, Li & Liu, 2020). Concerning that the theme of this research focuses on land use and rural development in China, it is therefore necessary to review the relationship between China’s rural development process and its land system reform process before analysing China’s rural vitalisation strategy.

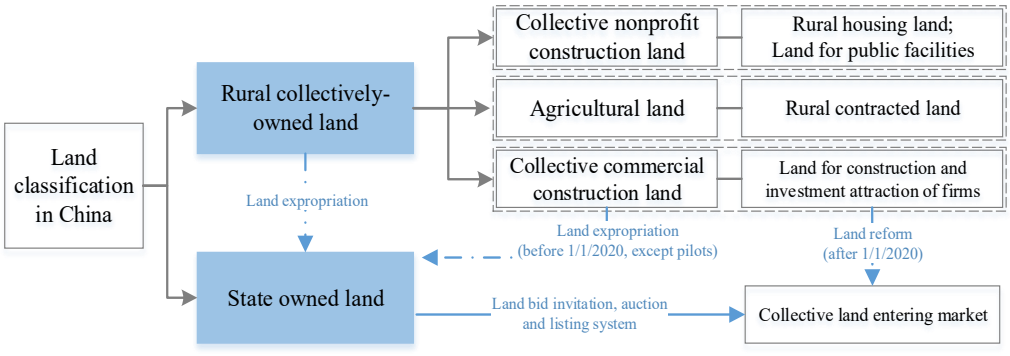
3.3.1 The current land administration system in China

In China, land is owned according to a socialist public ownership system; ownership by the people (in the form of state ownership), and ownership by the members of collectives (in the form of collective ownership). The earliest law on the current form of land ownership was the *Constitution* promulgated in 1982, which stipulates that land in urban areas is owned by the state, while land in rural

areas and urban suburbs, except for those under state ownership as stipulated by law, is collectively-owned. Since then, China has enacted the 1986 *Land Administration Law*, which was subsequently amended in 1988, 2004, and 2019[12]. According to the *Land Administration Law*, state-owned land mainly includes urban land as well as non-urban land legally expropriated for public interests such as urban, infrastructure, or military construction (The National People's Congress of the People's Republic of China, 2019). Rural collectively-owned land includes contracted agricultural land, non-profit construction land, the commercial (profit-oriented) construction land (Zhou, Li & Liu, 2020). According to previous laws and regulations, conversion to state-owned land through land expropriation was the only way for rural collectively-owned land to enter the land market (Liu, 2018). Currently, rural collectively-owned commercial construction land, according to the *Land Administration Law* amended in 2019, can directly enter the land market for the assignment, lease, and shareholding of the land use right (Fig. 3-1).



(a) based on land use types



(b) based on land ownership

Fig. 3-1. China's land reclassification (adapted from Zhou, Li & Liu, 2020)

[12] http://www.npc.gov.cn/npc/c30834/201909/d1e6c1a1eec345eba23796c6e8473347.shtml (access to the *Land Administration Law* amended in 2019)

3.3.2 Transition of rural development and land system reform

Rural development is closely related to the area and spatial allocation of land use, because land use change, mostly represented by the horizontal expansion and contraction of different land use types, has served, and continues to serve, an essential driving force affecting changes in rural development (Long, 2020; Smith et al., 2017). Change in the rural land system commonly cause large-scale land use changes; these decisions impact farmers' livelihood, agricultural development, and rural sustainability (Zhou, Li & Liu, 2020).

Rural land system reform has long been regarded as an important tool in stimulating the vitality of rural development (Long, 2020). Its purpose is the amendment of those institutions and laws which define and regulate the relationships between land and its users in order to properly redistribute land resources, thereby meeting diversified demands for the commodity and non-commodity outputs of land use which are a result of socio-economic development (OECD, 2001; Zhou, Li & Liu, 2020). This is why land system reform has been given priority in the agendas of many places, especially in developing areas (Gao, Liu & Chen, 2020; Peters, 2009; Smith, 2003; Travers et al., 2015). However, it is worth noting that rural China and the rural land system have been undergoing continuous reform for a long time. This is because a land system is the product of a specific era reflecting the socio-economic development of that time. However, when socio-economic development reaches a new stage, the previous land system may not only fail to promote socio-economical sustainability but may serve to hinder it (Jürgenson, 2016). Therefore, the reform and update of land systems are normal parts of the socio-economic developmental process; all the more so in periods of rapid development.

Compared with most developed countries, China is still a major agricultural country with a dense population but insufficient arable land resources; hence the stark contradiction between stakeholders. Moreover, the majority of China's reforms are addressing rural and peasants' issues, and rural and peasants' reform

originated from rural land system reforms (Lin & Ho, 2005; Xu & Tan, 2001; Zhou, Li & Liu, 2020). Since 1949, the Chinese central government has implemented a series of rural land system reforms to ease the tense human-land relationship and thus promote rural development (Chen et al., 2019; Liu, 2018). Over the past seven decades, the land system of rural China has gone through a series of reforms (Zhou, Li & Liu, 2020), such as the Land Reform (1950), Rural Collective Ownership (1956), Household Contract Responsibility System (1978), Land Administration Law (1986), Dynamic Equilibrium of Farmland (1997), Increasing vs. Decreasing Balance of Urban-Rural Construction Land (2004, 2005), National Land Consolidation Plan (2011-2015), and Rural Land Property Reform (2015). Chronologically, like the above-mentioned land system, rural China has also undergone some systemic political and socio-economic reforms, such as the People's Commune System (1958), Reform and Opening-up (1978), Township and Village Enterprises (TVEs) (1984), Reform of Market Economy System (1992), New Rural Construction (2005), and Rural Vitalisation (2017). Rural development in China can be roughly divided into four stages, during which land system reform has provided an indispensable impetus (Table 3-1). The four stages are critically reviewed as following.

(1) Socialist transformation of the countryside (1949-1977)

In 1946, the Communist Party of China (CPC) promulgated the *Outline of Land Law*, followed by the *Land Reform Law* in 1950. This is the legal basis to implement private land ownership, according to which farmers own their land. Reform of the national land system had almost been completed by 1953, and about 700 million mu[13] of rural land had been reallocated to 300 million farmers (Zou, 2020). The land reforms during this period not only ensured the establishment of the People's Republic of China and social stability, but also mobilised farmers' enthusiasm for production, promoted agricultural production, and created favourable conditions conducive to subsequent industrial and

[13] Mu is a unit of area in China, and 1 ha = 15 mu.

agricultural cooperation, given that improvements in agricultural productivity freed some labour. For example, China's grain output increased by nearly 25% in 4 years, from 113 million tons in 1949 to 139 million tons in 1953 (National Bureau of Statistics Rural Socio-economic Survey Team, 2000).

Although grain production increased somewhat after the land reform, it still did not meet the needs of society at the time. Moreover, the scattered and fragile individual agricultural production not only lacked the ability to resist natural disasters, but also hindered agricultural modernisation. The result of this was a prominent contradiction between food supply and demand. In the meantime, with the strategic direction being to make the development of heavy industry a national priority, the central government made the decision of "countryside support for cities" (Kamal-Chaoui, Edward & Zhang, 2009). Therefore, the policy of "state monopoly on the purchase and marketing of grain" (also known as the "unified grain procurement and marketing system") was implemented in 1953 to support the national strategy of developing the heavy industry sector (Zhong, 2001). This meant that peasants were not free to buy and sell the agricultural products that had been regulated by the state, but had to sell their surplus products to the government, which then distributed these products in urban areas. From the end of 1953 to 1956, a nationwide agricultural cooperative transformation campaign was subsequently conducted; that is, farmers, on a voluntary and mutual-assistance basis, formed non-profit cooperative economic organisations mainly engaged in agricultural production. This promoted the realisation of public ownership of the means of production, which further facilitated the implementation of the policy of the "state monopoly on the purchase and marketing of grain" (Zhong, 2001). By 1958, the movement had further developed into the People's Commune System; that is, a grass-roots regime characterised by highly unified administrative power and social power. This system continued in China for more than two decades. The reform of the rural system during this period had its flaws such as the famine of 1959 - 61, but it boosted the secondary sector. According to statistics, the ratio of the country's

total primary output to secondary industrial output had fallen from 2.33:1 in 1949 to 1:2.59 in 1978, with the share of heavy industry in the secondary sector rising from 26% to nearly 57% (Ministry of Agriculture and Rural Affairs of the People's Republic of China, 1989).

In addition, China established a household registration system (*Hukou zhidu*) to restrict the free movement of peasants to urban areas in order to ensure that farmland would not be abandoned and that there was sufficient labour for agricultural production. This was a measure taken by the Chinese government to control the size and management of towns and cities and to ensure the supply of agricultural products at a time when the level of socio-economic development was lower (Ye & Gao, 2019). The *Regulations of Household Registration* promulgated for the first time in January 1958 differentiated “agricultural household registration” and “non-agricultural household registration” for the first time to carry out household registration for urban and rural residents. This laid the foundation for the current household registration management system. In 1964, the *Provisions of the Ministry of Public Security on Handling Hukou Migration* further restricted the free movement of urban-rural populations.

A series of reforms were implemented during 1949-1978, which had a significant impact on the development of rural China at the time. On the one hand, these promoted the large-scale construction of farmland and water conservancy facilities, facilitated agricultural mechanisation, and provided a large amount of agricultural surplus for China’s industrialisation; On the other hand, enforced equalitarianism originated from the People’s Commune System had long damaged the basic rights and interests of farmers and rural areas and restricted their enthusiasm for production, resulting in the sluggish increase of agricultural production and even ecological degradation (Han, 2009; Li & Yang, 2005; Lin, 1990; Zhou, Li & Liu, 2020).

Table 3-1. The evolution of China's rural development and rural land system since 1949

(Gao, Liu & Chen, 2020; Zhang et al., 2019; Zhou, Li & Liu, 2020)

Rural reforms	Time	Rural land system reforms and Features
State Monopoly on the Purchase and Marketing of Grain (1953); People's Commune (1958); Regulations of Household Registration (1958)	1950	**Land Reform Law:** Private ownership of agricultural land
	1956	**Rural collective land ownership:** Rural land is collectively-owned and managed
Reform and Opening-up (1978); Township and Village Enterprises (TVEs) (1984); Abolishment of the System of Purchasing and Distributing Agricultural and By-products (1985); Two-tier Management System of Household Contract Responsibility System and Combination of Centralisation and Decentralisation (1991); Reform of Property Right System of TVEs (1992), Reform of Market Economy System (1992); Reform of the Household Registration System (1997);	1978	**Household contract responsibility system:** Farmers can contractually own management rights of rural collective land
	1986	**Land Administration Law (1986) and the Amendment (1988):** The use right of RLC can be legally transferred
	1988	
	1998	**Amendment of the Land Administration Law:** RLC can hardly be used for non-agricultural construction
Balance Urban-Rural Development (2003); New Rural Cooperative Medical System (2003), The Construction of the New Socialist Countryside (2005); Abolishment of Agricultural Tax (2006); Urban-Rural Integration (2007); New Rural Social Pension Insurance System (2009); Beautiful China Construction and Ecological Civilisation Construction (2012); Basic Pension Insurance System for Urban and Rural Residents (2014); Targeted Poverty Alleviation (2014)	2002	**Rural Land Contract Law:** Farmers' long-term contractual management right is legally protected
	2004	**Amendment of the Land Administration Law:** Rural land consolidation has been encouraged
	2005	**Increasing vs. decreasing balance of urban-rural construction land:** To ensure that the total amount of construction land will not increase, as well as that farmland area will not decrease
	2010	**Registration and certification of rural land rights:** The rights of rural collective land will be clarified and certified legally
	2014	**The separation of the three rights of rural land:** Promote the division of rural land ownership, contracting rights and management rights, and the transfer of management rights
	2015	**Rural three lands reform:** Rural land requisition, market reform for rural collective commercial construction, and homestead management
Rural Vitalisation (2017); Establish and Improve the Urban-Rural Integrated Development System, Mechanism, and Policy System (2019)	2017	**National land consolidation plan (2016-2020):** Comprehensive rural land consolidation becomes an important platform and starting point for promoting rural development.
	2018	**Cross-provincial circulation of surplus quotas for the increasing vs. decreasing balance of urban-rural construction land:** Promote the economical and intensive use of land as well as the urban-rural integration
	2019	**Amendment of Rural Land Contract Law:** Ensure gender balance in land contracting and prevent farmland from being abandoned
	2019	**Amendment of the Land Administration Law:** Protect permanent basic farmland and consolidate the achievements of "Rural three lands reform"

(2) Exploration and construction of the rural market economy (1978-2001)

In 1978, the Third Plenary Session of the 11th Central Committee of the CPC reflected on issues concerning rural development in the previous period, made a strategic decision to shift the focus of the whole Party's work to the modernisation of social and economic development, and put forward the policy of "Reform and Opening-up".

Between 1978 and 1992, the Chinese government carried out major reforms in rural political and economic systems in order to make full use of surplus rural labour, promote urban and rural population mobility, and gradually grow the rural market economy. For example, from the beginning of 1978, the central government encouraged farmers to develop a variety of side-line businesses (1982), encouraged the development of TVEs (1978, 1984), established township governments to replace the People's Commune System (1983), gradually relaxed the original strict household registration system to promote the flow of rural populations to towns and urban areas (1984, 1985), and abolished the system of uniformly purchasing and distributing agricultural and side-line products (1985). The result was that the market-oriented reform of agriculture enabled the huge potential of rural social productivity to be rapidly released. For example, by the 1990s, grain production had risen from 350 billion kilograms at the beginning of the "Reform and Opening-up" to nearly 500 billion kilograms in just 18 years; China had roughly solved the problem of feeding more than a billion people (around 21% of the world's population) with nearly 9% of the world's arable land and 6.5% of the world's water resources; the per capita production and consumption levels of agricultural products had surpassed the global average; and the value added of the industry by TVEs accounted for 50% of the country's industrial value added (Han, 2009).

In addition, the *Constitution* promulgated and implemented in 1982 stipulated that the villagers' self-governance system (the separation of

administrative and social powers) should be implemented in rural areas[14]. Special legislation (*Organic Law of Village Committees*) was made on this in 1998 (Zou, 2020), amended in 2010, and then revised in 2018[15].

Since 1992, a series of policies concerning system reform, enterprise development and population flow have been enacted to accelerate the pace of reform of the rural socialist market. In terms of systematic reform, the goal of systematic economic reform was formally established at the 14th CPC National Congress in 1992, being the construction of a socialist market economy, aiming to break away from the shackles of the planned economic system. In the same year, the reform of the property rights system of TVEs promoted the coexistence of multiple economic forms, the diversification of development modes in TVEs, and the active participation of TVEs in market competition to enhance the vitality of enterprises. Moreover, from 1997 to 2001, three documents on the reform of the household registration system were issued to ensure that farmers could work and settle in towns and small cities. In reality, the mobility of migrant workers has evolved from being predominantly between local TVEs in the 1980s to being predominantly inter-regional since the 1990s; the number of migrant workers moving across townships and regions grew from 50 to 60 million in the early 1990s to 130 million in 2007 (Han, 2009; Ning & Ye, 2016). This has facilitated the free flow of capital and goods, thereby stimulating the formation of a market economy, especially in the eastern coastal areas.

In the same period, the land system was also adjusted to meet the needs of socio-economic development and promote the establishment of a market economic system. At the end of 1978, Xiaogang Village of Fengyang County, as a pioneer in China's rural reform, took the lead in successfully implementing the Household Contract Responsibility System (HCRS), the main content of which was the "contracted fixed amount of production to the households (*baochan*

[14]https://flk.npc.gov.cn/detail2.html?MmM5MDlmZGQ2NzhiZjE3OTAxNjc4YmY1OWViODAwMzc%3D (access to the full text of *Constitution* (1982) of PRC)

[15] https://flk.npc.gov.cn/detail2.html?ZmY4MDgwODE2ZjEzNWY0NjAxNmYxZDkwMWM5NDE1ODk%3D (access to the full text of *Constitution* (2018) of PRC)

daohu, baogan daohu)[16]" (Crook, 1985; Lin & Ho, 2005). Subsequently, the Chinese government carried out pilot HCRS projects in different regions. In 1982, the HCRS was officially recognised as the agricultural production system of the socialist collective economy by the first *Central Document No.1* on rural work in the history of the CPC[17]. Since 1984, the HCRS has been popularised throughout China, covering 90% of rural households. The *Central Document No.1* of 1984 stipulated that the period of land contract would be 15 years, which was extended to 30 years in the Third Plenary Session of the 15th Central Committee of the CPC in 1998. Further, the *Land Administration Law* promulgated in 1986 (revised in 1988 and 1998) promoted the orderly and comprehensive management of urban and rural land nationwide, as well as the subcontracting and circulation of contracted land in the secondary market within the rural collective sector for agricultural production (Lin & Ho, 2005). However, in order to reduce the harm to agricultural land and food security caused by rural housing construction, the expansion of towns and urban areas, and the expansion of TVEs, converting the contracted agricultural land for non-agricultural purposes was prohibited (Lin & Ho, 2005).

The rural reform in the 1980s was centred on facilitating the migration of agricultural surplus labour to the industrial and commercial sectors and urban areas, as well as activating the rural market economy. The strategic orientation of rural development in the 1990s was, based on the foundation of the previous decade, the gradual construction of a socialist rural market economic system, thus putting China's agricultural and rural development onto a market-oriented track. However, due to price scissors, urban-biased policies, and restricted rural land transactions, urban-rural socio-economic and welfare gaps continued to widen. For example, the income ratio of urban and rural residents narrowed from

[16] Rural collective, based on the size and composition of the household, contract agricultural land to local farm households for agricultural production. Farmers can keep surplus grain beyond the contractual production quota for their own consumption.

[17] http://www.crnews.net/zt/zyyhwj/lnzyyhwjhg/440269_20210209111856.html (access to URL for the full text of the policy)

2.6:1 in 1978 to as low as 1.86:1 in 1985, but then expanded to 2.79:1 in 2000 (Han, 2009).

(3) Balancing socio-economic development between urban-rural areas (2002-2016)

Since 2002, to further stimulate the vitality of rural areas and narrow the rural-urban gap, the Chinese government has advanced the concepts of "Coordinating urban-rural development (*chengxiang tongchou*)[18]" and "Urban-rural integration" (*chengxiang yitihua*)[19] successively to alleviate the arising from the urban-rural dichotomy and to share the benefit that urban areas enjoy with rural areas. The Chinese government then started to establish a new rural cooperative medical system in 2003[20], completely abolished the agricultural tax in 2006, and proposed the establishment of a unified national basic pension insurance system for urban and rural residents in 2014. In addition, in order to improve the ecological environment and dilapidated appearance of rural scenery, three national programmes were proposed in 2005 and 2012 respectively, namely the "Construction of New Socialist Countryside"[21], the "Construction of Beautiful China"[22], and the "Construction of Ecological Civilisation"[23]. Further, the Chinese government has spent nearly 8 years implementing the "Targeted Poverty Alleviation" policy to address rural absolute poverty[24] since 2014 (Wang, Zhang & Nie, 2021; Zhou et al., 2018).

In terms of land system reform in this period, some efforts were made to protect the basic rights and interests of farmers and increase their income. For example, the *Land Contract Law*[25] was promulgated in 2002 to protect farmers' long-term contractual management rights and to encourage contractual land transfer. Since 2006, the policy of "Increasing vs. decreasing balance of urban-

[18] http://cpc.people.com.cn/GB/64162/64168/64569/65411/4429165.html (access to the official URL for the concept)
[19] http://cpc.people.com.cn/GB/64093/64094/8194418.html (ditto)
[20] http://www.gov.cn/zwgk/2005-08/12/content_21850.htm (access to the official URL for the policy)
[21] http://cpc.people.com.cn/GB/64162/64168/64569/65414/4429188.html (ditto)
[22] http://cpc.people.com.cn/n/2013/1115/c64094-23559163.html (ditto)
[23] http://www.gov.cn/ldhd/2012-11/08/content_2260053.htm (ditto)
[24] In 2020, the standard for rural absolute poverty is that the per capita income is less than 4,000 RMB.
[25] http://www.gov.cn/gongbao/content/2002/content_61729.htm (ditto)

rural construction land"[26] has largely controlled the expansion of rural construction land, protected the amount of arable land, and promoted transfer payments from urban areas to rural areas (Long et al., 2012). In 2006, the former Ministry of Land and Resources of the People's Republic of China (PRC) designated Shandong, Tianjin, Jiangsu, Hubei, and Sichuan as the first pilot areas for the implementation of the "increasing vs. decreasing balance" land use policy. This policy's principal objective is to establish balance in China's land supply by balancing the rise in urban construction land area with the decline in rural construction land area. This implies that, before the increase of urban construction land, the comparable amount of rural construction land should be reclaimed as agricultural land to support food security and rural development objectives (Long et al., 2012). If the amount of reclaimed rural construction land is greater than the amount of construction land needed for the building of cities and towns, the excess construction land quotas may be traded on a national or provincial platform. In this process, as the seller, the local government might reinvest part of the income in village development, whereas the purchasing local government(s) might put the acquired quota to use in expanding non-agricultural industries and building infrastructure (Rao, 2022).

Further, "Division of three rights (*sanquan fenzhi*)" (rural land ownership, contracting right, and management right) as well as "Rural three lands reform (*sandi gaige*)" (Contracted agricultural land requisition, market reform for collectively-owned commercial construction land, and homestead management) have played positive roles in promoting agricultural modernisation, clarifying the relationship of land property rights, safeguarding the legal rights and interests of stakeholders, and rationally utilising rural land resources (The National People's Congress of the People's Republic of China, 2018).

[26] http://www.gov.cn/gongbao/content/2004/content_63043.htm; http://www.jxwy.gov.cn/wyxxtx/gfxwj/201261/6bd28ef735d24d1bb5df0cd0a42bf6a2.shtml; and http://www.gov.cn/gongbao/content/2011/content_1845062.htm (ditto)

(4) Rural vitalisation (2017-)

The convening of the 19th National Congress of the CPC pushed the development of rural China into a new stage. It was there that the "Rural Vitalisation Strategy" – involving politics, economics, culture, ecology and governance – was advanced which, taken in tandem with the 2018 "Rural Vitalisation Strategic Plan 2018-2022"[27], signals that China's rural areas are moving towards a comprehensive stage in their development. In 2019, on the basis of the 19th National Congress, the Chinese central government proposed ideas for developing and improving the system and mechanism as well as policy system for urban-rural integrated development[28]. This resulting policy mainly focuses on the allocation of urban-rural development factors, the sharing of basic public services, the integrated development of urban-rural infrastructure, the diversified development of the rural economy, and the sustained growth of farmers' income.

During this period, the concept of comprehensive rural land consolidation was proposed in the "National Land Consolidation Plan (2016-2020)"[29], issued in 2017, to advance the achievement of comprehensive rural development. In 2018, the measures for the cross-provincial transfer of surplus quotas for the urban-rural construction land (*chengxiang jianshe yongdi zengjian guagou jieyu zhibiao kuashengyu tiaoji shishi banfa*)[30] formulated by the Ministry of Natural Resources were able to ameliorate hitherto unbalanced regional development. This has been because provinces with large quotas of construction land but undeveloped economies have been able to sell excess quotas to developed areas lacking such quotas, in order to obtain funds for their rural construction and development. Moreover, the amendment to the *Land Administration Law* passed by the Standing Committee of the National People's Congress in 2019 removed

[27] http://www.gov.cn/gongbao/content/2018/content_5331958.htm (access to the official URL for the policy)
[28] http://www.gov.cn/xinwen/2019-05/05/content_5388880.htm (ditto)
[29] https://www.ndrc.gov.cn/fggz/fzzlgh/gjjzxgh/201705/t20170517_1196769.html?code=&state=123 (ditto)
[30] http://www.gov.cn/zhengce/zhengceku/2018-12/31/content_5439377.htm (ditto)

legal barriers and allowed collectively-owned commercial construction land to enter the market, further clarified the scope of public interest in land acquisition, established the basic principles of compensation for land expropriation, reformed the procedures for land acquisition, and strengthened the protection of rights and interests in the rural homestead.

3.4 What is rural vitalisation in China?

This section explains and summarises what "rural vitalisation" in China is in the current context, mainly involving its definition and objectives.

3.4.1 "Rural vitalisation" or "Rural revitalisation"?

The concepts of 'rural revitalisation' (Li et al., 2019; Liu & Li, 2017; Onitsuka & Hoshino, 2018; Rossi & Hinrichs, 2011) and 'rural vitalisation' (Long, Zhang & Tu, 2019; Ma et al., 2019; Xie et al., 2020; Zhang et al., 2020) have both been adopted to describe the phenomenon and process of rural development in different places. According to the Merriam-Webster Dictionary, 'vitalisation' means the process of endowing something with vitality and animating it. In the Cambridge Dictionary, 'revitalisation' means the process of making something grow, develop, or become successful again. In addition, according to the record of the Merriam-Webster dictionary, the first known use of 'revitalise' was in 1848, while the first known use of 'vitalise' was in 1678. It can be found that revitalisation may occur after vitalisation. Therefore, for rural development, revitalisation should be expected after experiencing prosperity followed by recession. In China, the implementation of the household contract responsibility system and the development of TVEs since the 1980s have largely promoted the development of the rural economy. However, due to factors such as price scissors and the lack of proper planning and management, the urban-rural gap has been widening and the rural ecological environment has been negatively affected to a great extent (Liang, Chen & Gu, 2002; Long, Zou & Liu, 2009; Xu & Tan, 2002). As such, it is more accurate to say that the relevant

policies during this period have promoted partial prosperity in some areas rather than throughout rural China. Therefore, the term 'rural vitalisation' is adopted in this study to describe the redevelopment of rural China.

3.4.2 Rural vitalisation strategy

In 2017, in response to the contradiction between unbalanced and inadequate development and the people's ever-growing needs for a better life, the 19th National Congress of the CPC proposed the strategy of rural vitalisation (RV) and listed it as one of the most important national strategies (Xinhua News Agency, 2018).

Conceptually, RV is a rural development strategy covering the construction of economy, politics, culture, ecology and well-being in order to achieve the comprehensive revival of rural areas by systematically allocating and efficiently managing various development elements, i.e. population, land, and industry (Li et al., 2016; Liu, 2018; Long, Zhang & Tu, 2019). According to the strategic arrangement put forward by the 19th National Congress of the CPC, the central government has clarified the objectives and tasks of implementing the rural vitalisation strategy: by 2020, important progresses are expected to be made in RV, with the formation of a corresponding institutional framework and policy system; by 2035, decisive progresses are expected to be made in the achievement of agricultural and rural modernisation nationwide; by 2050, rural areas are expected to be comprehensively vitalised nationwide, reaching the standard of moderately developed countries, with strong agriculture, beautiful rural landscapes, and healthy and wealthy farmers.

3.4.3 An explanation of rural vitalisation at the village level

The objectives of RV are the affordance of "thriving industry (*chanye xingwang*), pleasant living environment (*shengtai yiju*), refined rural civilisation (*xiangfeng wenming*), effective governance (*zhili youxiao*), and prosperous life

(*shenghuo fuyu*)"[31], covering the development of the five aspects of economy, environment, culture, governance, and living (Long, Zhang & Tu, 2019). This section provides an interpretation of rural vitalisation at the village level, based on a literature review and the author's field surveys in rural China.

Thriving industry is the cornerstone of RV, focusing on the cultivation, transformation, and integration of primary, secondary, and tertiary industries (Chen, 2018). In rural China, the role of the primary sector is particularly important. By 2020, China's primary sector accounted for only 7.7% of the total GDP[32], but the rural population accounted for over 36%[33]. In terms of agriculture, given the present situation in which the productivity of the crops is in relative surplus, the economic returns from staple crops are low in the bulk agricultural products phase. Blindly pursuing the growth of the total amount of agricultural products, especially grain crops, may thus harm the overall interests of individual farmers (He, 2018). For most villages whose economic earnings are dominated by agricultural production, improving production efficiency and properly expanding high-economic-return agricultural projects is a vital way to promote agricultural prosperity (Ye, 2018). The improvement of production efficiency benefits food security and the efficient use of farmland, while the optimisation of agricultural structure can enable some farmers to earn a considerable income without having to leave their hometowns to work, or else reduces working hours for some farmers so that they can also earn income in non-agricultural sectors. This can further drive the economically-sustainable development of local agriculture (Zhong, 2018). Additionally, for villages with conditions conducive to the development of secondary and tertiary industries, the reasonable provision of sufficient land and space for local factories and businesses is a prerequisite for their development under current strict controls on construction land quotas. This is because the majority of companies settled in such villages are in the

[31] http://www.gov.cn/zhuanti/2017-10/27/content_5234876.htm (access to the full text of the policy)
[32] http://www.stats.gov.cn/tjsj/ndsj/2021/indexch.htm (access to the official statistics)
[33] http://www.stats.gov.cn/tjsj/tjgb/rkpcgb/qgrkpcgb/202106/t20210628_1818826.html (ditto)

manufacturing and tourism sectors, which have a greater demand for land than high-tech companies.

Creating a pleasant living environment is the primary task of the construction of ecological civilisation, involving the settlement environment, production environment, and ecological environment (i.e. living, production, and ecological spaces). The key is to improve the quality of human settlements, to develop green industries, as well as to optimise the natural landscape (Zhong, 2018). Specifically, the improvement of the quality of human settlements mainly involves expanding the coverage of public services (such as medical care and leisure), updating living and production infrastructure (such as roads and ditches), and beautifying residential landscapes. In addition, the development of green industries involves reducing the emission of pollutants in the production process and/or developing low-polluting industries. Moreover, the optimisation of the natural landscape means that the ecological space is protected in order to reduce damage caused by human activities. Further, a pleasant living environment is expected to make local residents feel comfortable and satisfied.

Refined rural civilisation is the cultural context of RV. China's rapid urbanisation during the past decades has not only downplayed the preservation of rural culture but also endangered the rural culture inheritance (Li et al., 2018). From a cultural perspective, the rural vitalisation strategy involves production, living and ideological aspects, such as farming knowledge and methods, folk customs, artistry, buildings with local characteristics, neighbourhood relations, and education (Cao & Shi, 2021). It can be achieved through the inheritance of valuable and unique traditional culture, the change of outdated ideology and bad habits such as littering, the construction of harmonious neighbourhood relations, and the development of cultural and vocational education (Zhong, 2018). Refined rural civilisation may not only help to strengthen the sense of belonging of villagers who have lived and worked away from the area for a long time, thus motivating them to contribute to village development, but also increase its

attractiveness to urban dwellers so that developing tourism may be possible when necessary.

Effective governance is one of the most important goals for political construction. At the village level, it requires the innovation of governance mechanisms and improvement of the management system of grassroots (community-level) organisations such as the village branch, village committee, and rural collective economic organisation (Zhong, 2018). In other words, under the effective management and leadership of these community-level organisations, villagers are able to actively participate in various affairs in the village. Meanwhile, grassroots organisations also respond positively to some of the decisions made by local governments, such as the protection of farmland, so that regional policies on rural development can be implemented. In this way, an effective governance model that organically combines bottom-up management of village affairs and top-down implementation of planning tasks is likely to be achieved.

Further, achieving a prosperous life is the purpose of social construction. To achieve a prosperous life, the current primary task in rural villages is to enhance the local livelihood capacity and economic strength. Achieving this goal requires not only an increase in economic income, but also a diversification of income sources. This is because diversifying economic income can not only help farmers and villages to increase their income but also enhance their resilience to the fluctuation of agricultural income due to natural and market factors (Li et al., 2013). In addition, the situation of uneven urban-rural development and the resulting prominent “dual structure” which has long pertained in China has deprived rural villages of access to development resources (Chan & Wei, 2019; Wong, Tang & Liu, 2022). Also, many rural residents in the central and western regions, in tandem with urbanisation, have to work in more developed areas far from their hometowns to earn more income for family expenses, causing social problems such as village hollowing as well as left-behind elderly and children

(Liu et al., 2010; Zhang, Jiang & Zhang, 2019). Therefore, in order to promote social stability and the development of healthy rural villages, narrowing the rural-urban income gap and increasing local employment ratio have also become two of the requirements for achieving a prosperous life in rural villages (Huang, 2018; Liu, 2018).

3.5 Chapter summary

In essence, (re)vitalising the countryside is a process of multifunctional rural development. It pursues not only the multifunctional output of rural development, but also the coordinated development of various services/functions. Historically, rural development in China has been closely connected with land system reform. Rural development in China since 1949 can be roughly divided into four stages based on historical events and shifts in policy focus, during which land system reform provided an indispensable impetus. However, while the land system reforms of the previous three periods have led to the progression of rural development, they also resulted in some social and ecological issues, something that the latest phase of land system reform is attempting to alleviate and address. The reason why there are still problems after the three-stage development is that, compared with most developed countries, China remains a densely populated agricultural country with insufficient arable land resources, where conflicts between stakeholders concerning land use are still prominent. Meanwhile, China is still in the process of rapid socio-economic development, during which the land system continues to be reformed in order to meet the needs of contemporary socio-economic conditions from the supply side. It is, therefore, particularly important to formulate reasonable and far-sighted land use planning based on the supply-demand of and for local land resources which contributes to the efficient use of resources and the sustainable development of a given region.

In 2017, the central government of China proposed the strategy of "rural

vitalisation" to relieve and resolve the tension between imbalanced and inadequate socio-economic growth and the people's ever-increasing demands for a better life. This is a rural development strategy covering the construction of economics, politics, culture, ecology, and well-being in order to achieve the comprehensive revival of rural areas by systematically allocating and efficiently managing various development elements (i.e. population, land, and industry). Based on a literature review as well as the understanding and knowledge of Chinese rural villages, this chapter provided the rationale of the Chinese approaches in pursuit of RV at the village level.

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Chapter 4 Rural land consolidation

4.1 Introduction

Given that rural land consolidation (RLC) is the key policy tool of this study interested in achieving rural multifunctionality and vitalisation, this chapter provides a broad review of it. RLC is reviewed from five aspects. To closely connect with the topic, Section 4.2 first identifies the relationship between RLC and multifunctional land use (MLU) in general. Section 4.3 provides a brief history of the evolution of RLC worldwide and then conceptualises it in the case of China. The next section classifies different types of RLC based on the desired outcomes, target objects, and decision-makers addressed in the literature about China and abroad. Then, Section 4.5 focuses on the evolution of RLC in China from a functional perspective, with the introduction of the main influence of RLC in Section 4.6. Finally, the main factors affecting the implementation of RLC in different social backgrounds are identified.

4.2 Rural land consolidation and multifunctional land use

During the 20th century, land fragmentation mainly caused by historical and physical factors in rural areas has been one of the major obstacles to rural sustainable development (Bentley, 1987; Naylon, 1959; Van Dijk, 2003). It hinders the development of agricultural mechanisation, causes low production efficiency, additional production costs to farmers, land abandonment (Jürgenson, 2016), and a depressed land market (FAO, 2004). From the beginning of the 20th century to the 1970s, the main task of rural development in someplace of the world, such as West Europe, was to solve land fragmentation and thus promote the production function of farmland and forestland in order to alleviate the contradiction between rapid population growth and food shortage. RLC has been

hitherto considered an effective way to address the issue of land fragmentation and increase the economic efficiency of agricultural production since it can facilitate trafficability, management procedures, and agricultural mechanisation (Asiama, Bennett & Zevenbergen, 2017; Crecente, Alvarez & Fra, 2002; Long, 2014; Pašakarnis & Maliene, 2010; Zhou, Guo & Liu, 2019). However, a series of environmentally-unfriendly RLC measures taken during this period have led to environmental degradation in rural areas, including soil erosion, the loss of nutrients, groundwater pollution, as well as a decrease in biodiversity and landscape values (Mander, Helming & Wiggering, 2007). This has resulted in increased public awareness of eco-environmental issues. Meanwhile, emphasis has increasingly been placed on many developed countries' approaches to agriculture on non-productivity objectives such as culture and landscape protection rather than the 'traditional' productivist objective of producing crops (Wilson, 2007). The focus of rural development gradually shifted from an agricultural economy under productivism to a more comprehensive one incorporating elements of agriculture, industry, commerce, tourism, and ecology. Since the 1980s, society, especially in developed countries, has given heightened attention to natural resources, landscapes, and ecosystems in rural areas, and sought to decouple economic growth from environmental degradation (Costanza et al., 1997).

Against this background, concepts of agricultural multifunctionality and multifunctional land use (MLU) have catered to the need for a new conceptualisation of the contemporary agricultural transition and better generalises the trend of rural and agricultural processes (Wilson, 2007). Running almost parallel with this, the connotation of RLC was expanded to take the protection of ecology, environment, and landscape values into consideration as well (Janus & Markuszewska, 2017; Kupidura et al., 2014; Van Huylenbroeck, Coelho & Pinto, 1996), which has transformed RLC from a practice with a narrow emphasis on economic benefit into a comprehensive level which takes

into account economic, social, and ecological interests as a whole (Hartvigsen, 2015; Hehl-Lange, 2001; Lisec & Pintar, 2005; Thomas, 2006). This reflects the multifunctionality of RLC in the non-productivism era. RLC is also a means of rural land use, since multifunctional RLC refers to the multifunctional use of rural land. As of today, RLC has become the primary tool and platform used to achieve multifunctional rural land use (Long, Zhang, & Tu, 2019; Sobolewska-Mikulska & Stańczuk-Gałwiaczek, 2018).

4.3 Brief history of RLC and its conceptualisation in Europe and China

Land consolidation had its earliest adoption in China and Europe (Jiang et al., 2022). RLC has been practised in Europe since the medieval era with its relevant legislation being introduced and refined from the 18th Century onwards (Lambert, 1963; Van Dijk, 2003). It has since become a critical part of the land policies of most European countries, especially in Western Europe (Hartvigsen, 2015). Bavaria, Germany, is a notable example, where RLC has been around for almost half a millennium (Naylon, 1959) and has seen a dramatic increase in the productivity of consolidated rural land (Bronstert, Vollmer & Ihringer, 1995). Since then, many developed and developing countries have launched RLC for eliminating rural poverty and facilitating rural development given its ability to change land use structure (Asiama, Bennett & Zevenbergen, 2017; Hartvigsen, 2015; Huy & Warr, 2020; Korthals Altes & Bong Im, 2011; Mihara, 1996; Thapa & Niroula, 2008). Up until now, although RLC projects have been negatively perceived in certain cases (Bullard, 2007; Liu et al., 2018; Mander, Helming & Wiggering, 2007), many studies and cases have demonstrated the utility of RLC as an instrument in the provision of socio-economic and technical solutions to ameliorate rural issues by affecting rural land use structures and having a boosting effect on rural development (Cay, Ayten & Iscan, 2010; Hudecová, 2015; Kupidura et al., 2014; Long, Zhang & Tu, 2019; Rao, 2022).

As a country with is origins as a major farming civilisation, China has also a long history of farmland use and has executed land reforms related to RLC for several millennia (Wu, 2014). For example, the "well-field system" (*Jing tian zhi*), which can be traced back to the Western Zhou Dynasty (around 1066 BCE - 600 BCE), involved the distribution of land ownership and the construction of infrastructures such as roads and ditches. Although China had substantial experience in RLC before 1949, praxis and research in the field of RLC took a new direction after this date due to dramatic changes in the social and economic environment. However, it was not until the late 1990s that formal RLC projects were implemented in mainland China to ensure food security and to stabilise farmland quantity and quality (Huang et al., 2011). Although China has only three decades of experience in the formal implementation of RLC, a great deal of research and related practical work has been carried out in this period, particularly since the turn of the 21st Century (Jiang et al., 2022).

Regarding the definition of RLC, there is a natural tendency to interpret the term in accordance with what is applicable to the place where the RLC project is being implemented (Hartvigsen, 2015; Jin et al., 2017). For example, Bronstert et al. (1995), based on the German RLC experience, stated that RLC in practice consists of various redevelopment and structural measures: the rearrangement and/or merging of different, distributed plots, the removal of terraces and defiles, the construction of rural roads, the restructuring of local streams, and soil improvement. The FAO has explained this concept based on European experience: *"Land consolidation is a legally regulated procedure led by a public authority and used to adjust the property structure in rural areas through a comprehensive reallocation of parcels, coordinated between landowners and users in order to reduce land fragmentation, facilitate farm enlargement, and/or achieve other public objectives, including nature restoration and construction of infrastructure, and is regarded as an instrument for integrated rural development"* (FAO, 2008; Veršinskas et al., 2020). RLC is also a fluid concept,

in that its connotation changes with time and space. Naylon (1959) suggested that the concept of RLC involves three different levels over time: it is initially limited to the redistribution of fragmented property holdings in rural areas, then involves the construction of roads and other facilities, and is eventually extended to bring local prosperity and make rural life more liveable. In China, RLC is considered to be a collective term for land development (*tudi kaifa*), land readjustment (*tudi tiaozheng*), land restoration (*tudi xiufu*), and land reclamation (*tudi fuken*), the connotation of which has transferred from a tool for agricultural development to a platform for the comprehensive development of rural socio-economy and eco-environment (Long, Zhang & Tu, 2019; Ministry of Land and Resources of PRC, 2018; Wang & Zhong, 2016; Zhou, Li & Xu, 2020).

Based on the above review and the situation in China, this study defines rural land consolidation (*nongcun tudi zhengzhi*) as an important toolkit, based on land consolidation planning and other related plans, to be utilised to reorganise rural land property (e.g. use, ownership, and managerial rights), optimise physical conditions (e.g. roads, ditches, terraces, and irrigation systems), and tackle environmental issues (such as landscape fragmentation, soil erosion, lack of soil fertility, and a loss of biodiversity) (Jiang et al., 2022). The main targets of RLC are unused, inefficient, idle, abandoned, contaminated, and degraded rural land. The aim of its implementation is to meet human needs for various functions of land use by improving land use efficiency and optimising land use structure, thereby improving the quality of life in rural areas, narrowing the rural-urban socio-economic gap, and promoting rural sustainability.

4.4 Classification of RLC

The implementation of RLC is usually affected by socio-economic conditions, historical and cultural background, and political and legal environment, so the forms of RLC and the method adopted in RLC are diverse. There are three main approaches to the classification of RLC (Jiang et al., 2022).

4.4.1 Classification based on desired outcomes

Based on the experiences of countries and regions (Asiama et al., 2019; Jacoby, 1959; Mihara, 1996; Niroula & Thapa, 2005; Ravallion & Dominique, 2006; Swab et al., 2017), RLC generally can be differentiated into simple rural land consolidation (SRLC) and comprehensive rural land consolidation (CRLC), depending largely on the desired outcome (Table 4-1). Nevertheless, the specific purposes of RLC vary from country to country because of different natural and cultural conditions.

Table 4-1. Main objectives of SRLC and CRLC

Objectives	SRLC	CRLC
Improvement of fragmentation of the property rights and physical structures of landholdings in rural areas	✓	✓
Land use planning of rural residential areas	✓	✓
Improvement of the infrastructure in rural areas	✓	✓
Improvement of the ecological and natural environment	---	✓
Promotion of rural (re)vitalisation	---	✓
Promotion of regional coordinated development	---	✓

SRLC mainly focuses on the following three perspectives: (a) solving fragmentation of rural land ownership, joint-ownership shares, and use rights, as well as optimising the structure issues concerning parcels and agricultural production (Lisec et al., 2014; Thomas, 2006); (b) supporting the construction of rural roads and other infrastructure, such as the removal of terraces and reconstruction of local runoffs; and (c) increasing the competitiveness of agricultural and forest production and improving the quality of rural work and living conditions (Jacoby, 1959; Muchová et al., 2017). These show that the implementation of SRLC is economically-oriented and that is involves certain social benefits. Nowadays, SRLC is mainly adapted in some underdeveloped regions, such as Africa (Asiama et al., 2019).

The CRLC, in addition to the above-mentioned benefits of SRLC, can support environmental protection and natural resource management, help restore human landscapes which have been disturbed due to historical/political reasons (Bažík & Muchová, 2015), and protect structural elements of landscapes with

ecological and visual value (Hehl-Lange, 2001). The reason for this is that, once the amount of immediate output obtained from farmland meets the population's subsistence needs, people begin to shift their focus to the improved preservation of the natural environment. After all, the fragmentation of the ecosystem could cause the decline of biodiversity and environmental degradation, influencing the sustainability of human beings (Lisec & Pintar, 2005). From the perspective of socio-economic sustainability, CRLC is also an ideal tool for the improvement of land use efficiency (Liu, Li & Yang, 2018), the vitalisation of rural areas (Long, Zhang & Tu, 2019), and the narrowing of the socio-economic gap between rural and urban areas (Long, 2014; Pašakarnis, Morley & Malienė, 2013). Moreover, long-term experience gained from the considerable amount of completed SRLC projects in other regions or locally can form the basis for the implementation of CRLC (Hartvigsen, 2015; Muchová et al., 2017). The concept of CRLC is therefore preferred at present in many countries, especially in developed countries and China.

4.4.2 Classification based on the target objects

The main object of RLC is rural land with different utilisation methods. That is, different types of land use may correspond to different types of land consolidation. According to the classification of land use types in rural China, RLC at the village level can be mainly divided into agricultural land consolidation, construction land consolidation, and undeveloped land consolidation (or idle land development) (Long, 2014; Long, Zhang & Tu, 2019).

Agricultural land consolidation is a method of land engineering and an agricultural land management tool designed to increase the quality and quantity of agricultural land (especially farmland) and improve agricultural production efficiency. The area of agricultural land can usually be expanded by reclaiming abandoned land and developing idle land; the improvement of land quality involves the conservation of the ecological environment, the upgradation of

irrigation and drainage facilities, the improvement of soil quality, and the protection of cultivated land, while paving field roads, levelling land, and solving land fragmentation are adapted in RLC for the improvement of production efficiency. By doing so, the construction of agricultural infrastructure can be enhanced, the mass production of high-standard and disaster-resistant basic farmland can be strengthened, the layout of agricultural land can be optimised, and the concentration and connection of fragmented parcels can be effectively facilitated so as to promote large-scale operations (Long, 2014).

The main components of construction land consolidation are residential land consolidation, industrial and mining land consolidation, and village environment renovation. Residential land consolidation involves the demolition and reclamation of scattered, abandoned, idle and/or inefficiently used buildings (mainly old houses which have been abandoned and have no further use or historical value) in villages, as well as the improvement of rural infrastructure and public service facilities. The main aims are improving rural production and living conditions, raising the economical level and intensive use of construction land in villages, promoting the construction of new rural villages, and realising the integrated allocation of urban and rural land quotas. In terms of industrial and mining land consolidation, the main targets are local factories, mining sites, and brick kilns, intending to direct industrial production to concentrate in industrial parks, repairing and reclaiming some of the land damaged by industrial pollution, increasing the efficiency of land use, and improving production, living and ecological environments (Long, 2014; Qiao, 2015). Village environment renovation refers to improving sanitary conditions, beautifying their appearance and surrounding landscape, and increasing blue and green spaces, thus improving the quality of the rural habitat (Kong et al., 2019).

The development of idle land entails its rational exploitation; that is, its conversion – and that of previously used land – into other types of land (usually agricultural) in order to meet a village's developmental needs (Jin et al., 2017).

4.4.3 Classification according to the decision-makers

Identifying the party responsible (landowner or authority) for the RLC in the law/regulation is a key issue that needs to be determined as a priority (Jacoby, 1959). Inter alia, this means choosing between approaches to be used in the practice of RLC. There are three common approaches to this: voluntary, compulsory, and majority-based, depending on the degree of stakeholders' say in RLC planning (Veršinskas et al., 2020). In voluntary RLC, as practised in many European countries, there is no requirement for voting on the RLC plan, given that the final plan is a decision on the conditions of reallotment of landowners' parcels made by the landowners based on the reallotment planning proposal (Veršinskas et al, 2020). In China, the holders of contractual land management rights can voluntarily transfer land rights (though not land ownership) by methods such as subcontracting, leasing, and exchange in accordance with the law. During this process, a written contract is signed by both parties and an application is made to the town government and the corresponding authorities at the county level for approval. In principle, the adjustment of the contracted land between individual villagers requires that over two-thirds of villagers' council members or over 2/3 of village representatives vote in favour of the application[34]. In majority-based RLC projects, the main stakeholders hold the right to veto the final plan, but the final decision depends on the wishes of the majority of stakeholders (Hartvigsen, 2015). In both China and Europe, compulsory RLC projects initiated by the authorities (Jiang et al., 2022; Hartvigsen, 2015; Vitikainen, 2004) involve no voting by the landowners or land contractors on an RLC planning. Moreover, before the commencement of a national RLC program, the country usually appoints specialist cadastral investigators to conduct a country-wide assessment to identify those areas deemed most suitable for RLC (Veršinskas et al, 2020). Like many European countries, China has conducted national cadastral surveys. Starting in late 2017,

[34] http://www.npc.gov.cn/npc/c30834/201901/cd063e4c0f19465e9d41946001fe839c.shtml (Access to *Rural land contract law of the People's Republic of China*)

China launched its third national land survey, a more detailed assessment than its predecessors, which lays a solid foundation for subsequent RLC programmes.

4.5 The functional evolution of land consolidation in China

China, as a populous agricultural country, has been executing land reforms related to land consolidation for thousands of years in order to improve agricultural production, but the dramatic changes in the socio-economic context in 1949 promoted a new wave of development of land consolidation in China (Jiang et al., 2022). Decades of this land consolidation have seen the achievement of remarkable results in rural China. The practice of land consolidation has now entered a new stage, and become an essential part of the toolkit for comprehensive rural development rather than for agricultural production alone (Long, Zhang & Tu, 2019). Although a few studies have attempted to identify the different stages of Chinese RLC from various perspectives (Long, Zhang & Tu, 2019; Xia, Yang & Yan, 2018; Zhang & Tan, 2021; Zhang & Ye, 2022; Zhou, Li & Xu, 2020), the main functions and features of RLC at each stage – and the interrelations between them – remain unclear. Moreover, these studies mainly focus on the development of land consolidation in China after the 1980s, and lack a summary of the period from 1949 to the 1980s. Though the RLC praxis before the 1980s was mainly adopted at the local level and lacked nationwide unified management and institution, it is obvious that years of efforts at the local level allowed the central government to accumulate the experience and confidence necessary to carry out formal RLC programmes across the country. This section therefore summarises the development stages of RLC in China from a functional perspective, based on rural land policies at the national level since 1949 (Table 4-2).

4.5.1 Production function stage (1949-1997)

Between 1949 and 1997, a large amount of idle land was reclaimed and some farmland infrastructure was improved to promote grain production. This

was accompanied by land ownership adjustments, such as allowing the private ownership of agricultural land between 1949 and 1956 and the household contract responsibility system based on public ownership since 1978 (Zhou, Li & Liu, 2020). According to the National Bureau of Statistics, China's per capita grain output increased from 208.9 kg in 1949 to 399.7 kg in 1997 (National Bureau of Statistics, 2021).

Table 4-2. The main stages of development of land consolidation in China

Stage	Main features	Main policies concerning rural land use
Production function stage (1949-1997)	Increased agricultural production capacity and industrial production capacity	Socialist public ownership of land (1956); Household contract responsibility (1978); Land Administration Law (1986[35], 1988[36]) and Land Reclamation Regulations (1988)[37]; Regulations Governing the Implementation of Land Administration Law (1991)[38]
Multifunctional stage (1998-2011)	Multiple functions such as production, living, and ecological functions coexist but lack coordination with each other	Basic farmland protection (1994)[39]; Dynamic equilibrium of farmland (1997)[40]; Land Administration Law (1998[41], 2004[42]); National land consolidation plan (2000-2010)[43]; Well-facilitated farmland (2004)[44]; "Increasing vs. decreasing balance" land use policy (2004)[45]; Outline of the National Overall Plan for Land Use (2006-2020)[46]
Comprehensive stage (2012-now)	The coordination among various functions	National land consolidation plan (2011-2015)[47]; Ecological redline (2014)[48]; Rural land property reform (2015)[49]; National land consolidation plan (2016-2020)[50]; Land Administration Law (2019)[51]; Regulations for the Implementation of the Land Administration Law (2021)[52]

[35] http://www.npc.gov.cn/zgrdw/huiyi/lfzt/tdglfxza/2012-12/19/content_1747330.htm (access to full text)
[36] http://www.gov.cn/gongbao/shuju/1988/gwyb198827.pdf (ditto)
[37] http://www.gov.cn/gongbao/shuju/1988/gwyb198824.pdf (ditto)
[38] http://www.gov.cn/gongbao/shuju/1991/gwyb199101.pdf (ditto)
[39] http://www.gov.cn/gongbao/shuju/1994/gwyb199419.pdf (ditto)
[40] http://www.gov.cn/gongbao/shuju/1997/gwyb199716.pdf (ditto)
[41] http://www.peopledaily.com.cn/zgrdxw/faguiku/jjf/T1060.html (ditto)
[42] http://www.gov.cn/banshi/2005-05/26/content_989.htm (ditto)
[43] http://www.gov.cn/gongbao/content/2003/content_62354.htm (ditto)
[44] http://www.gov.cn/gongbao/content/2004/content_63144.htm (ditto)
[45] http://www.gov.cn/zwgk/2005-08/12/content_22138.htm (ditto)
[46] http://www.gov.cn/zxft/ft149/content_1144625_5.htm (ditto)
[47] https://www.ndrc.gov.cn/fggz/fzzlgh/gjjzxgh/201604/P020191104624001711032.doc (ditto)
[48] http://www.gov.cn/xinwen/2014-02/04/content_2612994.htm (ditto)
[49] http://www.gov.cn/gongbao/content/2015/content_2955704.htm (ditto)
[50] https://www.ndrc.gov.cn/fggz/fzzlgh/gjjzxgh/201705/t20170517_1196769.html?code=&state=123
[51] http://www.npc.gov.cn/npc/c30834/201909/d1e6c1a1eec345eba23796c6e8473347.shtml (ditto)
[52] http://www.gov.cn/zhengce/content/2021-07/30/content_5628461.htm (ditto)

However, since the start of the "Reform and Opening-up" process in 1978, township and village enterprises (TVEs) have sprung up in rural China. Many villages in relatively developed regions, such as metropolitan suburbs and eastern coastal areas, have begun to increase the industrial and even commercial production functions of rural land use by increasing the types and quantities of rural industrial, mining, and commercial land. Taken alongside the promotion of the development of rural industry and urbanisation, this has, however, led to the continuous erosion of agricultural and ecological land by construction land (Zhou, Li & Xu, 2020). This means the reduction of the agricultural production function of rural land in these areas. To promote the standardised use of land resources and protect arable land resources, the Chinese government established the State Land Administration in 1986, and also promulgated the *Land Administration Law* in 1987 and the *Land Reclamation Regulations* in 1988. Before 1998, the main purposes of land consolidation in rural China were the increase of the agricultural production capacity of rural land by expanding the area of arable land and the improvement of agricultural infrastructures such as roads and channels, as well as the increase of industrial production capacity by increasing the types and quantities of industrial and mining land in rural areas.

4.5.2 Multiple functions stage (1998-2011)

The *Land Administration Law* was amended in 1998. The concept of land consolidation (*tudi zhengli*) was officially mentioned in the 'Law', marking the beginning of the formal land consolidation movement in rural China. A decade later, the Chinese government incorporated land consolidation into national strategies and put forward the goal of "implementing large-scale land consolidation programmes nationwide" (National Development and Reform Commission, 2012).

During this period, the rapid progress of urbanisation and industrialisation accelerated the erosion of agricultural land by construction land. To ensure food

security and maintain the living function of rural land use, large-scale land consolidation programmes across the country, such as converting unused land, grassland, and wetland to arable land, have been launched to compensate for the decrease in cultivated land. In addition, the "Increasing vs. decreasing balance" land use policy (*Zengjian Guagou Tudi Liyong Zhengce*) (Long et al., 2012), implemented in 2005[53], has further ensured the amount of cultivated land and the agricultural production function of rural land use to a certain extent. As for ecological function, it has been taken into account in land consolidation policies and practices since 2006. For example, many slope modification and protection construction projects have been implemented to control land erosion, and trees for farmland shelterbelts have been planted (Rao, 2022). The policy of "Returning farmland to forests", which has been in operation since 2002, is also regarded as having an emphasis on the ecological function of land consolidation. Although the strategy of "Building a new countryside" (Long et al., 2010), begun in 2005, emphasised the joint development of production, living, ecological, and cultural functions in the process of rural construction, factors such as inertia led to former land consolidation practices continuing at the local level; that is, ones focusing only on the development of certain functions rather than the coordinated development of various functions (Wang, 2011).

In this period, in addition to the production function, other functions, such as the ecological and living functions of rural land use were also emphasised in some of the policies and practices of RLC. While this promoted the multifunctional character of land consolidation, the coordination between different functions had not yet been emphasised.

4.5.3 Comprehensive stage (2012-- Present)

In 2012, China implemented the "National Land Consolidation Plan (2011-2015)", which not only achieved a uniform use of the term "land consolidation"

[53] This policy was revised and formally adopted by the central government of China in 2010 after a number of pilot schemes (Available at: http://www.gov.cn/zhengce/content/2011-04/02/content_2377.htm).

(*tu di zheng zhi*) but also granted RLC a comprehensive character in its connotation, purpose, and content (Jiang et al., 2022). Comprehensive rural land consolidation is a systematic project designed to improve rural production, living, and ecological spaces in a certain area; its specific purpose being to promote productivity, improve public services, protect cultural value, tackle environmental issues, and facilitate urban-rural integration through the comprehensive improvement of farmlands, waters, roads, forests, grasses and villages (Long, Zhang & Tu, 2019). Meanwhile, the "Well-facilitated farmland programme", which has been implemented nationwide since 2012, has gradually promoted the integrated development of the productive, ecological, and social functions of agricultural land consolidation. Additionally, the rural vitalisation strategy proposed in 2017, and the "National Land Consolidation Plan (2016-2020)" formulated the same year, further augmented land consolidation with functions and missions focused on the general development of rural China. Since then, China has been actively promoting CRLC to activate the social, cultural, economic, and environmental functions of rural land use and the coordination among them, in the process of which the type and intensity of RLUFs have been emphasised simultaneously and MLU, especially farmland, has been requested for high-quality development.

During this period, the pursuit of functional coordination has become the main purpose of land consolidation in rural China since the beginning of the CRLC pilot programme.

4.6 The effect of land consolidation in China

The main purposes of RLC in China are to ensure food production, narrow the rural-urban gap, and conserve the eco-environment. Although these goals have not been fully completed, certain results have been achieved.

4.6.1 Ensuring food production

In China, RLC is essential to the process of increasing farmland area and

improving agricultural productivity, and thus ensuring food security (Jin et al., 2017; Zhang, Zhao & Gu, 2014). From 1997 to 2015, China invested 76.17 billion dollars in its national land consolidation programme, and 16.65 million hectares of rural land were consolidated (Bryan et al., 2018). Although the area of arable land has been decreasing over the past three decades due to urban sprawl and industrialisation, total grain production has increased from 494.1 million tonnes in 1997 to 682.8 million tonnes in 2021 and per capita grain output has increased from 399 kg in 1997 to 480 kg in 2021 since the launch of the national land consolidation program in 1997[54]. This indicates that RLC has contributed to mitigating food insecurity caused by the reduction of farmland. Although other related factors, such as the advancement of agricultural science and technology as well as more rational management, have also contributed to the increase in food production, there is no doubt that RLC practices have laid a solid foundation for improving farmland production efficiency and promoting modern agricultural production (Du, Zhang & Jin, 2018).

Globally, with the support of RLC programmes, China, as the most populous developing country, has supported nearly one-fifth of the world's population with only 9% of global farmland. This has made a significant contribution not only to dwindling levels of hunger in China, but also to alleviating the pressure on international food provision. According to the Report on China's Implementation of the Millennium Development Goals (2000–2015), the proportion of the undernourished population in China has more than halved in 25 years, from 23.9 % in 1990 to 10.6 % in 2014 (Ministry of Foreign Affairs of People's Republic of China, and United Nations System in China, 2015). In 2021, China reached a per capita grain output of 480 kg, a grain self-sufficiency rate of over 95%, and a grain output per unit area of 5,800 kg per hectare (National Bureau of Statistics of China, 2021).

[54] Data source: http://www.stats.gov.cn/

4.6.2 Narrowing the rural-urban gap

Since the beginning of the new millennium, rural development and the inequality between rural and urban areas have been two of the central concerns of the Chinese government. In this vein, a great number of policies such as *The Construction of New Socialist Countryside, The Beautiful Countryside*, *Urban-Rural Integration*, and *Rural Vitalisation* have been formulated. RLC, as a toolkit with attributes of both policy and practice, is of great significance in improving rural productivity and living standards (Long, Zhang & Tu, 2019), since the functions of RLC are highly consistent with the needs of rural development (Zhang & Tan, 2021). This determines that RLC can serve as an important platform for boosting rural development and reducing urban-rural inequality. The most direct influence of RLC in narrowing the rural-urban gap is mainly reflected in increasing farmers' income and improving rural living conditions (Du, Zhang & Jin, 2018; Jiang et al., 2021; Wu, Liu & Davis, 2005).

First, the implementation of land consolidation projects has effectively activated the utilisation efficiency of a large amount of rural land, which has augmented farmers' income. By eliminating land fragmentation, optimising agricultural infrastructure, and improving soil quality, RLC has effectively increased agricultural productivity, thereby benefitting farmers economically (Chen et al., 2022; Ying et al., 2020). The Chinese government has supported 14 major land consolidation projects since 2008 (see Zhou, Li & Xu, 2020), which involves China's 55 state-designated poverty-stricken counties, from which over 65 million farmers have derived the benefit of a per capita income increase of almost 700 RMB (Meng & Li, 2018; Zhou, Li & Xu, 2020).

Second, shifting to large-scale farming via RLC could certainly help release rural surplus labour, and alleviate the pressure of labour shortages during continuing urbanisation and industrialisation, thereby increasing farmers' income and supporting the diversification of rural economic development (Lu, 2021). Additionally, in recent years, the high price of construction land has seen

the construction land quotas generated by RLC projects obtain rich returns in the land property market (Long et al., 2012; Tan & Zhou, 2015; Zhang & Tan, 2021). Farmers, as owners of the contracted management rights of rural land[55], can get a generous portion of the proceeds after deducting the development costs.

In addition, rural residential buildings, health and education facilities, roads, landscapes, affordable housing, and infrastructures have also been (re)developed and improved during RLC, especially the CRLC, which greatly helps to improve the rural living conditions (National Development and Reform Commission, 2012; National Development and Reform Commission, 2017; Rao, 2022). Moreover, construction land consolidation, in conjunction with the "Increasing vs. decreasing balance" land use policy, has concentrated the resettlement of formerly-scattered and inefficient rural construction land through relocation and redevelopment of rural settlements, thereby improving the coverage of public service facilities. For example, by 2020, the policy of "centralised domestic waste collection and treatment" has covered more than 90% of administrative villages; the length of impermeable roads in rural areas has reached 4.2 million km, more than three times the length in 2002; and high-quality houses with concrete structures have become common in rural China (Zhang & Tan, 2021).

However, some disappointing phenomena can also be observed in the RLC process. In certain areas of China, RLC projects have caused social conflicts and even hindered local development, because the excessive agglomeration of rural settlements deviates from the actual needs of villagers. These limitations are manifested in the facts that some rural residents dislike adjusting to new communities, that relocated villagers experience livelihood insecurity and higher costs of living, and that governance in some new communities is poor (Liu et al., 2018; Lo, Xue & Wang, 2016).

[55] Rural land ownership is owned by rural collectives.

4.6.3 Conserving the ecological environment

The protection of the ecological environment plays an increasingly important role in land consolidation. As mentioned in Section 3.5, ecological protection was scarcely taken into account during the first stage of the evolution of RLC; in the second stage, although the ecological function of RLC was mentioned, environmental conservation and restoration were taken to be of secondary importance. This led to increasingly serious environmental problems such as soil erosion, water pollution, and biodiversity decline (Shan et al., 2019; Zhong et al., 2020). Therefore, since the beginning of the third stage, the ecological function of land consolidation has been given higher priority. It is not only necessary to solve the environmental problems left by previous SRLC, but also to further improve the quality of the ecological environment (Li et al., 2019; Shan et al., 2019; Zhou, Li & Xu, 2020). Although the effects of these initiatives on a national scale are not yet clear due to the relatively short period of policies and measures implementation, the approaches in some pilot projects partially reflect the ecological tendency of the CRLC. For example, implementation of the Gully Land Consolidation Project implementation has produced significant and positive influences in improving land use structure, landscape pattern and ecological security on the Loess Plateau (Li et al., 2019). It can be seen that RLC has had a positive effect on the ecological environment in China.

4.7 Main factors affecting the implementation of RLC

The application of RLC is case specific and is a process of continuous development and change. Thus, the factors influencing the planning and outcomes of the RLC may be diverse in a spatial-temporal manner (Jiang et al., 2022). Taking many countries and regions in Central and Eastern Europe as an example, the financial and technical support from the European Union and FAO has been the main impetus for successfully carrying out RLC since the 1990s to solve the problem of land fragmentation and improve agricultural productivity

(Hartvigsen, 2015). Although the technical means of RLC are almost the same in many regions in terms of the promotion of RLC policies and technologies, differences in natural resource endowments, historical contexts, laws and regulations, cultures and societies could lead to different outcomes (Borec, 2000; Gorton & White, 2003; Sklenicka, 2006). For example, the lack of clarity about land property rights and political will on the part of the government have been the main factors affecting the implementation of the RLC in Slovenia (Lisec et al., 2014). In Turkey, the exclusion of landowners from the participation process and the inadequacy of related laws were the main factors restricting the development of land consolidation in the early stage (Erdem & Meshur, 2009), while the high priority the government has assigned to land consolidation since 2002 has prompted the subsequent scaling up of the land consolidation programme (Veršinskas et al., 2020). In South Asia, on the other hand, the main reasons for the lag and slowness of the implementation of RLC are the equal inheritance system, a growing proportion of the agricultural population, emotional attachment to the paternal property, uneven land quality, and underdeveloped land markets (Niroula & Thapa, 2005; Thapa & Niroula, 2008).

In China, scholars have also carried out various research to attempt to explain the main factors affecting RLC. At the macro level, the formulation of national land consolidation schemes is influenced by policies, funding, and functional zoning (Fan, 2015; Jiang et al., 2022; Zhang & Ye, 2022). At the provincial and municipal levels, higher level land consolidation planning, differences in regional socio-economic conditions, capital investment, the willingness of local governments, as well as support from relevant laws, regulations, and policies, constitute the main factors affecting the arrangement of RLC projects (Feng & Yang, 2014; Ge et al., 2020; Li et al., 2020; Liu, Zhu & Li, 2012). At the micro-level, the distribution of benefits, local leadership, the definition of ‘property rights’, public participation, farmers’ level of understanding of RLC-related information, natural endowments, and local elites

also critically affect the practice of RLC (Gong & Tan, 2021; Lin, Niu & Cao, 2016; Xu, 2019).

In short, implementing an RLC scheme is a complex process since it is susceptible to various factors. The factors influencing RLC mainly include policy and will at the political level, funding, public participation, cultural and historical contexts, legislation, land use status, administration, local elites, and natural endowments. Therefore, each locale should adopt differentiated RLC strategies based on local conditions rather than uncritically transferring any practices and experiences which have been successful elsewhere.

4.8 Chapter summary

In essence, the process of rural land consolidation is a multifunctional land use process, and it is also an instrument and platform for achieving multifunctional rural land use. RLC can be a highly effective land management toolkit which allows for the reorganisation of rural land property, the optimisation of farmland's physical conditions, and the improvement of environmental issues. It can improve the socio-economic and ecological efficiency of rural land use and also bring benefits both to rights holders and to society in general. The praxis of RLC mainly have the following three approaches: mandatory, majority-based, and voluntary; in accordance with objectives, RLC can be divided into SRLC and CRLC. Moreover, based on the classification of land use types in rural China, RLC, at the village level, can be mainly divided into agricultural land consolidation, construction land consolidation (i.e. residential, industrial and mining land consolidation, and village environment renovation), and undeveloped land consolidation.

From a functional perspective, RLC in China has experienced the production function stage dominated by agricultural and industrial production, the multifunctional stage in which multiple functions coexist but lack coordination, and is currently in the comprehensive stage of pursuing

coordinated development among different functions. Although the praxis of RLC projects have had a certain negative impact in specific periods and regions, it is generally positive for China's social, economic, and ecological development. In order to facilitate the smooth and effective implementation of RLC schemes, it is necessary to comprehensively consider and coordinate various factors such as political and funding support, regional differences, public participation, cultural and historical contexts, legislation, and local governance.

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Chapter 5 Conceptual framework

5.1 Introduction

The conceptual framework in this research is constructed to investigate the following three components: 1) the relationship between rural land consolidation (RLC) and rural vitalisation (RV) within the supply-demand framework of rural land use functions (RLUFs); 2) modes of RV promoted by RLC from a functional perspective; and 3) mechanisms of RLC in promoting vitalisation of rural villages close to and far from major cities.

5.2 The relationship between RLC and RV from a multifunctional perspective

The supply-demand framework in this section includes the following four main components: 1) how the rural land use structure (RLUS) may impact the supply capacity of rural land resources which could be used in a multifunctional way; 2) how RLC impacts the land use structure and functions; 3) the demand of rural vitalisation for RLUFs; and 4) the interaction among multifunctionality, RLC, RV, and the supply-demand of and for RLUFs.

5.2.1 The spatial and functional relationship between rural developed land and natural cover

In the past few decades, the core task of RLC in China has gradually shifted from ensuring grain output to ensuring the quality and quantity of agricultural production, promoting rural development, and protecting the ecological environment (Jiang et al., 2022b; Zhang & Tan, 2021). Based on the principle of making full use of developed land, the land use types (see Table 5.1) involved in this study do not include the natural cover that is less affected by humans, but which has higher ecological value; that is, large areas of water (such as rivers

and lakes), grasslands, virgin forests, glaciers, and nature reserves[56].

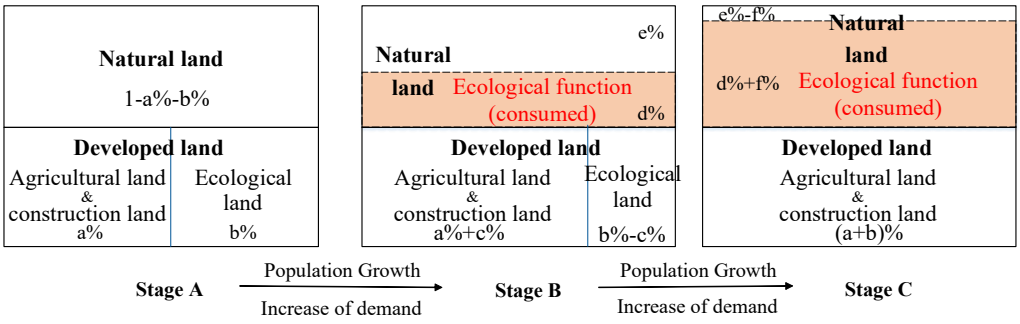

Fig. 5-1. A potentially ideal model of rural land use

Fig. 5-1 represents a potentially ideal land use model that can simultaneously satisfy people's needs and protect natural cover to the greatest extent. In stage A of socio-economic development, it is assumed that the developed land in a certain region accounts for a%+b% (a% accounted by agricultural land & construction land and b% accounted by ecological land) of the total area, while the rest is a natural cover (1-a%-b%), and the supply and demand of and for the ecological functions of the developed land remain balanced at this stage. As the population grows and the increased demand for ecological functions of human development, the socio-economy will develop to stage B. If demand cannot be met with the full use of existing agricultural and built-up land, part of the ecological land (also c% of the developed land area, c =< b) will be developed for farming and/or construction to meet further growth in demand for other functions. At some point, the ecological functions provided by the developed land will be in short supply; it is necessary to take advantage of d% of ecological functions of natural land without encroaching on natural land in order to achieve the balance of supply-demand of and for ecological functions. By stage C, 100% (a%+b%) of the developed land will be completely occupied by farming and construction. In order to achieve a balance between the functional supply and demand, f% (d%+f%≤1-a%-b%) of the ecological functions of natural land may need further to be activated in a state of natural

[56] The final determination of natural land needs to be analysed and classified on the basis of field surveys, especially at the village scale.

land being minimally affected. From that point on, with technological advances in society and a possible period of stagnation or decline of the total population, land use patterns may remain in Stage C in the long-term or regress to stage B.

Therefore, the land use types involved in this study are limited to developed land, not natural cover. The ecological function in the model refers only to the one provided by the developed land. But no matter how much the ecological function in developed land is consumed, it can be supplemented by natural land.

5.2.2 Transforming the supply of RLUFs by restructuring rural land use

According to general system theory (Bertalanffy, 1969), each system is composed of various elements and has two attributes: structure and function; elements are at the base of a system, the structure of a system manifests itself in its function, its function and structure are mutually constrained, and a system is understood as a structure with certain properties (Jian, 1999; Spirkin, 1983). This means the structure is the type of connection between the elements, and the structure in turn determines the function of the system (Ma et al., 2019; Spirkin, 1983). In terms of a land use system; the land use type is the *element* of the system; the land use *structure* is comprised of the spatio-temporal layout and relations between lands with differing uses, and land use *functions* are the embodiment of the land use structure (Thinh et al., 2002; Zhang et al., 2014). In other words, a RLUS can be understood from the type, area and location, in which land use type corresponds to the functional supply type, the percentage of the area of a given land use type within a given area affects the intensity of the corresponding function(s), and the contribution of different RLUFs to the overall function performance is determined by their location/types (which will be presented in greater detail in Chapter 6). The types of RLUFs, therefore, can be represented by rural land use types (e.g. residential land, industrial and mining land, commercial service land, and agricultural land), and the change of RLUFs can be regarded as the change of RLUSs. Consequently, the dynamic interaction

between RLUSs can reflect the change of RLUFs on the supply side (Ma et al., 2018; Zhu et al., 2014). The dialectical unification relations between RLUS and RLUFs have been claimed by some studies; that is, it is appropriate to reveal RLUFs via analysis of the RLUS, while the rational (re)arrangement of the land use structure is conducive to the achievement of the multifunctional use of rural land (Jiang et al., 2016; Verburg et al., 2009; Zhu et al., 2014).

This study identifies the functional supply (FS) of rural land use in the village from its structure, and classifies rural land use types according to the Land Use Classification (GB/T21010-2017) (Ministry of Land and Resources, 2017), field surveys in rural China, as well as some previous studies (De, Xu & Lin, 2017; Jiang, Long & Tang, 2021; Ma et al., 2018). Considering the RLUFs framework reviewed in Section 2.6 and that a single land use type may be designed to meet multiple needs (De, Xu & Lin, 2017), this study divided first-level RLUFs into production, living, cultural and ecological functions. For example, agricultural land is not only used to produce crops and thus create economic value, but also plays an important role in the employment of farmers and in ecological regulation. The detailed classification of RLUFs and their relationship with the corresponding land use types are shown in Table 5-1. RLUFs consist of five first-level functions (i.e. production, living, cultural, ecological, and unexploited functions), and ten second-level functions including nine substantial functions (i.e. agricultural, commercial, industrial, employment, residential, public service, maintenance, education, and heritage functions) and one unexploited function.

The living function (**LF**), as the basic function of rural land use, mainly involves habitation, work and daily life of rural residents. This function is served by residential land, public administration and service land, infrastructure land, as well as agricultural land (e.g. farmland, orchard, and vegetable field). Specifically, the function of residential land is mainly residential; public administration and service land and infrastructure land exhibit public service

functions; and commercial service land, industrial and mining land, as well as agricultural land can supply employment functions.

Table 5-1. The relationship between rural land use types and function types

Rural land use types (the content of rural land use structure)		Definition	The supply of land use functions	
			First-level functions	Second-level functions
Agricultural land	Agricultural land	Land used for growing crops, fruits, breeding, and aquaculture	Production function	Agricultural production function
			Living function	Employment function
			Cultural function	Heritage function
			Ecological function	Maintenance function
Construction land	Residential land	Land used for human habitation and its affiliated facilities	Living function	Residential function
	Public administration and service land	Land used for public administration and services, such as official organisations, the press and publishing, science, health, and recreation	Living function	Public service function
	Infrastructure land	Land used for infrastructure, such as roads and electrical equipment in villages		
	Commercial service land	Land used for commercial and service activities	Production function	Commercial production function
			Living function	Employment function
	Industrial and mining land	Land used for industrial production, mining and storage	Production function	Industrial production function
			Living function	Employment function
	Cultural land	Land used for education, research, cultural facilities, scenic spots, and religious activities	Cultural function	Educational function
				Heritage function
	Ecological land	Land cover that forms the basic components of terrestrial ecosystem structure (e.g. woodland, grassland, and water area)	Ecological function	Maintenance function
Undeveloped land	Undeveloped land	Untapped, idle, and abandoned land	Unexploited function	Unexploited function

The production function (**PF**) creates the conditions for villagers to engage in agricultural, industrial and commercial productions. The agricultural function is defined as the productivity of agricultural land. The industrial function means industrial production, mining and material storage within a certain rural area. It is provided by industrial and mining land. The commercial function mainly involves commercial and service activities (e.g. retail business, agricultural marketing, and tourism), sustained by commercial services land.

The cultural function (CF) can be divided into the educational function and the heritage function. The education function, mainly provided by land for education, research and cultural facilities, offers rural residents opportunities to acquire knowledge and improve their education level. The heritage function refers to the land as a site of religious activities, tourist attractions, museums, and farming, enabling people to appreciate and understand the local historic, humanistic, and natural landscape.

The ecological function (EF) is an important guarantor of the habitability of a village. It is mainly provided by the natural and agricultural landscapes. Natural landscape mainly refers to the state of the ecological land coverage, such as the woodland, grassland, and water area. Agricultural landscape here mainly refers to the land used for growing grains, flowers, fruits, vegetables, aquaculture, while it excludes the land for raising poultry and sealed greenhouse vegetables given that they are too weak in ecological function or are spatially independent.

In addition, the function of land use and cover that currently have no available or substantial functions (e.g. vacant and raw land, as well as abandoned land previously used for living and production), but are greatly affected by humans or are close to human production and life, is defined as the **unexploited function (UF)**. There is the potential for such lands to be reclaimed or exploited in the future to further meet rural development needs in the case where developmental needs cannot be met even when the existing developed land is fully utilised.

5.2.3 RLC as a tool to restructure the RLUS

Land use morphology, initially referring to the structure of the main land use types in a country/region in a specific period, corresponds to the present socio-economic stage of a given country or region (Grainger, 1995; Long & Li, 2012). This means that land use structure is closely connected with land use morphology. Traditionally, land use morphology has focused on the quantity and spatial structure characteristics of land use within a certain space and time. With the socio-economic development, merely analysing the types and quantities of land use is not enough to explain the more complex socio-economic phenomena hidden behind land use, nor can it meet the needs of the development of Land Change Science/Land System Science (Lambin & Meyfroidt, 2010; Turner, 2009). In this case, land use morphology is depicted as the two formats (i.e. dominant morphology and recessive morphology) (Long & Li, 2012) to respond to socio-economic changes and disciplinary development. The dominant morphologies, such as the amount, area, and spatial location of different land use types, can be directly obtained by visual inspection, while the recessive morphologies such as land ownership, land quality, and management regime can only be obtained from analysis, testing, and investigation. Meanwhile, recessive morphologies can exert an influence on dominant morphologies, since the dominant morphology is the external embodiment of recessive morphology. Besides, changes in RLUS depend on changes in land use morphology which could be affected by RLC.

Fig. 5-2 depicts how RLC affects RLUFs. First, the main content of RLC involves multiple attributes of land use, such as quantity, type, location, structure of property rights, soil structure, and operation mode. Changes in these attributes will lead to the readjustment of the recessive morphology and dominant morphology of rural land use, respectively. This will further affect the land use structure. Therefore, the structural change of land use caused by RLC will lead to the change of RLUFs.

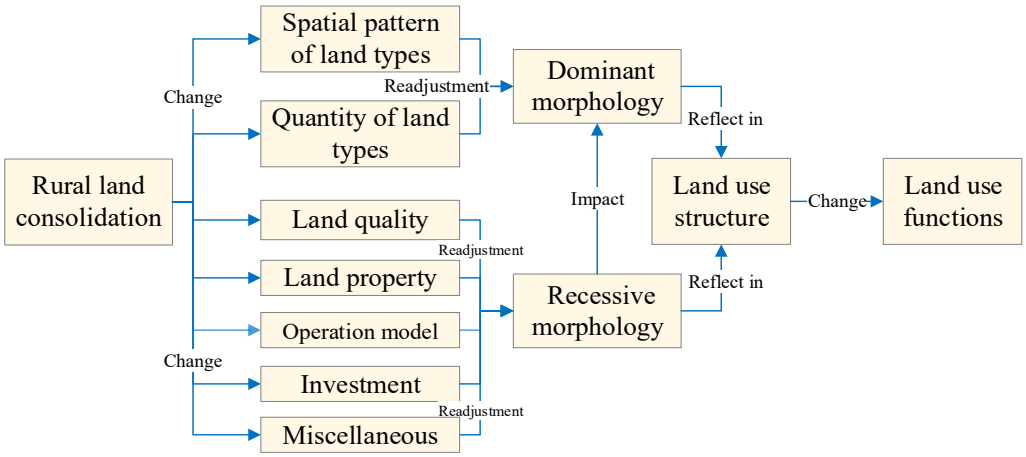

Fig. 5-2. The relationship among RLC, RLUS, and RLUFs

5.2.4 Rural vitalisation's demand for RLUFs

As a resource, rural land provides living, production and ecological space for rural residents and provides food for a wider population, but has faced huge challenges and pressures in recent decades due to excessively fast industrialisation and urbanisation in China (Long, 2020). Some unfortunate phenomena, such as rural depopulation, rural poverty, industrial recession, cultural decline and land deterioration, have generated negative effects on the performance of land use multifunctionality. To relieve and even resolve these problems, the concept of RV has been proposed as a guideline to make rural more sustainable (Long, Zhang & Tu, 2019).

RV's demand for specific types of RLUFs can be understood as the demand for the adapted RLUS reflected in the state of rural development over a certain period. This added demand can be considered as the base to promote rural development through the change of land use structure.

As mentioned in Section 3.4.3, "thriving industry, pleasant living environment, refined rural civilisation, effective governance, and prosperous life" are the five objectives of the rural vitalisation strategy. At the village level, residents and enterprises are the main promoters and beneficiaries of local development. For many of them, especially residents, it is the responsibility of the government or decision-makers to provide competent administrative services.

In other words, the achievement of effective governance is a task for the government, rather than for residents and enterprises. The proposal of the rural vitalisation strategy promotes the influx of elements such as capital and manpower into the countryside, and the socio-economic transformation of rural villages. During this period, competent local governance is of increased importance in order to ensure that rural society can make full use of extrinsic capital without being eroded and unfairly exploited, as well as that the ecological environment be maintained or even improved. Thus, effective governance is the political foundation and guarantor of the achievement of the other four principles (Guo et al., 2018; Zhang, Hao & Yan, 2018). As some scholars (Jiang, Long & Tang, 2021; Long, Zhang & Tu, 2019) therefore state, the demands of RV in China can be defined as social stability, economic efficiency, cultural prosperity, and environmental friendliness. Each of these four demands has corresponding RLUFs; that is, the living function may contribute to social harmony, the production function may help to achieve economic efficiency, the cultural function is needed for cultural prosperity, and the ecological function is necessary for maintaining environmental quality.

In China, it is a common perception that social harmony is a prerequisite for socio-economic development. The social harmony required by most villages in rural China is manifested in that people in a given area can live and work in peace and contentment with sufficient public services (Guan, 2018), which is closely connected to the living function of rural land use. As previously analysed, rural land can provide habitation, affiliated facilities, and jobs for local residents in this perspective.

As the productivity of China's agricultural and industrial production is lower overall than that of developed countries (Li & Yang, 2006; Zhao & Gu, 2018; Zhu, 2016), developing the economy and improving the level of industrialisation and mechanisation remains an extremely important task to advance the development and vitalisation of most rural areas in China. With the

acceleration of industrialisation and vigorous development of Township and Village Enterprises (TVEs) since the 1980s, many areas of rural Eastern China have experienced or are experiencing a transition from a self-sustaining peasant economy to a modern industrial economy involving multifunctional development. According to the China Statistical Yearbooks (County-level)[57] and village-level research done by some scholars (e.g. Wu & Song, 2007), it can be found that the secondary sector has become the dominant sector in the development of most rural areas in Eastern China. Moreover, alongside the secondary sector, rural tourism and commerce have become important means capable of driving local development while reducing environmental impact (Gao et al., 2019; Shi & Li, 2018). Although agricultural output (which accounts for less than 9% of GDP) is much lower than that of manufacturing and services, agriculture is responsible for providing income and employment for over 600 million rural people, as well as providing income for a variety of businesses and large industrial and commercial enterprises engaged in agricultural production (He, 2018). This shows that agriculture still occupies an important economic position in China's rural development and farmers' income composition. Economic efficiency in rural China, therefore, involves the primary, secondary, and tertiary industries.

With the accelerating process of urbanisation and China's market economy over the past decades, problems such as rural depopulation and village hollowing have gradually emerged and intensified in recent years (Liu, Yang & Li, 2013). Some villages, especially those of historical, academic and representative significance, have been constantly demolished to make way for what resembles urban-style residential areas, but these urban-style residential areas might not be suitable for all villages (Fig. 5-3). In this case, many valuable traditional cultures have gradually been marginalised or stereotyped. This may not only jeopardise the preservation of rural cultural heritage, but also lead to the homogenisation of

[57] https://navi.cnki.net/knavi/yearbooks/YXSKU/detail (access to the URL of data)

RLC and landscape to a detrimental degree and even endanger the maintenance of rural social ties (Li et al., 2018).

Fig. 5-3. Hollowing village (a) and new residential buildings in rural areas (b)

Villages that lack local characters and whose living conditions are inferior to those of urban communities can lead to a loss of a sense of local belonging. This would be detrimental to the self-governance of villages and local sustainable development. Recently, there have arisen concerns about the preservation of meaningful rural traditional culture; it has become one of the core tasks of the "New Rural Construction" to improve the ability of rural culture and landscape to enhance the sense of local belonging (Li et al., 2018). Additionally, the cultural construction of rural China has long been the result of the combined effect of traditional culture and modern civilisation under the influence of socio-economic development and rapid urbanisation. Indeed, the construction of Chinese rural villages today is inseparable from the modern socio-cultural environment and also requires the infusion of new knowledge and culture to develop local culture while being in keeping with the broader developmental standards of the day. For most rural people, education, especially higher education, is an important way to improve their economic and social conditions and to acquire new knowledge and culture. This is why many villages show that they value and expect the younger generation to pursue higher education by giving financial support to villagers who are doing so. Going forward, the preservation and inheritance of valuable or meaningful traditional culture, as well as the promotion of the modernisation of rural areas by raising the level of education of local people, will be the core contents of cultural

vitalisation in rural China (Cao & Shi, 2021; Chen, 2018; Huang, 2018).

Environmental friendliness, focusing on environmentally friendly behaviours and reducing enterprises' pollutive potential, is measured by the performance of rural production and life in reducing environmental impacts (Chen, Lin & Weng, 2015). The long-term extensive development modes and lifestyles in rural China have had adverse impacts on the ecological environment (Huang & Liu, 2010; Zhang, 2004). For example, the construction of a large number of rural factories and residential houses at the expense of agricultural land and ecological land has caused problems such as food insecurity and deterioration of the ecological environment; simple rural land consolidation (SRLC) and the application of chemical fertilisers have been widely promoted in pursuit of short-term high yields in the past few decades (as mentioned in Chapter 3), resulting in damage to the production environment (e.g. soil contamination and soil erosion); unmanaged waste disposal behaviours and the absence of waste treatment systems (including sewage) have had long-term negative impacts on the natural environment. With the continuous increase of overall national economic levels and the elevation of rural per capita net income, people are no longer only satisfied with larger houses and local economic development but have a demand for a natural-looking living environment and eco-friendly production environment (Ye, 2018; Zhang, 2018). In this case, environmental friendliness can be further explained by landscapes that satisfy local residents, high greening rates, as well as low-polluting agricultural and industrial production processes.

Similar to the functional supply (see Table 5-1), the demands of RV are also categorised under the four first-level functions: living, production, cultural and ecological functions, as well as nine second-level functions. With the rural transformation, the reciprocal relationships between substantial material elements such as people and land and nonmaterial elements such as culture and property in living and production have contributed to the diversification of

demand for RLUFs (Ma et al., 2019).

5.2.5 The evolution of the relationship between functional supply, functional demand, and RLC

Residential land and agricultural land are the earliest forms of rural land use, and they are mainly used for living and agricultural production. Although the population was small and people's needs were limited in the early days of human activity, low levels of socio-economic development restricted the supply of RLUFs, resulting in a functional supply that was chronically beneath the needs of people and local development. With the development of agricultural mechanisation driven by SRLC and industrialisation (Jacoby, 1959), there was a simultaneous growth between the supply and demand of and for functions. At a certain point, demand and supply were likely to reach a relatively balanced state. However, a large amount of rural land was transformed for industrial and commercial uses after experiencing rural industrialisation and rural urbanisation, accompanied by a growing need for non-agricultural production. The rapid urbanisation and industrialisation then sped up population growth and urban sprawl; the human-land relationship subsequently became more fraught. The severe contradiction between population growth and the reduction of available rural land has caused the original multifunctional supply to fall short of demand (Mander, Wiggering & Helming, 2007). As a result of people's increasing reliance on rural areas for a wide range of purposes – such as entertainment, commerce, social interaction, and cultural expression – traditional living and production modes are struggling to keep up with population growth. In addition, driven by people's increasing needs, a large amount of previously unused land and ecological land in rural areas has been reclaimed and consolidated for agricultural and construction land, such as residential land, roads, and industrial and mining land. This series of SRLC activities designed to meet people's production and living needs were carried out at the expense of the natural and

cultural environment, failing the ecological and cultural functions of rural land use to meet the rural developmental demands for a good ecological environment (Mander, Wiggering & Helming, 2007). Meanwhile, the degradation of the natural environment, especially the encroachment on and pollution of cultivated land by urbanisation and industrialisation, has restricted the functional supply of rural land, leading to issues such as food insecurity and soil degradation (Huang & Liu, 2010; Xu, 2020; Zhang, 2004).

Therefore, to ensure social stability, improve economic efficiency, achieve cultural prosperity, and preserve a good eco-environment in rural areas, comprehensive rural land consolidation (CRLC) has been adopted to create a comfortable living environment, improve land use efficiency, and restore damaged human and natural environments (Fig. 5-4). However, given the limitations of geographical conditions and land policies in China, the supply of RLUFs (internal structure) is changing positively but slowly, while a disparity between supply and demand still remains (Ma et al., 2019).

5.2.6 Interaction among functional supply-demand, RV, and RLC

As the outcome of reciprocal relationships between the demand and supply for and of RLUFs, the study of multifunctionality is considered to be important in addressing the complexities of interactions among different rural land uses, and in facilitating policymakers to implement effective policies for rural vitalisation and sustainability (DeFries, Foley & Asner, 2004; Kearney et al., 2019; Ma et al., 2019). RLC can change rural land use types and structures. The supply of RLUFs can be represented by the RLUS that has been realised and can be viewed as a functional input, while functional demand can be seen as the land use structure required for rural vitalisation and can be expressed as a functional output (Ma et al., 2019). The multifunctionality framework integrates the RLUFs affected by RLC observed in rural areas into four main functions (LF, PF, CF, and EF), which are balanced among the four demands of RV (Fig. 5-5).

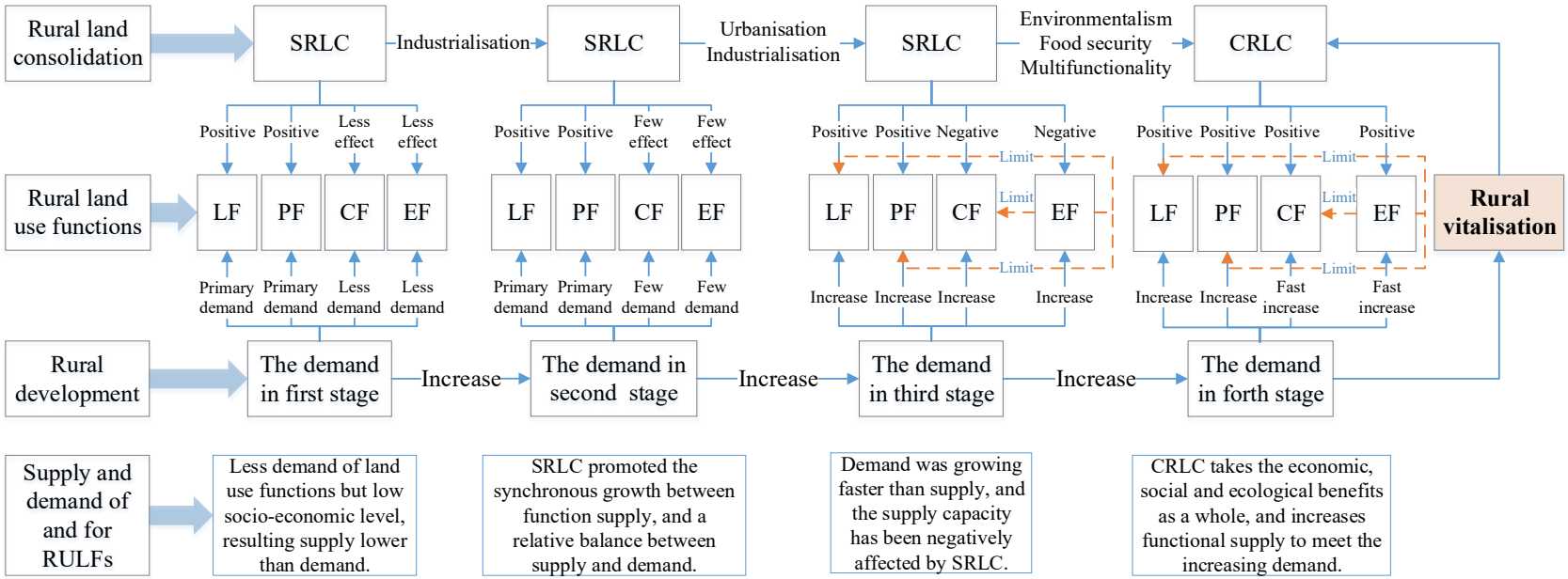

Fig. 5-4. Change of the relationships among the supply of RLUFs, demand for RLUFs, and RLC

(Adapted from Jiang, Long & Tang, 2021)

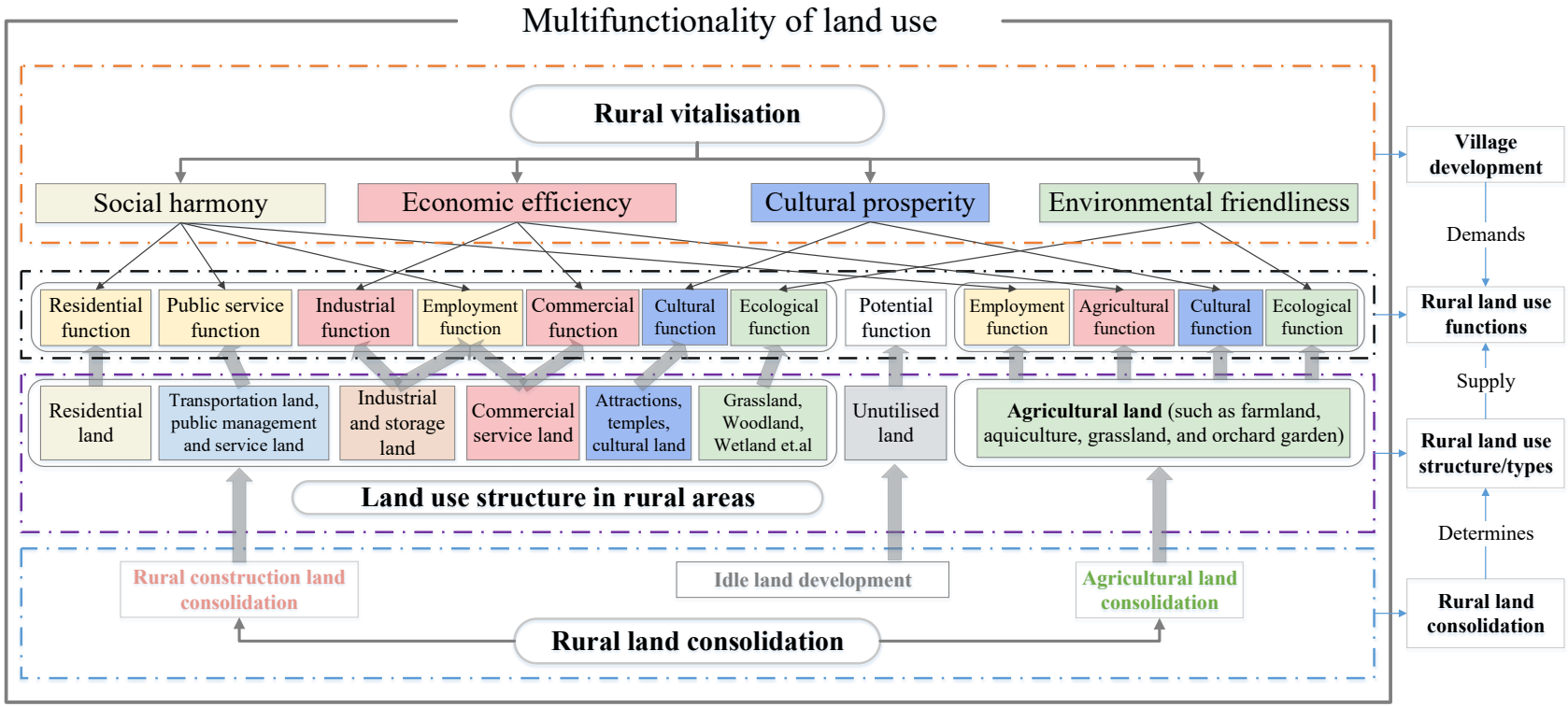

Fig. 5-5. Multifunctional conceptual framework of the relationship between RLC and R

Based on this conceptual framework, changing a RLUS in planning motivates change in RLUFs and further balances the supply and demand of and for functions in promoting rural vitalisation. Furthermore, rural development is a dynamic process, which means that the structure of rural land use is also dynamic. To drive this dynamism in the direction of RV, RLC is used as the main tool and platform during the land use transition. As the current state of a RLUS is the starting point for necessary changes, promoting the readjustment of the land use structure through RLC can therefore be seen as the supply-led land use planning that seeks to balance the functions' supply and demand. Coordinating the coupling relationship between the implementation of RLC and rural development's demand is of great significance for the achievement of RV and urban-rural integrated development (Long, 2020; Long, Zhang & Tu, 2019).

5.2.7 The theoretical framework between RLC in promoting RV

Based on the critical review and discussion of the three core concepts from Chapters 2 to 4 and the theoretical analysis in section 5.2, it is clear that RLC, as a multifunctional toolkit combining land use policies and engineering, can be used by villages to promote the multifunctional output of rural land use. The direct purpose is to meet the corresponding demand from village vitalisation. However, due to the synergies and trade-offs between multifunctional land use and rural development as discussed in Section 3.2, while RLC has the ability to promote village vitalisation, unreasonable land consolidation planning and implementation can also constrain local development (Fig. 5-6).

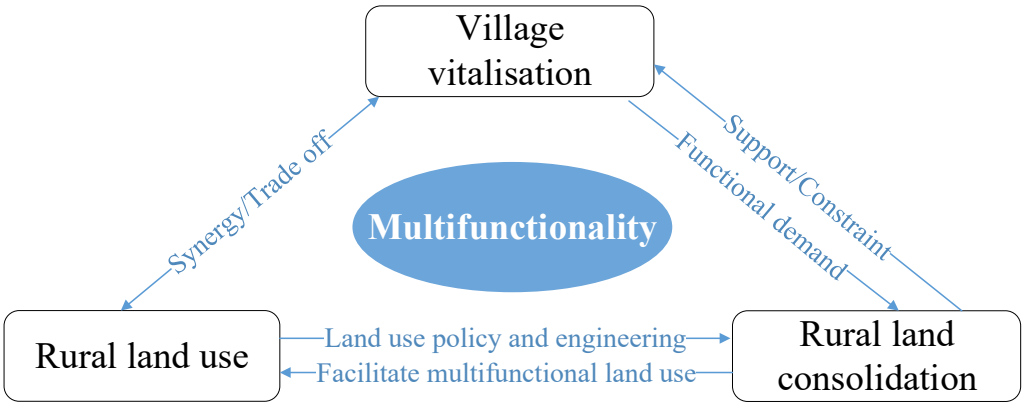

Fig. 5-6. The theoretical framework of RLC in promoting village vitalisation

The above theoretical framework suggests that analysing the relationship between RLC and village development from a multifunctional perspective needs

to consider not only how RLC contributes to the multifunctionality of local land use, which can be shown through spatial analysis and qualitative analysis, but also to quantify the effects of RLC on local development in order to reveal the synergy and trade-off between them. In addition, the implementation of RLC stems from the needs of local development; thus the analysis and measurement of the functional needs of local development for RLC is necessary to comprehend the relationship between the above three concepts (i.e. RLC, RV, and MLU) under a variety type of villages. The villagers, the village collective, and the local government are the main body of local development, which means their needs represent the needs of village development. Therefore, the formulation and implementation of the village land consolidation scheme needs to be carried out based on the opinions of different stakeholders, and the adoption of specific methods may vary from case to case.

5.3 Modes of RLC in promoting RV from the perspective of multifunctional land use

The word “mode” is derived from the Latin word for “modus”, and one of its meanings is “manner”. In this study, “mode” is understood as a way or manner in which RLC is performed and in which the resulting RV is experienced by stakeholders. Summarising the modes of RLC in promoting rural development not only helps to concretise and clarify the abstract development process, but also helps us to understand the impact of different modes on rural development (Xie et al., 2021; Yang et al., 2020).

5.3.1 The impact path of RLC on rural vitalisation

RLC mainly involves the consolidation of agricultural land and construction land (e.g. homestead as well as industrial and mining land), both of which are land use behaviours involving the readjustment of rural production, living, and ecological spaces through engineering and technical means (Long, 2014). The essence of this process is the adjustment of recessive morphology, such as land ownership, and dominant morphology, such as spatial layout and quantity structure, in order to change land use morphology (Long & Li, 2012). The change in land use morphology initiates the change of such key elements of rural development as population, land, and industry. This is because intentional

changes in rural land use (e.g. landscape optimisation; the improvement of soil quality or facilities) directly affect the economic and ecological benefits of activities relating to the production and the development of associated industrial chains; this, in turn, affects the process of regional socio-economic, cultural, and ecological development, leading to the structural transformation of local development as a whole (Long, Zhang & Tu, 2019).

As one of the tools used in the process of promoting rural vitalisation, RLC is able to impact rural socio-economic conditions via restructuring rural spaces, in the process of which administrative forces and engineering techniques intervene in rural production, living, and ecology by changing the land use structure. During the rural spatial restructuring, the evolution of various urban-rural development factors could cause different degrees of feedback and response from the rural territorial system, thus affecting the sustainable development of regional agriculture and rural areas. In this process, RLC plays the dual role of policy tool and engineering technique. RLC adjusts the evolutionary vectors of key elements of the developmental process (people, land, and industry), and promotes coordination among these various elements as they develop, which is consistent with the requirements of the rural vitalisation strategy (Long, Zhang & Tu, 2019). In summary, the change in land use morphologies brought about by RLC is the spatial projection of rural spatial redistribution on land, and this rural spatial restructuring can further promote rural development (Fig. 5-7).

5.3.2 The reciprocal relationship between RLC and RV from a functional perspective

Although the diversity of land use types makes functional issues a complex matter, the imbalance between RLUFs supply and demand, based on the above analysis, can be mainly reflected in the following two aspects: incongruent function types and disharmonious function intensities. The former is an effect of the fact that the number of land use types/functions may be more or fewer, while the latter refers to the fact that the area of different land use types/functions may be larger or smaller. The rationality and accuracy of the supply of RLUFs will trigger varying degrees of feedback and response in the rural territorial system, thereby influencing rural sustainability (Jiang, Long & Tang, 2021).

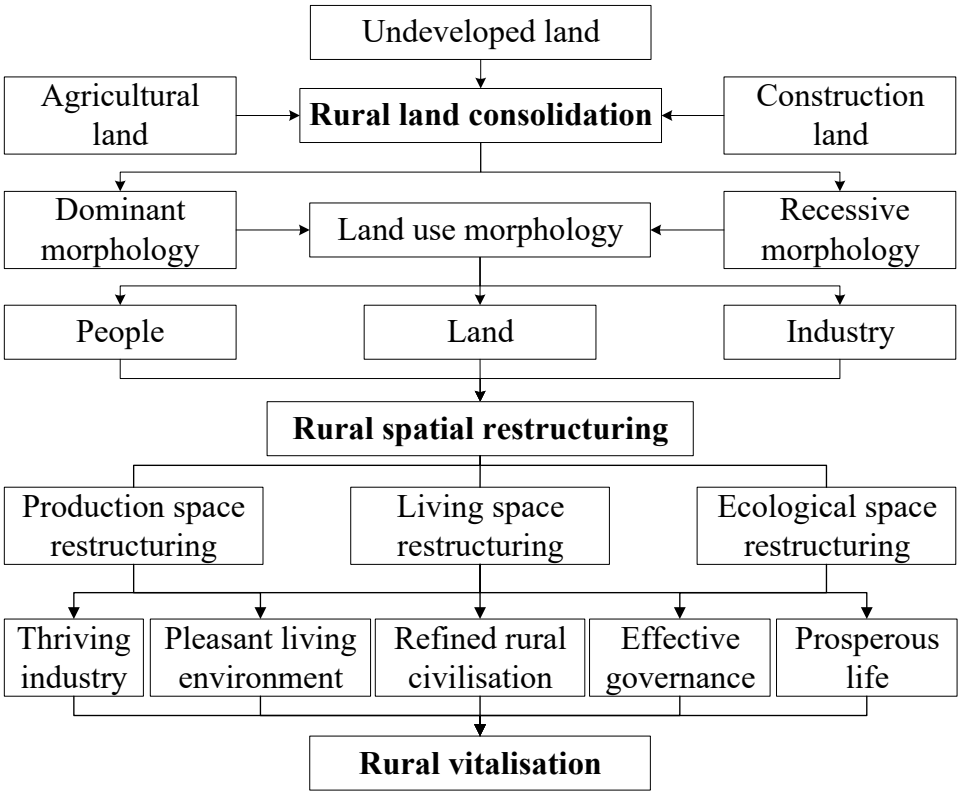

Fig. 5-7. The impact path of RLC on RV from a spatial perspective

As a national strategy, rural vitalisation aims to pursue functional diversity and multifunctional coordination in the rural territorial system under the effective policy guidance and administrative governance, thereby promoting the construction of an economically-efficient, socially-harmonious, environmentally-friendly, and culturally-prosperous rural society (Jiang et al., 2021). RLC is an instrument for restructuring rural production, living and ecological spaces by utilising policy tools and engineering technologies in tandem to change rural land use morphologies and structures (Long, 2020; Long, Zhang & Tu, 2019). Although there are differences in the specific targets and roles of the three types of land consolidation, their identical and overarching goal is the promotion of land use efficiency, the optimisation of land use structures, and the improvement of the ecological environment (Jiang et al., 2017; Long, Zhang & Tu, 2019). Throughout the process of integrating land use types, restructuring land use structures, and optimising land use functions, land consolidation can promote the supply-demand balance of RLUFs from the supply side according to local conditions (Jiang, Long & Tang, 2021). In cases where RLUFs are unable to meet or do not match local developmental needs, they can be readjusted through land consolidation.

Rural vitalisation can be understood as the process of rural transformation and development moving in a positive direction. This process requires that land use entities optimise RLUFs through land consolidation and other means, while the transformation of RLUFs, in turn, affects the multifunctional transition and vitalisation of a rural territorial system (Long, Zhang & Tu, 2019). The basic logic underpinning rural vitalisation by means of land consolidation is that RLC is able to promote multifunctional land use (MLU) in rural areas both quantitatively and qualitatively to meet rural development's demand for RLUFs. After a while, along with the development of the social economy, the original land use functions may no longer meet the demands of rural development according to the needs of the new era. This will create new functional problems and further trigger the next round of the RLC (Fig. 5-8).

5.3.3 The modes of rural vitalisation promoted by land consolidation

Notwithstanding the diversity of land use types and the differentiation of imbalanced patterns of the RLUFs supply-demand, the modes of RV promoted by RLC, with reference to the reciprocity outlined above, can be divided into the 'type-conversion' mode and 'intensity-adjustment' mode (Jiang et al., 2022a).

(1) The type-conversion mode

The 'type-conversion' mode refers to when the function types required for rural development do not match those provided by the current land use structure, land consolidation is thus employed in order to adjust the land use types to increase or reduce certain types of RLUFs. There are the following two situations.

One involves the number of current land use types, based on a local development strategy, exceeding the amount required for rural development, and land consolidation thus is needed to convert the excess land use types into other land use types needed for rural development. For example, with the continuous depletion of resource reserves and the deterioration of the surrounding eco-environment, some rural areas, whose local economies were originally dominated by the exploitation of natural resources such as coal and metals, have been converting industrial and mining land into other land use types through land consolidation in order to achieve local sustainability. And for those villages that have been dilapidated for a long time and or even abandoned, residences in certain areas can be demolished for the purpose of farming or planting trees.

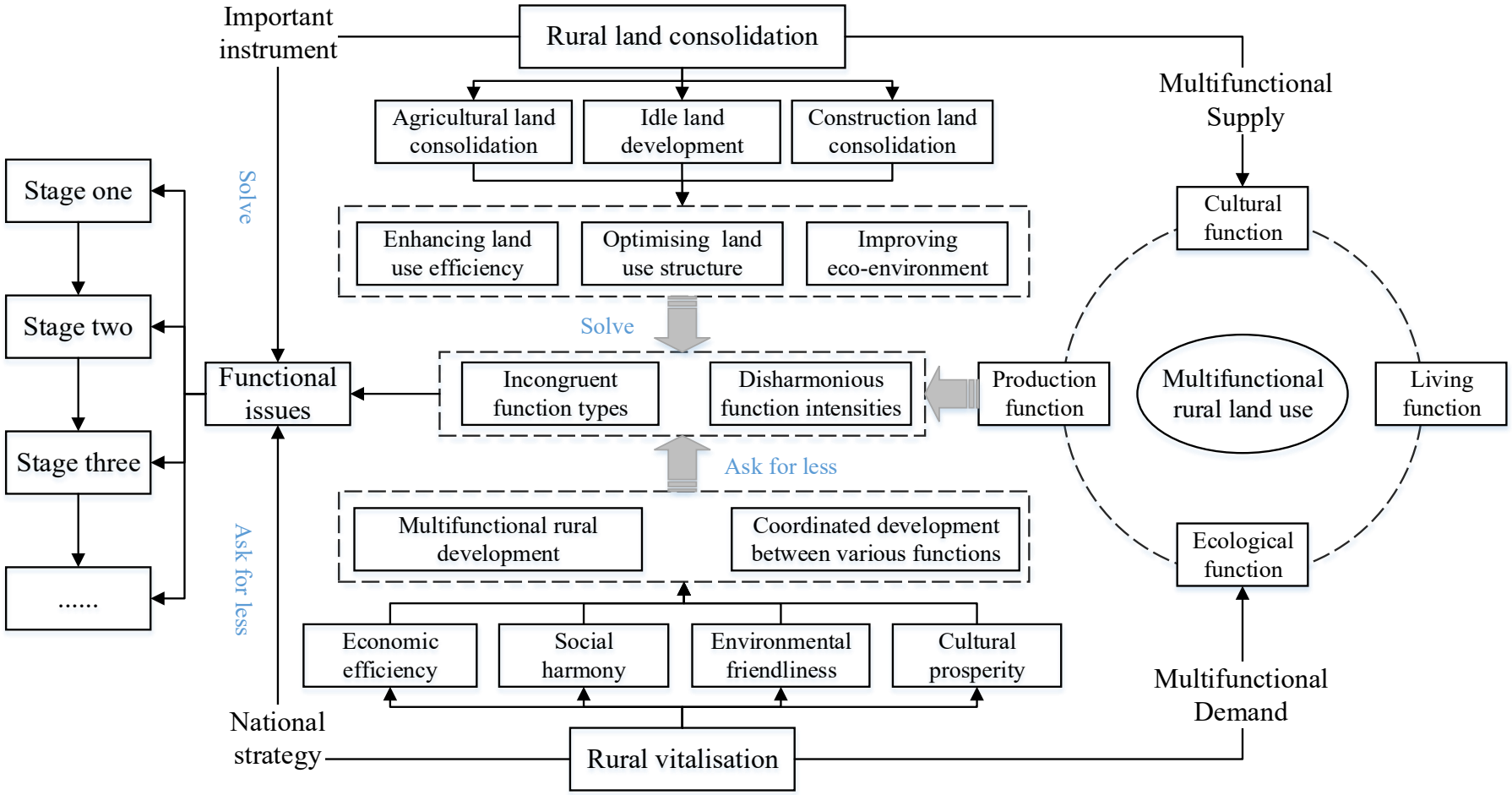

Fig. 5-8. Reciprocity between RLC and RV in China from the perspective of multifunctional land use (Jiang et al., 2022a)

Another involves the amount of current land types being insufficient to meet the demands of rural development. In this situation, one can adopt land consolidation to reclaim wasteland, idle land, and abandoned land, or else change the use of other surplus land use types and transform them into the types needed for local development. For instance, in the case of metropolitan development, land in outer suburbs can be reclaimed for farming to ensure food supply, while some suburban land may be converted into industrial, residential, commercial service, or public service land to meet the needs of urban development and urban residents (Tu et al., 2018).

(2) The intensity-adjustment mode

The 'intensity-adjustment' mode denotes that when certain functions cannot meet or else inefficiently exceed the needs of rural development, one can adopt land consolidation to increase or reduce the area proportion of relevant land use types in order to reduce the differences between functional supply and demand. If the use intensity of a certain type of land places unbearable demands on the environment or else exceeds the need for rural development, the use intensity of that type of land use can be reduced through land consolidation; if the supply intensity is lower than the demand intensity, the supply intensity can be increased. A good way to understand this is to consider that rural areas near metropolises can appropriately increase the intensity of cultural, leisure, entertainment and production functions, while remote rural areas with relatively fragile ecology may be more suitable for weakening production functions while strengthening ecological functions (Liu et al., 2021).

5.4 The mechanisms of RLC in promoting RV

A mechanism is a key process that drives or ceases the operation of a concrete system (Bunge, 1997). However, proposing a proper explanation of what affects the operation of the system is not enough to demonstrate a law-like mechanism. The operation of a social system is usually steered by multiple mechanisms. To understand a mechanism in a system, we need not only to explain what affects the functioning of the system, but further analyse and reveal the operational process of the mechanism and even the interaction of different processes or mechanisms. Although all mechanisms are system specific, it is

possible and desirable to group them into a few general classes based on the level of their similarities (Bunge, 1997). Therefore, in demonstrating the mechanisms of land consolidation in promoting local development at the village level, the study analyses which factors contribute to the process of land consolidation in the promotion of village development, and how they combine.

In China, national or regional development strategies can determine the multifunctional use and synergy of different regions (Lu et al., 2009). The spatial-temporal change of land use functions is affected by multiple factors such as natural resource endowments, socio-economic conditions, regional development policies, land use decisions and behaviours, and stakeholders (Du, Sun & Wang, 2016; König et al., 2014; Wang & Dong, 2015). However, the concept of scale needs to be borne in mind when analysing land use changes and regional/local development. For example, Hein et al. (2006) state that the roles of different ecosystem service functions and the interest of stakeholders within them all vary with scale. This means that RLC mechanisms designed to promote RV by changing RLUFs may be different at the village level from that at the national and regional levels. To be specific, at the national or provincial level, functional areas are usually divided according to the natural and geographical conditions of each region, so that each region can give full play to its comparative advantages within the defined territories and strengthen the functional connection between regions through land consolidation and related land policies; at the mesoscale, such as the municipality, county, and even town levels, emphasis is placed on industrial positioning based on a locale's comparative advantages within its region and then on the promotion of industrial layout and development through land consolidation; at the village scale, the functions of the village space can be categorised into three fundamental elements: those for living, for production, and for ecological services, and these three types of space should ideally be (re)arranged rationally through land consolidation in order to make full use of all types of RLUFs (Chen et al., 2011; Zhu et al., 2019).

From an overall perspective,, RLC implemented at the village level is supposed to meet the extrinsic demand for rural territorial functions, while simultaneously meeting the needs of rural developmental shakeholders internally, such as local villagers and organisations. The research on RLC in the promotion of RV, from a multifunctional land use perspective, can be measured in terms of

land use type and intensity in a specific area. The advantage of research at the micro level is precisely the use of this refined method to measure the supply of and demand for land use functions and types. Therefore, the changes of RLUFs involving function types, intensities, and locations are affected by RLC, while RLC is subject to both extrinsic factors such as regional policies and market demand, and intrinsic factors such as rural natural resource endowment and socio-economic conditions. This is because these factors can directly affect planning, the decision-making process, and the implementation of local plans; that is, factors involving geographic location, type, investment and area will affect land use change throughout the process. At the same time, due to the extrinsic influence of urbanisation and social-economic transition, rural land users are in a state of gradual change. This affects the implementation of RLC and subsequent land use methods, causing changes in RLUFs and rural developmental status involving aspects of society, economy, culture, governance, and environment (Zhu et al., 2019). These changes will be fed back into regional policies and will affect the needs of rural development entities over time (Fig. 5-9). The process described above outlines the mechanisms of RLC in the promotion of RV from a functional perspective.

However, it is generally considered that the primary factors driving change are intrinsic, while extrinsic factors provide the conditions for change to occur (Clanton Harpine, 2015). Among the intrinsic factors, the efforts of local elites and geographical position are usually more significant for the development of rural villages in China, because the former determines whether and how local resources can be fully utilised while the latter usually determines the extent to which the development of a village is affected by extrinsic factors.

In ancient China, the governance of rural society was mainly undertaken by the "rural gentries/gentlemen (*Xiang shen*[58])". Since the founding of the People's Republic of China in 1949, the participation of rural gentries in local governance has been almost eliminated, and a rural governance system at the village level with a village committee and a village branch composed of village cadres as the main body has been gradually developed to replace it.

[58] A rural gentry, in ancient China, generally refers to a person who has achieved fame through the imperial examination, while in modern times it usually refers to a person who is well educated or/and has a sound economic foundation and ability, and has a certain prestige in the local area.

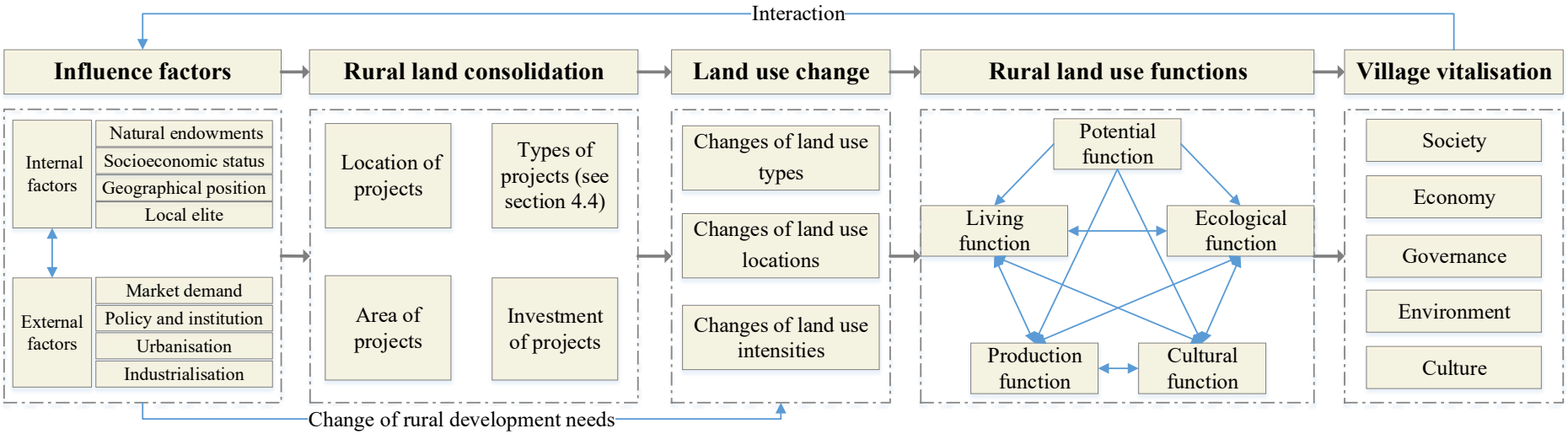

Fig. 5-9. The mechanism of RLC in promoting RV at the village level

Considering that the local prestige, such as rural gentries enjoyed, is an important advantage in the exercise of governing power, post-1949 rural governors often encountered the phenomenon whereby “rural gentries still keep local prestige from the old time without governance rights” and “village committees own governance rights without local prestige” (Lang, Zhang & Xiao, 2017). Since both local gentries and village cadres found it difficult to exercise full authority in local governance, the effectiveness of rural governance was limited. Moreover, as times change, the appearance and development of new productive forces require new production relations to adapt to it. Therefore, realising the reorganisation of rural socio-economic structures and exploring (a) village governance mode(s) that can more effectively connect state power and the wishes of villagers have gradually become the focus of modern rural governance in China (Lang, Zhang & Xiao, 2017). Given this requirement, RLC is a complex project, one which takes land as its main object (as an important and limited resource which farmers rely on for food production and livelihood), resulting in a large number of stakeholders associated with it and resultant difficulties in coordinating interests. Under the current socio-economic context in rural China, the participation of rural gentries, who are often selected by villagers, in local governance has been proposed and implemented as a reasonable path (Lang, Zhang & Xiao, 2017). Additionally, the development of villages in rural China is usually considered to be influenced by two forces, namely administrative embeddedness and village endogeny (Li, 2006); both require promotion from rural elites.

Rural elites are formed with reference to changing socio-economic contexts and have become the backbone of the new rural governance. Rural elites can be divided into two categories based on whether or not they have rights granted by higher authority or by law: those within the administrative system (such as village cadres) and those outside the administrative system (such as local entrepreneurs and major local grain producers, also known as rural gentries). The former belongs to exogenous authority, while the latter constitutes endogenous

authority. The combined forces of these elites can become an important part in the promotion of rural reorganisation and play leading roles in local development. To a certain degree, elites from outside the system can be transformed into elites within it. For example, if villagers of wealth and a high degree of prestige in the village (i.e. village gentries) intend to participate in the election of the village committee, it is relatively easy for they to become elected and become elites in the system. Furthermore, according to the composition of elites, current Chinese village governance can be divided into the following four types: 1) "Original authoritative rural governance", in which village authority is mostly in the hands of local rural gentries; 2) "Embedding authoritative rural governance", in which village authority is mostly in the hands of village cadres within the administrative system; 3) "Cooperative rural governance", that is, the village gentries and the village cadres jointly hold the authority to govern; 4) "Disorderly rural governance", meaning that the village lacks an authority or authorities capable of unifying or coordinating everyone's opinions, and the village governance is therefore relatively chaotic (Li, 2015). However, the fourth type hardly exists in current rural China.

Moreover, since China is still in the process of rapid urbanisation, the development strategies and land consolidation priorities of different rural areas generally vary according to their distance from large cities[59] (Guan et al., 2011; Liu & Feng, 2017; Shi et al., 2015; Song & Liu, 2011; Tan, 2014). Comparatively, the closer villages are to major cities, the more they can enjoy the spillover economic and political surpluses of urbanisation and industrialisation, thereby promoting local industrial development and facilitating socio-economic transformation. This can also bring about the diversification or specialisation of land use, which will affect the forms that subsequent land

[59] There is no uniform standard to determine what constitutes "close to" and "far from" a large city, as these definitions are affected by the varying natural conditions and developmental statuses across regions. Considering that the study areas located in the plain area of eastern China, this study, combined with author's field surveys in rural China, defines the distance, within an hour's drive from the core area (CBD) of the closest metropolis and city where its municipal government is located, as being close to a large city; a distance of about or more than an hour and a half from both cities (closest metropolis and its prefecture-level city) is defined as being far from a major city.

consolidation projects take. For example, villages close to major cities are commonly chosen for establishing manufactory bases due to their logistical convenience and sufficient labour resources, while areas far away from major cities are often used as the main areas for food production because they are far away from pollution and may have sufficient land resources that are still suitable for cultivation (Shi et al., 2015). Similarly, resource endowments and socio-economic conditions can also affect the type and scale of RLC projects.

5.5 Chapter summary

In this chapter, the relationship between RLC and RV as well as the modes and mechanisms of RLC in promoting village development have been theoretically discussed from a multifunctional perspective. The emergence of rural issues lies in the imbalance between the supply and demand of and for RLUFs. The basic logic of RLC in the promotion of RV is that land consolidation can change the land use structure of a specific area in terms of land use type and intensity, so as to readjust RLUFs (production, living, cultural, ecological, and unexploited functions), and also reconstruct rural space (production, living and ecological spaces). This can further meet the demands of rural development for RLUFs and spaces. Correspondingly, RLC in the promotion of RV can be achieved via two modes: the type-conversion (for updating the land use functions) and the intensity-adjustment (via rearranging the spatial layout). In addition, the effect of RLC on the promotion of village development is a product of the combined effect of intrinsic factors (such as natural endowments, socio-economic status, geographical position, and local elites) and extrinsic factors (such as market demand, policy, urbanisation, and industrialisation). However, it is generally considered that intrinsic factors are the main driving forces of change, among which the efforts of local elites and geographical position are usually the most significant.

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Chapter 6 Measuring supply-demand of and for RLUFs and the effectiveness of RLC

6.1 Introduction

This chapter continues to construct the theoretical model of this thesis, mainly involving the construction of two measurement systems. Section 6.2 expounds upon methods of evaluating the effectiveness of rural land consolidation (RLC) on rural vitalisation (RV) at the village level, explaining it according to the five objectives of economy, environment, culture, governance, and living). Next, Sections 6.3 and 6.4 introduce the formulas and indicators used to calculate the supply intensity and demand intensity of rural land use functions (RLUFs), as well as the reasons for their selection. The reason for conducting an effectiveness evaluation is to understand the impact of RLC on different aspects of village development, in order to provide guidance for the formulation and implementation of land consolidation projects in subsequent stages. The reason for analysing the balance between supply and demand is to understand the usage state of different RLUFs and rural land use types (RLUTs) in order to provide a reference for the readjustment of land use structure, one of the most important parts of a land consolidation project.

6.2 The effectiveness of RLC on rural development

As mentioned in Section 3.4.3, the objectives of rural vitalisation are the affordance of “thriving industry, pleasant living environment, refined rural civilisation, effective governance, and prosperous life”. Because of its ability to promote socio-economic development by changing land use structures, RLC is widely adopted in rural developmental processes to achieve the five objectives of RV. Thus, the evaluation of the performance of RLC on local development is

mainly reflected in the degree to which a rural vitalisation strategy aimed at accomplishing these five objectives has been promoted by RLC.

6.2.1 Indicator selection

Based on the literature review, general field investigations in rural China, and consultation with experts, this study proposes a general indicator system (Table 6-1) based on the above five aspects to evaluate the impact of RLC on rural vitalisation at the village level in plain areas. The indicator system is divided into two levels, wherein the first-level indicators reflect the above five aspects individually and the second-level indicators are used to quantify the corresponding indicators in the first level. The indicators are selected to reflect the impact of land use change on local development (Jiang et al., 2021).

(1) Indicators for evaluating the level of industrial development

As previously mentioned, increasing the efficiency and scale of agricultural production, as well as providing adequate land and space for secondary and tertiary industries, are the main approaches to the achievement of thriving industry in most rural villages. The main roles of RLC in the objective of industrial prosperity are to facilitate mechanised production by levelling the land and adjusting the structure of property rights; to increase grain yields by improving soil quality and agricultural infrastructure; to increase the total output of agricultural products with a high economic return by scaling up corresponding projects (Rao, 2022); and to lay a foundation for the development of secondary and tertiary industries by providing them with sufficient land quotas through the reclamation of abandoned or idle construction land, as well as by improving the intensification and efficiency of industrial land use (Long, Zhang & Tu, 2019). Given these, the level of agricultural mechanisation (I1 in Table 6-1), grain output per unit area (I2), the scale of agricultural projects with high economic return (such as cash crops and breeding industry) (I3), and the proportion of the area of secondary and/or tertiary sector (I4) were selected to evaluate the role of RLC in the promotion of thriving industry at the village level.

Table 6-1. Description of the assessment indicators for measuring the effectiveness of RLC on village vitalisation

Goals	Indications	Explanation	Effect
Thriving industry (0.2)	The level of agricultural mechanisation (I1)	I1 = The extent to which machinery is used in agricultural activities (%)	+
	Grain output per unit area (I2)	I2 = Total grain yield/total planting area	+
	The scale of high-economic-return agricultural projects (I3)	I3 = Area of high-economic-return agricultural projects	+
	Proportion of area of secondary and/or tertiary sector (I4)	I4 = Area of secondary and/or tertiary sector/Total area of the village	+
Pleasant living environment (0.2)	Ecological space coverage (E1)	E1 = Area of ecological land/total area of the village	+
	Road area per capita (E2)	E2 = Road area/ total population	+
	Per capita area of public service facilities (E3)	E3 = Area of public service facilities/total population	+
	Excessive use of chemical fertilisers (E4)	E4 = The fertiliser input per unit area – the upper limit of the safety standard of fertiliser input per unit area[1)] (kg/ha) (household-level)	-
	Treatment of industrial wastewater (E5)	E5 = Proportion of industrial wastewater not centrally treated	-
	Satisfaction of villagers (E6)	E6 = The mean of villagers' assessment of the village environment (0-100)	+
Refined rural civilisation (0.2)	Centralised pollution treatment rate (C1)	C1 = Number of households with centralised pollution treatment/total households	+
	Per capita land for cultural facilities (C2)	C2 = Area of cultural facilities/total population	+
	Function index of landscape aesthetics (C3)	C3 = The concentration and accessibility of farmland (Pang et al., 2016)	+
Effective governance (0.2)	Level of public participation (G1)	G1 = Number of people involved in the RLC project/total population	+
	Villagers' satisfaction (G2)	G2 = Villagers' scoring of the entire land consolidation project (household-level)	+
	Change in farmland area (G3)	G3 = Difference between the farmland area in two adjacent years (2010, 2005, 2020)	+
Prosperous life (0.2)	Per capita income (L1)	L1 = Average annual income of villagers	+
	Diversification of villagers' incomes (L2)	L2= Average number of major income sources (household-level)	+
	Collective income (L3)	L3 = Average annual income of village collective	+
	Local employment ratio (L4)	L4 = Number of local employees/total employees	+
	Rural-urban income gap (L5)	L5 = Per capita disposable income of rural residents/Per capita disposable income of urban residents	+

Note: 1) The upper limit of the international safety standard of fertiliser input per unit area is 225 kg/ha

(2) Indicators for evaluating the quality of the living environment

As mentioned in Section 3.4.3, the core content of a pleasant living environment involves an optimised natural landscape, the improved quality of human settlements, as well as the establishment of green and ecological industries with low pollution. In a village, ecological space coverage (i.e. green and blue spaces) (E1 in Table 6-1) was selected as one of the indicators to show the degree of impact of land consolidation on the natural landscape. Improving the coverage of public services and infrastructure conditions reflects how RLC improves the quality of residential spaces. Based on the author's investigations in rural China, the construction of roads and the construction of ditches alongside them are usually carried out simultaneously in villages' RLC projects. The quality of rural settlement, therefore, can be expressed by the area of public service facilities (E2) and roads (E3) per capita. In addition, given that tertiary industries are less pollutive than others, only the excess use of chemical fertilisers from the agricultural production (E4) and the wastewater discharge from the secondary sector following RLC (E5) were selected to examine whether RLC had a negative impact on the quality of rural ecological environment. This may also demonstrate the level of local green industrial development. Moreover, villagers' evaluation of the village environment (E6) was used as a subjective evaluation index to measure the quality of the living environment. This is because the perceptions and subjective judgements of villagers, being long-term local residents and the most direct stakeholders in the village vitalisation process, are of great reference value in demonstrating whether the changes or improvements to the general living conditions are necessary or acceptable.

(3) Indicators for evaluating the level of rural civilisation

For the vitalisation of rural civilisation, RLC is mainly used in the following aspects. First, the improvement of sanitation and the landscape of the living space are key goals of RLC. The enforcement of centralised waste collection can not only improve the sanitation and appearance of the village, but also contribute to the correction the bad habits such as littering among some villagers (Zhong,

2018). Second, RLC is implemented to provide spaces for cultural development in order to promote the protection and development of valuable traditional culture, enhance farmers' leisure activities, to build a harmonious community, and to improve local cultural education. Additionally, land consolidation can effectively relieve the problem of land fragmentation and promote the concentration of farmland. It is generally accepted that a large area of continuous farmland will, inter alia, increase the attractiveness of the rural landscape (Zhang et al., 2018), thereby inspiring more rural youth and non-agricultural populations to appreciate agricultural landscape and knowledge. Therefore, the centralised pollution treatment rate (C1 in Table 6-1), land for cultural facilities per capita (C2), and the function index of landscape aesthetics (C3) were selected to demonstrate the effectiveness of RLC in achieving refined rural civilisation.

(4) Indicators for evaluating the effectiveness of governance

In the process of land consolidation at the village level, the degree of effective governance is first reflected in whether grassroots/community-level organisations (see Section 3.4.3) are able to guide local residents to participate in the planning and implementation of the projects as well as their subsequent supervision and management. Secondly, land consolidation projects in rural China are mostly carried out under the leadership of local governments or grassroots organisations. Thus, the degree of villagers' satisfaction with local RLC projects can reflect the performance of local governance. In addition, considering that insurance of food security and farmland area remains one of the main goals of RLC in China, alleviating the issue of non-agriculturalisation, non-grain, and the abandonment of farmland has become one of the key responsibilities in local land management (Long, 2020). Public participation (G1 in Table 6-1), villagers' satisfaction (G2), and the change of farmland area (G3) therefore were chosen to show the impact of RLC on local governance.

(5) Indicators for evaluating prosperous life

Due to China's particular societal characteristics (see Section 3.3), the village collective plays an important role in the process of land consolidation

and local development. In return, it is also one of the direct beneficiaries of land use (Yao & Tian, 2020). Therefore, the economic income of the village collective and of villagers usually accounts for the majority of the economic strength at the village level. Meanwhile, the diversification of income is regarded as a reflection of farmers' economic resilience and economic strength (Oostindië, Roep & Renting, 2006), because it helps them maintain income at an acceptable level even during years in which harvests are poor or market demand low (Li & Tang, 2013). Per capita income (L1 in Table 6-1), the diversification of villagers' incomes (L2) and collective income (L3) have been selected to exhibit the economic power of ordinary villagers and the village collective, respectively.

Concerning the rural-urban gap, RLC is considered to narrow the income gap and to promote the indigenisation of employment. Increasing the local employment rate is a reflection of the improvement of social security. Thus, the impact of RLC in bridging the rural-urban gap can be represented by the local employment ratio (L4) and rural-urban income gap (L5).

6.2.2 Calculation method

Given that the indicators outlined above are measured on different scales, the normalisation method needs to be used to scale down the range of these data between 0 and 1 to render them comparable and computable (Rothe, Susse & Voss, 1996). In this way, mean normalisation and Z-score normalisation (also known as standardisation) cannot be adopted since some of the normalised values from these two methods will be negative (Han, Kamber & Pei, 2012), while the demands of current rural China should not be negative. These two methods are more suitable for displaying the distribution of a data set rather than calculating the intensity of demand. Concerning the limited number of samples in a village as well as the fact that the min-max normalisation method results in the appearance of values 0 and 1, the sum normalisation method below (Eq. 1) was adopted to quantify the value of each indicator between 0 to 1, thus making the values comparable (Chen, 2019; Vafaei, Ribeiro & Camarinha-Matos, 2020).

The closer they get to 1, the higher the effectiveness.

$$D_i = \frac{I_i}{\sum_1^n I_i} \quad (1)$$

where D_i is the standardised score of the indicator I_i, while I_i is the actual score of indicator i ($i \leq n$). The comprehensive evaluation method was then adopted, and the formula was as follows:

$$RV = In(\sum_{j=1}^{4} I_{(i,j)} * W_j) * W_{In} + En\left(\sum_{j=1}^{6} I_{(i,j)} * W_j\right) * W_{En} + Cu\left(\sum_{j=1}^{3} I_{(i,j)} * W_j\right) * W_{Cu} + Go(\sum_{j=1}^{3} I_{(i,j)} * W_j) * W_{Go} + Li(\sum_{j=1}^{5} I_{(i,j)} * W_j) * W_{Li} \quad (2)$$

where RV, In, En, Cu, Go, and Li represent the level of rural vitalisation, industrial effectiveness, environmental effectiveness, cultural effectiveness, governance effectiveness, and living effectiveness respectively. $I_{(i,j)}$ is the value of indicator j in Year i, and W_j is the weight of indicator j. Given that the different goals are given equal value in the rural vitalisation strategy (Jiang, 2018), as well as that no goal (function) or sub-goal (sub-function) should be held superior to others despite differing in attributes or form (Gu et al., 2019; Pérez-Soba et al., 2008; Paracchini et al., 2011), this research adopted an equal division method for weighting indicators at the same level.

6.3 Quantification of the supply intensity of RLUFs

As mentioned in Sections 2.6 and 5.2, RLUFs can be understood from function type and function intensity. The type of function can be expressed in terms of land use to show the diversity of land use function, while the functional supply intensity (FSI) signifies the strength of a land use function and serves as an important indicator to reflect the supply capacity of a land use function; they are able to not only reveal the physical constraints of land use in different regions, but to reflect the utilisation status of land (Chen, Zeng & Li, 2021; Felipe-Lucia et al., 2020; Xu & Chi, 2019). In order to quantitatively evaluate FSI, different FSI coefficients were assigned to corresponding land use types according to previous studies on Chinese land use functions (Chen, Chi & Li, 2019; Liu, 1992;

Xu & Chi, 2019) and land use classification as outlined in Section 5.2.2. Specifically, construction land, as the highest land use level, is given with a value of 0.4; agricultural land is assigned the weighted value of 0.3 and ecological land is given a value of 0.2; and undeveloped land is defined as the lowest level, with a coefficient value of 0.1. Therefore, the FSI can be quantitatively represented by the product of the area ratio of each land use type and the corresponding coefficient value (Chen, Chi & Li, 2019), as illustrated in Eq. (3).

$$FSI_j = \frac{A_j}{VA} * D_j \quad (3)$$

where FSI_j is the supply intensity of RLUF j, A_j is the area of land use type j, VA is the total area of the study area, and D_j is the FSI coefficient of land use type j.

6.4 Indicators of demand of RV for RLUFs at the village level

The demand for RLUFs in RV signifies the demand for local land use structure and functions in the next stage of local development. As mentioned in Section 5.2, the "land use structure" corresponds to the socio-economic stage of a given region (Long & Li, 2012). This suggests that socio-economic indicators can be used to reflect land use structure and functions. The socio-economic indicators at the end of a given period following intense RLC activities in a given area are essentially the results of a series of socio-economic activities carried out under the umbrella of 'RLC', and reflect the basic local needs going into the next stage of development. Therefore, some socio-economic indicators of a region in a certain period can be used to quantify the demand intensity for RLUFs to further measure the gap between the supply and demand of and for RLUFs. Some appropriate indicators, based on the analysis in Section 5.2.4, are selected to calculate the demand intensity of RV for RLUFs. In this section, the indicators, the reasons for their selection, how to use these indicators to calculate the demand intensity of RV for RLUFs, and the classification of strategies to balance the supply and demand of and for RLUFs are presented.

6.4.1 Indicators for assessing the demand intensity of RV for RLUFs

The functional demand intensity (FDI) of rural vitalisation can be calculated by establishing a targeted index system. This research selected indicators that quantify the nine substantial functions (see Table 5-1). These indicators have been selected based on (i) the analysis of the conceptual framework in Section 5.2; (ii) some related research (Ma et al., 2019; Tan et al., 2018; Zhang et al., 2018); (iii) information can be collected via field investigations and official statistics; and (iv) consultation with academic experts in the field of rural development and land use. Taken together, the collection of indices proposed in this research establishes a general index system which covers the living, production, ecological and cultural functions in order to estimate the demand of rural vitalisation for RLUFs at the village level in rural Eastern China, the exemplary region of RLC practice (as explained in Section 1.1.3). These indicators were selected to depict the levels of social stability, economic efficiency, environmental friendliness, and cultural prosperity, as these are considered the goods to be achieved by bettering the four functions (Table 6-2). However, it should be noted that the index system developed in this chapter is a general one and that the index system used for the evaluation of different case areas may be subject to case-specific modifications to this index system.

Based on the literature review, the considerations in selecting these indicators are summarised as follows:

(1) The demand for the living function (social harmony)

As mentioned in Section 5.2.4, providing sufficient public service facilities, high-quality living conditions and stable jobs for local people is necessary for promoting villages' social harmony (Guan, 2018; Li et al., 2018; Ma et al., 2019).

In order to achieve social harmony in rural villages near major cities, construction land can provide residential functions, public service functions, and employment functions through residential land, public administration and service land, infrastructure land, industrial and mining land, as well as commercial land, respectively. Conversely, the employment function in rural

villages far from major cities is mainly supplied by agricultural land. The term 'living conditions' denotes local residents' desires with regard to their housing conditions, such as floor space and architectural details, which are the embodiment of the residential function. In rural China, per capita housing area (R_1 in Table 6-2) and housing structure (R_2) can be used to present the demand for residential conditions (Ma et al., 2019). Additionally, the availability of infrastructure and public facilities (e.g. the availability of water and electricity and the accessibility of transportation) is an essential factor in determining how public services are distributed (Ma et al., 2019). At present, most rural villages in China have easy access to tap water (around 83% in 2020)[60] and electricity (99.7% in 2016)[61]. The number of public facilities (e.g. banks, clinics, and service centres) (P_1 in Table 6-2) and the length of physical infrastructure (P_2) (such as roads and irrigation ditches) were thus selected to exhibit the demand for public service functions. Moreover, in some economically-developed villages, the labour force may be more engaged in the secondary or tertiary sector (Che, 2016; Zhang, Zhu & Zhang, 2020). The proportion of labour in secondary and/or tertiary industries (E_2) was therefore selected to present the demand for employment function placed on construction land.

The demand for the living function from agricultural land is mainly reflected in the ability of agricultural land to provide jobs for farmers. Although the phenomenon of concurrent business[62] is common in contemporary rural China, especially in Eastern China, many rural populations are still engaged in agricultural production and consider it to be one of their main jobs (Zhang, Zhu & Zhang, 2020), given that the non-agricultural jobs many farmers engage in during the slack season of farming constitute neither regular nor formal employment. The more a local labour force is engaged in the primary sector, the stronger the employment function of agricultural land (Li & Han, 2007; Luo &

[60] http://mwr.gov.cn/sj/tjgb/ncslsdnb/202111/t20211119_1552021.html (data source)
[61] http://www.stats.gov.cn/tjsj/tjgb/nypcgb/qgnypcgb/201712/t20171215_1563589.html (ditto)
[62] Concurrent business refers to the phenomenon wherein farmers are engaged in agricultural production activities while also participating in industrial and commercial ones.

Cai, 2016). Based on this, this study selected the ratio of labour in primary sector (E_1) in order to represent the demand for the living function placed on agricultural land.

(2) The demand for the production function (economic efficiency)

Four indicators were selected to represent the demand for the production function of rural construction land. At present, farming households are involved in non-agricultural sectors on a continual basis, and the share of these households' income from non-agricultural activities has exceeded that from agricultural activities in over half of China's provinces, particularly in eastern ones (Zhang, Zhu & Zhang, 2020). Therefore, in most rural areas of Eastern China, the main function of the rural secondary and tertiary sectors is to increase the income of the rural population. The income ratio and/or labour ratio of the secondary (I_1 in Table 6-2) and/or tertiary sectors (C_1 in Table 6-2) can be used to reflect the degree of the local demand for a non-agricultural economy[63]. Furthermore, the number of enterprises (I_2) and the number of stores/shops (C_2) in the village can also manifest the overall demand for non-agricultural economic output.

To evaluate the demand for the economic function placed on agricultural land, the output and its economic value need to be taken into consideration (Zhang et al., 2018). For example, in a year without major events such as natural and human disasters, if the proportion of a household's income from agricultural production increases, it usually means that the investment in agricultural production is relatively higher, and that agricultural production can bring this household higher economic benefits. This household's demand for agricultural land capable of bringing even higher economic benefits therefore generally

[63] Through field investigations in some of China's provinces, it was found that most farmers' non-agricultural income comes from temporary employment (fixed term contract and casual work) rather than from long-term or permanent jobs. If farmers have a strong willingness to obtain non-agricultural income, the proportion of them participating in the secondary and tertiary industries will increase. However, quite a number of them could only roughly remember their total wage income, and it was difficult for them to calculate the income obtained from the secondary and tertiary industries respectively. Therefore, in villages where too many people are unable to clearly separate the degree of their income from secondary sector activities and the degree from tertiary sector activities, only the labour share ratio of industries which they have reported working in will be selected for calculation.

increases. The per capita output of grain (A_1 in Table 6-2)[64] and the proportion of income from major non-grain products (A_2) (such as aquatic and terrestrial livestock) can almost reflect the output level, and they are selected to represent the demand on the economic function placed on agricultural land (Sal & García, 2007; Tan, 2014).

(3) The demand for the cultural function (cultural prosperity)

The demand for the cultural function requires not only physical space for its fulfilment (i.e. for cultural activities and the storage of items of commemorative significance), but also the cultural participation of local people. The main role of construction land in the cultural function is to provide rural residents with space for cultural preservation, inheritance and development, as well as education. First and foremost, everyone has the right to education. In China, rural residents' lower average levels of education compared with urban residents is one of the main factors inhibiting the formers' ability to increase their levels of income and cultural consumption, and also to improve their cultural literacy and standards of behaviour (Liu, 2018; Wang, 2012; Wen, Zhang & Li, 2017). Put differently: the higher the local level of education – including cultural education – the greater the potential demand for more cultural types and knowledge. Thus, the educational level of local residents (H_1 in Table 6-2) can be used to present the demand for the education function. Moreover, the preservation and inheritance of traditional culture and the development of modern culture are also key factors in RV, involving both the material and immaterial levels (Huang, 2018). To do so, the number of humanistic attractions (H_2) (e.g. tourist attractions, ancestral temples, churches, museums, and exhibition halls) and the number of cultural activities per month (H_3) were selected to display the demand for heritage function.

[64] In rural China today, many families do not rely on grain cultivation for their main source of income, but instead use it for their own consumption. Although the grain they produce does not bring them direct economic benefits, it saves them the cost of purchasing food. Additionally, it is difficult to count the annual output of each household, but the total grain output or per capita output of different years can be obtained through random surveys. Lastly, the per capita grain output of the whole village can be estimated based on the data from the village committee survey and interviews with the villagers as an indicator to measure the village's economic demand for farmland.

Table 6-2. Description of the assessment indicators for measuring the demand for RLUFs at the village level

First-level function	Sub-function	Land use types	Indicators	Explanation
Living function (Social harmony)	Residential function	Residential land	Per capita housing area (R_1)	R_1 = Building area of houses/total population
			The architectural structure of houses (R_2)	R_2 = Number of brick and concrete structure houses/total number of houses
	Public service function	Public services land	The number of public facilities (P_1)	P_1 = Number of public service facilities (e.g. school, bank, clinic, nursing home…)
		Infrastructure land	The growth of infrastructure facilities (P_2)	P_2 = The length of the village's roads and ditches
	Employment function	Agricultural land	Labour ratio in primary sector (E_1)	E_1 = Number of workers in primary sector/total number of workers
		Industrial land	Labour ratio in secondary and/or tertiary sector (E_2)	E_2 = (Number of workers in secondary and/or tertiary sector)/total number of workers
Production function (Economic efficiency)	Commercial production function	Commercial service land	Labour ratio or income ratio in tertiary sector (C_1)	C_1 = Number of workers in tertiary sector/total number of workers or Households' income from tertiary sector/their total income
			Allocation of stores/shops (C_2)	C_2 = Total number of stores/shops
	Agricultural production function	Agricultural land	Grain output per capita (A_1)	A_1 = Total grain output/total population
			Income ratio of non-grain products (A_2)	A_2 = Income from non-grain products/total income
	Industrial production function	Industrial land	Labour ratio or income ratio in secondary sector (I_1)	I_1 = Number of workers in secondary sector/total number of workers or Households' income from secondary sector/their total income
			Allocation of TVEs (I_2)	I_2 = Total number of TVEs
Cultural function (Cultural prosperity)	Educational function	Cultural land	Education level of rural residents (H_1)	H_1 = Average years in education of villagers over the age of 14 (>=15)
	Heritage function	Cultural land	Humanistic environmental attractions (H_2)	H_2 = Number of tourist attractions
			Organised cultural activities (H_3)	H_3 = Number of cultural activities per month
		Agricultural land	Area ratio of agricultural land (H_4)	H_4 = Area of agricultural land/total village area
			Inheritance of farming culture (H_5)	H_5 = Proportion of the population over the age of 14 with farming knowledge in the village
Ecological function (Environmental friendliness)	Maintenance function	Ecological land	Habitat quality (M_1)	M_1 = Habitat quality index
			Energy use (M_2)	M_2 = Proportion of villagers using clean energy in their daily lives
		Agricultural land	Population per unit of agricultural land area (M_3)	M_3 = Agricultural land area/total population

Improvements in the mechanisation of agriculture mean that the demand for labour in agriculture has decreased, and younger generations of rural people therefore need to engage in non-agricultural production to make a living. As a result, ever greater numbers of younger people registered as permanent residents in rural areas are increasingly likely to lose the ability to engage in and knowledge of agricultural production. In a context where increasing levels of mechanisation are accompanied by reduced demand for agricultural labour, if the number of young people with farming knowledge is increasing, it implies that there is a growing demand for the heritage function of agricultural land. In addition, the change in the area of agricultural land can reflect the change of the governments' and farmers' emphasis on maintaining the total farmland area given that the change of farmland area is affected by bottom-up pressure from farmers and top-down pressure from governments. This can further reflect the change in emphasis on farming civilisation, since agricultural land is the main spatial carrier of farming civilisation. Specifically, if farmers cherish limited farmland resources and attach importance to farming culture, the conversion of farmland to residential land is likely to decrease. Farmland protection has become one of the performance evaluation criteria for many local government officials in China. Thus, the total farmland area (H_4) and the proportion of the population over the age of 14 with farming knowledge in a village (H_5) were selected to display the demand for the heritage function of agricultural land.

(4) The demand for the ecological function (environmental friendliness)

In China, long-term rapid socio-economic development has been achieved at the expense of the natural environment, resulting in a series of issues such as soil erosion, desertification, soil pollution, and food insecurity. As ordinary people, scholars and politicians alike assign increasing value to the value of the ecological environment, the Chinese government has taken a series of land improvement measures since the end of the 20th Century, such as returning farmland to forests and demolishing dilapidated homesteads to make space for farmland, thereby attempting to restore the damaged ecological environment and

landscape as much as possible (Fang, Shi & Niu, 2016; Long, 2020; Zinda et al., 2017). Because of this, indicators for evaluating the demand for ecological functions were selected with regard to environmental protection and ecological landscape. Previously, villagers relied on trees and coal as their main sources of energy. With the demand for energy consumption growing in tandem with population growth, cutting down trees and burning coal will not only destroy the woodland habitats but also damage air quality. On the other hand, the use of energy from cleaner sources such as solar energy and hydropower is a win-win for protecting woodlands while improving air quality. Meanwhile, people nowadays usually reconstruct the surrounding environment according to their perceived desirable environmental quality. The modified environment usually creates biodiversity that reflects the minimum level of ecological characteristics that can be maintained and co-exist with anthropogenic activities. Thus, the habitat quality index (M_1 in Table 6-2)[65] and the proportion of clean energy use (M_2) can be regarded as revealing the local ecological demand for RLUFs. Additionally, due to the large share of agricultural land, especially farmland, and the important role of agricultural land in maintaining eco-environmental security in the plains of Eastern China (Sun, Zhou & Xie, 2007; Zhang et al., 2018), the population per unit agricultural land area (M_3)[66] can indicate the meaning of agricultural land to eco-environmental security and the demand for ecological function of agricultural land.

6.4.2 Calculating the value of RLUFs

Considering that the units of the above-mentioned indicators are different and that the sample is usually limited in a village, the method of normalisation as mentioned in Section 6.2.2 was adopted to normalise these indicators, thus

[65] Habitat quality index is used to express the habitat quality of villagers. The calculation of this indicator refers to the Technical Criterion for Ecosystem Status Evaluation in the National Environmental protection Standard of the People's Republic of China (HJ192-2015).

[66] The agricultural land here to be able to provide ecological functions to the overall environment of the village, such as cultivated land, open aquaculture farms, woodlands, and grasslands, and usually does not include the land for protected agriculture, such as enclosed greenhouse vegetable land, enclosed aquaculture farms, and poultry farms, as well as field roads.

making the value of each indicator range from 0 to 1 (Eq. 4). The closer they get to 1, the higher the intensity of demand and supply.

$$D_i = \frac{X_i}{\sum_1^n X_i} \quad (4)$$

where D_i is the standardised score of the indicator X_i, while X_i is the actual score of indicator i ($i \leq n$).

Given that the hierarchy of RLUFs and the demand intensities in a village for different land use functions may vary, the calculation of the demand intensity for each function must take the rate of contribution of each function to the total functional demand intensity into full account. As previously reviewed (e.g. Ma et al., 2019), different types of villages require different land use structures, so it may be more appropriate to combine the types of villages and field surveys to determine the weights of demands for different functions. Then, based on the literature review and the research content of this study, an opinion-based evaluation approach (Ritz et al., 2009) combining expert scoring method and villager scoring method is used to determine the contribution rate of each indicator (also land use function/type) in the case studies (see Chapter 9).

There are three main reasons for adopting the aforementioned method. First, due to the limited number of case areas and questionnaires, it is not suitable to use objective weighting methods such as the multi-correlation coefficient method and coefficient of variation method to calculate the contribution of each indicator. Second, village developmental needs vary by village type, so the indicators used to evaluate the demand for different functions in each case area need to be assigned values separately; it might, therefore, be more reasonable to use the subjective evaluation method to assign indicator weights. Third, taking into account the villagers' status as direct stakeholders, the villager scoring method is adapted in the weighting of indicators. However, to balance the potentially one-sided views of some villagers, the expert scoring method is also used, according to which scholars and local public officials with some knowledge of the case area are invited to assign values to the indicators.

Therefore, the people selected to participate in weighing the indicators include villagers with a better understanding of the overall development of the village (including village cadres, village gentries, and ordinary villagers), local government officials working in rural development, and scholars who are knowledgeable about the region in which the case area is located. This choice is made based with regard to the utility of combining different perspectives – those of villagers, government officials, and academics – on village development. Finally, the highest and lowest values are removed after combining the weighting values collected from the villagers, officials, and scholars, and the remaining values are averaged to obtain the final weight of each indicator. This study calculated the demand intensity for RLUFs (FDI) based on Eq. (5) & (6)

$$\text{FDI} = \sum_{i=1}^{n} FDI_i * W_i \quad \text{..... (5)}$$

where FDI is the sum of the demand intensity for all first-level RLUFs, FDI_i is the demand intensity for first-level function i, and W_i is the weight of the first-level function i.

$$\sum_{i=1}^{n} FDI_i * W_i = \sum_{i=1}^{n} F(l)_i * W(l)_i + \sum_{i=1}^{n} F(p)_i * W(p)_i + \sum_{i=1}^{n} F(c)_i * W(c)_i + \sum_{i=1}^{n} F(e)_i * W(e)_i \quad \text{..... (6)}$$

where $F(l)_i$, $F(p)_i$, $F(c)_i$, and $F(e)_i$ represent the standardised values of the indicators corresponding to land use types/functions (l is living, p means production, c signifies culture, and e denotes environment). Similarly, $W(l)_i$, $W(p)_i$, $W(c)_i$ and $W(e)_i$ are the contributions of corresponding indicators. $F(l)_i$, $F(p)_i$, $F(c)_i$ and $F(e)_i$ range from 0 to 1; the larger the standardised value, the stronger the demand for functions.

6.4.3 Classification of strategies to balance the supply and demand of and for RLUFs

As discussed in Chapter 5, readjusting the RLUS is a vital way to balance the supply and demand of and for RLUFs, achieved via the optimisation of the supply of land use types/functions. Considering that there are different patterns of developmental imbalance between the supply and demand of and for

RLUFs/RLUTs, as well as and the research of other scholars (Ma et al., 2019), strategies for land use readjustment can be divided into three types: 1) Function/Type conversion, in which the functions/types whose supply intensity exceeds demand intensity can be reduced in those areas by decreasing the area ratio of the corresponding land use types in order to provide land for those functions/types which are in short supply but where demand cannot currently be met; 2) Function/Type supplement, in which undeveloped land is reclaimed or exploited to enhance the supply capacity of functions/types that cannot currently meet demand; and 3) Function/Type enhancement, in which the functions/types related to construction land are enhanced by increasing the number of storeys on buildings.

Additionally, the difference value between the supply and demand of and for RLUFs (D_{ds}) is the basis for the change of function intensity through the reorganisation of the RLUS, as shown in Eq. (7).

$$D_{ds} = FSI_i - FDI_i \quad (7)$$

where D_{ds} is the difference value between the supply and demand of and for RLUFs; FS_i and FDi are the supply intensity and demand intensity of and for rural land use function i, respectively.

6.5 Chapter summary

To quantitatively analyse the relationship between RLC and RV, this chapter constructed two indicator systems in order to evaluate the effectiveness of RLC on RV and to measure the relationship between the supply and demand of and for RLUFs.

For the evaluation of the effectiveness of RLC in the promotion of local development, the five basic objectives of rural vitalisation (see Section 3.4) are used as the bases of the first-level indicators, while the representative indicators at the village- or household-level are selected as the second-level indicators. Considering that the five objectives are assigned equal importance in the rural

vitalisation strategy, indicators at the same level in the effectiveness evaluation of RLC were given the same weight in this study. Therefore, indicators at the same level were given the same weight in this study. Moreover, in analysing the quantitative relationship between the supply and demand of and for RLUFs, the supply intensity of a land use function is expressed by the area proportion of the corresponding land use type, while its demand intensity is calculated by the selected indicators. Given that different types of villages develop differently, an opinion-based evaluation approach combining the expert scoring method and villager scoring method was used to determine the contribution rate of each function/type in the case studies. Furthermore, the land use strategies proposed based on land use structure readjustment to balance the supply and demand of and for RLUFs can theoretically be classified into three types: function/type conversion, function/type supplement, and function/type enhancement.

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Chapter 7 Case selection and data processing

7.1 Introduction

The process and results of rural land consolidation (RLC) in the promotion of rural vitalisation (RV) are demonstrated by means of two real-world case studies. This chapter presents the criteria for the case selection, data collection and the process of data collected. The areas under study and the rationale for their selection are presented in Section 7.2. Section 7.3 elaborates on the data involved in evaluating the effect of RLC on village vitalisation and the supply-demand of and for rural land use functions, including the types and sources of data collected, as well as data collection and processing methods, such as field investigation and visual interpretation.

7.2 Selection of study areas

7.2.1 Rationale of case selection

Land Change Science/Land System Science (LCS/LSS) seeks not only to understand the influence of human and environmental dynamics on the types, quantity, and location of land uses, but the impact of land use changes (Rindfuss et al., 2004; Turner, Lambin & Reenberg, 2007; van Diggelen et al., 2005; Verburg et al., 2013). This suggests that land use change patterns and their impacts may vary across geographical locations. It is therefore necessary to elaborate on the two modes mentioned in Chapter 5 via typical practices with different geographical locations in order to gain a deeper understanding of how the implementation of RLC contributes to village vitalisation.

The case study method, as a method of scientific and empirical inquiry, has been used to investigate a complex issue in a specific research area and to generate an in-depth and comprehensive understanding of the issue within its real-life context, the objective being to contribute to our understanding of

complex social phenomena and the growth of knowledge in general (Crowe et al., 2011; Krusenvik, 2016). Given this, the case study method was adopted in this study to reveal the impacts of the implementation of RLC on RV in different locations from a multifunctional perspective. Based on the list of pilot counties in land system reform[67], field surveys in rural China, and the recommendation of local governments, Dongheng Village in Deqing County and Jinzhuang Village in Yucheng City (a county-level city) (Fig. 7-1) were selected as case areas to illustrate how RLC is conducive to RV at the village level.

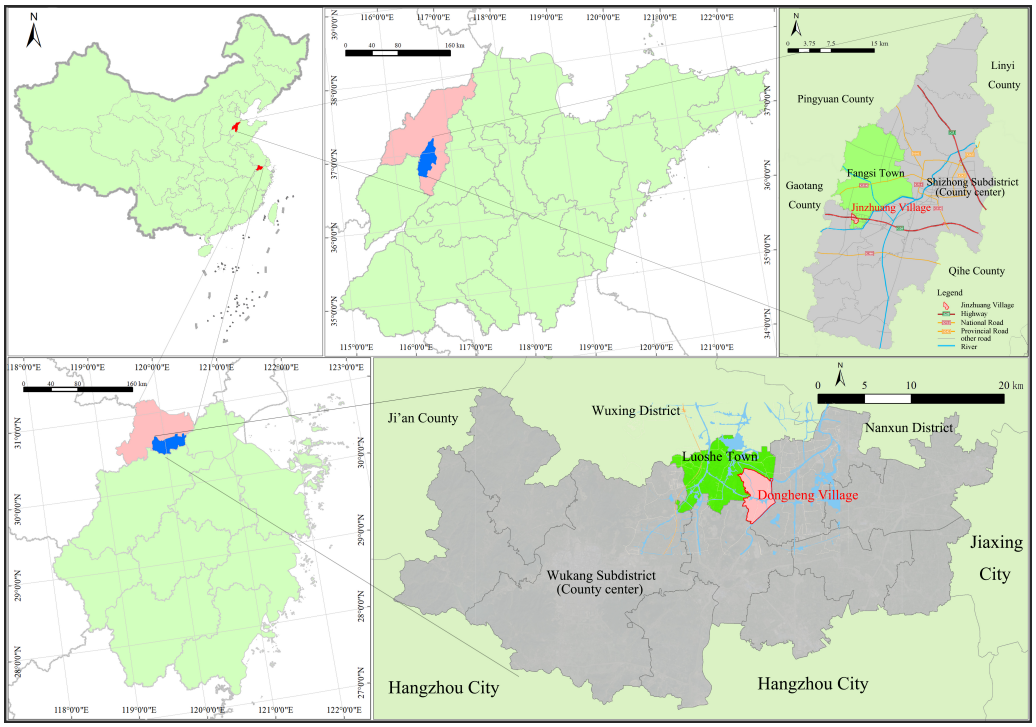

Fig. 7-1. Location of case areas in China

There are four main reasons for the selection of Jinzhuang Village and Dongheng Village as typical cases to demonstrate the operation of RLC and its contribution to rural development at the micro-level (Jiang et al., 2022; Jiang et al., 2021). First, based on field investigations conducted in 10 counties (districts) in the east, central, and west of China from August 2020 to June 2021, it is found that Yucheng and Deqing have achieved relatively successful results in RLC among all these counties, and compared with their surrounding counties. And,

[67] http://www.npc.gov.cn/zgrdw/npc/xinwen/2015-02/28/content_1906228.htm (access to the full list)

Yucheng City (Lv et al., 2021; Qiao, 2018) and Deqing County (Dong, 2016; Gong & Mao, 2020) are both pilot counties in land reform (with RLC forming part of the implementation of land system reform) located in the eastern plains of China. Second, the village is the basic social-economic unit of rural development and the basic site of the implementation of RLC projects (Long, 2020). Jinzhuang and Dongheng are both ordinary villages in their counties and generally reflect the common characteristics of their regions. Third, they were recommended by local governments to do field surveys, given that both have rich experience in RLC to which their industrial development is closely connected. Forth, Jinzhuang is a traditional agricultural village far from two major cities (it is more than a 1.5-hour drive to the centres of Ji'nan and Dezhou, the closest major cities), while Dongheng's local industry is non-agriculturally-oriented and is located close to two major cities (it is a roughly 40-minute drive to the city centres of Hangzhou and Huzhou). Thus, it is reasonable to select them as representative cases to demonstrate how RLC has contributed to the development of rural villages in different locations in the eastern plains of China.

7.2.2 Case introduction

(1) Jinzhuang Village in Yucheng City

The study area of Jinzhuang village is located in Fangsi Town, Yucheng City, Shandong Province. Fangsi Town is located in the west of Yucheng, at the intersection of Gaotang County, Pingyuan County, and Yucheng City. Fangsi Town occupies an area of approximately 145.94 km^2 and administers 162 administrative villages. It had a total population of 74,300 in 2019, 24,000 (roughly 32%) of whom are urban dwellers (Qu et al., 2022). The topography of the town is dominated by plains, with a warm temperate continental monsoon climate. Situated in a plain area, the town is rich in farmland resources with 120,000 mu[68] (8,000 ha) of farmland. The traditional crops grown in Fangsi

[68] mu is a unit of area in China and 15 mu is equal to 1 hectare.

Town are largely corn and wheat, and farmers generally follow a corn-wheat rotation system. Besides, with the popularisation of greenhouse-led RLC in this area in the past two decades, local villagers have begun to plant fruits and vegetables in greenhouses on a large scale. It is presently the largest centre of trade and the distribution of agricultural products in the intersectional tri-county region (described above). In 2019, Fangsi Town officially named among the "Top Thousand Towns of National Comprehensive Strength", ranking 363rd in all towns in China.

Jinzhuang Village is an ordinary village in terms of area, population, and industrial structure in Yucheng City, and is situated in the southern part of Fangsi Town. Covering an area of 1.1 km^2, the village is 7.7 km away from two National Roads, 8.6 km away from the centre of Fangsi Town, and 23 km away from the urban centre of Yucheng City. RLC projects have been carried out in Jinzhuang since the start of the new millennium.. For example, land consolidation projects (such as land levelling, infrastructure construction, land reclamation, and land development) have been carried out on farmland and undeveloped land. Then, Jinzhuang built greenhouses on these consolidated parcels to grow vegetables such as tomatoes and cucumbers. Moreover, construction land consolidation (mainly residential land consolidation and village environmental renovation) has been carried out since 2010.

As of 2019, there were 135 households (with a total of 510 people) in Jinzhuang Village, 89 of which are involved in the cultivation of greenhouse tomatoes. According to interviews with village cadres, the amount of farmland in the village was 937 mu in 2020 (about 62.46ha), most of which have been transferred. The land transfer process entails the villagers transferring farmland management rights to the village collective, following which the village collective builds greenhouses for rent. In 2019, the per capita income of villagers was around 30,000 RMB, and the village collective income was around 150,000 RMB. The main source of income for the village collective is the rent of greenhouses, while it is agriculture and wages for most local households.

(2) Dongheng Village in Deqing County

Dongheng Village is located in Luoshe Town, Deqing County, Zhejiang Province. The administrative area of Luoshe Town is 49.86 km^2 and its jurisdiction consists of one town community and six administrative villages. The eastern part of Luoshe is a plain crisscrossed by waterways, while the western part is a hilly area. Luoshe has convenient transportation, with the Hangzhou-Nanjing Motorway, Nanjing-Hangzhou High-speed Railway, and Wuluo Highway passing through the territory. By the end of 2020, the registered population of Luoshe Town was about 18,500 and the registered migrant population was about 8,500. Since the establishment of the first piano enterprise in 1984, the secondary sector in Luoshe Town has rapidly developed. As of today, two characteristic industries have formed – wood processing and piano production – which together account for over 80% of the town's total economic output. By the end of 2020, there were more than 300 industrial enterprises in this town, including 31 enterprises above the designated size[69]. By that same period, Luoshe was producing two-thirds of China's annual output of wood veneer and one-seventh of its pianos. Moreover, the town has won national honorary titles in the fields of environmentalism and sanitation, and provincial honorary titles in education, ecology, culture, landscaping, and tourism. Furthermore, it was successfully selected as a national pilot for comprehensive rural land consolidation (CRLC) in 2020 and was rated as one of the "National Top 1000 Towns in 2021" based on a comprehensive comparison in terms of GDP, general budget revenue, industrial and commercial development, and income of urban and rural residents[70].

Dongheng village is located in the southeast of Luoshe Town. The location of the village committee is 18 km away from Deqing County and 45 km from the city centre of Hangzhou. The village covers an area of 10.4 km^2 and includes

[69] Industrial enterprises above the designated size in China are those with an annual main business income of over 20 million RMB.

[70] Data comes from: http://www.csmcity.cn/news/info-14603.html and http://www.deqing.gov.cn/art/2020/9/3/art_1229212617_56162731.html

various agricultural lands such as paddy fields, orchards, and aquafarms. Dongheng was originally a rural village dominated by the mining industry. Perennial mining has left a large area covered by mine pits and severely reduced local air and water quality, which not only destroyed the local ecological environment and harmed residents' health but also restricted local sustainability. In order to change the image of the village from that of a dirty, chaotic, and unsustainable locale, the county and municipal governments and Dongheng Village, taking advantage of policies within the national land system reform such as the "increasing vs. decreasing balance" land use policy (Long et al., 2012) and the right-of-use transfer of rural collectively-owned construction land (Wang et al., 2017), have jointly promoted local vitalisation and sustainable development through land consolidation projects focusing on the reclamation and utilisation of abandoned mines since the end of 2009.

As of 2020, the total population of the village is about 3900, of whom 3,100 are registered residents. The number of these in the labour force was about 1,600, of which 200 specialised in agricultural production. The per capita arable land in the village was 2.86 mu, and most of the agricultural land in the village has been transferred, the process of which involves villagers transferring the management rights of their agricultural land to the village collective, following which the village collective leases it to enterprises and households engaged in large-scale planting or aquaculture. There are more than 100 large households with a planting or aquaculture area of more than 30 mu. Additionally, in 2020, the village's per capita annual income was about 48,000 RMB, the main sources of this being income from agriculture and wages, land dividends, and corporate dividends. The annual income of the village's collective economy was 25.77 million RMB, mainly sourced from factory rents and corporate dividends.

7.3 Data collection and processing

7.3.1 Data sources

Considering that a combination of qualitative and quantitative methods helps to produce more comprehensive results (Jiang et al., 2021), a combination of quantitative and qualitative analysis will be used. The data used in this thesis are related to the status of rural land consolidation projects, land use (in the years 2010, 2015, and 2020), gross floor area (in the years 2010, 2015, and 2020), socio-economy (in the years 2010, 2015, and 2019[71]), and other data such as vector data (such as rivers, roads, and administrative boundaries) and interviewees' perceptions on local development and other indicators (Table 7-1). The sequential collection of quantitative and qualitative data into one study allows for better comprehension and insight into a given research topic than could have been attained by analysing and assessing the data individually (Bowen, Rose & Pilkington, 2017).

7.3.2 Field investigations in Jinzhuang and Dongheng

For Dongheng Village and Jinzhuang Village, field investigations were carried out in August and October 2020 and September 2021[72] to obtain socio-economic and land use data as well as local people's perceptions on local development between 2010-2020 to help reveal the influence of RLC on local development. Land use information was obtained through local governments, Google Earth, interviews, and field observations.

[71] First round field investigations took place during the summer and autumn period of 2020, the economic income and other related information of 2020 have not been fully counted by villagers committee and villagers. In addition, according to the second round of field investigations in the fall of 2021, the COVID-19 pandemic has had a great impact on the socio-economic development and community governance of the case areas in 2020. Moreover, in case areas, there is no significant difference between the land use in 2020 and that in 2019. Therefore, the socio-economic data of 2019 is used instead of 2020.

[72] Between October 2020 and September 2021, several online interviews with village officials from both villages were conducted as a complementary method of data acquisition.

Table 7-1. Data types and sources

Data	Attribute	Data sources
The status of rural land consolidation	investment, number, and area	Local land departments, local government websites, and field investigations in two villages
Land use data	e.g. area, spatial location, land use types	Local land departments, Google Earth, and filed investigations in two villages
Gross floor area[73]	The total area of buildings such as housing and industry	Field investigations and Google Earth
Socio-economic data	e.g. population, grain yield, employment, infrastructure, industry structure, GDP, and fertiliser use	China County Statistical Yearbook (2010-2020), Statistical Yearbooks of Deqing and Yucheng (2010-2020), Deqing and Yucheng statistical bureaus, local government websites, and field surveys
Other data	e.g. vector data such as rivers, administrative boundaries, and roads	National Basic Geographic Information System Database (http://nfgis.nsdi.gov.cn), Resource and Environmental Sciences and Data Centre of the IGSNRR of CAS (https://www.resdc.cn/), local governments, Google Earth, and field surveys
	Interviewees' perceptions on local development and other indicators	Interviews and questionnaires with interviewees

For survey research, a sample of 10% to 20% of the population is usually taken (Gay, Mills & Airasian, 2012). In both villages, a 30-minute interview was conducted with two village cadres in the village committee office to learn about the local socio-economic and land use situation from 2010 to 2020. In addition, 30 households in Jinzhuang (nearly 20% of the total) were randomly selected to conduct questionnaire surveys, and 10 of which were further selected for semi-structured interviews lasting 10-20 minutes based on their knowledge and perceptions concerning village development. In the central village of Dongheng, the one most significantly influenced by RLC, 50 households out of 392

[73] The gross floor area was estimated by combining the characteristics of different types of buildings in different years such as the building area and number of storeys, learned through interviews with village officials and villagers, with the number of buildings obtained from historical images provided by Google Earth. In addition, it should be stressed that although the gross floor area calculated in this study for the two case areas does not have a high degree of accuracy, it can reflect the change trend of gross floor area in the two villages.

households were randomly selected to participate in questionnaire surveys, and 20 of which were selected for semi-structured interviews, each lasting 10-20 minutes. The rule for the selection of interviewees was the same as in Jinzhuang. All questionnaires and interviews conducted were conducted voluntarily on the part of respondents. Moreover, questionnaires and interviews with villagers were conducted in their residences, workplaces, or open spaces according to the respondents' convenience and needs.

The content of questionnaires and interviews (see appendices A, B, and C) mainly covers the age, education level, and income (source and amount) of each respondent, as well as other basic information such as family members, housing area, amount of farmland owned, amount of grain produced, living environment, and local land consolidation. The questionnaire for villagers included questions about their level of satisfaction with environmental quality, RLC projects, and village governance, using a 101-point scale (0-100) to assess villagers' views.

7.3.3 Land use information

Land use data for the areas under study were collected from local land departments, field investigations in the two villages, and Google Earth. The visual interpretation method was adopted to identify some land use information from historical colour aerial photographs taken between 2010 and 2020 given that the names of some buildings and spaces are labelled on Google Earth. For example, residential land, some public service and infrastructure land (e.g. schools and streets), some ecological land (e.g. woodland and ponds), and unutilised land (e.g. abandoned land) can be identified through their shape and colour on the maps. In addition, field investigations were adopted to check and supplement land use information, as well as architectural information on houses. Moreover, the data obtained through GIS technology has been verified with village cadres and villagers to obtain more accurate land use data, so as to analyse the restructuring of production, living, and ecological spaces in Jinzhuang Village and Dongheng Village. In this process, some software, such

as ArcGIS 10.2, Excel, Fragstats4.2, Visio, and Photoshop, have been introduced to process and analyse the databases.

According to the land use classification summarised in Section 5.2.2, and field investigations, this research divided the types of land use in Jinzhuang and Dongheng into agricultural land, construction land, ecological land, and undeveloped land (Table 7-2). And the production, living, and ecological spaces were then defined based on the land use reclassification of Jinzhuang and Dongheng (Table 7-3).

Table 7-2. Land use reclassification in Jinzhuang and Dongheng

Land use types	Jinzhuang	Dongheng
Agricultural land	Farmland; Greenhouse vegetable land	Farmland (divided into paddy fields and other agricultural land); Aquafarm
Construction land	Rural residential land; Commercial and service land; Public administration and service land; Cultural land; Infrastructure land (Road); --	Rural residential land; Commercial and service land; Public administration and service land; Cultural land; Infrastructure land (Road); Industrial and mining land
Ecological land	Water area; Woodland	Water area; Woodland
Undeveloped land[74]	--	Undeveloped land

Table 7-3. The production, living and ecological spaces based on land use types

Spatial Types	Land use types in Jinzhuang and Dongheng
Production space	Agricultural land, Industrial and mining land, Commercial and service land, and Infrastructure land serving agricultural and industrial production
Living space	Rural residential land, Public administration and service land, Cultural land, and Infrastructure land serving residential daily life
Ecological space	Woodland and Water area
Potential space	Undeveloped land

[74] Jinzhuang is situated on a plain close to a river, and the climatic conditions are suitable for vegetation growth. The undeveloped land in Jinzhuang is mainly distributed around housing land and is almost entirely covered by shrubs/shrubbery, and was rarely used until RLC and greenhouse infrastructure were developed

7.3.4 Interviewees' scores for different indicators

Based on field investigations, an approach combining the expert scoring method with the villager scoring method (the rationale for which has been provided in Section 6.4.2) was adopted to assign values to different indicators. The people selected to participate in the weighting of the indicators in both villagers include four local residents (composed of two village cadres, one member of the village gentry, and one ordinary villager) who had a better understanding of the overall development of the village, two local government officials working in rural development whom we met during the interviews with government departments, and a scholar who has participated in the village investigations together and has a relatively comprehensive understanding about the rural development of Eastern China. And a 101-point scale (0 is the lowest while 100 is the highest) was adopted to count weights assigned for different indicators.

First, the villager scoring method was adopted to obtain the opinions of villagers. Two village cadres, as the villagers who are most likely to have a comprehensive knowledge of their village's development, were chosen to assign weights to different indicators concerning the demand for functions (see Section 6.4.1) by means of a questionnaire conducted in the field investigations. One member of the village gentry was randomly selected, and a questionnaire and an interview were used to obtain the rural gentry's evaluation of the contribution of different indicators. As concerns the ordinary villagers, a villager with a relatively comprehensive knowledge of, and original insights on, their village development was identified during the field interviews, and a further interview and a questionnaire were used to obtain his/her evaluation of the contribution of different indicators. Then, the expert scoring method was adopted to obtain the views of the two government officials and the scholar on the weighting of the indicators via questionnaires and interviews. Finally, the highest and lowest values were removed after combining the weighting values collected, and the remaining values were averaged to obtain the final weight of each indicator.

7.4 Chapter summary

This chapter has presented the case studies that will be used to elaborate on the theoretical model. The selection of appropriate case areas, data collection and processing, and data quality issues were addressed. The task of case selection was laborious and relatively long because it was based on months of field investigations in rural China. Jinzhuang Village in Shandong Province and Dongheng Village in Zhejiang Province were ultimately selected as the case areas. Field investigation, semi-structured interviews, visual interpretation, statistical yearbook, and related websites were the main approaches to and sources of data collection concerning local land consolidation, land use, and socio-economy.

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Chapter 8 Modes of local vitalisation promoted by RLC from a multifunctional perspective in the two case areas

8.1 Introduction

Based on the conceptual framework constructed in Chapter 5, this chapter focuses on the elaboration of the modes of rural land consolidation (RLC) in promoting local vitalisation from a functional perspective in two case areas. Distinct modes of action regarding how the implementation of RLC promoted local vitalisation for each case are expounded through examining the relationship between RLC and local development as well as their spatial restructuring driven by RLC.

8.2 Modes of RV promoted by RLC in Jinzhuang Village

8.2.1 RLC and rural development in Jinzhuang Village

In the late 1990s, the current village party secretary (*Mr. Jin*) of Jinzhuang Village returned to the village after working outside of Jinzhuang for years and began to introduce RLC technology in combination with greenhouse tomato cultivation to villagers based on his experience. Starting in 2000, some villagers started to work in the greenhouse industry. In the decade that followed, the 70 mu of farmland belonging to the village collective was consolidated and transformed into greenhouses which were then rented to villagers. During this time, with the encouragement and leadership of *Mr. Jin*, a small number of villagers who had been working outside Jinzhuang for a long time returned to the village to be tomato farmers. From 2000 to 2010, given the scepticism of many farmers with regard to the prospects of the greenhouse tomato industry, the growth rate of the greenhouse tomato industry in Jinzhuang was slow and its effect on the comprehensive development of the village was limited. Some

villagers, however, subsequently learned from tomato farmers that working in greenhouses produces greater economic benefits and a better working and living environment than working as migrant labourers in urban areas. Seeing the advantages of RLC, many villagers who had left their homes in Jinzhuang to seek employment elsewhere began to return, starting in 2010. Since then, Jinzhuang Village has entered a stage of rapid development the greenhouse area in 2020 was triple what it was in 2010; the return of a large number of labourers had increased the village's vitality; and the economic benefit of agricultural land has also been greatly improved.

Currently, there are 135 households, with a total of 510 people[75], in Jinzhuang Village, 89 of which grow greenhouse tomatoes. The total income of the village collective increased from around 80,000 RMB in 2010 to 150,000 RMB in 2019, and the per capita income increased from around 15,000 RMB to 30,000 RMB within the same period. The income of the village collective relies mainly on the rent of its greenhouses with an area of 144 mu (i.e. 9.6 ha). Among them, 70 mu were obtained from farmland collectively managed by the village through agricultural land consolidation, while the remaining 74 mu were obtained through the development of idle land owned by the village collective since 2015.

8.2.2 Spatial restructuring of Jinzhuang driven by RLC from 2010-2020

The implementation of RLC projects has been accompanied by noticeable changes in the rural space of Jinzhuang Village since 2010. For example, the ratio of the areas of production, living, and ecological space has changed from 81.4:9.8:8.8 in 2010 to 84.6:10.1:5.3 in 2020. Different types of spaces in Jinzhuang, especially production and ecological spaces, have undergone a process of restructuring (Fig. 8-1).

[75] The total population in Jinzhuang Village in 2010, 2015 and 2020 is 500, 506, 510 respectively, while the resident population is 380, 405 and 420 respectively.

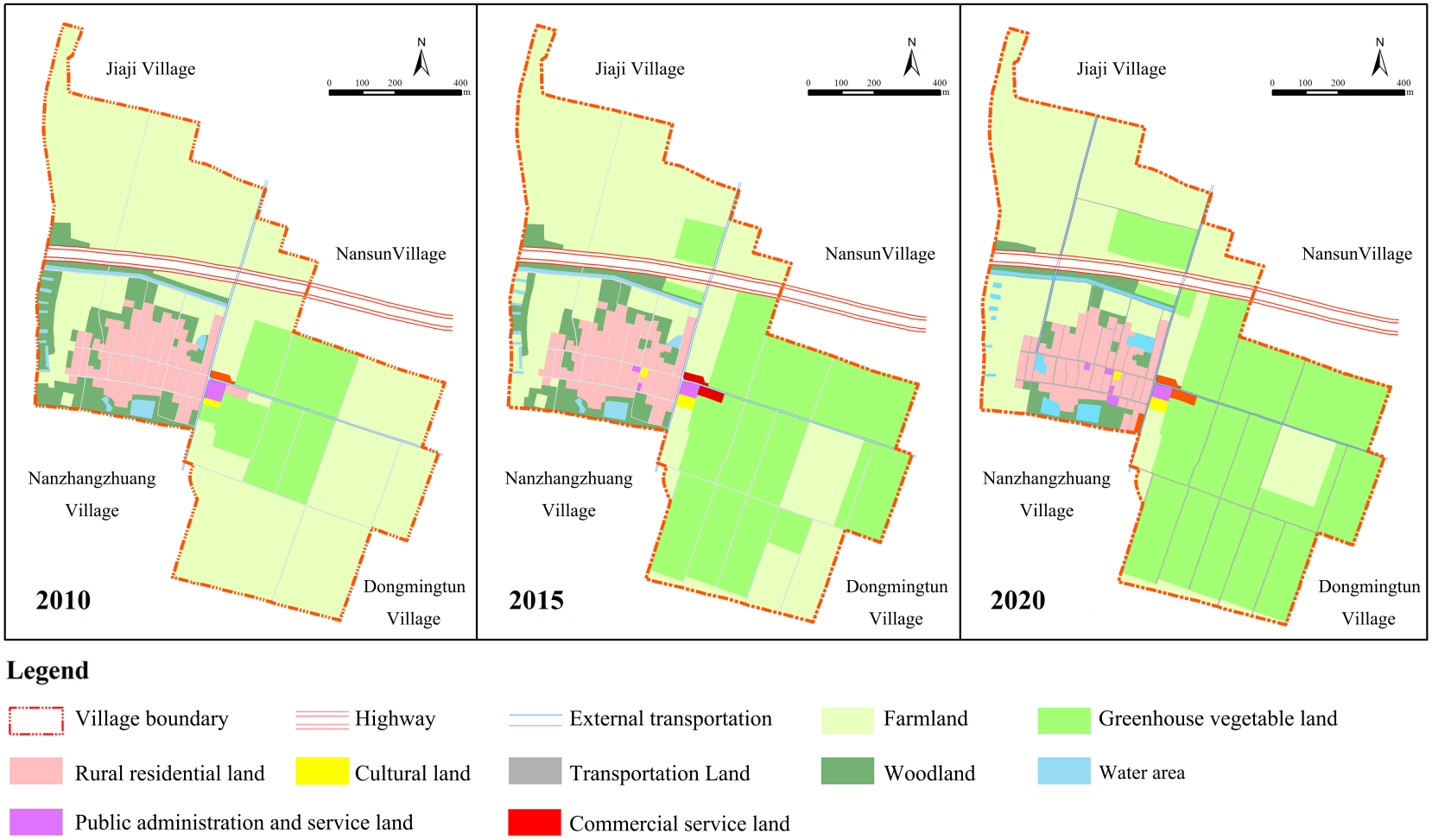

Fig. 8-1. Land use evolution of Jinzhuang Village from 2010 to 2020

(1) Production space restructuring

The most obvious production space restructuring in Jinzhuang Village is closely related to the development of the local greenhouse tomato industry. With the industrial transformation of Jinzhuang, land use morphologies are changing unceasingly among production spaces. Among all types of RLC projects involving production space, agricultural land consolidation is the one with the longest duration, the largest quantity, and the broadest area.

With the development of the tomato industry, a large amount of cultivated land used for growing wheat and corn has been converted into greenhouses. From the perspective of spatial layout, the farmland used for tomato greenhouses is mainly concentrated in the eastern part of the village. More than 80% of the farmland in the east of the village has been gradually transformed into tomato greenhouses in the past decade and showed a pattern of circular expansion, with the centre of gravity of farmland used for growing wheat and corn gradually moving westward. From 2010 to 2020, the area of agricultural land, including farmland and greenhouse land in Jinzhuang, increased by 2.95 ha (from 87.82 ha to 90.77 ha), mainly transformed from woodland and idle land. However, nearly 30 ha of farmland has been developed into greenhouse land for growing tomatoes during the same period.

There are three notable changes concerning farmers' working environments and property rights. First, the development of greenhouses altered the traditional seasonal migration of many villagers (who would leave the village to work during the slack farming season) allowing them to remain in the village and work in the greenhouses throughout the year. Second, almost all households have transferred their farmland use right to the village collective, following which the village collective has leased these lands out to major grain-producing households or else used them to build greenhouses. These farmers who obtain the corresponding rent of their farmland then rent the vegetable greenhouses from the village collective to grow tomatoes at a rent of yield of wheat per mu (usually 500 kilograms/mu). Some farmers not only grow corn and wheat, but also work in greenhouses. Moreover, apart from during the active farming period, almost all the working spaces of the local population are concentrated in the eastern part of the village, where they were once relatively scattered, given that farmers' lands were previously physically dispersed throughout the village.

(2) Ecological space restructuring

From the perspective of spatial layout, ecological land was mainly scattered around the periphery of the living space (i.e. residential land) and separated living space from production space and surrounding villages. With the implementation of RLC projects, the restructuring of ecological space has two main characteristics.

The total area of ecological space has reduced sharply. From 2010 to 2020, the proportion of ecological space decreased by 3.51%, from 8.79% to 5.28%, on account of the encroachment of agricultural land. Although the area of water coverage, mainly due to the enlargement of ponds, has increased following environmental renovation conducted in the village, it is far less than the loss of woodland.

In terms of spatial distribution, ecological spaces gradually but significantly decreased in the periphery of the village, but started to be created in the living space. In 2010, a large amount of ecological land was distributed around the living space and the westernmost side of the village. However, with the continuous implementation of agricultural land consolidation projects during the period 2010-2020, more than half of the woodland has been converted into agricultural land to meet the needs of farmers for the development of agricultural production, especially greenhouse tomatoes. Since 2015, Jinzhuang Village has actively responded to the government's call to implement construction land consolidation. In the past five years, 7 out of 20 dilapidated buildings have been demolished to build squares and small gardens for villagers' daily leisure and parking (i.e. car parking), or else to be reclaimed for farming. Five of the seven buildings belonged to five households that had at least two dwellings in the village at that time (i.e. a single household with multiple dwellings in a village), which is prohibited according to the current *Land Administration Law* in China. Moreover, some environmental qualities, such as water quality and sanitation, have been improved around the three ponds according to questionnaire results, and a new pond has been built on idle land in the western part of the living space. The main measures taken have included regularising the shape of the ponds, removing the surrounding bushes and garbage in order to plant trees uniformly, improving the water quality, facilitating the environmental management of the village, keeping the village clean and tidy, as well as enhancing the villagers'

awareness of the importance of protecting the living environment.

Overall, great changes have taken place in the ecological space of the village. Its total area has decreased over the period under study and characteristics of the improved blue-green spaces have become more artificial, rather than nature-based.

(3) Living space restructuring

Compared with production space and ecological space, the living space experienced less change in the period under study. In terms of land area, the area of living space of Jinzhuang Village has hardly changed in the past decade, with an increase of only 0.26 ha. However, the area of rural residential land showed an opposite developmental trend. The decrease in homesteads has been mainly caused by several dilapidated homesteads in the north and centre of the residential area being demolished for reclamation or else converted into squares and small gardens, while no applications have been made for new homesteads in the village. Besides, some changes have also been made to the roads in the living space, especially the road on the west and south of the residential area. In 2015, a new east-west road was built in the south of the residential areas near to a neighbouring village to facilitate residents' access and connection. This is because the two villages (Jinzhuang Village and Nanzhangzhuang Village) have been administratively merged into one community with another two villages since 2014, but residents' work, lives and daily governance remain separate. With the increase in private car ownership and the improvement of agricultural mechanisation, the road in the north of the village has also been widened and diverted to make it more convenient for residents' access and farming.

In addition to what can be seen directly from Fig.8-1, there is another change in villagers' living space. More than 65% of farmers are engaged in greenhouse tomato farming in Jinzhuang Village. During the busy season, farmers need to spend a lot of time in the greenhouses to take care of the tomatoes; many have therefore built small houses next to their greenhouses as entrances to their greenhouse and to bridge the work-life divide during the busy season. Therefore, the living space and production space of residents in Jinzhuang Village are not as separated as the spaces observed in other traditional agricultural areas. To some extent, it can be said that there is an integration between the production and living spaces of tomato farmers (Jiang et al., 2021).

8.2.3 Modes of RV promoted by RLC in Jinzhuang: Intensity-adjustment

Jinzhuang Village's period of experience in RLC from 2010 onwards suggests that local development can be promoted, based on local conditions, by adjusting the land use structure and the intensity of different rural land use functions (RLUFs) in a timely manner by means of RLC (Fig. 8-2).

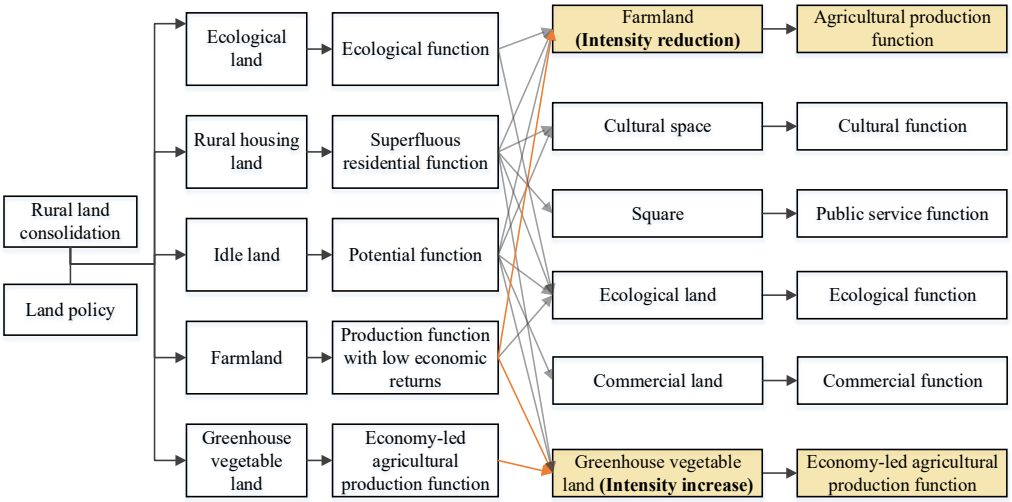

Fig. 8-2 Intensity-adjustment of main RLUFs in Jinzhuang driven by RLC

(note: the highlighted parts indicate the intensity-adjustments that have the most significant local impact)

Given that greenhouse vegetables can produce higher economic benefits than grain production[76], idle land and some farmland used for grain production (mainly corn and wheat) in Jinzhuang have been transformed into greenhouse land through greenhouse-led land consolidation. This follows the trend of the greenhouse-led agricultural land transition which has occurred in many traditionally-agricultural areas in China since the late 1990s (Ge et al., 2018; Ge et al., 2019). From 2010 to 2020, the area of idle land consolidated into agricultural land was nearly 5 ha, according to the interview conducted with village cadres. During this period, the area of greenhouse land has more than tripled (from 15.1 ha to 47.9 ha), while the area of farmland has shrunk to less than 60% of its original size (from 72.7 ha to 42.8 ha). The development of the tomato industry has almost doubled the per capita income of villagers and the income of the village collective in the past decade. In terms of cultural development, the area of cultural facilities such as the library and community centre, with the help of construction land consolidation, was triple that of 2010

[76] In Jinzhuang Village, the economic benefit of tomatoes per mu is almost five to six times that of grain crops (corn and wheat).

in 2020, increasing from 1,000 m^2 to 3000 m^2.

In addition, villagers, as long-term residents, are highly sensitive to the surrounding environment of their locale. Based on 101-point scales filled out by respondents in field investigation, it is found that villagers' scores for environmental quality increased from 65 points in 2010 to 85 points in 2020, the highest possible score being 100 points. This is largely a result of the area of land used for leisure and landscaping (i.e. gardens and ponds) nearly tripling over this period as well as the sanitation of the area greatly improving as a result of construction land consolidation (residential land consolidation and renovation of the village environment), as observed during field investigation. Moreover, most of the interviewees showed high satisfaction with their current living conditions and working status. The following reasons contribute to this. One is that, before local people were engaged in the greenhouse tomato production, labourers chose to work in urban areas – such as Yucheng, Dezhou, and Jinan – during the slack farming season to earn more money to support their families, resulting in a large number of left-behind elderly and children in the village. The development of greenhouse-led land consolidation and the tomato industry allows them to earn profit compatible with the amount of work in urban areas while being able to spend time with their families. Moreover, living and working environment in the village is better than those they experienced while working outside it. Another reason is that, along with the increase in economic income brought by the expansion of the greenhouse land, more than 80% of households (110 out of 135 local households) have bought new apartments in urban areas or towns and updated their household appliances in the village, thereby improving their quality of life.

With the promotion of RLC, the functional intensities of different land types have been adjusted in Jinzhuang Village, particularly farmland and greenhouse vegetable land. This has contributed to the enhancement of production efficiency, the increase of farmers' and the village collective's income, the improvement of living conditions, and the promotion of socio-economic development, thus vitalising local development to a great extent (Jiang et al., 2022).

8.3 Modes of RV promoted by RLC in Dongheng Village

8.3.1 Recent rural improvement in Dongheng Village related to RLC

The development of the mining industry in Dongheng Village can be traced back to the 1980s. Many villagers quickly grew rich by engaging in the mining industry, and the collective income of the village was among the top in Deqing County at that time. However, with the continuous reduction of ore resources and the ecological turn in China's rural development strategy, such as *The Construction of New Socialist Countryside* (The State Council of People's Government of China, 2006), the development of the mining industry at the expense of the ecological environment of the village has gradually entered a bottleneck period.

In 2009, all mining enterprises in Dongheng Village were forced to close to protect the ecological environment due to the ecological turn in China's land use policies, such as "Outline of the National Overall Plan for Land Use (2006-2020)" (The State Council of People's Government of China, 2008), and the village committee's thinking on promoting local sustainable development. Ecological restoration and the filling of abandoned pits were subsequently used to rehabilitate the mines. Since 2011, with the approval of the Zhejiang Provincial Government, comprehensive rural land consolidation (CRLC), including industry and mining land consolidation, agricultural land consolidation and residential land consolidation, has been carried out in Dongheng Village. This mainly involved the following measures. First, the polluted ecological environment was restored through land engineering and biotechnology, and the restored mines were then reclaimed in order to obtain a large amount of cultivated land. Dongheng Village also obtained some construction land quotas via the policy of "increasing vs. decreasing balance of urban-rural construction land" (Long et al., 2012) (see Section 3.3.2). Second, a new village with an area of roughly 80 mu has been built in the central village[77] through land acquisition, industrial and mining land consolidation, and residential land consolidation. When the new village was almost completed, all residents of one natural village

[77] In China, an administrative village, such as Dongheng Village, is a rural grass-roots management unit established by the state in accordance with the law, and its organisational form is the village committee. In many provinces, it is common for an administrative village to be made up of a central village and several natural villages (hamlets). And the central village is usually the location of the village committee.

and some residents of other natural villages in Dongheng moved to the new village after agreeing that the village collective could reclaim their old houses. The main purpose of this was to promote village agglomeration, promote the intensive use of land, and improve the coverage and service efficiency of infrastructure and public service facilities, respectively. Third, industry and mining land consolidation as well as the consolidation and transfer of agricultural land have been carried out to facilitate the construction of industrial parks and well-facilitated farmland, so as to achieve the agglomeration effect of local industries and promote the large-scale and mechanisation of agricultural production.

Driven by CRLC and the active participation of most villagers, Dongheng Village has become well-known for its cultural construction, socio-economic development, and ecological environment. For example, the village's collective economy has grown from less than 200,000 RMB at the end of 2009 to 28.35 million RMB in 2020; 46 piano companies have settled in the "Piano Innovation Park" in the south side of the village with a total output value of 2.1 billion RMB in 2020, employing almost 1,000 people. Furthermore, through years of effort, the village has been awarded national and municipal honorary titles, such as being named a "National Ecological and Cultural Village" in 2014[78], a "Municipal Beautiful Village" in 2016[79], a "Provincial 3A Tourist Attraction Village" in 2019[80], a "National Wenming (civilised) Village" in 2020[81] and a "National Demonstration Village for Rural Governance" in 2021[82].

8.3.2 RLC-driven spatial restructuring in Dongheng from 2010-2020

Driven by CRLC, the land use situation in Dongheng Village has been changing continuously since 2010, causing significant changes in the land use structure of the village. The ratio of the area of production, living, ecological, and potential spaces has changed approximately from 53.89:5.87:19.98:20.26 in 2010 to 60.33:7.04:18.15:14.48 in 2020. Fig. 8-3 reflects the process of land use evolution that Dongheng has undergone over the past decade.

[78] http://www.ceca-china.com/news_view.asp?id=3970
[79] http://zjnews.china.com.cn/yuanchuan/2017-02-02/116503.html
[80] http://ct.zj.gov.cn/art/2022/1/7/art_1643514_59009165.html
[81] http://www.wenming.cn/specials/2020bz/bzjd_51677/202011/t20201120_5857117.shtml
[82] http://www.moa.gov.cn/xw/bmdt/202111/t20211116_6382260.htm

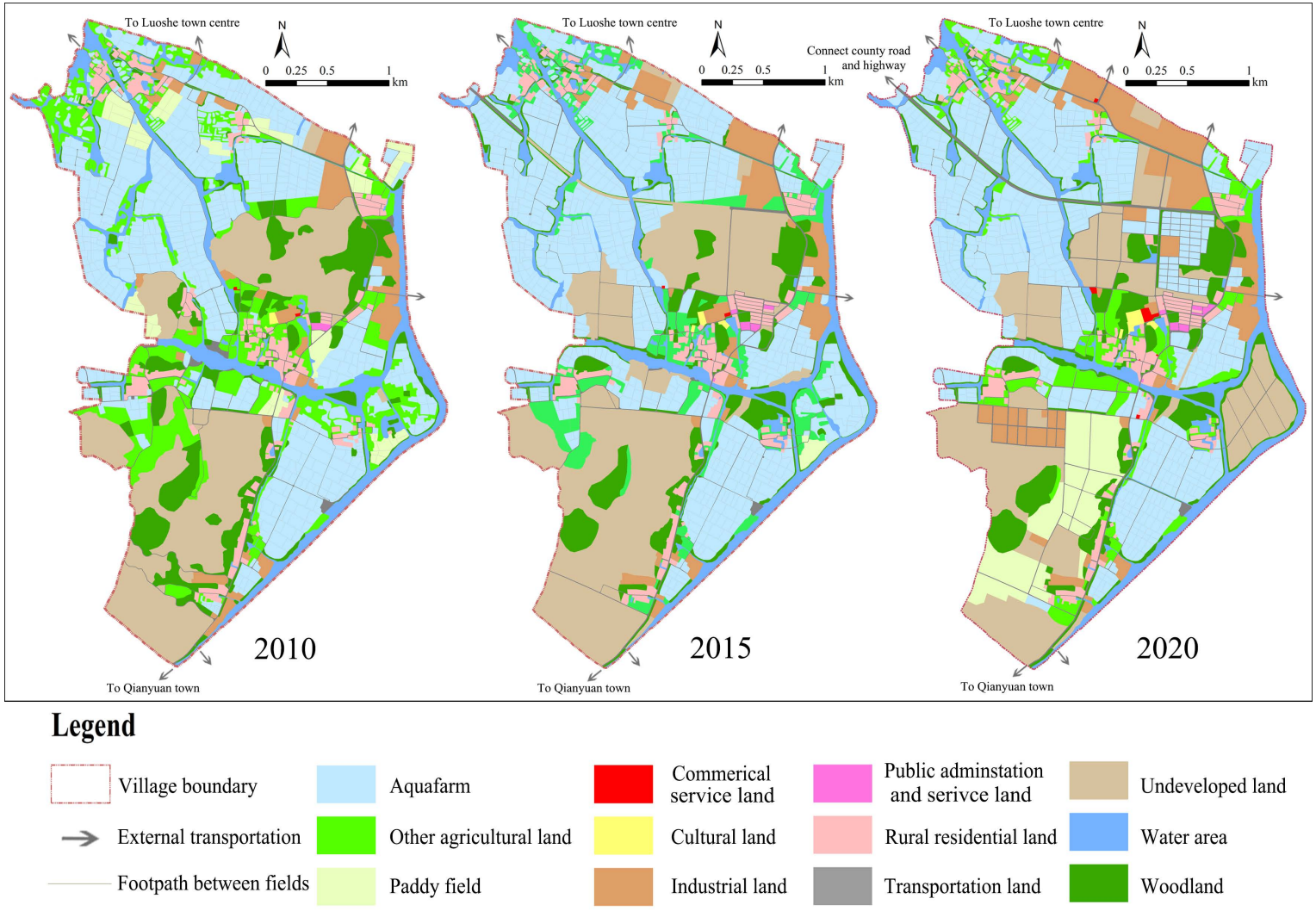

Fig. 8-3. Land use evolution in Dongheng Village from 2010 to 2020

(1) Production space restructuring

For a long time, the production space of Dongheng Village has consisted mainly of agricultural production space and industrial production space. Before 2010, the industrial space was dominated by mining areas, lumber companies, and piano companies, while paddy fields, vegetable gardens, and aquafarms dominated the agricultural space. Following the closure of all mines in 2009, in addition to the dominant timber company and piano company, various types of production space, such as furniture and food factories, have been added, while the composition type of agricultural space remains largely unchanged.

In 2010, all mines were abandoned and turned into potential space (idle land). Under the promotion of CRLC since 2011, the original mine and some surrounding woodland and cultivated land were consolidated in a unified way to promote the overall development of the area. With the reclamation of some mines, the local government and Dongheng Village have successively built industrial parks in the north and south of the village by means of "increasing vs. decreasing balance" land use policy and land acquisition. For the piano and wood processing industries, the spatial layout has gradually shifted from being scattered to being agglomerated in two industrial parks. The northern industrial park, which has been under construction since 2015, is part of the Luoshe Town Industrial Park (located on the north of Dongheng Village and across the river from Dongheng Village), and is mainly the site of activities involving wooden skin processing and home furnishing. The industrial park in the south – "Piano Innovation Park" (Fig. 8-4) has been built by Dongheng Village in 2017. It specialises in the research and development, manufacturing, and sale of pianos, as well as technical training.

Fig. 8-4. The Piano Innovation Park in Dongheng Village
(Data source: Photos obtained during the field investigation)

On the other hand, aquaculture farms, mainly engaging in the cultivation of freshwater shrimp and fish, have occupied most of the agricultural production space. Its spatial scale has continued to expand, growing rapidly from slightly

less than two-thirds of the agricultural production space in 2010 to almost three-quarters in 2020. Agricultural land dominated by rice cultivation occupied a small part (around 8%) of the agricultural production space in 2010 and its proportion fell sharply to less than 1% in 2015. This trend was substantially reversed, however, following the completed reclamation of abandoned mines: in 2020, paddy fields accounted for roughly one-eighth of the agricultural production space. Meanwhile, its spatial pattern has altered from one of decentralised reduction to centralised expansion. In addition, other agricultural land, mainly used for planting vegetables and mulberries, has been distributed around the natural villages, and its ratio of the agricultural production space has been reduced by more than half, from about 27% in 2010 to about 13 % in 2020.

The production space of Dongheng Village shrunk sharply after the mine closure in late 2009. With the development of CRLC projects, although the proportion of production space continued to trend downward from 2010 to 2015, its reduction rate significantly decreased and subsequently tended to a stable state. Since 2016, with the mine consolidation process ongoing, part of the original mine has been renovated into developable flat land, which has been rapidly transformed into production space. At the same time, the smooth development of consolidation of agricultural land and construction land, support from relevant land use policies, as well as the agricultural land transfer from households to the rural collective have promoted the spatial agglomeration and large-scale production of primary and secondary industries. Furthermore, with the continuous development of the village in recent years, commercial production space has also appeared in Dongheng as one of the important production spaces.

(2) Living space restructuring

Similar to the production space, spatial agglomeration can also be observed in the living space. However, unlike the multi-point agglomeration of the production space, it can be observed that over the past decade, some natural villages, being the scattered living spaces in Dongheng, have been shrinking in size, while the central village has been expanding.

In the process of living space restructuring, the change in the central village has been the most significant. The natural village (roughly a total of 45 households) located in the southwest corner of the northern sector was relocated

to the central village, and some households from other natural villages also moved into the central village voluntarily by demolishing their old houses in exchange for new ones in the central village. Based on the CRLC project, Dongheng Village has prepared nearly 20 ha of land for the development and construction of a central village which is planned to accommodate 1,000 households. By the end of 2020, 220 households have moved into five 11- storey apartments with an average area of 220 m^2 each while 172 households have moved into townhouses with an average area of 310–330 m^2 each. Supporting facilities, such as a fitness square, farmers' market, community health centre, bank, nursery, nursing housing, 280 garages, 40 storage rooms, and 200 parking spaces, have also been constructed and updated according to the village planning. The development of the central village has changed the horizontal expansion method which villages traditionally follow and has realised the synchronisation of horizontal and vertical development. Specifically, the construction of high-rise residences and townhouses reduces the consumption of land resources and frees up more space for the improvement of villagers' living conditions. For example, after the completion of the central village, the average area of a single homestead has been reduced from 140 m^2 to 87.5 m^2, vacating more than 100 mu of land for the construction of infrastructure and public service facilities in the central village.

In the west of the central village, a cultural centre has been built with historical figures (Mengfu Zhao and Daosheng Guan[83]) and their paintings and calligraphy as the core theme. This cultural centre is composed of Mengfu Zhao cemetery, Zhaogong Memorial Temple, Mengfu Zhao and Daosheng Guan Art Gallery, a cultural street, an artificial lake, a farmers' library, and an outdoor stage for cultural events. Zhaogong Memorial Temple was built on the site of Mengfu Zhao's former residence. The focus of this cultural street, transformed from what was once a silk factory, is the creation and consumption of culture and art. The construction of this cultural centre is not only designed to improve the quantity and quality of villagers' daily cultural activities, to promote cultural

[83] Zhao, Mengfu (1254-1322) was an accomplished and far-reaching artist born in the Yuan Dynasty. When he was young, he lived in seclusion in Dongheng Village to escape the war. After that, he married Guan, Daosheng (1262-1319), a female artist who was engaged in painting, calligraphy and poetry. Today, they are known as China's foremost historical artistic couple. Now, their bisomum is listed as a major historical and cultural site protected at the national level by the Chinese government.

construction and enhance village cohesion, but also to provide a space for cultural tourism, which is regarded as a new growth point for the socio-economic development of Dongheng.

Moreover, a large number of roads have been updated to make residents' daily travel more convenient and to facilitate the development of local industries. The original north-south main road, for instance, was not only updated from a five-meter-wide concrete road to a seven-meter-wide asphalt road, but was also diverted to reduce the number of vehicles passing through the residential area. both in the interests of the overall development of the village and of reducing the noise and safety hazards caused by vehicles to the residents.

(3) Ecological space restructuring

The ecological space of Dongheng Village is composed of water areas and woodland. The whole village is surrounded by rivers and is divided into two major areas — the northern part and the southern part— as well as the island in the east. However, the area of the ecological space shrunk during 2010 to 2020.

Most of the woodlands in Dongheng are in hilly terrain. The closure of the mine has promoted the restoration of the hills and woodlands. However, some of the hills far from the residential agglomeration area were levelled during the land consolidation projects, the purpose being to promote the connectivity of different spaces and to provide sufficient space for subsequent agricultural and industrial development. This is the main cause of the substantial decline (nearly 15%) of woodland areas between 2010 and 2015. After 2016, with most of the land-levelling work completed, the trend of woodland shrinkage was reversed. With the gradual restoration post-2016 of the ecological environment that had been damaged by mining and land levelling, a nearly 6.5% increase in the woodland was observed over the next five years.

On the other hand, the area of water has declined by an average of nearly 1% per year during the period 2010-2020. This is mainly due to a large amount of agricultural land for farming fish and shrimp being reclaimed from rivers and canals. The island in the east of the village and the west side of the north part are the areas that have witnessed the most significant reduction in water area. However, with the continued recovery of the woodland and the reduction of the declining rate of the water area, the ecological space has shown an overall small increase since 2015.

Both production space and ecological space showed a decreasing pattern in the first half of the decade 2010-2020, followed by a pattern of an overall increase in the latter half, while the opposite pattern was observed with undeveloped space. On the other hand, the area and proportion of living space have been increasing. Driven by CRLC, a large number of abandoned mining areas have been and are being reclaimed into production and living spaces, but this has also resulted in a simultaneous almost 9% reduction in ecological space.

8.3.3 Modes of RV promoted by RLC in Dongheng: type-conversion

As mentioned above, Dongheng was originally a rural village dominated by the mining industry. Perennial mining has left a large area of mine pits and severely reduced soil and water quality, which not only damaged the local ecological environment and harmed residents' health, but also restricted the potential for future local growth. To improve the village's hitherto dirty, chaotic, and unsustainable image, the local governments and Dongheng Village have jointly promoted local vitalisation and sustainable development by means of CRLC, mainly focusing on the reclamation and utilisation of abandoned mines. Land is still the main spatial carrier for rural development in China (Long, 2020), and the development of Dongheng Village is also strongly dependent on local land use. Reasonable change in land usage has formed the premise for the optimisation of the spatial layout, the healthy development of the socio-economy, and the improvement of the ecological environment, while RLC is the main tool and platform for local land use change. Thus, the significant conversion of RLUFs driven by land consolidation (Fig. 8-5) is one of the most important driving forces of local development in the area. The main measures undertaken in order to achieve these rural land usage goals were as follows.

First, with the ecological improvement of the countryside having become a key priority in China, all mining enterprises in Dongheng Village were forced to close at the end of 2009 in order to protect the local environment. Abandoned pits were then backfilled and ecological restoration projects were implemented to renovate the areas where the mines had operated. Although the total area of ecological space has declined since that time due to land engineering projects, the air, soil and water quality and the originally dilapidated landscape environment have been greatly improved, as well as the traditional and widely

recognised landscape pattern – the village is surrounded by mountains and waters (*Yishan Bangshui*) – has been retained. Through years of effort, the village has successively won honorary titles (as mentioned in Section 8.3.1).

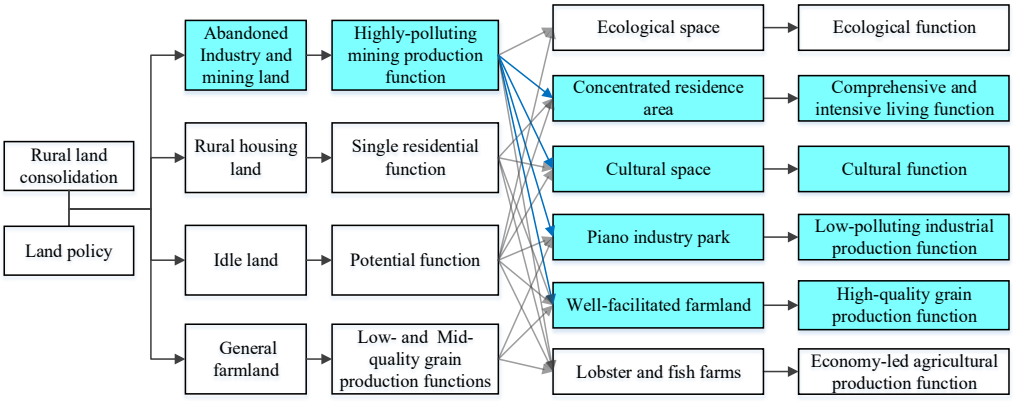

Fig. 8-5 Type-conversion of main RLUFs in Dongheng driven by RLC

(note: the highlighted parts indicate the type-conversions that have the most significant local impact)

Second, mining land and residential land consolidation were adopted to promote the transformation of traditionally scattered rural settlements with inefficient land use into modern settlements with efficient land use. The purpose of this is to improve the living environment with measures such as increasing public service coverage, infrastructure, and improving the image of the village's physical landscape, as well as promoting local social development. Based on the two land consolidation projects mentioned above, Dongheng Village has rearranged nearly 20 ha of land for the development and construction of the new central village. During this process, some new space types, such as the cultural street, art gallery, park, and visitor service centre were built. As of today, the new central village has not only won the praise of the vast majority of interviewed villagers, but has also become an exemplar of CRLC in Zhejiang Province.

Economic development is also key to local development. Since March 2013 – in order to counter problems arising from the substantial reduction of many villagers' incomes and the village collective income[84] following the mine closure – the Dongheng village committee has negotiated with villagers to transfer the use rights of their agricultural land to the village collective by means of equity investment. Since then, the village collective has readjusted the spatial layout of land use through land consolidation and related land use policies such

[84] According to the field interview, after the mine closure, the collective economic income of Dongheng dropped from a high of about 4 million RMB/year to about 0.2 million RMB in 2010.

as the "increasing vs. decreasing balance" land use policy. In this process, the fragmentation of agricultural land and industrial land in the village has been improved, which is conducive to subsequent mechanisation and large-scale production. Thereafter, the agricultural land was leased to companies or individuals for large-scale grain planting as well as aquaculture involving the cultivation of shrimp and lobsters. Besides, after consolidating rural collectively-owned construction land and the land obtained by backfilling abandoned mine pits, the village collective, based on their long-term experience in the piano industry, registered and established a company to build and operate the "Piano Innovation Park" in the southern part. Meanwhile, with the support of the "collectively-owned commercial construction land into the market" policy (Zhou, Li & Liu, 2020), some piano enterprises paid land transaction fees (around 3.2 million RMB per ha) to the company to rent land in the "Piano Innovation Park" from the village collective to build factories. In this process, over 80% of the land transaction fees were distributed to farmers and the village collective, while much of the rest (16%) was used for urban-rural infrastructure construction and environmental improvement. In this way, the village collective obtained enough rent to further promote the construction and development of the village, while villagers obtained wages by taking jobs at the enterprises in the park. According to the interview conducted with village cadres, the equity in 2013 was quantified at 684 RMB per person per share, but by the end of 2019, the value of each share had reached 50,000 RMB, an increase of more than 70 times in six years. In 2020, the total income of the collective economy of Dongheng Village was 28.35 million RMB, ranking first among nearly 1,000 village-level collective economy organisations of Huzhou City for three consecutive years, and the per capita disposable income of villagers was roughly 43,000 RMB. Furthermore, Dongheng Village has also brought the seven underdeveloped villages in the county out of poverty by jointly developing a part of the "Piano Innovation Park".

During the last decade, local culture has also been increasingly valued in Dongheng Village. As part of the CRLC process, starting in 2013, the Cultural Hall, the first Chinese Farmers' Library, and the Hemei Xiangfeng Museum[85]

[85] The Hemei Township Style Museum is a rural museum which showcases local customs, famous people, and cultural development, as part of the process of building a beautiful and harmonious village.

have been successively built on the original site of the abandoned mine. The main purpose of this undertaking is to enrich the spiritual and cultural life of villagers and to promote traditional cultural practices such as winemaking, calligraphy, Chinese painting, and farming. According to the on-site investigation, it can be seen that these cultural facilities not only constitute the cultural life space of villagers but have also gradually become the spiritual centre of the entire village.

In sum, Dongheng has converted various of RLUFs through land consolidation and related policies, thus realising its transition from an economic development-oriented but unsustainable mining village to a model village of rural vitalisation with the co-development of economy, society, eco-environment, and culture (Jiang et al., 2022).

8.4 Discussion

Considering the scarcity and importance of land resources, the adjustment of land use structures and RLUFs via RLC was shown in the case examples to be significant in tackling rural issues and promoting rural development, which is consistent with the findings from some previous studies (Huy & Warr, 2020; Rao, 2022). Although the modes of land consolidation in the promotion of rural development from a functional perspective can be divided into the intensity-adjustment mode and type-conversion mode, these two modes often coexist in practice and may transform each other with the spatial-temporal changes in research scales. Existing studies have demonstrated the importance of scale changes to the research results (Song et al., 2020).

Within a fixed boundary, the size of the area is constant; the increase of the supply capacity of a function, except for increasing the supply capacity by adding building floors, usually involves the weakening of the supply capacity of another function or multiple RLUFs. When the enhancement of the intensity of a certain type of land use function only leads to the weakening of other functions rather than the disappearance of other functions, this study defines it as the "intensity-adjustment mode"; otherwise, it is called the "type-conversion mode". The two modes coexist when an increase in the intensity of a function leads to the disappearance of some functional types and the weakening of the intensity

of other functions. However, these two modes will transform each other with the changes in the research scale. For instance, at the village scale, all mining land in Dongheng has been consolidated and converted to other land types, which is termed as the type-conversion mode; at the township scale, however, the disappearance of mining land in Dongheng can be viewed as part of intensity-adjustment given that mining land still exists and is operational in other villages within the township. For Jinzhuang, if the time scale of the study was extended to more than ten years before 2010, the development of Jinzhuang would have to be classified as the type-conversion mode given that greenhouses did not appear here before 2000.

In addition, an increase in the intensity of RLUFs or there being more of them does not necessarily mean a stronger functional supply capacity, given that the supply capacity is affected by both type and intensity. If the functional types of an area are inappropriate, the stronger the intensity of these functions, the more likely it is to restrict local sustainability; when the functional intensity is insufficient, the increase of function types may also not necessarily promote local sustainable development. The case of Dongheng exemplifies this. Before the implementation of CRLC, the area of exposed mines increased year by year. Although it brought attractive economic benefits, it also increasingly aggravated the deterioration of the eco-environment, the decline of socio-cultural construction, and the deterioration of residents' health (Jiang et al., 2022).

Further, the modes of RLC for village development can be analysed from perspectives other than the functional one. For example, from the perspective of leading force, there are three modes: government-led mode, farmer-led model, and company-led mode (Wang et al., 2022; Zeng, 2016; Zhang et al., 2019). According to the project scale and content, there are three modes: comprehensive compulsory mode, consolidation as part of investment projects, and simple voluntary mode (Hartvigsen, 2015). In addition, the modes of land consolidation in promoting rural development in China can be summarised from the perspectives of geographical characteristics, land use types, objectives, and operation approaches (Zhang, 2007), while three models were specified in Rwanda: facilitated contract farming, cooperative farming, and the farming corporation (Asiama et al., 2021). In the implementation of RLC, the intensity-adjustment mode and type-conversion mode may be used alone or together with

these modes. Therefore, the modes of RLC in promoting village vitalisation are diverse and intersecting, which also determines the need to comprehensively consider the application and implementation of different modes in praxis.

8.5 Chapter summary

In the process of RLC between 2010-2020, Jinzhuang Village has improved its local economic strength by carrying out agricultural land consolidation to adjust the functional intensity between greenhouse land and farmland. It has also improved the village landscape and promoted socio-economic development by actively carrying out construction land consolidation to adjust the functional intensity between residential land, public administration and service land, and idle land. During the same period, the abandoned mines in Dongheng Village were transformed into other spaces such as industrial parks, modern residential areas, well-facilitated farmland, and aquafarms through CRLC. At present, through the type-conversion of RLUFs, Dongheng Village has promoted the comprehensive development of the local socio-economy, cultural tourism, and ecological environment, and has become a recognised example in Zhejiang Province and even nationwide of how land consolidation can successfully promote rural vitalisation. Moreover, these two modes in praxis often coexist or transform each other with the spatial-temporal changes of research scales, and functional supply capacity is affected by both the intensities and types of RLUFs.

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Chapter 9 RLUFs supply-demand and local vitalisation in two villages under the influence of RLC

9.1 Introduction

A combination of the theoretical model constructed in Chapters 5 and 6 and data from multiple sources (e.g. field survey data, official data, and land use data obtained through the interpretation of remote sensing images) is used in this chapter to analyse the effectiveness of rural land consolidation (RLC) on different aspects of local vitalisation as well as the supply-demand of and for rural land use functions (RLUFs) in Jinzhuang Village and Dongheng Village. Furthermore, the hidden mechanisms of RLC in promoting the two villages' development are revealed and elaborated upon.

9.2 The effectiveness of RLC on the two villages' vitalisation

In Section 6.2.1, a general evaluation indicator system was built based on a general and theoretical understanding of Chinese rural villages in the eastern plains region, in order to evaluate the effectiveness of RLC on RV at the village level. However, due to the diverse developmental conditions among villages, this general evaluation indicator system, based on field investigations, was modified to target Jinzhuang and Dongheng, respectively. Since industrial development usually requires to be diversified to fit local needs, the customised indicators are mostly concentrated in industrial development.

9.2.1 The effectiveness of RLC in Jinzhuang

(1) Indicator selection of Jinzhuang

Based on the index system provided in Section 6.2.1 and the field investigation in Jinzhuang Village, a targeted index system was customised for evaluating the effectiveness of RLC on the vitalisation of Jinzhuang in its various aspects (Table 9-1).

Table 9-1. Indicators for evaluating the effectiveness of RLC in Jinzhuang

Goals	Indications	Explanation	Effect	Weight
Thriving industry (0.2)	The level of agricultural mechanisation (I1)	I1 = The extent to which machinery is used in agricultural activities (%)	+	1/3
	Grain output per unit area (I2)	I2 = Total grain yield/Area of farmland	+	1/3
	The scale of tomato cultivation (I3)	I3 = Area of tomato greenhouses	+	1/3
Pleasant living environment (0.2)	Per capita area of public service facilities (E1)	E1 = The area of public service facilities/Total population	+	1/5
	Road area per capita (E2)	E2 = Road area/Total population	+	1/5
	Ecological space coverage (E3)	E3 = (Area of ecological land + half of the farmland area)/Area of Jinzhuang	+	1/5
	Excessive use of chemical fertilisers (E4)	E4 = The fertiliser input per unit area – the upper limit of the safety standard of fertiliser input per unit area[1)] (kg/ha) (household-level)	-	1/5
	Satisfaction of villagers (E5)	E5 = Mean value of the environmental quality rating by villagers (0-100)	+	1/5
Refined rural civilisation (0.2)	Centralised pollution treatment rate (C1)	R1 = The number of households with centralised pollution treatment/total households	+	1/3
	Per capita land for cultural facilities (C2)	R2 = The area of cultural facilities/Total population	+	1/3
	Function index of landscape aesthetics (C3)	R3 = The concentration and accessibility of farmland (Pang et al., 2016)	+	1/3
Effective governance (0.2)	Level of public participation (G1)	G1 = Number of people involved in the RLC projects/Total population	+	1/3
	Villagers' satisfaction (G2)	G2 = Mean value of villagers' ratings of RLC projects (0-100)	+	1/3
	Change in farmland area (G3)	G3 = The difference between the farmland area in two adjacent years	+	1/3
Prosperous life (0.2)	Diversification of villagers' incomes (L1)	L1 = The average number of major income sources (household-level)	+	1/5
	Per capita income (L2)	L2 = Average annual income of villagers	+	1/5
	Collective income (L3)	L3 = The annual income of the village collective	+	1/5
	Local employment ratio (L4)	L4 = Number of people employed locally/Total employees	+	1/5
	Rural-urban income gap (L5)	L5 = Per capita disposable income of villagers/ Per capita disposable income of urban residents in Yucheng	+	1/5

Note: 1) The upper limit of the international safety standard of fertiliser input per unit of farmland area is 225 kg/ha

There is no secondary industry in Jinzhuang, and only a small number of villagers are employed in the tertiary sector, such as working in retail and catering. Thus, the industrial prosperity of Jinzhuang Village is mainly reflected in agriculture. Meanwhile, the development of greenhouse tomatoes, rather than grain production, is the major focus of local RLC. The level of agricultural mechanisation, the output of grain per unit area, and the area of greenhouse tomatoes were therefore selected as the main evaluation indicators. Similarly, the indicator of industrial wastewater treatment does not apply to Jinzhuang Village. In addition, the area proportion of farmland has always been relatively high in Jinzhuang. The reasonable planting of crops has a certain positive effect on local climatic conditions and the ecological environment, although it is weaker than the effect of ecological space (Sun et al., 2007). When calculating the ecological area coverage, the area of farmland is therefore halved and then included in the ecological space.

(2) Results and analysis

Fig. 9-1 shows the development of the corresponding index of Jinzhuang's industry, environment, culture, governance, and life under the influence of RLC from 2010 to 2020. Three main characteristics can be observed from this figure based on the development indices related to the objectives of village vitalisation (Fig. 9-1). On the one hand, RLC has promoted the ongoing development of industry, life, and governance, while its effect on governance was relatively weak; on the other hand, although RLC from 2010 to 2015 promoted rapid prosperity in the cultural aspect – the score of which increased from 0.0339 to 0.0845 – RLC restricted cultural development in the next five years. Most notably, the value of the environmental index continued to decline over that decade.

From the perspective of industry, governance and life, RLC's effects were consistently positive in this decade, the manifestation of which was that the development indices for these three targets were all in an uptrend between 2010 and 2020. The following three reasons contributed to this phenomenon.

First, greenhouse-oriented land consolidation promoted the transformation of farmland and idle land into greenhouse land (see Fig. 8-1), thereby revising the original grain-based monocultural structure of Jinzhuang Village to a more diversified one; this has promoted the balanced development of local agriculture. Meanwhile, some farmers who originally planted grain switched to growing

tomatoes and then transferred their contracted farmland to major grain-producing households. This has had a positive impact on the promotion of large-scale and mechanised production in local agriculture. Large-scale agricultural production can not only facilitate production efficiency but also promote the unified management of grain planting, contributing to the improvement of grain output per unit area.

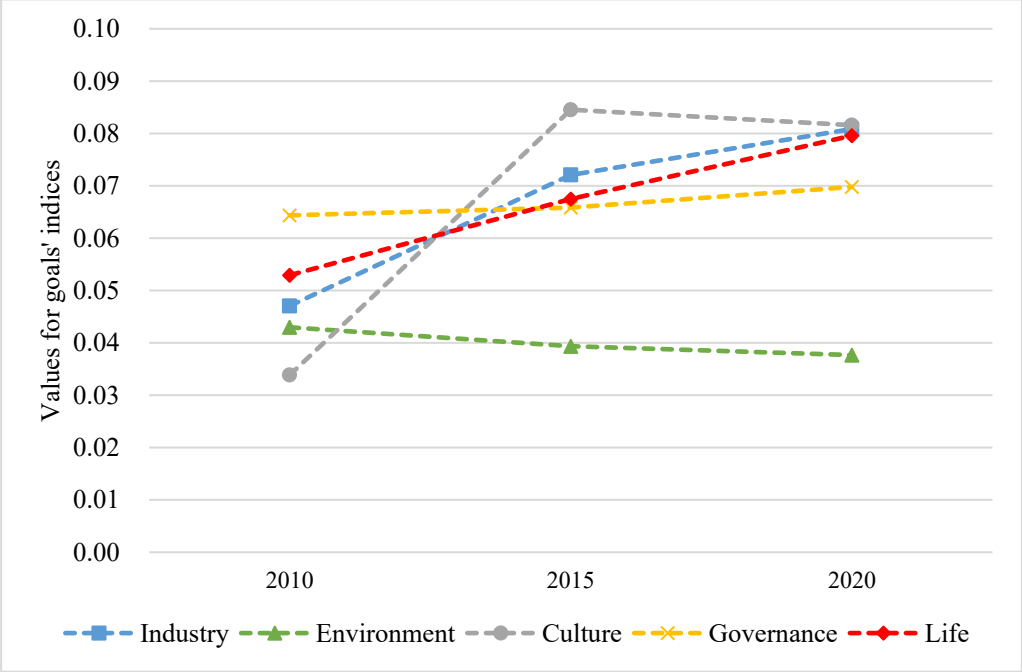

Fig. 9-1. The influence of RLC on five aspects in Jinzhuang during 2010-2020

Second, compared with growing grains (i.e. corn and wheat), growing tomatoes in greenhouses has brought higher economic benefits to farmers. It was discovered in interviews with local tomato farmers that the net income from growing tomatoes was almost five to six times that of growing grains with the same acreage. While some villagers obtained higher economic benefits by renting the greenhouses from the village collective to grow tomatoes, the village collective also obtained rent from them, which was then used to improve the infrastructure in the village. Additionally, the expansion of the greenhouse tomato industry has provided local employment opportunities for villagers, increasing the local employment rate from roughly 75% in 2010 to 82% in 2020. Specifically, the per capita annual income of the villagers and the annual income of the village collective have almost doubled in that decade; the rural-urban income gap has been narrowed and indicator L5 has increased from 0.558 to

0.699[86]; and the income sources of households have also increased from two types (grain planting and migrating to work) to four types at present (grain planting, tomato planting, migrant work, and renting farmland).

Third, increases in economic income and the local employment rate have not only improved the vitality of Jinzhuang, but also alleviated some social problems such as "village hollowing", "children being left behind" and "elderly people being left with an empty nest" (Jiang et al., 2021). This has contributed to social harmony in Jinzhuang Village. Moreover, the high economic benefits brought by greenhouse tomatoes have attracted more and more villagers to participate in greenhouse-led land consolidation. During this process, the village committee, according to the descriptions of villagers and village officials, played a coordinating and assisting role in helping farmers to solve problems and disputes in land consolidation, greenhouse construction, and tomato planting. As a result, the enthusiasm of farmers to participate in RLC has increased, as has the reputation of the village committee among the villagers, which has promoted the orderly autonomous management of the village.

However, RLC seems to be a little weak in promoting sustainable cultural development in Jinzhuang. The development of construction land consolidation led to an increase in cultural facilities land per capita from 2.6 m^2 in 2010 to 7.3 m^2 in 2015, which then fell by less than 3% over the next five years. Similarly, with the support of construction land consolidation, centralised pollution treatment increased from 0% in 2010 to almost 100% in 2015 and remained stable thereafter. On the other hand, the landscape aesthetic index continued to decline throughout the decade as a large amount of cultivated land was converted into greenhouses covered with permanent structures. This is the reason why the cultural index rose rapidly from 0.034 to 0.0845 in the first five years, but then slightly fell to 0.0816 in the next five years.

As for the environment, although the quality of the built environment in the settlement was considered to have improved given the increase in per capita area of public service facilities and infrastructure, the quality of the ecological environment, as reflected in the index, appears to has been declining during the decade. Specifically, ecological space coverage dropped from 8.8% in 2010 to

[86] The per capita disposable income of urban residents in Yucheng City by year can be found on: http://www.yuchengshi.gov.cn/.

5.53% in 2020; the area of farmland fell by more than 40%; and the excessive use of fertilisers (E4, by the international safety standard) for grain production more than doubled from 2010 to 2020. This not only eroded the rise of the environmental index brought about by the improvement of the living environment, but also resulted in a continuous decline in the overall value of the environmental index by more than 12%.

Interestingly, although the ecological quality has dropped significantly due to the shrinking of ecological space and the overuse of fertilisers, the respondents' views of the overall environment, during interviews conducted during the field investigation, were almost always positive. This is reflected in the subsequent analysis, with the satisfaction of the village environment rising from 65 points in 2010 to 85 points in 2020. This can be explained by the following. In 2015, Jinzhuang Village carried out residential land consolidation and environmental renovation projects. With the help of government funding and the growth of the village's collective economy, in addition to converting around 5 ha of idle land into greenhouses, Jinzhuang Village also demolished seven abandoned homesteads and turned them into squares or farmland, installed garbage collection bins covering the whole village, planted street trees, repaired drainage ditches, and widened and repaired roads (Fig. 9-2). These measures have greatly improved the environment in the village in terms of sanitary conditions, landscape, and leisure. The smooth implementation of construction land consolidation and idle land development has made the originally chaotic living space tidier, which was the main reason for the significant improvement in the villagers' satisfaction with the village environment (Jiang et al., 2021).

a) Improvement of the sanitary environment b) Improvement of the natural landscape

Fig. 9-2. Settlement environment improvement in Jinzhuang Village

(Data Source: photographed and drawn by the author)

In general, RLC has promoted the vitalisation of Jinzhuang Village (Fig. 9-3). However, the approaches were more effective during the period between 2010 and 2015, as it can be observed that indices from four aspects moved in a positive direction during this period. Considering the decline in the value of the ecological index and the stagnation of the cultural index, the effectiveness of RLC on the overall vitalisation index of Jinzhuang Village was significantly weaker in the next five years from 2015.

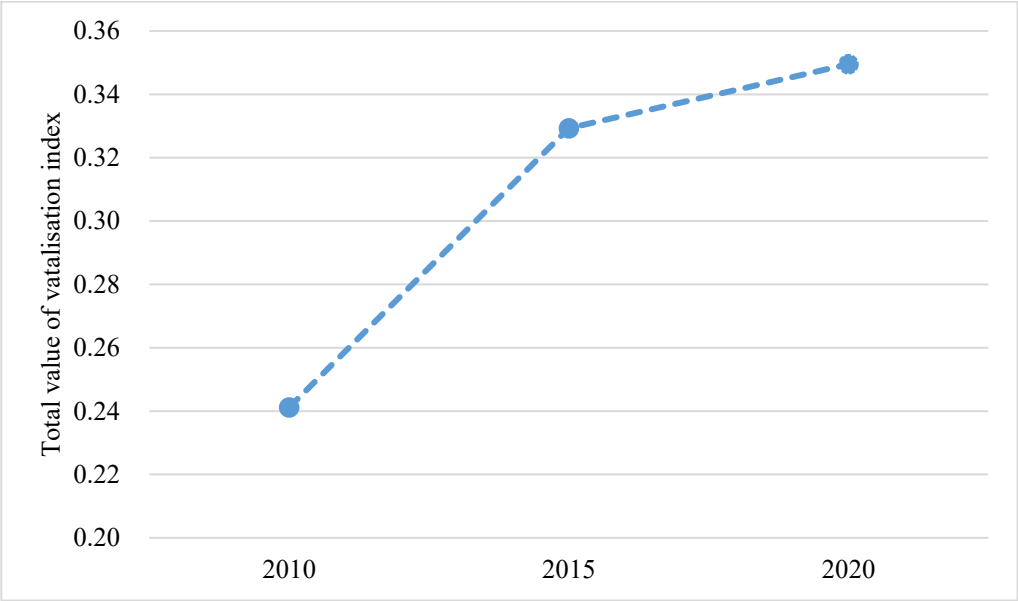

Fig. 9-3. The overall impact of RLC on Jinzhuang's vitalisation from 2010 to 2020

9.2.2 The effectiveness of RLC in Dongheng

(1) Indicator selection of Dongheng

Based on the indicator system in Section 6.2 and the field investigation in Dongheng, a targeted indicator system was further customised for evaluating the effectiveness of RLC on the vitalisation of Dongheng in its various aspects (Table 9-2).

In terms of the level of industrial development in Dongheng, mechanised grain production has already been achieved through agricultural land transfer, and aquafarm produce has become the main source of agricultural income since a decade ago. Therefore, among the indicators representing the development of agriculture, the output per unit area of grain crops and the area of aquafarms were retained in the evaluation of the objective of "thriving industry". Secondly, the implementation of RLC has not only promoted the development of primary and secondary sectors in Dongheng Village, but has also stimulated the vitality

of Dongheng in the tertiary sector (e.g. tourism and art). For example, about 40,000 tourists visited Dongheng Village in 2020 [87], far more than the surrounding villages and the number of visitors to Dongheng Village ten years ago. As some villagers said: "*When the village mining, except for visiting businesspeople, almost no one took a trip to a place with such a dirty environment as this used to be".* Therefore, the proportions of the area of the secondary and tertiary industries were selected to represent the boosting effect of land consolidation on the secondary and tertiary industries of Dongheng Village, respectively. Additionally, agricultural land in Dongheng Village has always accounted for a high proportion of the total (over 44%), most of which is covered by water or used for growing vegetables. These agricultural lands have a similar, but weaker, regulatory effect on the local climate than ecological space has been evaluated (Sun et al., 2007). Thus, when calculating the ecological area coverage, the area of the agricultural land is halved and included in the ecological space. Meanwhile, nearly 100 ha of abandoned mines (which accounted for more than 1/10 of the total area of the village) in the south of the village have been reclaimed into farmland for growing crops since 2012; the use of fertilisers in food production has therefore also become an important factor affecting the environment in the form of local water and soil quality. Moreover, driven by RLC, the secondary sector in the village experienced spatial agglomeration and scale expansion; increases in the amount and concentration of industrial wastewater can have a major impact on local environments. The selection of the remaining indices follows the general set of indicators presented in Section 6.2.

(2) Results and analysis

The influence of RLC on the vitalisation index of industry, environment, culture, governance, and life in Dongheng from 2010 to 2020 is shown in Fig. 9-4. A notable feature is that all but the governance indices continued to rise throughout the decade; the governance index dipped between 2010 and 2015 but increased to a level higher than that in 2010 in 2020.

[87] https://www.ndrc.gov.cn/fggz/nyncjj/xczx/202108/t20210809_1293343.html?code=&state=123

Table 9-2. Indicators for evaluating the effectiveness of RLC in Dongheng

Goals	Indications	Explanation	Effect	Weight
Thriving industry (0.2)	Grain output per unit area (I1)	I1 = Total grain yield/The area of farmland (%)	+	1/4
	Scale of aquafarms (I2)	I2 = Area of aquafarms	+	1/4
	The proportion of secondary sector area (I3)	I3 = Area of secondary/Total area of the village	+	1/4
	The proportion of tertiary sector area (I4)	I4 = Area of tertiary sector/Total area of the village		1/4
Pleasant living environment (0.2)	Per capita area of public service facilities (E1)	E1 = The area of public service facilities/Total population	+	1/6
	Road area per capita (E2)	E2 = Road area/Total population	+	1/6
	Ecological space coverage (E3)	E3 = (Area of ecological land + half area of agricultural land)/ Total area of the village	+	1/6
	Excessive use of chemical fertilisers (E4)	E4 = The fertiliser input per unit area – the upper limit of the safety standard of fertiliser input per unit area[1)] (household-level)	-	1/6
	Villagers' satisfaction (E5)	E5 = Mean value of villagers' ratings of RLC projects (0-100)	+	1/6
	Discharge of industrial wastewater (E6)	E6 = Ratio of industrial wastewater not centrally treated (%)	-	1/6
Refined rural civilisation (0.2)	Centralised pollution treatment rate (C1)	C1 = The number of households with centralised pollution treatment/total households	+	1/3
	Per capita land for cultural facilities (C2)	C2 = The area of cultural facilities /Total population	+	1/3
	Function index of landscape aesthetics (C3)	C3 = The concentration and accessibility of farmland (Pang et al., 2016)	+	1/3
Effective governance (0.2)	Level of public participation (G1)	G1 = Number of people involved in RLC projects/Total population	+	1/3
	Villagers' satisfaction (G2)	G2 = Mean value of RLC projects rating by villagers (0-100)	+	1/3
	Change in farmland area (G3)	G3 = Difference between the area of farmland in two adjacent years	+	1/3
Prosperous life (0.2)	Diversification of villagers' incomes (L1)	L1 = The average number of major income sources (household-level)	+	1/5
	Per capita income (L2)	L2 = Average annual income of villagers	+	1/5
	Collective income (L3)	L3 = The annual income of the village collective	+	1/5
	Local employment ratio (L4)	L4 = Number of people employed locally/Total employees	+	1/5
	Rural-urban income gap (L5)	L5 = Per capita disposable income of villagers/Per capita disposable income of urban residents in Deqing	+	1/5

Note: 1) The upper limit of the international safety standard of fertiliser input per unit of farmland area is 225 kg/ha

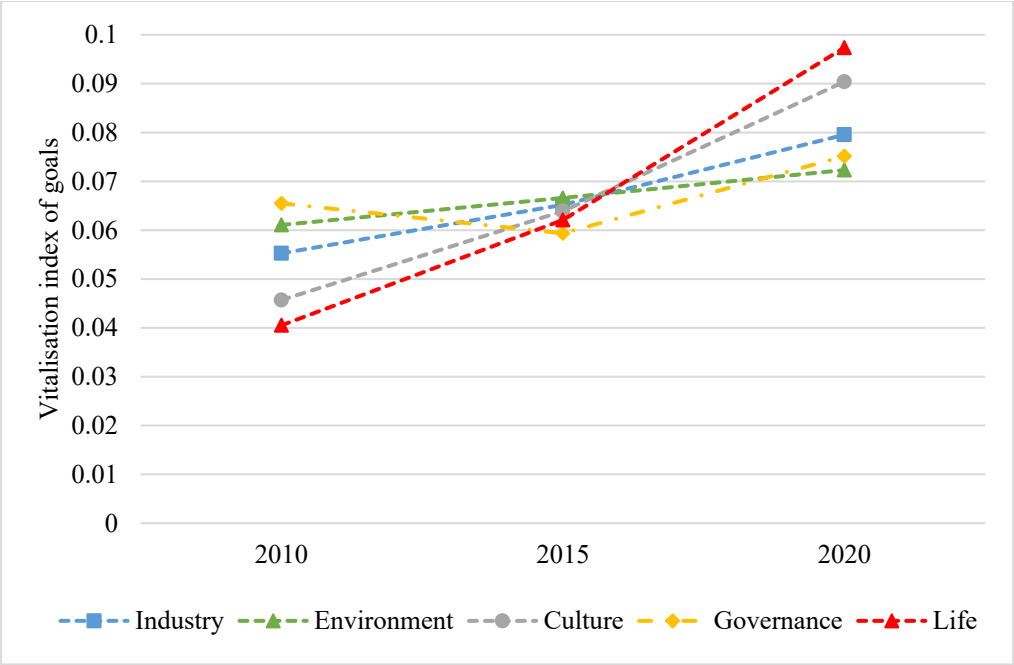

Fig. 9-4. The influence of RLC on five aspects in Dongheng during 2010-2020

The continuous increases in the industry, culture and life indices are due to the continuous development of aquaculture, the revitalisation of the planting industry, the rapid development of the secondary sector dominated by piano production, wood processing, and furniture production, as well as the gradual rise of cultural tourism. The simultaneous development and integration of the primary, secondary and tertiary industries have promoted local economic development, increased local employment rates, expanded cultural influence, and narrowed the economic gap between rural and urban[88] areas. As a result, the values of various indices, such as the scale of aquafarming, the scale of secondary and tertiary industries, landscape aesthetics, cultural facilities, as well as incomes of individuals and the collective, have shown an upward trend. This has driven the continuous rise of the values of industry, culture, and life indices. Comparatively, the effect of RLC on environment vitalisation was weak. This is mainly because the per capita public service facilities, the per capita infrastructure area, the centralised treatment rate of industrial wastewater, and the satisfaction of villagers have all been improved by the implementation of RLC, but at the expense of the reduction of ecological area coverage. Moreover, increased agricultural fertiliser usage has inhibited the positive effect of RLC.

Regarding governance, the corresponding index saw a decline in the first

[88] The per capita disposable income of urban residents in Deqing County from 2010 to 2020 can be found on: http://www.deqing.gov.cn/col/col1229212621/index.html

five years, even as every other index rose. This was not caused by the decline in local residents' satisfaction with the village committee's governance, but because a large amount of cultivated land, and even basic farmland[89], was changed to non-grain or even non-agricultural utilisation at that time. The inadequate management of cultivated land contributed to the decline of the governance index between 2010 to 2015. With the gradual completion of RLC projects, a large number of abandoned mines were reclaimed as farmland, making up for what was previously lost. As a result, the governance index value rebounded and showed a rapid upward trend between 2015 and 2020.

Generally, RLC has promoted the vitalisation of Dongheng (Fig. 9-5). Concerning the industrial transformation of both villages that happened around 2010, it is worth noting that RLC was more effective in Dongheng during the period between 2015 and 2020, while the effect of RLC in Jinzhuang was more significant during 2010-2015. This is probably due to the small scale and short construction periods of most of the projects in Jinzhuang Village, meaning that the effects of RLC were evident more quickly, whereas the large scale and long construction period of Dongheng Village's project led to the effects of RLC not becoming apparent until a later stage.

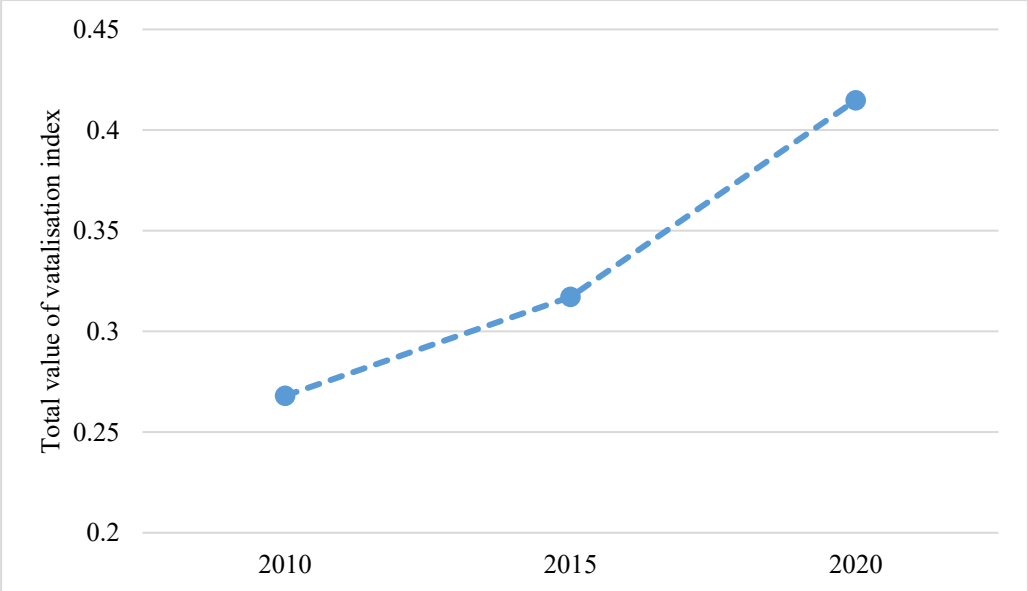

Fig. 9-5. The overall impact of RLC on Dongheng's vitalisation from 2010 to 2020

[89] http://www.npc.gov.cn/npc/c30834/201909/d1e6c1a1eec345eba23796c6e8473347.shtml (access to the explanation of the concept of "Basic farmland" in the *Land Administration Law* of the China)

9.3 RLUFs supply-demand in Jinzhuang and Dongheng

9.3.1 Supply-demand of and for RLUFs in Jinzhuang

Based on the theoretical analysis in Sections 5.2, 6.3 and 6.4 and field investigations in Jinzhuang, this research found eight types of functional supply within rural land use in Jinzhuang, i.e. the Agricultural production, Commercial production, Employment, Residential, Public service, Educational, Heritage, and Maintenance functions. There were also nine types of land use (i.e. Residential land, Public administration and services land, Infrastructure land, Farmland, Greenhouse vegetable land, Commercial service land, Cultural land, Woodland, and Water area) involved in the calculation. Additionally, the weight of each indicator was provided by the combination of the expert scoring method and villager scoring method (as mentioned in Sections 6.4.2 and 7.3.4). The indicators in Table 9-3 have been explained in Section 6.4.1.

(1) Functional supply intensity and demand intensity in Jinzhuang

The supply intensities of RLUFs (Fig. 9-6), based on the analysis provided in Section 6.3, are obtained by calculating land use data mainly obtained from field investigations and the interpretation of historical remote sensing images. In addition, the demand intensities of different RLUFs (Fig. 9-7) are obtained by calculating the socio-economic data of Jinzhuang Village, mainly collected through questionaries and interviews with villagers and village officials.

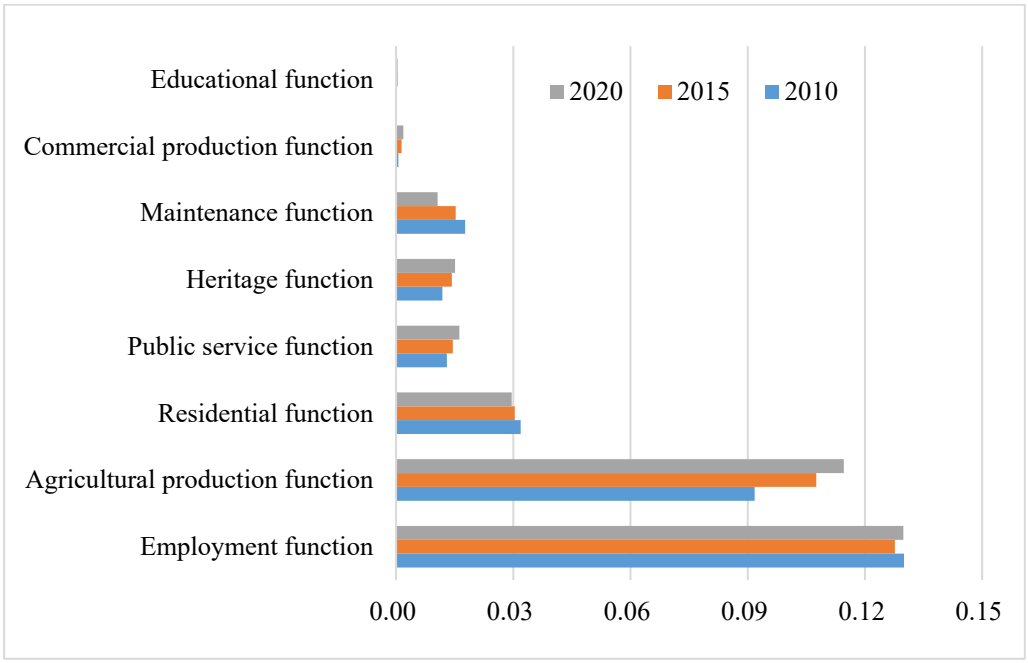

Fig. 9-6. Supply intensities of RLUFs in Jinzhuang

Table 9-3. Indicators and weights for measuring the demand for RLUFs in Jinzhuang

First-level function	Sub-function	Corresponding land use types	Indicators	Explanation	Weight
Living function	Residential function	Residential land	Per capita housing area (R_1)	R_1 = Building area of houses/total population	0.1
			The architectural structure of houses (R_2)	R_2 = The number of brick and concrete houses/total number of houses	
	Public service function	Public administration and service land	The number of public facilities (P_1)	P_1 = The number of public service facilities (e.g. school, bank, clinic, nursing home…)	0.02
		Infrastructure land	The growth of infrastructure facilities (P_2)	P_2 = The length of the village's roads	0.04
	Employment function	Farmland	Labour ratio in grain production (E_1)	E_1 = Number of workers in grain production/total number of workers	0.16
		Greenhouse vegetable land	Labour ratio in tomato production (E_2)	E_2 = Number of workers in tomato production /total number of workers	0.22
Production function	Commercial production function	Commercial service land	Labour ratio in tertiary sector (C_1)	C_1 = The number of workers in tertiary sector/total number of workers	0.01
			Allocation of stores/shops (C_2)	C_2 = Total number of stores/shops	
	Agricultural production function	Farmland	Grain output per capita (A_1)	A_1 = The total grain output of the village/total population	0.10
		Greenhouse vegetable land	Proportion of income from tomato production (A_2)	A_2 = Households' income from tomato production/total income of households	0.25
Cultural function	Heritage function	Cultural land	Organised cultural activities (H_1)	H_1 = Number of cultural activities per month	0.01
		Farmland	Inheritance of farming culture (H_2)	H_2 = The proportion of the population over the age of 14 (>=15) with farming knowledge in the village	0.02
			Area ratio of farmland (H_3)	H_3 = Area of farmland/total village area	
		Greenhouse vegetable land	Inheritance of farming culture (H_4)	H_4 = The proportion of the population over the age of 14 (>=15) with farming knowledge in the village	0.02
			Area ratio of Greenhouse vegetable land (H_5)	H_5 = Area of greenhouse vegetable land /total village area	
	Educational function	Cultural land	Education level of rural residents (H_6)	H_6 = Average years in education of villagers over 14 years old	0.02
Ecological function	Maintenance function	Ecological land	Habitat quality (M_1)	M_1 = Habitat quality index	0.02
			Energy use (M_2)	M_2 = The proportion of villagers using clean energy in their daily lives	
		Farmland	Population per unit farmland area (M_3)	M_3 = Farmland area/total population	0.01

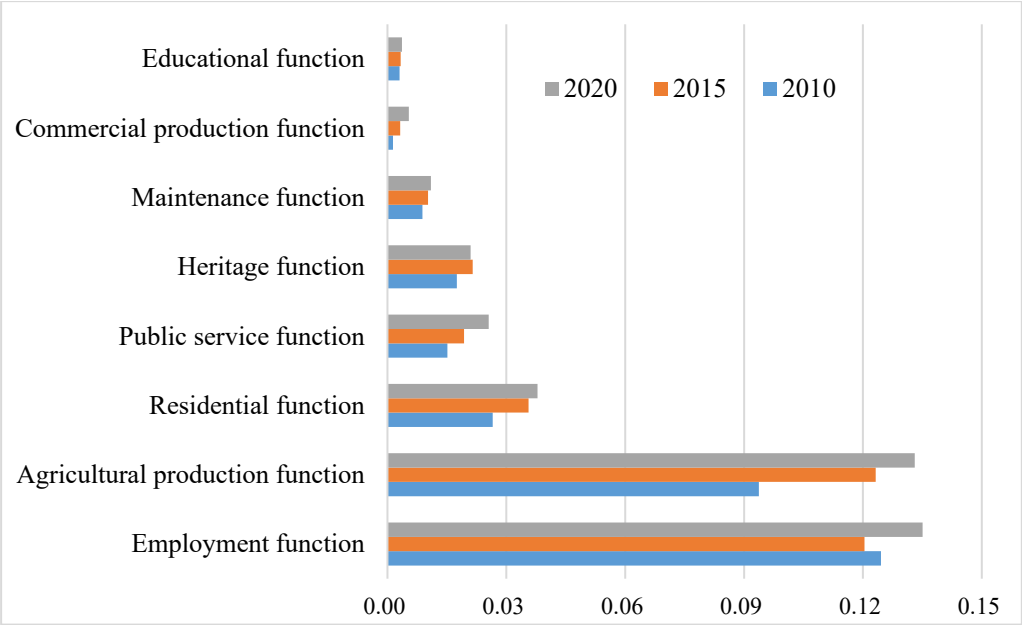

Fig. 9-7. Demand intensities for RLUFs in Jinzhuang

Fig. 9-6 and Fig. 9-7 exhibit two main features of supply and demand intensities of the RLUFs in Jinzhuang. In terms of the functional intensity value, the employment function and agricultural production function have the highest supply intensity and demand intensity, followed by the living, public service, heritage, and maintenance functions, while the weakest supply and demand intensities are observed in the commercial production and educational functions. On the one hand, due to work related to the cultivation of greenhouse tomatoes having become the main source of income and occupation for more than half of the workforce in Jinzhuang, as well as the fact that agricultural land accounts for a large proportion of the village total, high intensities of the supply and demand of and for the agricultural production and employment functions were observed throughout the period studied. On the other hand, in most rural areas in China, due to limited resources as well as horizontal dispersion of the population, educational and commercial service functions are usually concentrated in a densely populated town centre with convenient transportation. This explains why the supply and demand intensities of and for both functions were observed to be very weak in Jinzhuang.

In terms of the change of functional intensity, the demand intensity for almost all functions showed an upward trend between 2010 and 2020, while in the functional supply, with the exception of the maintenance and residential functions, the intensities of all other functions were also rising or remained more

or less constant. The increasing demand intensity for all functions is mainly due to the continuous growth of the local resident population, from around 380 in 2010 to around 420 in 2020, and the desire of local villagers to improve their living, productive, and ecological conditions. This could have resulted in an increase in the demand intensities for corresponding land use functions.

(2) The differences between RLUFs supply-demand in Jinzhuang

D_{sd} (see Section 6.4.3) was applied to evaluate the gaps between the supply and demand of and for RLUFs, and the results are shown in Fig. 9-8. The unbalanced development between the functional supply and demand is observable. First, except for the employment function and maintenance function, the D_{sd} of which were able to maintain positive in 2010 and 2015, the D_{sd} was negative for almost all other functions in 2010, 2015, and 2020. In addition, during that decade, the agricultural production function not only showed greater supply intensity and demand intensity, but also exhibited pronounced differences between the supply and demand of and for functions; this feature was not shown in the employment function, the intensities of supply and demand of which were among the highest observed. The main reason for this is that, from 2010 to 2015, many villagers who had engaged in grain production or else left Jinzhuang to work chose to switch to growing tomatoes in greenhouses, but they lacked mature planting technology and experience, resulting in poor economic benefits being derived from this activity in those years; a phenomenon which was, however, reversed in the following five years. The reason for the continuing decline in the supply-demand differential for the employment function is that, although farmland is slightly less able to provide the employment function than greenhouse vegetable land, the return of some migrant workers, the employment needs of the local youth population, as well as the contracting of some greenhouses in Jinzhuang by residents of the surrounding villages have gradually led to a situation where the employment function in Jinzhuang was in short supply. Moreover, although the values of the supply and demand intensities of the maintenance function were not significant, it was the only one in which hardly any deficit was observed during the decade under study. Overall, the total supply intensity of RLUFs in Jinzhuang Village in 2010 was slightly greater than the demand intensity, while in both 2015 and 2020 there were negative values of D_{sd} and the gap between supply and demand intensities continued to widen.

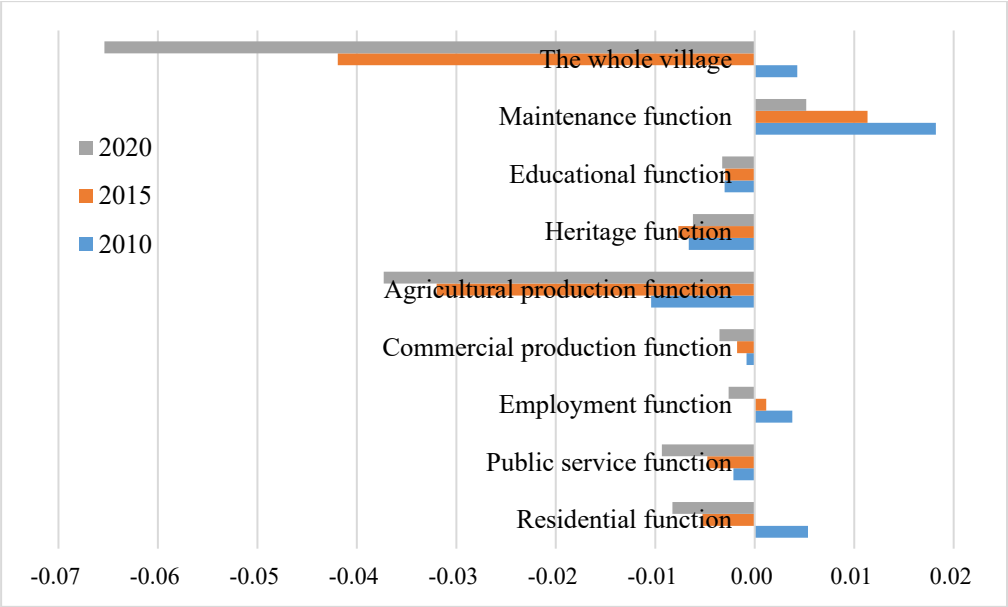

Fig. 9-8. Differences between the supply-demand of and for RLUFs in Jinzhuang

The following reasons contribute to the imbalance between the supply and demand of and for RLUFs in Jinzhuang. Before 2010, many of the local workforces[90] spent much of their time working outside the village, and the total area of ecological land and farmland in the village accounted for nearly three-quarters of the total. Therefore, the supply intensities of the residential, maintenance and employment functions were greater than their demand intensities, respectively. However, since 2011, a large number of labourers have gradually returned to the village to engage in greenhouse tomato production, and more than 40% of the total farmland and ecological land have been converted into greenhouse vegetable land. Meanwhile, with the improvement of economic conditions, the demand of villagers for improvement in the quality of housing and the local environment was gradually increasing. Against this background, the demand intensities for residential, employment and maintenance functions in village development were increasing, while the supply intensity of residential function remained almost unchanged, there was no apparent increase in the supply intensity of the employment function, and the supply capacity of the maintenance function continued to decline. As a result, the supply and demand of and for these three functions gradually changed from that of oversupply to undersupply.

[90] It was discovered during the field investigation that most farmers worked outside the town and even the city during less-intensive farming seasons before this time, but that no specific official statistics could be provided at the village level.

Table 9-4. Indicators and weights for measuring the demand for RLUFs in Dongheng

First-level function	Sub-function	Land use types	Indicators	Explanation	Weight
Living functions	Residential function	Residential land	Per capita housing area (R_1)	R_1 = Building area of houses/total population	0.1
			The architectural structure of houses (R_2)	R_2 = Number of brick and concrete houses/total number of houses	
	Public service function	Public administration and service land	The number of public facilities (P_1)	P_1 = Number of public service facilities (e.g. school, bank, clinic, nursing home…)	0.04
		Infrastructure land	The growth of infrastructure facilities (P_2)	P_2 = The length of the village's roads	0.03
	Employment function	Aquafarm	Labour ratio in aquafarming (E_1)	E_1 = Number of workers in aquafarm/total number of workers	0.08
		Industrial land	Labour ratio in secondary sector (E_2)	E_2 = Number of workers in secondary sector/total number of workers	0.15
Economic function	Commercial production function	Commercial service land	Labour ratio in tertiary sector (C_1)	C_1 = Number of workers in tertiary sector/total number of workers	0.03
			Allocation of stores/shops (C_2)	C_2 = Total number of stores/shops	
	Agricultural production function	Aquafarm	Proportion of income from aquaculture (A_1)	A_1 = Households' income from aquaculture/total income of households	0.08
	Industrial production function	Industrial land	Proportion of income from secondary sector (I_1)	I_1 = Farmers' income from secondary sector /total income of farmers	0.23
			Allocation of TVEs (I_2)	I_2 = The number of TVEs	
Cultural function	Heritage function	Cultural land	Organised cultural activities (H_1)	H_1 =Number of cultural activities per month	0.05
			Humanistic environmental attractions (H_2)	H_2 = Number of tourist attractions	
		Farmland	Inheritance of farming culture (H_3)	H_3 = Proportion of the population over the age of 14 (>=15) with farming knowledge in the village	0.02
			Area ratio of farmland (H_4)	H_4 = Area of farmland/total village area	
		Aquafarm	Inheritance of farming culture (H_5)	H_5 = Proportion of the population over the age of 14 (>=15) with aquafarming knowledge in the village	0.02
			Area ratio of aquafarms (H_6)	H_6 = Area of aquafarms/total village area	
	Educational function	Cultural land	Education level of rural residents (H_7)	H_7 = Average years in education of villagers who over 14	0.05
Ecological function	Maintenance function	Ecological land	Habitat quality (M_1)	M_1 = Habitat quality index	0.08
			Energy use (M_2)	M_2 = Proportion of villagers using clean energy in their daily lives	
		Farmland	Population per unit of farmland area (M_3)	M_3 = Farmland area/total population	0.02
		Aquafarm	Population per unit of aquafarm area (M_4)	M_4 = Aquafarm area/total population	0.02

Moreover, Jinzhuang Village has been in a stage of rapid socio-economic development since 2010[91]. For the villagers, obtaining higher incomes and improving living conditions are their long-term needs and these will continue to grow with socio-economic development. However, the supply intensity of these functions has been growing slower than the demand intensity. This has led to a long-term shortage of living, production, and cultural functions.

9.3.2 Supply-demand of and for RLUFs in Dongheng

Similar to the analysis provided in the last section, there were ten types of RLUFs – i.e. the residential, public service, employment, commercial production, agricultural production, industrial production, heritage, educational, and maintenance functions, as well as the unexploited function – in Dongheng. Also, ten types of land use (i.e. Residential land, Public administration and service land, Infrastructure land, Farmland, Aquafarm, Commercial service land, Cultural land, Woodland, Water area, and Undeveloped land) were found in Dongheng. Moreover, based on a combination of the expert scoring method and villager scoring method, a weight was assigned to each indicator. The indicators in Table 9-4 have been analysed and explained in Section 6.4.

(1) Functional supply intensity and demand intensity in Dongheng

Based on the land use data obtained from various sources as well as the analysis provided in Section 6.3, the supply intensities of RLUFs in Dongheng are shown in Fig. 9-9. With reference to the collected socio-economic data of Dongheng Village, the demand intensities of RLUFs of Dongheng were then measured and are presented in Fig. 9-10.

As concerns functional supply intensity, the strongest observed were in the maintenance, employment, and heritage functions, followed by the agricultural production, residential, industrial production, and public service functions, while the weakest were the educational and commercial production functions. Due to farmland, aquafarms and ecological land having occupied more than 60% of the total area of Dongheng Village for a long period of time, the supply intensities of maintenance and heritage functions have always been relatively high.

[91] From 2010 to 2020, the per capita income of villagers and the collective income of the village have both doubled; the vegetable park created by the village collective, which started running in 2010, had developed into the largest vegetable park (protected agriculture) in Yucheng City by 2020.

However, as a result of the RLC projects, portions of agricultural land and ecological land were recategorised as 'unused' or 'under construction', resulting in a decline of about 30% in the maintenance and heritage functions during the period 2010-2015. With the gradual completion of RLC projects, the supply intensity of both functions was supplemented with land reclamation and ecological construction, but as of 2020, they had yet to return to their 2010 levels. Meanwhile, the area of industrial buildings grew to more than 10% of the area of the village total by 2020 and the supply intensity of industrial production function increased by more than 50% in the period 2010-2020. Also, the coordinated development of the primary sector and the secondary sector has promoted the continuous improvement of the supply intensity of employment function. In addition, although the area of residential land has decreased since 2010, its total floor area has increased, thus ensuring that the supply intensity of the residential function was not observed to decline. Besides, the expansion of public administration and service land and infrastructure land - of which open spaces and roads were changed the most (see Fig. 8-3) - promoted an increase in the supply intensity of the public service function. Furthermore, as explained in the last section, since the supply of educational and commercial production functions in rural areas is usually concentrated in the town centre, the supply intensities of these functions were observed to be rather low in Dongheng.

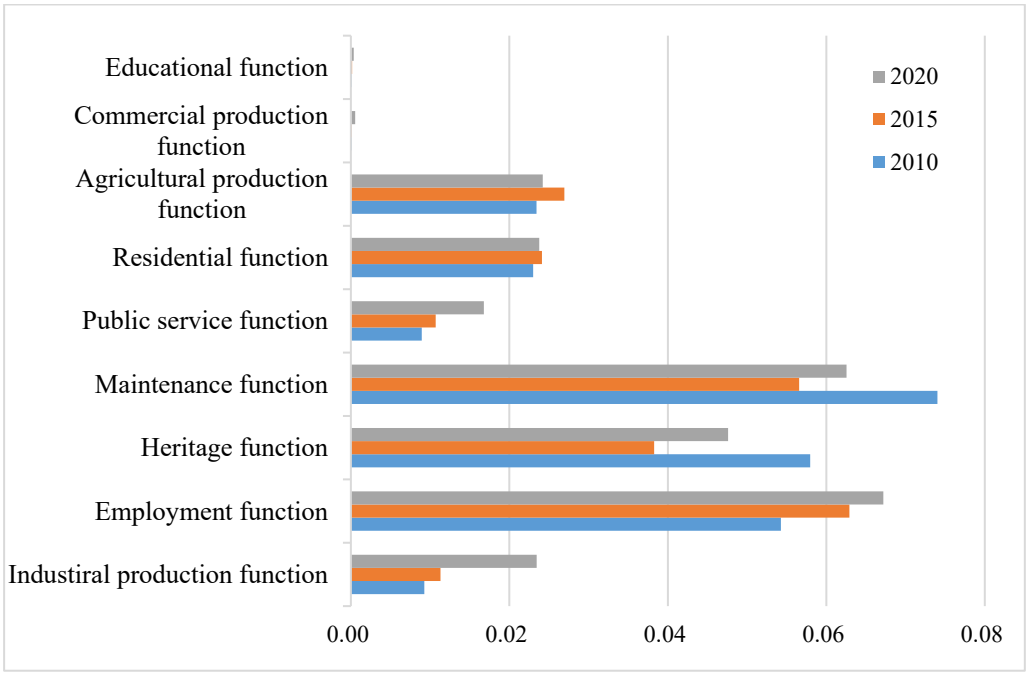

Fig. 9-9. Supply intensities of RLUFs in Dongheng

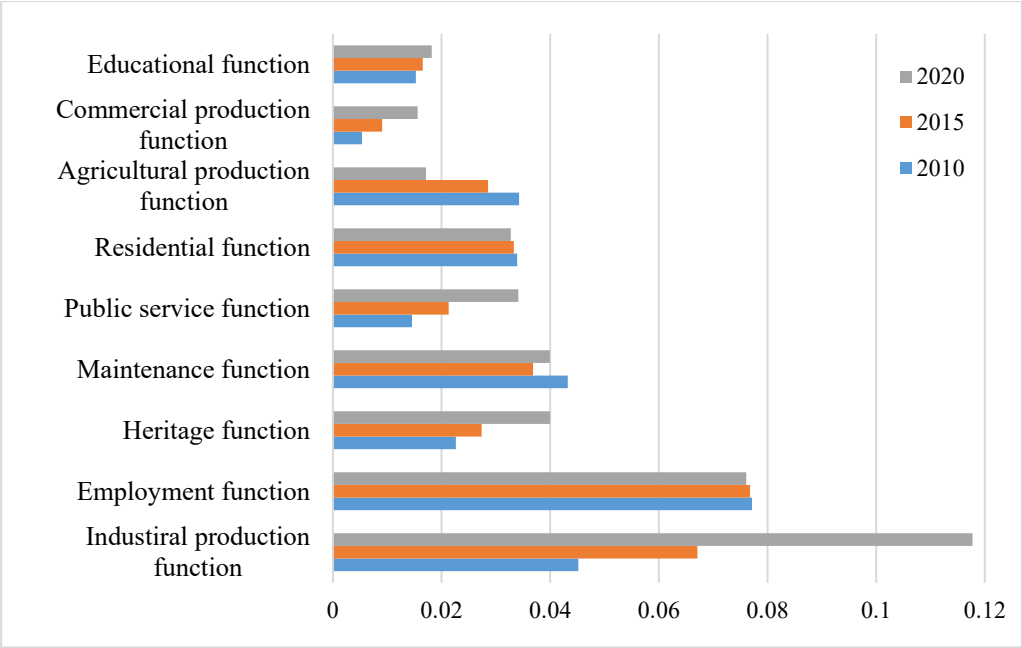

Fig. 9-10. Demand intensities for RLUFs in Dongheng

In terms of the demand tensity for functions, although employment, maintenance, and heritage functions were still in the top four, the greatest demand was for the industrial production function in 2020. Since the ban on mine development in Dongheng which came into force in late 2009, the gap between the supply of and demand for both the employment and economic functions was widened. At the same time, since the end of the last century, the main source of income for most permanent residents of Dongheng Village has been in the secondary rather than the primary sector. Consequently, there has been strong demand in both industrial production and employment functions since 2010, reflecting the rapidly rising demand for economic income. Meanwhile, the demand intensity for the agricultural production function has been decreasing, as the economic efficiency of traditional small-scale production has gradually declined. This has resulted in an increasing number of villagers no longer relying on agricultural production as their main source of income. Through field investigation, it was discovered that nearly 85% of the villagers in Dongheng Village were engaged in non-agricultural production as of 2020. On the other hand, the increase in demand for the heritage function is mainly due to the increasing local emphasis on cultural development, such as holding calligraphy exhibitions and holding art festivals with a focus on farming culture and piano culture. Moreover, the environmental pollution caused by mining has already aroused villagers' concern about the quality of life and health. The neater

village environment and surrounding landscape with its green hills and clear waters have made the villagers more conscious of the economic, living, and health benefits that a clean ecological environment can bring. For this reason, the ecological function continues to be in high demand. Besides, since Zhejiang Province, where Dongheng Village is located, is one of the earliest areas to carry out the "New Rural Construction" policy[92] and is one of the most economically developed areas in China, almost all villagers' housing conditions have been improved, meaning that their demand intensity for residential functions was relatively low. Also, with the gradual improvement of socio-economic conditions, local peoples' emphasis on education as well as demand for consumption, service industries, and public services were gradually increasing. According to Maslow's hierarchy of needs (Maslow, 1943), it is a natural process that people's focus shifts to their psychological and spiritual needs after their basic material needs have been largely met.

(2) The differences between RLUFs supply-demand in Dongheng

The results of the differences between supply intensity and demand intensity can be seen in Fig. 9-11. The most striking objectives in this figure are the "Industrial production function" and "The whole village", since no other functions were observed where the absolute value of the D_{sd} was greater than that of the two. The values of D_{sd} of the whole village in 2010, 2015, and 2020 were mostly contributed to by the values of the industrial production function at the same time. During this decade, the industrial production function was in short supply and the gap was growing. This is mainly due to the following reasons. Before the construction of the Piano Park in the south and the Industrial Park in the north, the production of pianos, furniture, and wood in Dongheng Village mainly existed in the form of small workshops. In this case, not many villagers participated in manufacturing industries in the village at that time, and the overall demand for industrial production functions was not strong. After 2015, with the successive construction and use of these two parks, the move-in of various enterprises, and the large-scale agricultural land transfers in the village, industrial production has become the main source of income for most villagers. However, since the development of the two parks was still in their early stage

[92] https://news.sina.com.cn/c/2006-04-06/12309548952.shtml (access to the relative news report)

around 2020, the industrial production functions they could provide could not meet the growing demand for industrial production functions in the village.

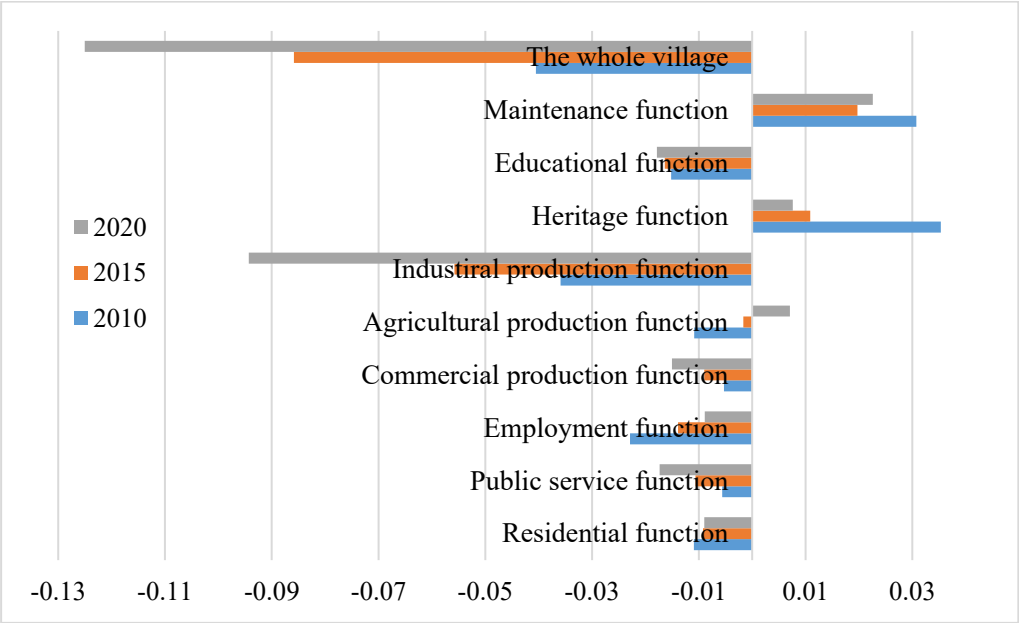

Fig. 9-11. Differences between supply-demand of and for RLUFs in Dongheng

Moreover, the commercial production function and public service function showed the same trend, albeit with a smaller difference. With the improvement of the village environment and landscape as well as the cultivation of traditional and industrial cultures, the tourism-dominated tertiary industry was observed to grow throughout this period in Dongheng Village, which has further promoted the local demand for the commercial service function. However, the space constructed for carrying commercial and service sector development lagged behind the needs of local development. Meanwhile, the improvement in economic conditions and living environment has led to increasing demand for public services from villagers. A majority of the households have purchased apartments in the urban areas of Deqing County and Huzhou City of Zhejiang Province. Although the public service facilities in Dongheng Village have improved considerably over the past decade, there is still a large gap compared to that of the surrounding urban/town areas. Moreover, the improvement in public service functions has been concentrated in the central village rather than the surrounding natural villages, so the value of D_{sd} of public service function was negative and decreasing overall.

However, the value of D_{sd} for the agricultural production function exhibited the opposite trend. The reasons for this phenomenon may be as follows.

According to the interview conducted with village cadres and villagers, although Dongheng Village has attached great importance to the development and improvement of cultural education and the ecological environment, economic development has long been the focus of local development. Since the end of the 20th Century, Dongheng Village has realised its industrial transformation from primary sector-led to secondary sector-led growth; that is, the income of the village collective and villagers had been increasingly dependent on secondary industry for some time before the period under study, and the GDP of the secondary sector of Dongheng Village has long exceeded that of the primary sector[93]. Although the closure of the mining sites at the end of 2009 led to a short period of increased demand for agricultural production functions by some unemployed workers who subsequently turned to farm work, this did not substantially reverse the trend of industrial transformation from the primary sector to the secondary sector. In addition, more and more aquafarms and paddy fields were leased through land transfers to companies or households engaged in large-scale planting or aquaculture for production, rather than being operated separately by the farmers themselves. Therefore, in the absence of a reduction in the supply intensity of the agricultural production function, a fall in demand would naturally lead to a positive increase in the difference between supply and demand. Meanwhile, the agricultural production function gradually shifted from undersupply to oversupply.

Moreover, except for the maintenance, heritage, and agricultural production functions, which originally occupied a large proportion of areas, other land use functions were in a stage of short supply by 2020. This indicates that, although Dongheng Village has achieved a certain level of economic success during a period of rapid development, the diverse needs of local development have not yet been met. This case reflects China's past two decades and even the current developmental stage in miniature, according to which development is driven by the construction of infrastructure and industrial space.

Fortunately, the serious imbalance between the supply and demand of and for industrial production functions found in Dongheng Village notwithstanding,

[93] According to the information obtained from the village committee during the field investigation, as early as 2004 to 2007, the output value of the secondary sector in Dongheng Village was 10 to 16 times that of the primary industry.

the gaps in the supply and demand of the education, commercial production, public service, residential, and employment functions were relatively small in 2020. The relatively large supply-demand gap in employment function was mainly caused by the sudden increase in the demand for employment caused by the closure of mines in 2009 and the demand for employment on the part of the surplus agricultural workforce following the transfer of agricultural land. This gap, however, has been gradually decreasing. This shows the promotional effect of the development of the secondary sector on indigenising employment.

9.4 Mechanisms of local vitalisation promoted by RLC

Based on the theoretical model construction in Chapter 5 and the case analyses in Chapters 8 and 9, this section reveals and elaborates on the mechanism of RLC in promoting the development of the two case villages.

9.4.1 The mechanisms of RLC in promoting the vitalisation of Dongheng

Based on the field investigations and above analysis, it was found that the smooth development of land consolidation and the subsequent vitalisation of Dongheng is largely a result of the combined effect of policy support, a solid industrial foundation, superior resource endowment, and the efforts of local elites (Fig. 9-12).

(1) Policies bring opportunities and motivation

Starting from 2005, rural eco-environmental protection and construction in Zhejiang Province, especially in Huzhou City, have been afforded increasing importance[94]. This has prompted the shift of land consolidation goals in a more ecologically friendly direction and further caused the closure of quarries in Dongheng. In addition, Dongheng Village was officially successfully declared to be a pilot project of comprehensive rural land consolidation (CRLC) in Zhejiang Province in 2011. As a result, Dongheng Village has been given more flexibility in land use planning; that is, the RLC planning in Dongheng can be made without being subject to the strict temporal and spatial constraints of farmland protection if Dongheng village follows the principle that the quantity and quality of farmland will remain undiminished towards the end of the RLC

[94] http://www.gov.cn/test/2006-02/10/content_185269.htm (access to the 2005 Government Work Report of Zhejiang Province); http://www.huzhou.gov.cn/art/2008/5/8/art_1229513804_3627013.html (access to the relative policy of Huzhou City)

project. Besides, it has had a greater amount of loans approved by banks than most villages in Deqing County. For example, Deqing Agricultural Bank provided 310 million RMB of loans to Dongheng Village during its land consolidation period. In 2018, Dongheng became one of the 100 national-level rural industrial integration development demonstration parks in the country, as a result of which Dongheng Village received a special fund of 200 million RMB for industrial development. Moreover, policies associated with the "increasing vs. decreasing balance" land use policy (Long et al., 2012) and the "right-of-use transfer" (RUT) of rural collectively-owned construction land (Wang et al., 2017) provided opportunities for the construction of the local "Piano Innovation Park". In conclusion, this series of policies have provided a good policy environment for Dongheng to carry out CRLC, involving mine reclamation, ecological renovation, village beautification, and the upgrading of public services facilities and infrastructure. It has also strengthened Dongheng's resolve to abandon the highly pollutive mining industry in favour of relatively environmentally-friendly industries, such as manufacturing, larger-scale farming, and cultural tourism.

(2) Its industrial foundation indicates the future development direction

Before quarrying and piano production became dominant local industries, Dongheng Village was an agricultural village dominated by aquaculture with its well-developed water network system. This is why the largest type of land use in Dongheng Village is currently aquafarm, and 15% to 20% of the labour force continue to engage in aquaculture directly or indirectly. However, since the implementation of CRLC, piano production has surpassed aquaculture as the dominant industry in Dongheng Village, and has developed further given its ability to generate higher economic benefits and more jobs.

Dongheng Village has been involved in the piano industry since the late 1980s and the industry has developed on an upward trend, but it did not become the pillar industry in the village before the closure of the local quarries. The closure of the mine in 2009 not only led to a sharp drop in the village's collective income, but also severely affected the livelihoods of many villagers. In this context, a large number of villagers have since moved to engage in the piano industry, as the piano industry had been 'rooted' in Dongheng Village for decades prior and a relatively complete piano manufacturing industry chain had been established in Luoshe Town. Due to the lack of centralised industrial parks,

the villagers had to convert some old buildings in the village, such as private houses and buildings originally used for raising silkworms, into factories for manufacturing pianos. However, there were several problems with this approach. The limited and inadequate production spaces in these old buildings could not accommodate the expansion of production and posed a major safety hazard; the lack of centralised sewage treatment led to the random discharge of industrial wastewater; and the scattered and dilapidated premises were inconvenient for management and not conducive to business negotiations. To amend this situation, Dongheng Village, with the guidance and help of the local government, decided to build an industrial park to centrally relocate the scattered piano factories, in order to expand the industrial scale and to reach the scale effect of industrial development on the land vacated via RLC. Today, the 45 ha "Piano Innovation Park" in Dongheng is the largest piano manufacturing centre in the Yangtze River Delta. Forty-six piano companies have settled here, forming a complete industrial chain involving piano research and development, production, sales, and technical training. The output value of the "Piano Innovation Park" in 2019 was 200 million RMB, creating nearly 1,000 jobs. Moreover, it provides more than 10 million RMB of rental income to the Dongheng Village collective each year, accounting for nearly half of the village collective's annual income.

(3) Superior resource endowment increases the development potential

"Resource endowment" here refers to the collection of geographical position, natural conditions, and humanistic resources.

The geographic location of Dongheng Village is conducive to economic growth; that is, it is close to Hangzhou, a key city located in China's most developed region, the Yangtze River Delta. This provides opportunities for Dongheng Village to enjoy the benefits of the latest policies and realise the transformation of local industries, given that China's economically developed coastal areas are often at the forefront of systemic land and economic reforms. To provide one example, taking advantage of its proximity to Hangzhou and a major river, Dongheng Village obtained a 108-million RMB Project, involving the backfilling and disposal of the brickrubbish and topsoil from the construction of the Hangzhou Subway, through public bidding in 2011. This not only promoted the backfilling and levelling of the abandoned mine craters but also brought start-up funds to be used in village construction projects.

From the perspective of natural resources, Dongheng Village is located in a plain area with abundant water resources and long sunshine hours: conditions conducive to the growth of vegetation. This provides good natural conditions for the improvement of the local ecological environment and the landscape. In terms of humanistic resources, Dongheng Village is the former residence of a famous couple (Mengfu Zhao and Daosheng Guan) who created calligraphic and painted artworks in the Yuan Dynasty of China; from the period of the Song Dynasty to the Qing Dynasty, there have been over 15 *Jinshi*[95] in Dongheng Village, demonstrating that Dongheng has long attached great significance to educational achievement; winemaking and sericulture have been long-held practices in Dongheng Village, realising the preservation and development of traditional crafts and culture; and, being at the forefront of the piano industry for over three decades, Luoshe Town, where Dongheng Village is located, is known as "The Hometown of Chinese Piano". These histories and heritages have not only laid a good foundation for the further development of local culture, but have also enhanced Dongheng's competitiveness in the development of cultural industries.

(4) Collaboration between rural elites within and without the administrative system facilitates the smooth development of local CRLC

In 2011, Dongheng Village held a general election for village cadres. The newly elected village cadres faced multiple pressures. First, due to the need to protect the ecological environment, the quarries in the village that had been in operation for a few decades closed at the end of 2009, impacting the collective economy. This severely restricted the financial capacity in the management of village affairs, as well as the operation and construction of the village. Second, economic construction was imminent at that time, but the vacated land designated for this purpose was full of polluted pits inadequate for deriving economic benefits from farming or aquaculture. Third, there were only six village cadres, while there were over 70 village representatives and more than 3,000 villagers. As the village cadres said during the interview, it was almost impossible for the six of them alone to coordinate and unify the opinions of the whole village, especially on major matters such as the relocation of the villagers'

[95] A *Jinshi* was a successful candidate in the highest imperial and national examinations in Ancient China. In the nearly 940 years from the Northern Song Dynasty to the Qing Dynasty, there were only roughly 160,000 *Jinshi* throughout Ancient Chinese history. It was not uncommon for cities and counties to not produce a single *Jinshi* for decades at a time.

ancestral graves. Fourth, an increase in the proportion of newcomers to Dongheng and population mobility affected the sense of identity among neighbours to a certain extent, resulting in the weakening of the sense of belonging and cohesion among the community. As some villagers complained: "*After lots of non-natives came to live and work here, the management of the village became more complicated and messier. One of the most troublesome things was the sanitation, as more people produce more rubbish, and some non-natives didn't care about sanitation when they first arrived, leaving rubbish everywhere. As you know, we couldn't say anything to them directly to avoid causing conflicts, so we could only report it to the village cadres."* Also, some village officials mentioned in the interviews: *"At that time, we often had to deal with a lot of complaints from villagers about non-natives, which made us too busy to spare enough time to engage in the construction and development of the village."* As such, Dongheng Village at that time lacked an effective mechanism or unified authority to manage both the local population and the non-local population. It is generally difficult to make widely accepted decisions in such a self-governing rural society by relying solely on a few village officials, especially when it comes to land use change.

After having extensively solicited villagers' opinions, the village committee established the Rural Gentry Council in 2011. The first Rural Gentry Council was composed of 19 members of the gentry with high prestige, strong ability, and broad vision who could actively and voluntarily participate in the planning, decision-making, and publicity of major affairs in the village. 17 of them are natives of Dongheng and have many years of experience in business or politics, while the rest represented the external population. They interacted and discussed with ordinary villagers and village representatives to understand their ideas on how the village should be developed and to promote the implementation of village planning. In addition, they have taken the initiative to supervise the various construction projects alongside village cadres in order to ensure the quality of these projects (Lang et al., 2017).

With the participation of the village gentries, the CRLC of Dongheng Village was implemented on schedule and with high quality, according to the results of the investigation. For example, the acquisition of land and reclamation of old houses, involving 250 households, for the construction of the central

village, were carried out smoothly without any appeals. Gradually, as they encountered problems, villagers became more inclined to talk to the gentries rather than directly ask the village cadres for help since issues in the village may be solved more efficiently or comprehensively through this approach. These gentries would pass the collected opinions and suggestions to the village cadres at meetings or privately. Over time, the prestige of the village cadres among villagers has gradually been established and these gentries also became more responsible due to the trust and respect afforded them by villagers, thus forming a virtuous circle. Nowadays, the planning and implementation of almost all projects in the village require the participation and supervision of village gentries.

In the process of RLC, the village cadres of Dongheng Village have updated the village management organisation by inviting village gentries to participate in local governance. Village cadres updated the organisation by elevating its official authority and local prestige. This has prompted the unification of opinions during the discussion of projects, which in turn has eased decision-making. In this way, policies can be implemented, public opinion can be respected and coordinated, and resources can thus be used rationally.

Furthermore, the urbanisation rate and industrialisation level of Zhejiang Province have been at the forefront of China for a long time[96], which has provided favourable external conditions and technical support for the industrial development of Dongheng Village. Meanwhile, the integration of industrial development and village development has certainly promoted the modernisation and in situ townisation (i.e. town-based urbanisation) (see Kamal-Chaoui, Edward & Zhang, 2009) of Dongheng Village. In this process, local vitality as well as the cohesion and sense of belonging of the community have both been enhanced. This has further played a positive role in the development of the local socio-economy, culture, and governance.

[96]According to China's official statistics (http://www.stats.gov.cn/tjsj/), in the past decade (2010-2020), Zhejiang's total industrial output value has been in the top five, and its population urbanisation rate (61.62% in 2010 to 72.17% in 2020) was also in the top six.

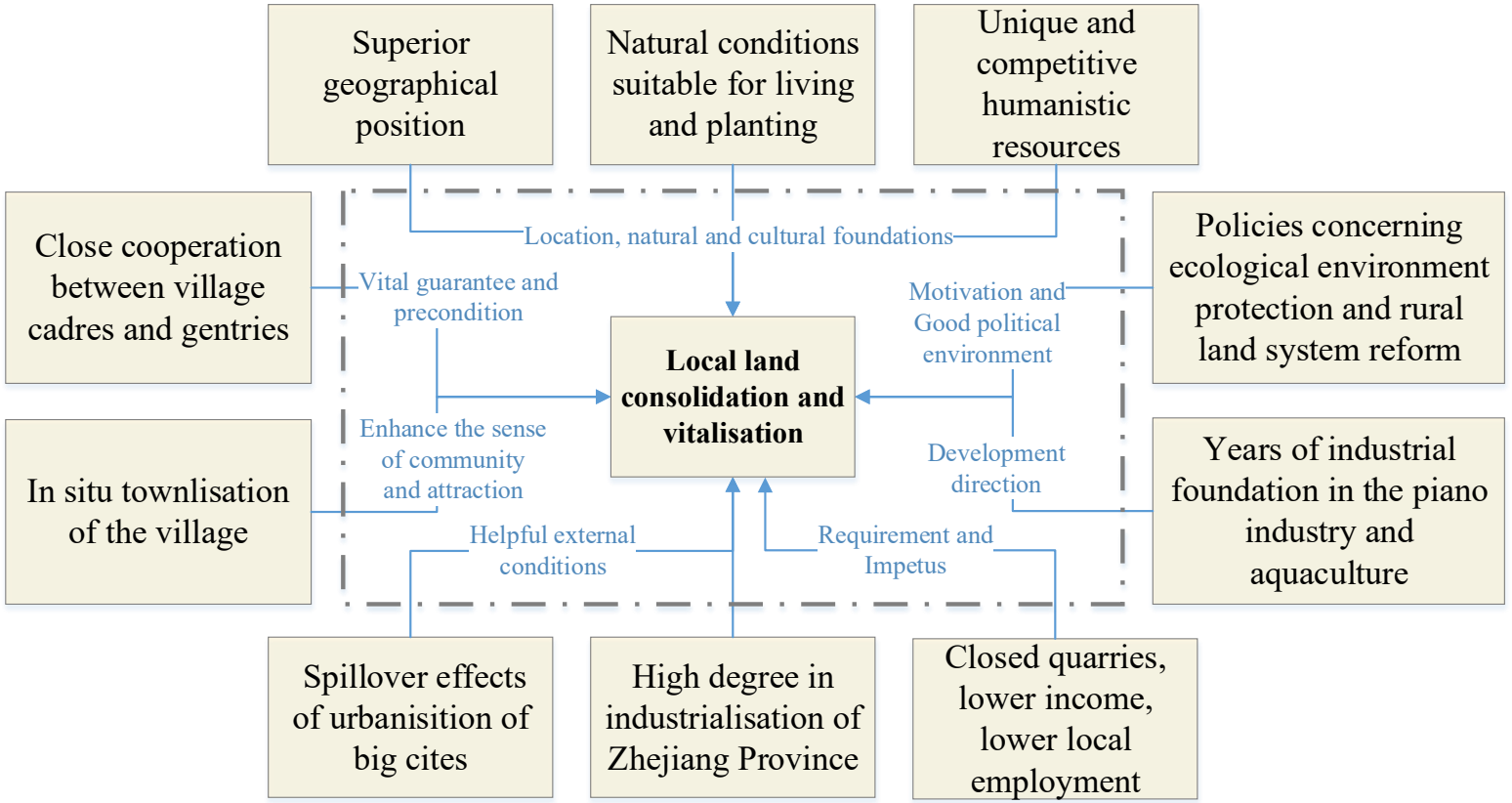

Fig. 9-12. Mechanisms of RLC in promoting the vitalisation of Dongheng (modified based on Fig. 5-8)

9.4.2 The mechanisms of RLC in promoting the vitalisation of Jinzhuang

Somewhat differently from that of Dongheng, the implementation of RLC and village development in Jinzhuang are the result of the combined effect of geographical location, market demand, policy, and local elites (Fig 9-13).

(1) Geographical location largely determines local people's livelihoods

The term "geographical location" here involves not only position but also resource endowments. From a geographical perspective, Jinzhuang Village is situated 20 km from the centre of Yucheng City (about half an hour's drive), and is nearly 100 km (more than one and a half hours' drive) from the centre of Ji'nan City, the provincial capital of Shandong Province. These distances prevent Jinzhuang from being hardly affected by the urban expansion in terms of space. For example, sacrificing agricultural land for urban expansion will not happen in Jinzhuang Village in the foreseeable future. However, the distance from urban areas also prevents Jinzhuang from enjoying the spillover effect of urbanisation. In terms of resource endowments, the natural environment of Jinzhuang Village shares a high degree of homogeneity with that of surrounding villages located on the Huang-Huai-Hai Plain, with good topography and climate conditions suitable for the growth of two harvests (one for wheat and one for corn) a year. In terms of culture, Jinzhuang, compared with Dongheng, lacks special human resources, such as historic buildings and famous historical residents, to attract tourists and visitors. As a result, agricultural production has always been the leading industry in Jinzhuang and the source of livelihood for lots of villagers.

(2) Market demand drives local industrial development

Before the 21st Century, Jinzhuang was a traditional rural village dominated by the cultivation of cereal crops such as wheat and corn. Since the 1990s, the establishment of the socialist market economic system has promoted rapid economic development and stimulated market demand for various commodities. Meanwhile, the demand for agricultural products was rising rapidly in the market, especially in urban markets. In this context, greenhouse vegetable cultivation began to be promoted for its high yields and less exposure to weather. At that time, most farmers in Shouguang County (also located in Shandong Province) achieved poverty alleviation and prosperity by actively participating in the greenhouse industry (Wang, Zhang & Cheong, 2014). Attracted by the successful experience of Shouguang, other places in Shandong Province have started to

grow greenhouse vegetables and fruits, one after another. Jinzhuang Village is one of them. After years of development, Jinzhuang Village, from 2010 to 2020, achieved an increase in per capita disposable income from 15,000 RMB to more than 30,000 RMB and an increase in the annual income of the collective income from 80,000 RMB to 150,000 RMB by implementing land consolidation designed to develop the greenhouse vegetable industry.

(3) The implementation of related policies improves the living environment

In 2015, Shandong Province officially promulgated the *Plan for Improving Rural Human Settlement Environment in Shandong Province (2015-2020)*. Since then, Shandong Province has accelerated the treatment of rural household waste and the improvement of village landscapes and environments[97]. Jinzhuang Village is one of the earliest villages to carry out the improvement of the human settlement environment as part of its RLC projects. According to this process, the local government allocated a special fund of 1 million RMB to Jinzhuang Village. With the funds from the local government, Jinzhuang has improved its living environment from the following perspectives. In addition to levelling idle land and converting it into agricultural land, seven abandoned houses have been reclaimed for agricultural production or transformed into squares; litter bins have been allocated to every road in the village and rubbish is removed almost daily by environmental staff; trees have been planted along the main streets of the village; and drainage ditches have been repaired. As a result, the beautified landscape and improved infrastructure have made the village more habitable. The newly created public spaces have also enhanced community cohesion by creating venues for villagers to meet and socialise. At the end of 2019, Jinzhuang was awarded the honorary title of Shandong Provincial Sanitary Village (*shengji weisheng cunzhuang*), in recognition of the excellent condition of the village's landscape and sanitation.

[97] http://www.shandong.gov.cn/art/2015/10/22/art_2259_24052.html (access to the full text of the policy)

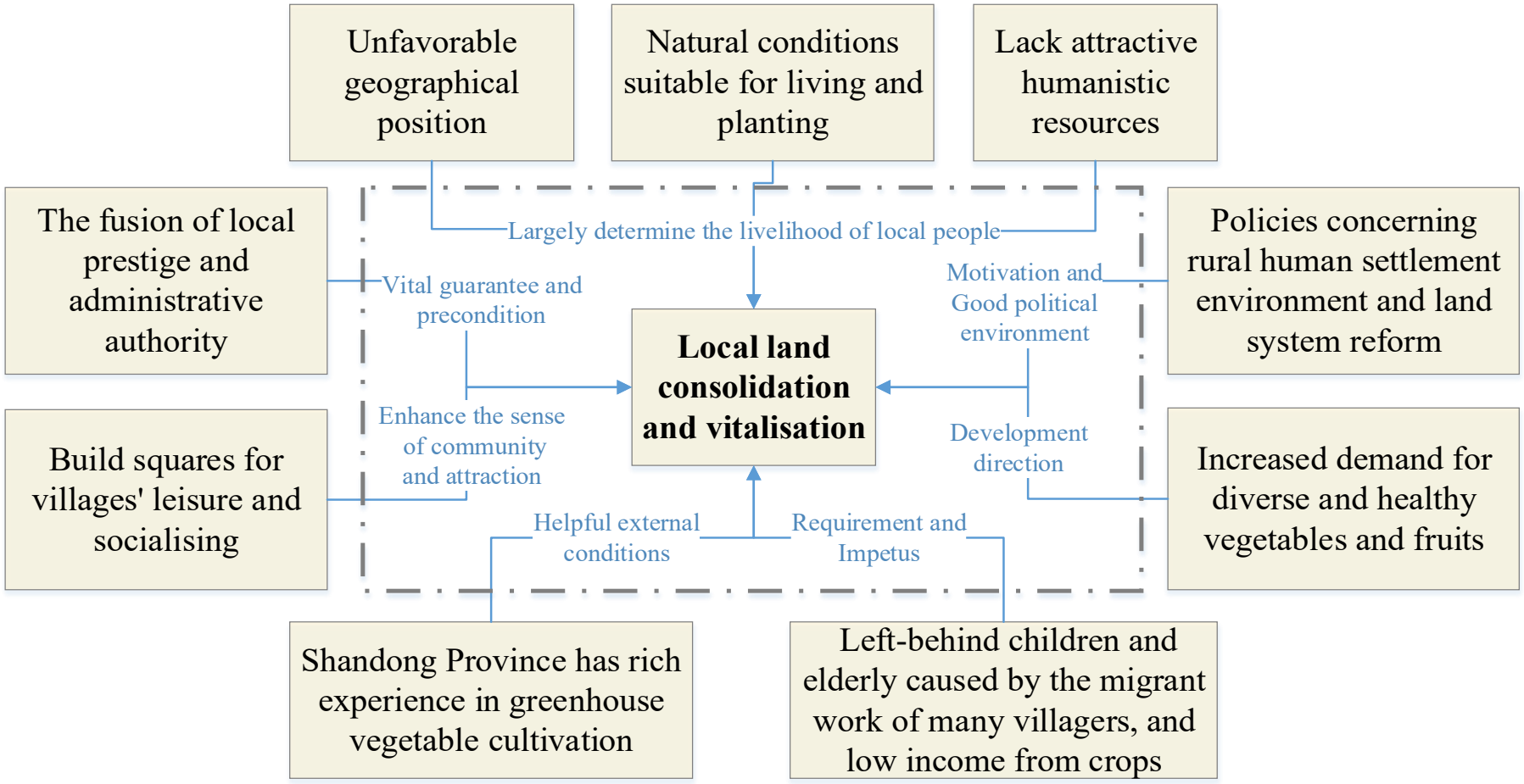

Fig. 9-13. Mechanisms of RLC in promoting the vitalisation of Jinzhuang (modified based on Fig. 5-8)

(4) The fusion of local prestige and administrative authority facilitates the construction and development of Jinzhuang

Jinzhuang Village is not geographically advantaged, for economic development, as shown by the fact that it is located far from main traffic arteries and major cities, and has been, therefore, later than other places in introducing greenhouse planting technology. It was not until the late 1990s that greenhouse vegetable cultivation appeared in Jinzhuang Village. At that time, the current village party secretary (*Mr. Jin*) brought back planting techniques involving vegetable greenhouses gained during years of experience working outside the village. By following his advice and using these advanced techniques, some villagers managed to move out of poverty and gain considerable incomes by growing greenhouse vegetables. This earned *Mr. Jin* respect as a member of the rural gentry. To better serve the villagers, he then joined the village branch committee and was later elected as the village party secretary. His case represents the possibility of transitioning from the elite outside the local administration system to that within the local administration system, and symbolises the unity of local prestige and administrative authority. Later, *Mr. Jin* led the village party branch to transfer more than 50 ha of agricultural land to be used for greenhouse vegetable cultivation and also invited technicians from Yucheng Agriculture and Rural Bureau to teach locals irrigation techniques, such as micro-irrigation and drip irrigation, and to promote modern planting methods such as greenhouse insulation. Under his leadership, the village party branch established a professional vegetable planting cooperative in 2009 and created a "Vegetable Park" with a total of 120 vegetable greenhouses, the purpose of which was to encourage the villagers to participate in greenhouse vegetable cultivation in order to achieve prosperity. Subsequently, some villagers who were engaged in greenhouse vegetable cultivation, in order to obtain higher returns, chose vegetables such as aubergines and cucumbers, instead of tomatoes grown by the majority of the villagers. However, the results were not satisfactory. Through market analysis of these cases, *Mr. Jin* found that market competitiveness and pricing power needed to be supported by the scale of productivity. Thus, he and other village cadres persuaded those villagers to give up their original products and grow tomatoes instead, which alleviated the unfavourable situation. Because of the positive development, more of *Mr. Jin*'s ideas and decisions have been

recognised and actively implemented by most village cadres and ordinary villagers. An ideal fusion between the powers authorised via the administrative system and entrusted by local people, therefore, has been achieved. It is for this reason that the subsequent reclamation of the abandoned homestead under *Mr. Jin's* management was able to proceed smoothly with almost no complaints.

By the end of 2020, there are nearly 480 vegetable greenhouses in the "Vegetable Park" led by *Mr. Jin*, with more than 200 growers, more than 70 million RMB in fixed assets, an annual sales income of more than 60 million RMB, and an average net income of 36,000 RMB per member. Today, it is the largest greenhouse vegetable park in Yucheng City.

9.5 Discussion

The evaluation of the effectiveness of RLC in both villages shows that the economic, social and cultural benefits of RLC for current village development in rural China are much higher than its ecological benefits. This is related to the fact that the ecologically oriented land consolidation policies have not been carried out in rural China for a long enough period (Zhang & Tan, 2021). In addition, the ecological effect of land consolidation in Dongheng Village was better than that in Jinzhuang Village, which demonstrates the ecological advantages of comprehensive land consolidation (Rao, 2022; Su & Wu, 2021). However, the functional supply-demand analysis reflects the fact that rural areas in China, even the most economically-developed areas, find it difficult at present to fully meet their local needs. This is why continued reform and innovative land consolidation practices from the supply side remain particularly important for China's rural development (Hu et al., 2018; Xiang et al., 2017). This also reflects the importance of ex-ante evaluation. Because ex-ante evaluation of RLC projects allows us to predict changes in actors' behaviours and land use patterns (Coelho, Pinto & Silva, 2001), which plays an important role in improving project effectiveness and improving the unbalanced functional supply-demand.

In terms of the mechanisms, compared with Dongheng, the importance of geographical advantages is lower in Jinzhuang Village. Other studies have also shown that the distance from cities has a great influence on the villages' land consolidation strategies (Liu et al., 2021; Wang, Fang & Chen, 2018). But the

role of market demand is more significant in the pursuit of positive land consolidation of Jinzhuang. It has also been shown in other Chinese studies that market mechanisms, in addition to policy, have a significant impact on the way land is used in rural villages (Xi, Zhao & Ge, 2011; Yang, Chen & Gong, 2019). Also, with the support from policies concerning rural construction and land use, Jinzhuang has achieved the improvement of its living environment, residential land consolidation as well as the construction of cultural space. In this case, a village party secretary with the dual qualities of administrative authority and local prestige also contributed to the smooth completion of these projects (Jiang et al., 2021). Indeed, cases similar to *Mr. Jin* can be found elsewhere in rural China (Guo & Wang, 2019; Li et al., 2020).

9.6 Chapter summary

Although the implementation of land consolidation has promoted the overall development of these two villages, the specific effects are different in each case. In Jinzhuang, RLC has promoted the ongoing development of industry and quality of life, and its effect on governance has been relatively weak; conversely, the value of the environmental index continued to decline over that decade. While RLC contributed to a rapid increase in the cultural index in the first five years, it restricted cultural development in the next five years. In Dongheng, a notable feature of the influence of RLC on local vitalisation is that all, but the governance, indices continued to rise throughout the decade studied; the governance index dipped between 2010 and 2015, but increased to a level higher than that in 2010 in 2020. Moreover, in terms of supply and demand of and for RLUFs, both villages show that all but a few functions are in short supply, especially agricultural and industrial production functions, which are the major sources of economic value. These two villages have achieved a certain level of economic success during a stage of rapid development, but the diverse needs for local comprehensive development have not yet been met during this specific process. Both villages are reflections in miniature of the past two decades and even the current average development stage in China, during which the development mode is driven by the construction of infrastructure and industrial space, given that China's development is still at a rapid stage in which there is a

huge demand for economic benefits. Furthermore, based on the field investigations and analysis, it was found that the smooth development of RLC and the subsequent vitalisation of Dongheng Village were mainly due to the combined effect of policy support, a solid industrial foundation, superior resource endowment, and the efforts of local elites; while the implementation of RLC and the development of Jinzhuang were the result of the combined effect of geographical location, market demand, policy, and local elites.

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Chapter 10 Discussions: Comparison, Strategies, and Inspiration

10.1 Introduction

Based on the case studies described in Chapters 8 and 9, this chapter discusses the following three aspects: 1) the similarities and differences of the two case areas in rural and consolidation (RLC) praxes; 2) the proposed land use strategies based on the supply-demand of and for rural land use functions (RLUFs) and rural land use types (RLUTs) in the two case areas; 3) lessons learned based on the case studies, field surveys in rural China, literature concerning RLC and rural development at the community/village level.

10.2 A comparison of RLC development in two villages

Land consolidation is a toolkit that integrates engineering measures and policies with a strong sense of purpose for local sustainability. Its development can have different degrees of impact on the local economy, society, ecology, and culture, depending on the extent to which the process is influenced by various factors (Asiama, Bennett & Zevenbergen, 2017; Hartvigsen, 2015; Liu et al., 2018). Therefore, this section will compare and contrast two case villages (Jinzhuang and Dongheng) studied by this research in terms of the purposes of conducting RLC, the influencing factors of project development, and the effectiveness of RLC.

10.2.1 The focuses of land consolidation in the two villages

In the case of Jinzhuang and Dongheng, the ultimate goal of land consolidation in both villages is to promote local vitalisation. However, due to their disparities in geographical positions and resource endowments, and divergent developmental pathways, their emphases and focuses on RLC differ.

Jinzhuang is located in Yucheng City in Shandong Province, one of China's major grain-producing regions. It is far from major cities and lacks secondary and tertiary industrial foundations, contributing to the subsequent land consolidation mainly on agricultural land. With the increasing market demand for vegetables and fruits and the success of Shouguang County, a county also

located in Shandong Province, in greenhouse planting (Wang, Zhang & Cheong, 2014a), Jinzhuang Village, among all the agricultural land consolidation projects, has carried out greenhouse-oriented land consolidation (e.g. converting undeveloped land and part of the farmland into greenhouse vegetable land). Concerning Dongheng Village which is located in Deqing County in Zhejiang Province, in the years before and after the closure of the local mine, villagers in Dongheng have also carried out bottom-up agricultural land consolidation to transform what was once farmland and ecological land into aquafarms because of the higher economic benefits of the aquaculture industry.

Both villages have undertaken construction land consolidation, and the similarities and differences between them can be explained in terms of scale and purpose. The construction land consolidation in Jinzhuang only involved the demolition of a few old buildings that have fallen into disrepair, which were subsequently reclaimed or turned into squares. The main objectives were to beautify the village's appearance, to reduce the frequency of situations in which one household owned more than one homestead, to provide recreational areas for the villagers, and to increase the urban and town construction land quotas for the development of the local economy and urbanisation. Comparatively, the construction land consolidation in Dongheng involved a wider range of types and areas, including the reclamation of most of the mining sites, a natural village and some old buildings in other natural villages, the upgradation of main roads, and the construction of the new central village. Specifically, the reclamation of mines and old buildings has provided sufficient construction land quotas for constructing the central village and the "Piano Innovation Park" managed by the village collective, thus achieving no increase in the overall construction land of the village. The main reason why these two villages have both carried out residential land consolidation (see Sections 8.2 and 8.3) is that the Chinese central government has explicitly requested the gradual elimination of cases in which a single household owns more than one house site, and also that dilapidated rural residences and valuable buildings be repaired or renovated. However, the gradual transition in development from an agricultural-led village to a secondary sector-led village has meant a change in the land use types required. Moreover, the larger village size of Dongheng compared with Jinzhuang means that there is a greater scope or likelihood that construction land

would be consolidated. As a result, the development of construction land consolidation became the dominant force in Dongheng, while the development of agricultural land consolidation was the leading force in Jinzhuang.

In terms of environmental renovation, the main means used in Dongheng to solve the environmental pollution caused by long-term mining included the closure of quarries, land levelling, soil remediation, and the increase of vegetation cover. For the natural village (explained in Section 8.3.1), the main measures taken were to tidy up the weeds and bushes around the residential areas and to place rubbish bins to encourage villagers to maintain a good sanitary environment. However, Jinzhuang had not been plagued by serious production pollution, so the focus there was merely on reversing the dirty and untidy appearance. The main measures involved the improvement of sanitary conditions, repair and painting of the facades of buildings along the street, repair of drainage ditches, the improvement of water quality of ponds, and the removal of bushes and garbage to plant trees (Jiang et al., 2021). However, the previous RLC practice in Jinzhuang focused more on the improvement of the visible environment and did not effectively address the unseen soil pollution caused by the excessive use of fertiliser.

10.2.2 Key factors for the relative success of RLC in the two villages

According to the field investigations and previous analyses (see Sections 8.2, 8.3, and 9.4), it is clear that policy support and village elites' efforts are the key factors behind the successful implementation and satisfactory results of the RLC projects in the two villages.

First, support from local government is required if land consolidation projects are to be carried out involving large areas of construction land and agricultural land (for example, if the natural village is used as the implementation unit), especially farmland. The approvers of land use planning are affiliated with government departments (Jiang et al., 2022b; Liu & Zhao, 2019). This means that if the particular characteristics of a local land consolidation project lead to its being valued and supported by the government at the local level or even higher, it is more likely that the new land consolidation scheme will be exempted from certain original land use planning restrictions and that administrative constraints on meeting the balance of farmland occupation and compensation

will be reduced. In addition, policy support can increase the availability of funding resources for the development of RLC projects. Projects that are supported by the government may not only receive a certain amount of government financial support, but may also find it easier to obtain financial loans of higher amounts. For example, Jinzhuang Village received one million RMB of funding from the local government for its residential land consolidation and environmental renovation projects; Dongheng Village, by virtue of becoming a provincial comprehensive rural land consolidation (CRLC) pilot and its subsequent major industrial transformation, received not only more than 200 million RMB of special funding but also an additional 310 million RMB of loan support from a bank during the implementation of its CRLC program.

Second, the ownership of the land in a village belongs to the village collective, while the majority of the agricultural land is contracted out to the villagers. Changes in land use in a village, unlike in the case of state land, therefore, usually need not only the support of land use planners but also that of the majority (usually more than two-thirds) of villagers or villagers' representatives, rather than being affected by top-down governmental decisions. This means that there are lots of stakeholders involved in a change of land use in the village. It is crucial to reconcile various points of view in order to arrive at a solution that is agreeable to the majority of stakeholders and to seek sufficient benefits for opponents to appease them or even convert them into supporters of the proposal. Moreover, rural Chinese society is governed by more traditional codes of behavioural norms than more urban areas (Fei, 1992), and to wield administrative authority to intervene without considering this may produce unintended consequences. In such circumstances, the role of village elites, including local gentries and village cadres, who have close ties with the villagers, is vital in the process of achieving the consensus necessary for the implementation of projects (Guo & Wang, 2019; Li et al., 2020). This situation has been reflected in both villages studied. In Jinzhuang, as mentioned before, the current village party secretary (*Mr. Jin*) is the promoter of the greenhouse-led RLC. When he returned to the village, few people were willing to work with him planting tomatoes in greenhouses. After several years of hard work, some farmers, with the help of the party secretary and other village cadres, managed to break out of poverty and became rich by planting tomatoes. This has to a large

extent stimulated the enthusiasm of other farmers to participate in the RLC and tomato industry. Since then, *Mr. Jin* has enjoyed a high reputation in the village. This is the main reason why subsequent construction land consolidation was able to be carried out smoothly under his leadership. In Dongheng, village cadres appropriately taken advantage of the roles of opinion leaders often played by the gentries among the villagers by mobilising gentries and granting them the right to participate in village decision-making. In this process, although the gentries were usually involved in the process without wages, the sense of honour and purpose that this responsibility granted them and their sense of being part of the development of their village enabled them to actively participate in the communication, advisory stage, and supervision of the entire programme. This has made it easier to collect and co-ordinate villagers' views on the village development, which in turn has facilitated the finalisation of proposals and made villagers more willing to participate in the village's development.

10.2.3 What has land consolidation brought to these two villages?

In Section 9.2, the impacts of RLC on the overall development of the two villages and its effectiveness in each of the five dimensions – economy, society, culture, environment, and governance – were respectively quantitatively analysed. In general, the implementation of land consolidation has contributed to the development of the two villages. However, not every aspect of each village has been positively impacted.

The similarities lie in the fact that RLC has had its most significant impact on the economic, social, and cultural development of both villages. The main reason for this is that the basic purpose of RLC is to provide sufficient space and favourable conditions for the development of local industries through changes in land use types, thus promoting the sustainability of the local economy. When the economic level of the village collective rises, sufficient funds will be available for the improvement of the public services, infrastructure, and sanitary environment of the village. When villagers' incomes increase, they will often invest in improving their housing conditions and conflicts arising from competition for limited resources can therefore be alleviated to a certain extent. These are essential for improving the social construction of a village. As for cultural development, since the Chinese government and society have

increasingly valued rural cultures[98], many physical cultural spaces such as village libraries and cultural exhibition halls have been built and local events held to promote intangible cultures such as local arts and crafts. However, for villages such as Jinzhuang that lack a strong economy and/or profound cultural traditions, they may encounter bottlenecks in cultural development due to the lack of sufficient and continuous support; while villages with strong economic strength and/or profound cultural foundations, such as Dongheng Village, are always able to sustain their cultural development through a variety of ways, such as space creation, industry, symbolism, and activities. This kind of discrepancy cannot be bridged by the development of land consolidation alone.

This study also observed a much lower effect of land consolidation on governance than the three above-mentioned aspects. This is due to the lag in policy response and governance effectiveness (Brodie & Waterhouse, 2012; Song et al., 2015). It is well known that the emergence of reasonable solutions often lags behind the emergence of problems and that it is difficult for managers to prevent all problems, e.g. village managers usually step in to find an appropriate solution after a conflict has arisen. In addition, solutions often require several rounds of discussion and the final solution may not satisfy all. In this process, some villagers may distrust or be dissatisfied with village managers. Meanwhile, according to my experience in conversing with villagers in different areas of rural China, they usually only demonstrated genuine approval of a project once they had already received the promised benefits. However, there is generally a delay between the implementation of a project and the desired outcomes making themselves evident. As a result, the lag of governance constrains the effect of RLC on the performance of local governance.

Moreover, the most significant difference between the two cases is the impact on the environment. Land consolidation has had a positive impact on the environment of Dongheng Village, but it seems to have failed in Jinzhuang Village. RLC has contributed to the improvement of the living environment of both villages, because of the improvements in public services facilities, infrastructure, landscapes, and sanitary conditions created by the RLC. The key difference lies in the changes in the ecological environment. To be specific,

[98] http://www.gov.cn/gongbao/content/2017/content_5171322.htm (access to the related policy)

through land consolidation, Dongheng Village has been improving the quality of its soil and water by remediating areas that had been affected by mining, promoting mechanised agricultural production and efficient fertiliser use by centralising and transferring agricultural land, and restoring damaged woodlands and water bodies through ecological restoration. However, in Jinzhuang, greenhouse-led land consolidation encroached not only on some ecological space, but also on some farmland. With the increase in population, the reduction of ecological space coverage means the reduction of per capita ecological area and possibly ecological quality, which in turn negatively affects the environmental index. In addition, the reduction in farmland per household is likely to lead to an increase in the average use of fertilisers and pesticides per hectare. The main reason is that farmers use far fewer fertilisers and pesticides on their own plots (i.e. the land used to produce grain for family members) than on the farmland used to produce grain for sale (Ni, Zheng & Yu, 2014; Xu, Zhou & Pan, 2013; Zhang et al., 2017). In Jinzhuang Village, for instance, a large amount of farmland was taken up by the construction of greenhouses. This has resulted in many households having less farmland available for cultivation. As a result, the solution of many villagers has been to apply more fertilisers and even pesticides on the land still being used to produce food for sale in order to ensure more food production, thus compensating for the reduction in food production due to the reduced farmland. But they use much fewer fertilisers and pesticides on land used for household consumption. For greenhouse vegetables, as their products usually need to compete in the market, they usually choose good varieties and control the use of fertilisers to ensure the quality of their products, in order to obtain good economic benefits.

10.3 Restructuring land use in balancing the supply and demand of and for land use functions/types

The multifunctionality derived from the land use in this study is considered positive, meaning that the supply of each function equals or exceeds the demand. Based on an analysis of the supply and demand of and for RLUFs in Jinzhuang and Dongheng, it can be said that there have been imbalanced developmental patterns in these two villages. In addition, the analysis presented in Chapter 5

demonstrates that land use functions are determined by land use types. This indicates that the supply-demand imbalance of RLUFs mentioned in Chapter 9 can also be understood as, and converted to, the supply-demand imbalance of rural land use types (RLUTs). It is thus possible to apply the rearrangement of land use structures as a strategy to balance the supply and demand of and for RLUFs/RLUTs in the two villages. Based on the results of field investigations and land use data analysis, this study proposes land use strategies for each of the two case areas, aiming to provide a reference for their future development and the development of land consolidation schemes in other rural areas. However, based on the analyses in this study related to governance and the author's experience in urban-rural planning, it is noted that the formulation of a detailed land use plan is a complex process that requires the participation of stakeholders from diverse backgrounds. As the development of the land use strategies mentioned in this study did not involve stakeholder participation in the process, the chapter only provided general directions and criteria for future land use, but did not provide specific land use schemes for the case areas.

10.3.1 Land use strategies for Jinzhuang Village

According to the relationship between RLUTs and RLUFs mentioned in Sections 5.2 and 6.4.1, the classification of strategies to balance the supply-demand of and for RLUFs mentioned in 6.4.3, as well as the supply-demand of and for RLUFs in Jinzhuang mentioned in Section 9.3.1, the supply-demand of and for RLUTs in Jinzhuang was further analysed based on the principle that the different indicators of the same land use function/type have the same status as each other. As shown in Fig. 10-1, most of the land use types were in short supply from 2010 to 2020 (indicators expressed in negative values), among which the value of land used for greenhouse vegetable farming was the most obvious deficit; in addition to farmland, the only land use type in greater supply than demand in 2020 was ecological land. According to Fig. 9-8, every function in Jinzhuang Village in 2020 was in short supply. Among them, the gap between supply and demand was obvious for the agricultural production, public service, residential, and employment functions. Therefore, the following land use strategies were proposed for Jinzhuang Village to balance the demand for and supply of RLUFs and RLUTs in the future RLC (Table 10-1), thereby further promoting local development.

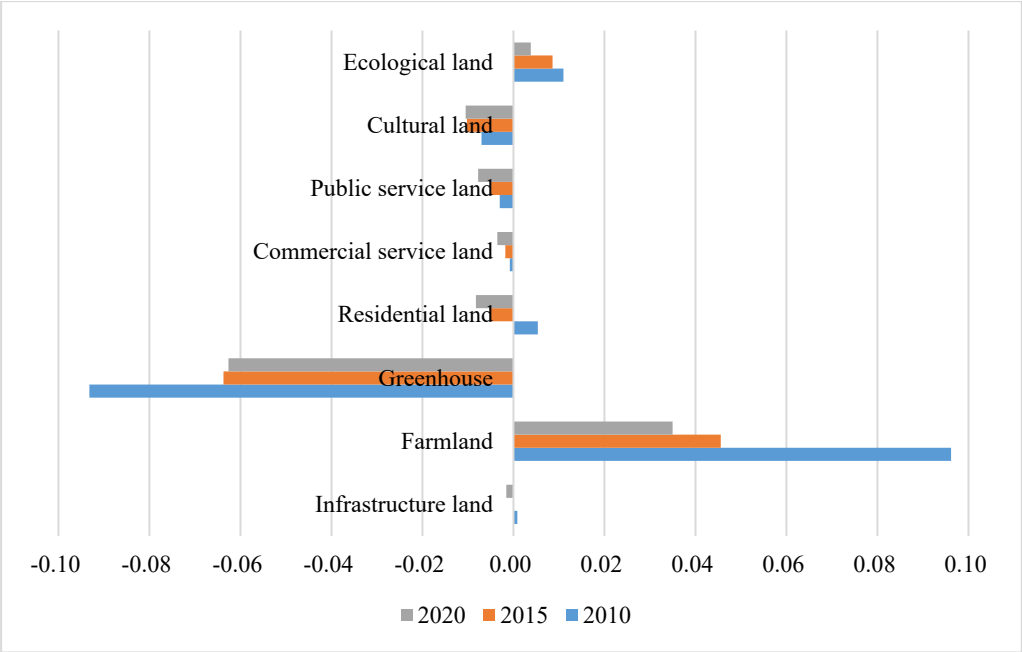

Fig. 10-1. Differences between supply-demand of and for RLUTs in Jinzhuang

First, Jinzhuang is currently facing the fact that the area of residential land per household far exceeds the standards of relevant laws and regulations in Shandong Province[99]. Meanwhile, alongside the process of urbanisation in China, real estate development in urban and town areas has become more mature, attracting lots of villagers to buy new apartments in city and town areas to meet their needs for housing space as well as urban welfare. This is also the case in Jinzhuang[100]. Therefore, type/function enhancement and conversion can be adopted as concerns residential land (residential function). It can be considered to reduce the proportion of residential land and increase the villagers' per capita housing area by increasing the number of storeys of housing for the residents in Jinzhuang. The land freed up by increasing the number of housing storeys could be used not only for the further development of the tomato industry, but also for the construction of infrastructure and public service facilities, thus meeting the

[99] According to *Shandong Province to implement the Land Administration Law of the People's Republic of China*, for villages in plain areas, the area of residential land for new households shall not exceed 200 square meters. However, in Jinzhuang, the actual area per household exceeded 300 square meters in 2020. This suggests that the area of original residential land may exceeded current optimal standards in terms of resource protection and farmers' production and living needs.

[100] There are two reasons why the residential function in Jinzhuang remains in short supply when the average area of residential land per household exceeds the government's regulation. Firstly, many villagers have purchased apartments in towns and urban areas, which represents part of their demand for residential functions. This study only counted the residential area of villagers within the village when calculating the supply intensity of residential function, and did not count the floor area of commercial apartments purchased by villagers in other places. Secondly, many households often use a small portion (around 30%) of the residential land they own to build a house for residential purposes, while the rest is mainly used for raising poultry and/or livestock and for agricultural work. As the scale of agricultural production expands and/or the family population increases, so does their demand for residential land.

villagers' needs for agricultural production and public service functions simultaneously. Similarly, the number of storeys could be added to buildings used for cultural purposes and public and commercial services in order to increase the supply intensity of the corresponding functions and thus move closer to a balance between supply and demand.

Table 10-1. Land use strategies for the further development of RLC in Jinzhuang

Land use types	Strategies
Residential land	**Enhancement**: reduce the proportion of residential land and increase the number of storeys of housing **Conversion**: conversion of some residential land to public administration and service land, infrastructure land, greenhouse vegetable land, and/or ecological land
Public administration and service land	**Enhancement**: increase the number of building floors
Commercial service land	**Enhancement**: increase the number of building floors
Cultural land	**Enhancement**: increase the number of building floors
Farmland	**Conversion**: conversion of some farmland to greenhouse vegetable land
Greenhouse vegetable land	**Conversion**: conversion of some greenhouse vegetable land to land for fruit and vegetable processing and research **Supplement:** from undeveloped land

Second, from Fig. 10-2, it can be seen that the area ratios of cultivated land and greenhouse vegetable land have always been the largest two. Considering that greenhouse vegetable land can provide more jobs and generate higher economic benefits than the same area of cultivated land, it would be intuitively reasonable to convert the remaining farmland into greenhouse vegetable land, provided that enough arable land be left for the villagers to produce enough grain to satisfy household consumption needs. This would not only further improve the employment function and production function of agricultural land, but also reduce the use of pesticides and fertilisers. However, given the national policy of strict restrictions on the non-grain production of farmland given domestic food security requirements [101], converting more farmland into greenhouse vegetable land may encounter great difficulties in practice. Therefore, reclaiming most of the residential land consolidated in the previous step into the land for

[101] http://www.gov.cn/zhengce/content/2020-11/17/content_5562053.htm (access to the related policy)

greenhouses would seem a suboptimal but more realistic arrangement. In addition, Jinzhuang could further promote the creation of locally-specific industry through large-scale greenhouse vegetable cultivation and the development of organic vegetables. It could also expand the influence of local industries and farming culture by expanding the industrial chain, by improving the plot ratio of construction land, and by making full use of agricultural land, such as by cooperating with neighbouring villages to process fruits and vegetables, establishing cultivation bases, and creating bases for agricultural education and scientific study.

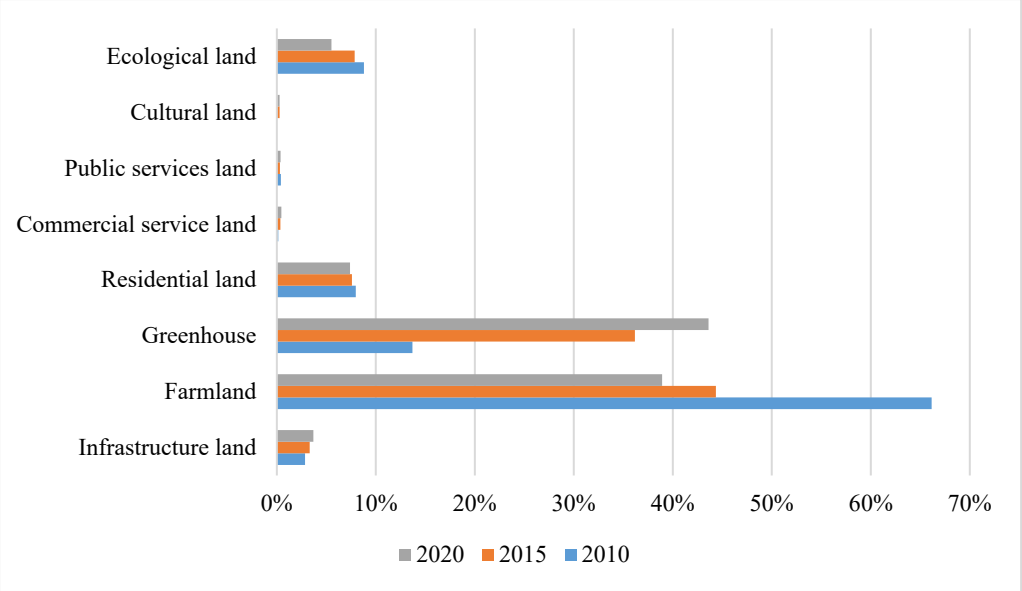

Fig. 10-2. Area percentages of different RLUTs in Jinzhuang

Third, the rural vitalisation not merely involves the residential and production functions, but also links with the idyllic nature of the countryside, such as a high-quality environment, leisure activities, and scenic beauty (Deller et al., 2001). Although the status of ecological land supply-demand is currently positive, it is necessary to continue to emphasise the protection of ecological and leisure spaces and to keep part of the land vacated free by increasing building storey numbers with ecological goals in mind, given that the potentially-erosive effect of industrial development on ecological land as well as the increasing demand for ecological and public service functions due to population increase. it is necessary to continue to emphasise the protection of ecological space and to keep part of the land vacated free by increasing building storey numbers with ecological goals in mind. This will go a long way to ensuring a balance between the supply and demand of ecological function/land within the village.

10.3.2 Land use strategies for Dongheng Village

As with Jinzhuang Village, the differences between the RLUTs supply and demand were calculated for Dongheng Village (Fig 10-3). As already known from Fig. 9-11, the smallest value of D_{sd} in 2020, i.e. the largest gap between supply and demand, was found in the industrial production function, followed by the education, public service, and commercial production functions, with only the maintenance and heritage functions showing positive value on D_{sd}. In terms of RLUTs (Fig. 10-3), ecological land, farmland, aquafarm, and infrastructural land all had a sufficient supply in 2020 while other RLUTs did not, and the gap of most of these which were in short supply has been widening. After combining the current policies, the results of field interviews, and the supply-demand of and for RLUTs and RLUFs in Dongheng, this study proposes the following strategies for restructuring the land use structure of Dongheng (Table 10-2).

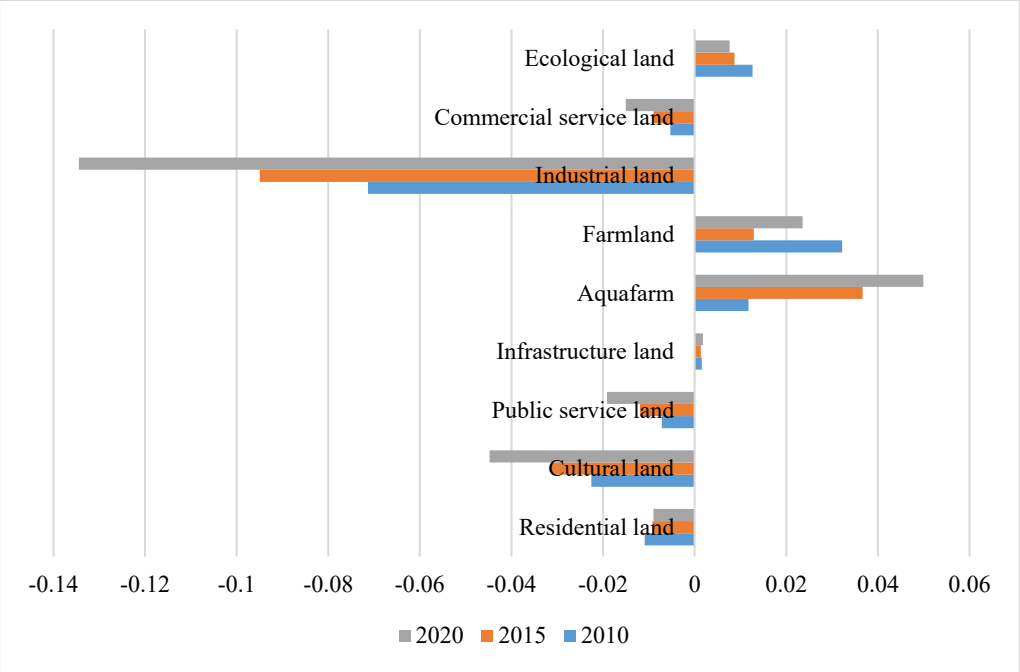

Fig. 10-3. Differences between supply-demand of and for RLUTs in Dongheng

The first land use that may be considered for rearrangement is the agricultural land which covers the largest percentage of the land in Dongheng and of which the area used for aquafarming accounts for the largest proportion and far exceeds all other RLUTs (Fig. 10-4). However, the supply intensity of the agricultural function outstrips the current demand. What is more, some small-scale farmers are more likely to discharge the sewage from their aquafarms directly into nearby water bodies because they have not installed expensive

sewage-treatment equipment. It is, therefore, necessary to control the number of small-scale aquafarms in terms of agricultural production to reduce their negative impact on the local ecological environment and to provide sufficient land for other purposes.

Table 10-2. Land use strategies for the further development of RLC in Dongheng

Land use types	Strategies
Aquafarm	**Conversion**: converse some aquafarms to farmland and/or ecological land
Farmland	**Supplement:** from undeveloped land
Industry land	**Supplement:** from undeveloped land
Residential land	**Enhancement**: reduce the floor space of residential buildings and increase the number of storeys of residential buildings in other natural villages
	Conversion: converse a part of residential land to public administration and service land, infrastructure land, and/or ecological land
Public administration and service land	**Enhancement**: increase the number of building floors **Supplement:** from undeveloped land
Commercial service land	**Enhancement**: increase the number of building floors **Supplement:** from undeveloped land
Cultural land	**Enhancement**: increase the number of building floors **Supplement:** from undeveloped land
Ecological land	**Supplement:** from undeveloped land

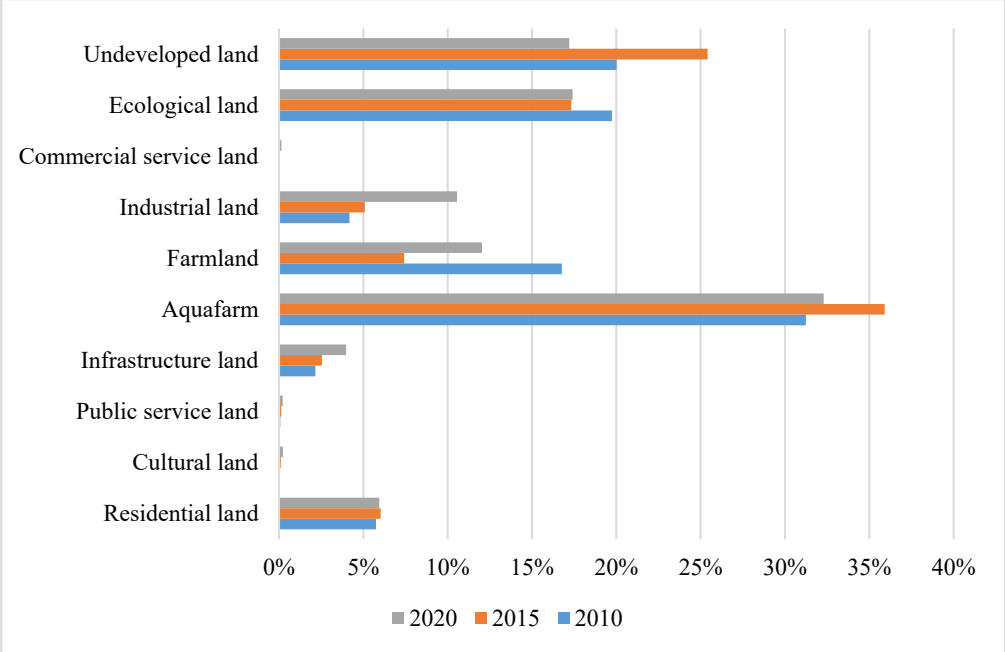

Fig. 10-4. Area percentages of different RLUTs in Dongheng

Second, considering that the construction land quotas for Dongheng's central village and industrial park were obtained by means of mine reclamation and that local development leaders have attached great importance to food security as well as continued development of farming culture, some aquafarms and undeveloped land could be converted into farmland through land consolidation. Then, new planting and production technologies are now available to be introduced to improve the production efficiency of agricultural production. Improved agricultural production can be integrated into agricultural product processing in order to expand the development of the entire industrial chain in both its horizontal and vertical aspects to expand the production scale while conserving land resources. For example, the "Deqing Baiyuankang Plant Dream Factory"[102], which was built in Dongheng in the second half of 2018, uses new technology to achieve the combinations of fish and plant cultivation. This process is known as aquaponics (Palm et al., 2018). The adoption of new technologies has promoted the diversity and compounding of rural land use. In this way, compared with traditional agricultural production, not only are fewer pollutants produced during the process and resources used more efficiently, but higher economic benefits are also created. This can also serve to reduce the economic and employment pressure on secondary and tertiary industries.

Additionally, the demand for public services, commercial, and cultural functions is naturally increasing as per capita economic income, years of education per capita and the number of permanent residents increase. Thus, idle land development is still needed to improve public service facilities and infrastructures, such as roads and domestic sewage treatment tanks, as well as to provide sufficient space for the development of commercial services and cultural programs. In the case of residential land, according to village officials, the central village will house 70% of the total number of households in the village, meaning that the size of the central village will continue to expand. Accordingly, the vacant land around the central village could be used to moderately expand the central village in order to cope with the increase in demand for residential functions arising from population growth. When conditions permit, other natural villages could also reduce the floor space of residential buildings by increasing

[102] For more information, please refer to: https://www.bilibili.com/s/video/BV1qt4y1Y7oU (in Chinese) and http://nync.huzhou.gov.cn/art/2020/8/27/art_1229209233_55775899.html (in Chinese)

the number of storeys on houses and/or relocating some households to the central village. Besides, industrial land is the main type of land used to meet the employment and economic needs of the village development. It is necessary to make full use of the levelled land around the “Piano Innovation Park” and convert it into industrial land in order to expand the scale of the piano industry, thereby strengthening the industrial agglomeration effect, extending the industry chain, and enhancing the market competitiveness of local brands. Dongheng could also actively make full use of its sufficient unused land and agricultural land resources to attract modern agricultural enterprises to settle in. The integration of primary, secondary and tertiary industries needs to be promoted through agricultural production, the processing of agricultural products, agricultural product sales, and agricultural tourism. This will not only further secure local employment rates, but also enhance the economic efficiency of primary sector. This is crucial to promoting the in-situ townisation (see Kamal-Chaoui, Edward & Zhang, 2009) and vitalisation of Dongheng and even the urban-rural integration of Luoshe Town and Deqing County.

For ecological land, it may be more beneficial to protect what ecological space exists from occupation by production and living spaces and to actively promote the ecological conversion of what used to be mining sites. The following four main reasons contribute to this. First, although the supply intensity of the maintenance function far exceeded the demand, over 40% was provided by farmland and aquafarms. And the maintenance functions provided by agricultural land may not be as stable as those provided by ecological land. Second, although the supply of ecological land has always been greater than the demand, the advantage is not prominent and has been decreasing. Besides, almost 40% of the ecological space of Dongheng was made up of waterways and rivers which are public resources managed by the local government. Therefore, Dongheng needs to continue to assign importance to the conservation of ecological spaces other than waterways and rivers. Moreover, similar to other places (Ma et al., 2019), the over-developed industry and irrational exploitation of natural resources had seriously deteriorated the local ecological environment. Practice during the past five years has proven that insisting on the combination of a good ecological environment with cultural tourism, modern agriculture and the piano industry is instrumental in promoting local sustainability.

10.4 Lessons learned and Inspiration

Based on the holistic understanding of the relationship between RLC and rural development obtained from theory and practice in this study, several lessons can be drawn, based upon which policy recommendations are proposed in this section.

10.4.1 Did every instance of RLC bring good results for local development?

In the case studies of Jinzhuang and Dongheng, it is found that RLC is conducive to local improvement, especially in terms of increasing the economic income of the villagers and village collective as well as the improvement of their production and living conditions. The author also observed similar processes and results when conducting field surveys in other rural areas of China. For instance, by combining different types of RLC projects, some towns in Liuyang County, Hunan Province, have not only carried out unified planning for rural housing to improve the living environment and the organised transfer of agricultural land in the village to improve land use efficiency, but have also built industrial parks to centralise local enterprises and factories, such as the fireworks industry, so as to take full advantage of the scale effect of industrial development as well as to monitor and manage industrial pollution. These findings agree with the results of some studies in terms of the effect of RLC on rural development, which are not restricted to China (Guo et al., 2015; Liu & Wang, 2019; Pašakarnis & Maliene, 2010).

However, certain contradictory phenomena have also been found in field surveys and research elsewhere. For example, through field investigations and the comparative analysis of rural communities in Chongqing city, Liu et al. (2018) found that RLC did not succeed in every village; that is, in some places, RLC did not promote local development to meet the actual needs of the villagers. The main limitations of RLC, especially with regard to residential land consolidation, include low willingness on the part of villagers to concentrate their residential spaces, livelihood insecurity on the part of relocated villagers, and weak governance in new communities. Based on field investigations in other towns of Yucheng City, it has also been found that although RLC projects carried out in conjunction with the “increase vs decrease” policy (Long et al., 2012) were able to improve the living environment and land use efficiency, the lack of subsequent

industrial support has led to a series of problems, such as increased living costs, the lack of sufficient space for farmers to store agricultural tools, and the aging of the community caused by the immigration of farmers who lost their land. Similar phenomena have also been observed in RLC studies of other regions (Wang & Wu, 2013; Zhou & Wang, 2015). Moreover, RLC is usually destructive to the local ecological environment in its initial stage, given that the process of land consolidation usually involves the establishment of a new land use pattern to promote local development after the destruction of the original land use pattern through land engineering. However, after the completion of the land levelling project, some ecological measures, such as improving soil quality and increasing vegetation coverage, could be taken in local areas to restore and improve the local ecological environment. The case of Dongheng confirms the efficacy of such measures.

Therefore, it is safe to say that not all RLC projects will bring benefits to the locals or be in line with local interests. Only those villages that comprehensively consider industrial development, villagers' livelihoods, and ecological environment during the RLC process (i.e. CRLC) are more likely to benefit the most from conducting RLC projects.

10.4.2 Potential drawbacks identified in the two villages

Although the implementation of RLC has contributed to the overall development of the two villages, there is a flipside to every coin. Several potential drawbacks beyond land use were also identified over the course of the RLC in the two villages.

(1) Dongheng: Insufficient regulation and environmental issues in a boom time

The current trend in Dongheng Village is that local development is maturing and flourishing under the auspices of CRLC. Most CRLC-related projects are able to be completed under the joint supervision of village cadres and gentries. This is mainly reflected in the fact that the operation of the "Piano Innovation Park" and the development of its internal enterprises have gradually harmonised; the official operation of the cultural street has attracted increasing numbers of tourists and boosted the local cultural industry; the vast majority of abandoned mine sites have been ecologically restored; and what ecological land was

damaged in the early stages of land consolidation has also been largely restored and improved.

However, it was reported that during the treatment of the substance (a mixture of mainly including brickrubbish, slurry, and mud) used to fill mine craters (i.e. goaf filling) in the southern part of the village, the effluent was directly discharged into the irrigation ditch and then flowed into the river without treatment, negatively affecting the quality of local water[103]. During the mine reclamation process, Dongheng Village signed an agreement with a Hangzhou-based environmental engineering company to speed up the reclamation of the abandoned mine through the implementation of new technologies. At the beginning of the reclamation, 100 mu of the land was chosen as an experimental area for the new technologies. However, in order to save costs, the company discharged the wastewater generated during the construction process without treating it. Throughout the experiment, some village cadres and gentries from Dongheng Village often visited the construction site to supervise the construction status. For example, when the substance was shipped and transported to Dongheng, they checked whether the company could provide proof that its quality met the local environmental requirements. However, due to a lack of sufficient knowledge and experience in environmental protection, they neglected to ask the company or invite a third party to test the quality of the sewage. Fortunately, this phenomenon was discovered by some surrounding villagers who informed the media of Zhejiang Satellite TV about it through this media's disclosure platform, who subsequently reported it to the environmental supervision department and exposed this phenomenon. By the end of 2020, the company had built a sewage treatment tank next to the site to treat wastewater during the construction process.

This even indirectly reflects that the inadequate supervision provided by some village officials and gentries in Dongheng, due to some reasons such as lack of professional knowledge, may be overshadowed by the current boom of Dongheng Village. The consequences of this could have negative externalities not only for Dongheng but also for other nearby villages. However, such negative effects may be difficult to observe in a short period, except through

[103] http://tv.cztv.com/vplay/920269.html (News report concerning the illegal discharge of sewage from Dongheng Village's mine reclamation)

experimentation. For example, according to local environmental requirements and tests conducted by the environmental authorities, the discharge of untreated sewage into the near river had resulted in serious water pollution up to 100 meters downstream.

(2) Jinzhuang: farmers' physical problems and industrial bottleneck

Although the tomato industry based on greenhouse-led RLC has injected vitality, especially economic and human capital, into local development in the past two decades, it has also created hidden concerns for future development.

Long-term exposure to greenhouse farming is more likely to have more serious negative effects on farmers' health than working in cereal cultivation. During the field investigation, it was found that the finger joints of many older farmers were swollen, something which was visible even to the author who did not have a medical background. As a man of about 65 said from the roadside, "*I have been working in greenhouses for 15 years, but I can't do it now. I transferred my greenhouse to someone else two years ago. The humidity in the greenhouse is so heavy that I am suffering from rheumatism now. Now, if I stay in the greenhouse just a little longer, my joints hurt*". Besides, some respondents told us in their greenhouses: *"After growing vegetables in the greenhouse for several years, the discomfort in the waist is getting stronger than when we only grew corn and wheat. We went to the hospital for an examination and found that this was due to a herniated lumbar disc"*. The main reason for this is that tomato plants are relatively short, and farmers have to spend a lot of time every day bending over to take care of them, such as tying ropes to tomatoes to prevent them from bending the plants (Fig. 10-5). Over time, this way of working has caused increasing damage to their lumbar spine. Comparatively, the mechanisation rate and technical maturity of corn and wheat planting are much higher than that of tomato planting, so the physical damage that the practice of growing wheat or corn does to the body is relatively low. Thus, it appears that occupational diseases caused by greenhouse work will seriously affect the quality of life of local farmers.

Moreover, the greenhouse tomato industry in Jinzhuang Village may face the dilemma of fewer successors in the near future. It was found that most of the current tomato farmers in Jinzhuang Village are around 50 years old and that few young people work alongside their parents. Several respondents interviewed

noted: "*We have been engaged in growing greenhouse tomatoes for more than ten years. To give the children a chance to get better education conditions, we sent them to school in Yucheng City or Fangsi Town when they were young, and they rarely entered the greenhouse to do farm work. After graduating from university or college, they either went to work in Yucheng or went to other places. They were unwilling to come back to take over the greenhouse. We don't know how long we can keep doing this job*." There are the following reasons that contribute to this phenomenon. First, engaging in the greenhouse planting industry requires a lot of time spent in the greenhouse, which is likely to lead to a lack of social activities, something not easily acceptable for many young people. Second, many of the farmers' children who went to school in cities or towns from childhood and seldom engaged in greenhouse farming, so they may be unfamiliar with or do not have the chance to develop an interest in this kind of work. In addition, years of vegetable growing in greenhouses can induce intractable health problems. This is not only the cause of some young people's unwillingness to do this job, but also why some parents do not want their children to take it over from them.

Fig. 10-5 The outside (a), entrance (b), and inside of the greenhouse of Jinzhuang (c) and tomato plants (d) (Data source: Photographed by the author)

Furthermore, unsatisfactory eco-environmental issues may restrict the sustainable development of Jinzhuang Village. In the past decade, the area of greenhouse land increased from 14.6 ha to 46.6 ha. Greenhouse-led RLC has greatly improved the use efficiency of agricultural land, brought considerable economic benefits to local farmers, and promoted social stability. However, this has been at the expense of ecological space. To ensure food security and increase economic income, nearly half of local woodland has been converted into agricultural land and the excessive use of fertilisers has been increasing year on year (from 675kg/ha in 2010 to 1325kg/ha in 2020). The negative impact of

greenhouse-led RLC on the ecological environment may be difficult to observe in a short time-frame. And it is gratifying that Jinzhuang has carried out environmental renovation since 2015, with the environmental quality of living space having been significantly improved since that time. However, the large reduction in ecological space and the excessive use of fertilisers may greatly affect local sustainability in the future.

All this shows that RLC in Jinzhuang Village is in the stage of transforming from a simple RLC process dominated by economic and social benefits to a CRLC process which attempts to integrate environmental, economic, social, and cultural benefits. Although the vitalisation level of Jinzhuang has been promoted through the linkage of RLC to its tomato industry, Jinzhuang Village also faces some dilemmas. These issues may become the bottleneck that the local community needs to breakthrough in seeking further development. Maybe a new round of CRLC, as has been taken in Dongheng, will be needed for Jinzhuang.

10.4.3 A comparison of the Chinese and European experiences in RLC

It is mentioned in Chapters 1 and 4 that RLC is a time-tested practice in Europe, especially in Western Europe, and China. The study, however, has identified room for improvement in practicing RLC in some villages. Considering that the sharing of RLC experiences between those places where RLC is mainly applied may contribute to identifying the lessons learned from past practices and achieving the Sustainable Development Goals (SDGs) as well as the goals of this thesis, a brief comparison of RLC in mainland China and Europe, especially at the community level, seems warranted. By comparing the experiences between China and Europe, some insight to advance the practices of RLC in China and other countries and regions, such as Eastern Europe and Africa, may be obtained.

First, whether in Europe or China, the definition of RLC has gone through the process of evolving from a traditionally narrow concept to a more modern, broader one. That is, RLC is no longer a measure taken solely to eliminate the effects of land fragmentation and improve the economic benefits of farms by adjusting the structure of land property rights, but has become a toolkit linked to rural societies, economies, cultures and the environment, one focused on comprehensive rural development (FAO, 2008; Jiang et al., 2022b; Pašakarnis,

2015; Veršinskas et al., 2020; Zhang & Tan, 2021). Many European countries, especially Western European countries, emphasise the multifunctional role of RLC aimed at rural sustainability early than China. At the community level, RLC in many European countries takes into account both changing farm structures and the direct environment in enhancing farmers' market competitiveness, as well as improving infrastructure, the natural environment, resource management, the landscape and the spatial distribution of economic activities to (re)vitalise rural communities (FAO, 2008; Veršinskas et al., 2020). In China, enhancing local economic strength, improving living environment, and protecting local culture are the main purposes of land consolidation in rural villages (Jiang et al., 2022a; Jiang et al., 2021). Comparatively, land consolidation practices in many of China's rural villages still focus more on economic benefits and the quality and quantity of farmland, which is mainly driven by the fact that China remains a country with a large population and little farmland in a stage of rapid socio-economic development (Jiang et al., 2022b; Tang et al., 2019).

Second, the formulation and implementation of RLC projects between China and Europe are different. When RLC is promoted from the pilot to the whole country, the formulation of relevant laws legitimises RLC projects by augmenting them with legal status that the process be standardised, and that the content be rational. These are of importance in ensuring the quality of the projects. In Europe, laws and regulations directly related to RLC are present at almost every level, from that of the European Union to those of nations and regions; but in mainland China, however, the RLC regulations are largely derived from other laws not specific to RLC and there is thus a lack of RLC-specific legislation at the national level (Jiang et al., 2022; Liu and Zhao, 2019; Veršinskas et al., 2020). This is why the development of land consolidation in Europe is more standardised and the responsibilities and rights more clearly defined, even at the community level. For example, at the local level, each land consolidation project usually needs to establish an organisation in a "committee model" or "cadastral surveyor model" (van der Molen, Lemmen & Uimonen, 2005) to manage the development of the project, establish a "Land Evaluation Committee" to value different plots, as well as make an environmental and social impact assessment of the project (Demetriou, 2014; Hartvigsen, 2015). Some European countries also require that RLC should be implemented in a

democratic and participatory approach that is driven by the local community (FAO, 2003; Veršinskas et al., 2020). This is one of the reasons why public participation in land consolidation in the rural community of Europe seems generally better than that in China. For example, some parts of China have not established a sound public participation mechanism for land consolidation at the level of policies or regulations, and lots of villagers have not developed the awareness of actively participating in local planning projects (Wang, Chen & Li, 2018). What is more, the formulation and implementation of land consolidation schemes in Europe are always explicitly associated with village renovation/renewal and regional planning (Demetriou, 2014). In other words, RLC planning is not only regarded as an important part of regional land use planning, but also closely connected with regional and village strategic development. For this, the RLC process in many European villages involves people from different backgrounds, such as government officials, land surveyors, lawyers, rural planners, engineers, agronomists, environmentalists, economists, geographers, and most importantly, the direct land-owning stakeholders themselves. Although the Chinese government advocates multilateralism in planning projects, due to the reason that China has not yet implemented and practiced formal land consolidation for a enough time, the society is not used to a bottom-up process and multilateralism in rural community-level planning is still in the exploratory stage of theory and practice (Land Consolidation and Rehabilitation Center of the Ministry of Land and Resource, 2017). Moreover, as concerns the content of land consolidation and the main approaches involved in it, land ownership adjustment (as mentioned in Chapter 4) is a key component of the process. However, due to differences in the land tenure system – i.e. rural land is mostly privately owned in Europe (Hartvigsen, 2014), and it is collective or state-owned in China – land consolidation in rural Europe usually involves the adjustment of land *ownership*, while it in China usually only involves the adjustment of land *use rights*. This further leads to the fact that the approaches applied to RLC projects in Europe are usually voluntary or majority-based (Hartvigsen, 2014). Although there are voluntary land parcel exchanges among villagers in rural China, mandatory and majority-based approaches predominate in most cases (Jiang et al., 2022b; Liu & Zhao, 2019). This is why such projects have not only failed to achieve the desired results in parts of rural China, but also

had a negative impact (Yuan, 2020; Zheng & Ding, 2013).

Moreover, although standardised processes, the active participation of stakeholders, and advanced technologies can promote the smooth development of land consolidation, policy support is also essential, particularly for projects which require government investment in public services and construction. This is why China and most countries in Europe have increasingly given high priority to land consolidation at the policy level (Jiang et al., 2022b). However, although some Western European countries have provided excellent examples as well as financial and technical support to the development of RLC, the implementation of land consolidation projects in some Central and Eastern European countries is not optimistic or stagnant due to unstable political environments or inappropriate political decision-making (Bažík & Muchová, 2015; Hartvigsen, 2015; Muchová et al., 2017).

In general, the definitions of RLC in China and Europe have undergone a transitional process from simple rural land consolidation (SRLC) to comprehensive rural land consolidation (CRLC). However, the standardisation of the process, the local communities' abilities to drive it, and public participation in European RLC practice, especially in Western Europe, are generally better than in rural China due to the advance of legislation and the accumulation of experience having had more time to develop in the European practice of land consolidation. At the same time, the RLC planning of rural communities in Western Europe is usually combined with regional strategic planning to promote the overall development of the region. At present, China is carrying out territorial spatial planning throughout the country, in which territorial consolidation (i.e. comprehensive land consolidation) is regarded as an important component (Wang & Hu, 2020). However, further theoretical research and practical exploration are still needed for community-level land consolidation to be embedded in the process of territorial spatial planning at the regional level (Liu et al., 2021; Zhou et al., 2021). Furthermore, compared with certain areas of Central and Eastern Europe, China has a more stable political environment and has given priority to land system reform for a long time (Jiang et al., 2022b). This is the reason for the rapid development of China's RLC.

10.4.4 Recommendations concerning RLC based on the lessons learned

Based on the observation, communication, discussion, and analysis concerning RLC and rural development in some villages of rural China, especially Jinzhuang and Dongheng, several implications should be emphasised while addressing the issues accompanying land use and rural development; in this way, the practice of land consolidation in other rural areas, at home and abroad, with similar situations might be improved by lessons learned.

First of all, RLC should not be an isolated policy or land engineering, but should be combined with the subsequent construction of facilities and supporting industries. Land is the spatial carrier of rural development (Long, 2020; Long & Qu, 2018), and the way land is used is thus crucial to local development. The type and intensity of RLUFs need both to be considered in land consolidation planning. If the function type is inappropriate, the stronger the function intensity, the more likely it is to negatively impact local sustainability; likewise, inappropriate function intensity may not be able to be mitigated by diversifying function types. Dongheng Village is a good example of this. Before the implementation of land consolidation, the area of exposed mines increased year by year. Although it brought attractive economic benefits, it also further aggravated the deterioration of the eco-environment, the decline of socio-cultural construction, and the deterioration of residents' health. Land use policy also plays a vital role in the smooth implementation of land consolidation and subsequent rural development (Long et al., 2012). The success of Dongheng Village illustrates this point. By taking advantage of the national land system reform, Dongheng Village has successfully realised the transformation of rural development and promoted local vitalisation by making full use of two major land policies of the reform: the "increasing vs. decreasing balance" and the "right-of-use transfer" of rural collectively-owned construction land, both on a CRLC platform. The advantages of existing land policies should therefore be fully considered in the implementation of land consolidation projects. Moreover, land, population, and industry are the core elements of rural development (Long, Zhang & Tu, 2019), and as such rural restructuring without reasonable industrial support may be ineffective (Long & Liu, 2016), given that it can cause resource wastage and aggravate the depopulation of rural areas. In the process of RLC, Jinzhuang Village and Dongheng Village have introduced relevant industries to

suit their local conditions, which has not only promoted local economic development and indigenisation of villagers' employment, but also improved the original shabby appearance of the countryside.

Moreover, giving full play to the role of rural elites inside and outside the local administrative system in RLC practice is of great significance to rural vitalisation (Guo & Wang, 2019; Li et al., 2016). In Jinzhuang Village, the current village secretary (*Mr. Jin*) has the dual role of village cadre and squire. *He*, in collaboration with other village officials, has been serving villagers for a long time, working to lift them out of poverty and promote the overall economic development of the village. His reputation in this regard as a locally-respected and trusted figure went some way toward the villagers approving the RLC project he supervised. This is why the RLC project under his supervision was easily approved by the villagers. Dongheng Village, through the concerted efforts of the village cadres and gentries, has achieved a win-win situation in which the government's requirements were implemented, villagers' interests were safeguarded, the village environment was improved, and collective power was strengthened. The households of the major grain producers have also actively made contributions to the projects in both villages. For instance, they rented farmland from other farmers to carry out large-scale production through land transfers. This not only promoted agricultural efficiency, reduced labour demand for food production, and increased the economic income of farming households, but also provided sufficient labour to develop other more economically-valuable local industries, such as tomatoes and pianos.

Farmers' wishes should also be fully considered in the implementation of land consolidation (Wang, Zhang & Cheong, 2014b). Farmers are the most direct stakeholders in rural land use, while the purpose of RLC, from a functional perspective, is to bridge the gaps between the supply and demand of and for functions/types of rural land use from the supply side. It has been noted by many studies (Li et al., 2019; Wang et al., 2019; Zhang et al., 2019) that the successful implementation of RLC must give priority to the bottom-up approach and depends on the extent to which farmers' demands and aspirations are acknowledged and met. This is because farmers will not participate actively until their interests and needs are adequately attended to. For example, the RLC projects implemented in Jinzhuang and Dongheng have not been without

concerns, but their successes were achieved through constant discussions with farmers to dispel their doubts and worries. Moreover, the focus of rural development should not always be solely on economic development, but on the strengthening of humanistic care, such as paying more attention to the physical and mental health of farmers. The health of farmers is the key to the healthy development of rural areas and a prerequisite for promoting local sustainability.

Additionally, RLC has gradually shifted from simple RLC focusing on a single function to a comprehensive tool that promotes coordinated development among regional multi-functions in China (Jiang et al., 2022; Zhang & Tan, 2021). This also means that the impact of land consolidation on all aspects of regional development needs to be valued. The social, economic, and environmental impacts of land consolidation have been widely studied (Jin et al., 2016; Zhang, Zhao & Gu, 2014; Zhong et al., 2020). Properly-implemented land consolidation projects are generally considered to have a positive socio-economic impact, but scholarly opinion is divided on the degree of their eco-environmental impact (Crecente, Alvarez & Fra, 2002; Ge et al., 2018; Li, Wu & Liu, 2018; Zhou, Guo & Liu, 2019). Some research has proven that land consolidation projects are not conducive to the ecological service value (i.e. the ecological function) (Wang et al., 2015), while it is observed in some studies that the impact on the local eco-environment is now trending in a positive direction (Wu, Feng & Zhou, 2019; Zhou, Guo & Liu, 2019). Besides, the degree of impact of a land consolidation project on local development also depends on the stage, scale, location, and type of the project (Zhong et al., 2020). The field investigation in Jinzhuang demonstrates that although the villagers interviewed are satisfied with the current eco-environment, local land consolidation has led to the fragmentation of the local farming landscape, a reduction of the area of ecological land, and the increased and extensive use of fertilisers by farmers. These results are detrimental to the sustainability of the local eco-environment. Considering that the impact of land consolidation, especially its eco-environmental impact, is difficult to obtain through short-term observations and that some farmers may lack sufficient knowledge of ecological protection, the potential eco-environmental risks brought by land consolidation projects and the subsequent land use patterns need to be attended to by the planners and managers (Jiang et al., 2021). The following are a few responses that may prove effective. First, it

is necessary to conduct a third-party assessment of the effects of land consolidation. Second, reforming the household registration system and establishing a site-specific soil quality monitoring system may be a fundamentally-important path to reducing the usage of chemical fertilisers (Zhang et al., 2020). Education programs that focus on teaching farmers how to apply pesticides and fertilisers appropriately to effectively achieve the desired results can also be helpful (Zhang et al., 2017; Zhou & Jin, 2009). Besides, promoting the transfer of agricultural land to promote agricultural modernisation and mechanisation, as well as strengthening the protection of ecological red lines, are effective ways to protect ecological space (Jiang et al., 2021).

Moreover, accessibility to major cities may have a significant impact on local land consolidation strategies, particularly on those located in plain areas. On the one hand, appropriate land consolidation strategies are necessary to strengthen agricultural production in villages that are far from major cities and lack distinctive cultural or natural resources. The main proposed strategies are as follows. First, it is necessary to improve agricultural production conditions, such as soil fertility, transport conditions, and irrigation facilities, through land engineering. Second, sufficient land should be provided for the development of special agricultural products via land supplement and/or conversion, thereby creating higher economic value. Third, by promoting cooperation among local villages, regional special industries can be developed and new businesses combining agro-tourism can be created to enhance market competitiveness. In this process, land consolidation can be used as a platform for cooperation among villages to improve the layout of regional production, living and ecological spaces. However, it is often important to start these measures from the premise of guaranteeing local food security. This is because rural areas, especially those far from major cities, are the foremost producers of foods such as cereals and grains, and villages are often considered to be self-sustaining units of habitation.

On the other hand, for rural villages close to major cities, land consolidation can be used to promote local industrial transformation and in situ townisation. First, as land resources are scarcer and the relationship between people and land is tensive in villages close to major cities than in villages far from them, it is appropriate for villages in general to promote the vertical development of local buildings rather than the traditional horizontal expansion. Second, through the

reclamation of dilapidated factory buildings and old abandoned houses, as well as the vertical development of new rural housing, some space can be made available for the development of valuable secondary and tertiary industries. Third, tourist-oriented ecological agriculture can be developed in conjunction with agricultural land consolidation to enhance the economic and environmental benefits of agricultural production. Fourth, land consolidation can be used as an opportunity to create conditions for the promotion of industrial transformation, thereby driving local employment and promoting village renovation. On this basis, local rural developmental policies can then be combined to promote what local urbanisation is possible, thus slowing down the rapid expansion of cities.

Furthermore, based on a comparison of the Chinese and European experiences in RLC, it was found that the provision of sure political guarantees, the continuous improvement of the laws and regulations related to land use, especially RLC, the adoption of a combination of multiple methods in practice, the conducting of relevant educational activities, and the promotion of public participation are also important to facilitate the implementation of RLC projects and the achievement of desired objectives (Jiang et al., 2022b). The latter three are particularly vital for land consolidation at the community level.

10.4.5 How should land consolidation respond to the next potential lockdown?

The COVID-19 pandemic, which began in late 2019, has rapidly swept the world, causing prolonged lockdowns in most countries and regions, especially in densely populated areas. Africa and Asia are home to 90% of the world's rural population (United Nations, Department of Economic and Social Affairs, Population Division, 2019), the vast majority of whom rely primarily on smallholder subsistence agriculture for their livelihoods (Baez, Kronick & Mason, 2013). Prolonged lockdowns often make it difficult to ensure the smooth operation of logistics and supply chains, leading to food security being a key concern for most people and facilitating discussions on potential shifts from reliance on long food supply chains to shorter, more localised ones (Laborde et al., 2020; Lusk & Anderson, 2020; Niles et al., 2020). What is more, agricultural products and supplies in less-developed countries have been more affected by COVID-19 than in developed countries (Laborde et al., 2020). As of today,

nearly three years after the outbreak of COVID-19, it is still affecting human activities from the local level to the global (Clemente-Suárez et al., 2021).

Land consolidation has been regarded by many countries as an important tool in the promotion of rural development and sustainability (Long, Zhang & Tu, 2019; Pašakarnis & Maliene, 2010; Sallaku et al., 2010; Veršinskas et al., 2020). The development of RLC activities can help make rural areas more resilient in the face of risks. For example, at the height of the epidemic, although some Jinzhuang workers' activities were disrupted, the rise in tomato prices during the epidemic reduced its impact on some households' income to some extent, which was made possible by greenhouse-led land consolidation. The piano industry in Dongheng Village, during the peak of COVID-19, was affected by reduced domestic and international demand as well as by the fact that factories could not come into operation on time; however, the reclamation of a large amount of abandoned mining land allowed Dongheng Village to carry out normal agricultural activities during the epidemic, thus ensuring food security and partially covering losses of income. Therefore, land consolidation needs to be given greater emphasis and mission in the context of global public security to respond to the possibility of more serious lockdowns in the future. This has important implications for strengthening the resilience of local development and further promoting sustainable local development.

At the local level of less developed countries, rural land consolidation can with the basic principle of ensuring regional food needs in mind (Asiama, Bennett & Zevenbergen, 2017; Thapa & Niroula, 2008), and that local people can survive by growing crops locally in emergency situations. Secondly, education and the promotion of agricultural culture can be carried out in conjunction with land consolidation projects. In the Global South, urban populations are mostly migrants from rural areas. Urban areas do not have the vast and plentiful arable land that rural areas do, but open spaces such as gardens and parks in urban areas can still provide space for food production. If even those urban residents who originally moved to the city from the countryside lack basic farming knowledge, they and their neighbours will still face serious food insecurity during a more severe lockdown, even if there are sufficient open spaces available for food production.

The fact that certain advanced agricultural production techniques such as

soilless cultivation and aquaponics are at present relatively well-established must be acknowledged; however, due to difficulties in some aspects such as technology, financial investment, and management, they are not widespread in most developing regions, and agricultural production on arable land remains the dominant method of food production in the vast majority of the Global South and a part of the Global North.

Therefore, given the impact of lockdowns due to COVID-19, land consolidation, both urban and rural, could be appropriately employed to increase resilience at the local level in the face of risks such as potential food insecurity, the purpose being to prepare for potential future lockdowns resulting from other emergencies.

10.5 Chapter summary

This chapter began with a comparison of the similarities and differences between the two villages in terms of the purposes, influencing factors, and effects of land consolidation. It was found that, due to the particularities of their geographical locations and resource endowments, the focuses of RLC in the two villages were not the same and the effects were consequently different. Following an analysis of supply and demand with regard to RLUFs and RLUTs, this study then proposed strategies for land use restructuring in both villages. It was further revealed using a combination of the case studies, field investigations in other areas, and a literature review that RLC is not always beneficial to local development and that unreasonable measures can in fact be counterproductive in some regions. While land consolidation has promoted the overall level of development in both case areas, it has also concealed problems that may affect their further development, such as inadequate management and a deficit of desire among younger generations to take over management from older ones of what local industrial development has been established through land consolidation. A comparison of RLC practices in China and Europe was then made. This chapter then highlighted several implications for addressing those issues which accompany land use and rural development based on lessons learned, and also made several recommendations in terms of land consolidation for villages close to and far from major cities, respectively. Finally, a brief analysis and discussion

were provided on the question of how countries and regions of the Global South might adapt RLC practices in light of the potential for future major lockdowns.

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Chapter 11 Conclusion and further research

11.1 Introduction

This concluding chapter first highlights the innovations of this research and key findings of the thesis. The second section discusses the research limitations and how further research might overcome these. Finally, a brief summary of this thesis is made in the concluding remarks.

11.2 Research outcomes

The thesis aims for advancing the understanding on the relationship between rural land consolidation (RLC) and village development to be used as a reference point to support RLC planning at the village level. It is proposed to achieve this aim by completing the work under the five objectives mentioned in Section 1.3. Thus, the findings and contributions of the work are summarised under five objectives. They are further integrated to conclude the research questions of this study to answer.

Objective one: To critically review the literature on multifunctional land use, rural vitalisation, and land consolidation, as well as to analyse the relationship between the three concepts (Chapters 2, 3, and 4).

The literature demonstrates that 'multifunctionality' was first introduced in Western Europe in forestry development, then subsequently made its way into agricultural and rural development. Since then, it has gained importance as a new way to achieve sustainable development and to provide fresh insights into agricultural and rural development. The phenomenon of the shift from monofunctional rural development to multifunctional rural development is known as the 'multifunctional rural transition'. Land use, as an important human activity that determines the performance of the environmental, economic, and social functions provided by ecosystems, is considered to be the mirror of socio-economic development. The concept of 'land use multifunctionality' (LUM), with the development of Land Change Science/Land System Science (LCS/LSS), was introduced and highlighted as a way through which to learn about and address the effects of land use on rural change and sustainability. Moreover, the

long-term imbalance between the supply and demand of and for rural land use functions (RLUFs) is considered to be one of the main causes of rural decline (as outlined in Chapter 2).

Rural areas provide a variety of services and resources for human development. With the pace of urbanisation accelerating worldwide, the phenomenon of rural decline has been significant in the past few decades, especially in developing countries such as China. As a response, 'rural vitalisation' (RV) has been proposed by the Chinese government since 2017 as one of the most important national strategies to alleviate the contradiction between unbalanced and inadequate development and people's ever-growing needs for a better life. Meanwhile, the development and evolution of rural China are closely linked to land use and the reform of its land system. In contrast to multifunctional rural development, RV is a development strategy which calls for the full development of predominant functions and synergy between different functions based on the diversity of rural development (as outlined in Chapter 3).

Land consolidation has been widely recognised as an important and multifunctional toolbox in the resolution of rural issues. This is because land consolidation is able to qualitatively and quantitatively influence the multifunctional output of land use by changing its morphology in order to meet rural developmental needs for RLUFs. The implementation of rural land consolidation (RLC) is influenced by various factors, and its forms and approaches taken are thus varied. There are three main approaches to classifying RLC: based on the desired outcomes, it can either be classified as simple rural land consolidation (SRLC) or comprehensive rural land consolidation (CRLC); considering target objects, RLC can be classified as being agricultural land consolidation, construction land consolidation, or idle land development; from the perspective of decision-making, the main approaches are voluntary, compulsory, and majority-based. China's RLC, with reference to national rural land policies, has gone through its production function and multifunctional stages, and is currently in the comprehensive stage, in which the main objectives are ensuring food security, narrowing developmental gaps between urban and rural areas, and conserving the eco-environment (as outlined in Chapter 4).

It is found that increasing number of studies have begun to focus on the relationship between land consolidation, rural development, and

multifunctionality, but research gaps still remain. For example, few studies have discussed the supply and demand relationship between RLC and rural development within the same framework; theoretical studies concerning the interrelationship between the two are more often conducted from a multi-factor perspective, while studies from the perspective of a single factor, such as land, remain rare. Additionally, scholars are increasingly targeting their research on the mechanisms and modes of RLC on rural vitalisation from various perspectives, but relevant research from a comparative perspective needs to be strengthened in order to better inform other regions in similar situations. Moreover, previous studies on RLC and rural development have focused more on macro-level policy optimisation but lacked attention to land use optimisation at the micro-level, making it difficult for their research results to provide concrete guidance for future local-level land consolidation planning and practice.

Objective two: To construct a theoretical model to systematically analyse the relationship between RLC and RV from a multifunctional perspective at the village level. This theoretical model integrates a conceptual framework for promoting RV via the implementation of land consolidation projects with a measurement framework for assessing the effectiveness of RLC on RV and the supply-demand of and for RLUFs (Chapters 5 and 6).

This is the first attempt to analyse the supply-demand relationship between rural land consolidation and village development in a multifunctional framework. The literature reviewed so far has not produced such a theoretical model. Many studies that aim to analyse the impact of RLC on rural land use and RLUFs focus only on a few land consolidation types and land use types, whereas this study attempts a theoretical model incorporating all presently-existing land consolidation types and land use types. Also, this new theoretical model complements the existing understanding of the interrelationship between land consolidation and rural development from the perspective of multifunctional land use. Specifically, this theoretical model is comprehensive, because it includes a conceptual framework for qualitatively analysing and a measurement framework for quantitatively analysing the interrelationship between RLC, RV, and multifunctionality at the micro-level; the model is made flexible for adapting to the realities of a given research context and allowing stakeholders and planners to decide the weight given to each evaluation factor in a particular

project; the model is also reliable because it has been tested and compared using cases in two different areas. As a result, the new theoretical model is more adaptable than existing models for case studies where the supply and demand of and for land use functions are analysed separately, and depending on the objective of evaluation, the model can be customised to only consider the impact of a certain type of RLC on local development.

Additionally, a new weighting method has been developed for weighing the different indicators that reflect demand for RLUFs. The method combines the expert scoring method with the villager scoring method, in which visionary villagers, local rural experts, and scholars who are engaged in Chinese rural research with a certain understanding of the case area are selected to assign values to different indicators (see Section 6.3.2 and 7.3.4). In China today, some villages or rural areas with bright prospects are often concerned not only with the development of their villages locally but are also actively involved in regional and international markets (Li et al., 2019; Long & Woods, 2011). This assignment method can combine the local expectation with the regional expectation, thus reflecting the comprehensiveness of the weighting method.

Besides, previous researchers have often used the same indicator system for different case areas in the same study, which may be more appropriate for evaluating and systematically comparing multiple cases. However, field investigations in rural China have shown that the relationship between land consolidation and rural vitalisation varies across different types of villages, especially in quantitative analysis. In practical research, it is reasonable to construct a general index system for large-scale measurement based on theoretical analysis, but in micro-level case studies, the selection of individual indicators and indicator weights needs to be adjusted accordingly. It should be noted that such an evaluation may be more appropriate for evaluating a case chronologically than systematically comparing multiple cases.

Moreover, adopting a comparative approach combining qualitative and quantitative methods can help us to more accurately evaluate the impact of RLC on local development and changes in the RLUFs supply-demand, as well as reflect changes in the degree of impact with reference to proximity to major cities.

Furthermore, the theoretical model constructed in this study, especially the conceptual framework, can be used as a reference when making suggestions not

only for land consolidation and rural development in other regions of China, but also for related research and projects in other developing countries and regions.

Objective three: To qualitatively analyse the processes and modes of the impact of RLC on two geographically diverse villages during the period 2010-2020 (Chapters 7 and 8).

The villages selected for the case study were Jinzhuang Village, Yucheng City, situated far from the nearest major cities of Jinan and Dezhou, and Dongheng Village, Deqing County, situated close to the major cities of Hangzhou and Huzhou. Both of the selected case areas are ordinary but somewhat distinctive villages in their local regions and can be said to generally reflect the common characteristics of their regions (see Section 7.2).

The implementation of RLC has led to dramatic changes in land use and spatial restructuring in both villages, which in turn has led to industrial transformation. In Jinzhuang Village, the land consolidation aimed at developing space for greenhouses (i.e. greenhouse-led land consolidation) has converted a large amount of farmland into greenhouse vegetable land, driving a shift from cereal cultivation and migrant work to tomato cultivation as the main source of income for local residents. Meanwhile, the village community has been able to earn a considerable income by renting out vegetable greenhouses and running their own agricultural companies. In addition, construction land consolidation was adopted to improve the residential environment and ecological space. Based on the field investigation and analysis, it is concluded that the development of Jinzhuang belongs to the "intensity-adjustment" mode; that is, by reducing the intensity of farmland while increasing the intensity of greenhouse vegetable land, the sustainability of the local economy has been promoted, thereby laying the foundation for the development of other aspects (see Section 8.2).

In the case of Dongheng, the emphasis of local RLC has been on construction land. This is reflected in the conversion of a part of the flattened abandoned mine into other lands such as residential and industrial lands as well as the restoration and reclamation of a part of the abandoned mine. These projects have improved the living conditions and ecological environment of Dongheng and provided space for cultural development. In addition, the transformation of local industries has been promoted. In agriculture, large-scale agricultural production has been promoted through land transfers and mine

reclamation; the development of the secondary sector has been further promoted from the highly-pollutive mining industry to the piano industry with low pollution and high brand value; and tertiary sectors such as tourism, art exhibitions and piano-making technique training have been developed. In general, the development of Dongheng has been dominated by the "type-conversion" mode, which has driven the spatial restructuring and industrial transformation of the village, and it in turn has led to the overall vitalisation of the village (see Section 8.3).

Furthermore, the experience of both villages reflects the importance of land tenure adjustment to the results of rural land consolidation. In both villages, the majority of villagers have transferred the use rights of their agricultural land to the village collectives. In this way, the village collectives were able to carry out subsequent projects such as land levelling and infrastructure construction, thus laying a solid foundation for the large-scale operation of agriculture and the centralisation of industrial enterprises. This is crucial to the current local economic and social development of China's rural areas.

Objective four: To quantitatively analyse the impact of RLC on local development and the supply-demand of and for RLUFs, and further reveal the influencing mechanisms of RLC on RV in the two case areas mentioned above (Chapter 9).

In terms of the effectiveness of RLC on village vitalisation, it was found that the implementation of RLC has promoted the development of the two villages overall, but that its specific effects have been different. In Jinzhuang, the implementation of RLC has promoted the development of industry, life, governance, and culture, but the value of the environmental index continued to decline over the decade studied. Interestingly, although the ecological quality has dropped since the shrinking of ecological space and the overuse of fertilisers, respondents' views on the overall environment, gleaned during the field investigations, were almost positive. This is in large part due to the successful implementation of construction land consolidation and the development of unused land, which has resulted in what was once a chaotic living space becoming tidier and more comfortable. In Dongheng, a notable feature of the influence of RLC on local vitalisation is that all but the governance indices continued to rise during the decade studied; the governance index dipped

between 2010 and 2015 but increased to a level higher in 2020. This is mainly because the reduction of farmland within the village in the first five years was reversed in the second five years with the completion of the mine reclamation (see Section 9.2).

Another interesting finding is that the environmental and governance indices of the two villages have their lowest values in 2020 compared with the other three indicators (i.e. industrial, life, and cultural indices), although the values of almost all the indices have increased over the decade and the values of the environmental and governance indices were not the lowest in 2010. This suggests that the current contribution of RLC to the eco-environment and local governance is still relatively limited. RLC projects, except for the ones that only focus on ecological restoration, usually have a negative impact on the eco-environment in the early stages, which makes it difficult to increase the index value significantly even if the ecological environment is subsequently restored and improved. In the case of governance, it is usually difficult to implement a project that satisfies all villagers. Thus, the changing demands of local development for RLUFs lead to a certain lag in the implementation of governance and therefore also affect the value of the governance index (see Section 9.2).

Evaluating effectiveness helps us to understand the impact of RLC on various aspects of village development. It can provide direction for the formulation and implementation of land consolidation projects in the next stage, but lacks the ability to provide a reference point for the formulation of specific land use plans. In this case, it is necessary to analyse the supply of and demand for rural land use functions/types, because this helps us to understand the status of the usage of different rural land use functions/types, which can then be referred to in the next phase of land use restructuring; it is thus one of the most important parts of a land consolidation project.

The analysis results from Jinzhuang show that, during the three periods studied (2010, 2015, and 2020), almost all functions, except for the employment and maintenance functions, were in short supply; the supply-demand gap between residential, public service, employment, and commercial functions were widening; and the imbalance between supply and demand in the agricultural production function was most pronounced. In Dongheng, the

imbalance between the supply and demand of and for RLUFs was similar to that in Jinzhuang. There were, however, differences: in Dongheng, the most pronounced supply shortage was in the industrial production function, and there were decreasing trends in short supply in agricultural production, employment, and residential functions. As shown, the strongest demand in both villages is for economic benefits and the gap between supply-demand was most evident in the production function. This is consistent with the fact that China is still in a stage of rapid development and there is a huge demand for economic benefits (see Section 9.3).

Moreover, the results from the supply-demand analysis of both villages show that, whether in traditional rural villages far from major cities or in developed villages that have achieved industrial transformation in proximity to major cities, the production function provided by local land use has been in a state of insufficiency during the beginning of its rapid development. This indirectly reflects the need to continue to promote the modernisation of China's rural areas and the large-scale mechanisation of rural production, as well as to promote the diversification of farmers' incomes in order to stabilise and increase their overall income. This is because the intensity of local development's demand for production functions is likely to stabilise or decrease when the overall economic strength and per capita income levels reach a certain scale. According to Maslow's hierarchy of needs (Maslow, 1943), people are likely to turn their attention to non-material aspects such as culture, knowledge, and the arts when their material conditions are largely met.

Furthermore, the relative success of RLC and the subsequent vitalisation of Dongheng were mainly contributed to by the combined effect of policy support, solid industrial foundation, superior resource endowment, and the efforts of local elites. Somewhat differently to Dongheng, the implementation of RLC in and local development of Jinzhuang were the result of a combination of geographical location, market demand, policy support, and the efforts of local elites (see Section 9.4).

Based on the elaboration, evaluation, and analysis of these two cases, other rural areas with similar characteristics can draw lessons from them. For example, other rural areas might ask themselves what the key factors are which might be stimulated to make land consolidation maximally conducive to local

development. We also need to not ignore some of the negative impacts of RLC on local development because, if the idea and measures of comprehensive land consolidation are adhered to, some of the negative impacts will be eliminated with the completion of the project.

Objective five: To compare RLC and rural development in the two villages, propose land use strategies for their future development from the supply side, and summarise the lessons learnt and make recommendations (Chapter 10).

The two case areas were compared and contrasted in terms of the purposes of conducting land consolidation, the factors which influenced the project development, and the effectiveness of RLC. Due to their disparities in geographical positions and resource endowments, and divergent developmental pathways, their objectives and focuses with regard to land consolidation differ. On the one hand, because of the distance from major cities, the lack of a secondary and tertiary industrial foundation, the positive development of greenhouse vegetables in Shandong Province as well as the growing demand for organic vegetables, agricultural land consolidation led by greenhouse development has emerged in Jinzhuang and its surrounding villages. However, since land consolidation in Jinzhuang Village is still in the process of transformation from simple land consolidation focusing on economic and some social benefits to comprehensive land consolidation, the local ecological environment has even further deteriorated in quality during the ten years of RLC. Conversely, with its advantages of proximity to major cities, larger village area, rich cultural heritage, and solid industrial foundations, Dongheng Village has successfully achieved the general development of its economy, culture, governance, and environment through CRLC. Moreover, the successful implementation of RLC in both villages is largely the result of policy support and the efforts of local elites (see Section 10.2).

Based on the results of field investigations and the aforementioned analysis, this study proposes land use strategies for both case areas. In Jinzhuang, there are three approaches to be taken. First, it is reasonable to reduce the footprint of residential dwellings by increasing the number of housing levels, thus converting the vacated residential land into land for public administration and services, infrastructure, greenhouse vegetable land and/or ecological land. Second, Jinzhuang can convert part of its farmland into greenhouse vegetable land. Third,

one forward-thinking measure could be to further convert a small portion of the greenhouse land into land for the processing of fruits and vegetables and for research, as this could help to further expand its chain and product reach. Turning to Dongheng, there is a need to continue to convert some undeveloped land into farmland and industrial land in order to promote local industrial development. In terms of residential land, in a strategy similar to the one pursued in Jinzhuang, the scattered natural villages could be appropriately clustered for the provision of public service facilities (see Section 10.3). However, several potential concurrent drawbacks were identified in the course of the RLC in the two villages, such as inadequate regulation and environmental pollution concealed by local prosperity in Dongheng, as well as farmers' physical problems and industrial bottlenecks in Jinzhuang. The amelioration of these issues needs to be supported by forces other than RLC, such as social forces, entrepreneurship, and villagers' efforts (see Section 10.4.2).

Related research (Liu et al., 2018; Wang & Wu, 2013; Zhou & Wang, 2015), this study, as well as the author's surveys in rural areas of China in addition to these two villages, all show that inappropriate RLC projects in some places constrain local development and provide few contributions – if any – to local vitalisation. Some recommendations have been put forward to give full play to the role of RLC in local development. First, RLC should not be an isolated policy and land engineering, but be combined with the subsequent construction of facilities and supporting industries. Second, giving full play to the role of rural elites inside and outside the administrative system in RLC practice is of great significance to local vitalisation. Third, there is a need to continue to promote a shift from a SRLC mainly focused on a single function – generally production – to a CRLC which promotes multifunctional and synergistic regional development. This also means that the impact of land consolidation on all aspects of regional development needs to be valued. Further, accessibility to major cities may have a significant impact on local land consolidation strategies, particularly in the plains. For villages that are far from large cities and lack distinctive cultural or natural resources, appropriate land consolidation strategies are necessary to be taken to strengthen agricultural production; in rural villages close to large cities, land consolidation can be used to promote local industrial transformation and in situ townisation (see sections 10.4.1 and 10.4.2). Moreover,

based on a comparison of the Chinese and European experiences in RLC, it was found that the combination of multiple approaches in practice, appropriate education and publicity, and active public participation, are also important for the success of RLC projects at the community level.

By achieving these five objectives, the two research questions – *Can land consolidation promote the vitalisation of rural villages in Eastern China? What factors influence the effectiveness of land consolidation to achieve RV at the villager level?* – are answered. First, the above results show that land consolidation can and has been contributing to the vitalisation of rural villages in the eastern plains of China during the study period (2010-2020). However, due to their disparities in geographical positions, resource endowments, developmental pathways, the effect of RLC may vary from place to place, and its impact on different aspects of the same village, such as industry, governance, and environment, may also vary. Second, the effect of RLC on the promotion of village development is a product of the combined effect of intrinsic factors (such as natural endowments, geographical position, and local elites) and extrinsic factors (such as market demand, policy, and industrialisation). The contribution of RLC to the development of Dongheng is the result of the combined effect of policy support, solid industrial foundation, superior resource endowment, and local elites' efforts. Although the effect of land consolidation in Jinzhuang is not so successful when compared with that in Dongheng, the overall development of Jinzhuang has been promoted by land consolidation under the combined effect of geographical location, market demand, policy support, and local elites' efforts.

Overall, this is the first attempt to establish a theoretical model for a comprehensive analysis of the relationship between land consolidation and rural development from a multifunctional perspective. This thesis then provides insight into this relationship at the micro level via the combination of the theoretical analysis and case studies. Moreover, as planning from multifunctional aspects is now considered a more needed approach and CRLC is recognised as an effective tool in the realisation of sustainable development of rural areas, this study informed what is a better practice of RLC in China and to some extent in plain rural areas of other developing countries and regions. However, given the cultural context, this study may be of greater reference value to other Asian rural areas.

11.3 Limitations and further research

11.3.1 Research limitations

While this study provided new insights into the relationship between land consolidation and rural vitalisation from a multifunctional perspective, it has several limitations. Some are generic limitations related to the theoretical model constructed in the study; others are specifically related to the cases studied.

At the theoretical level, this study treats rural villages in China as self-sufficient individual units, thus making a meaningful and comparable comparison between the supply of RLUFs provided by RLC and the demand for RLUFs in village development. However, with socio-economic development, quite a few villages in China have been involved in local, regional and even global developmental processes, especially those that are economically developed. This suggests that the development needs of some villages cannot only be met by the functions generated by local land use, as this kind of village has placed its needs within the context of regional development. This demonstrates the limitation of the theoretical model in this study if it is only used to analyse the supply-demand of and for RLUFs at the village level. In order to resolve the above limitation, the theoretical model proposed in this study involves reflecting the impact of the development of RLC at a specific time on the relationship between the supply and demand of and for RLUFs, rather than merely reflecting the supply-demand balance of local RLUFs. However, this model does not take into account other factors that would have a significant impact on village development over other periods. This indicates the limitation of the referential scope of this model; that is, it is only applicable to those villages whose development is largely dependent on land consolidation projects within the villages at a certain stage.

Although the philosophy of the whole study is driven by the general concepts of and the relationship between land consolidation and village development, the constructed measurement framework specifically reflects the practice of land consolidation in China. Therefore, some parts and elements of this research, such as the cultural background, the weight assigned to each influencing factor in the measurement system, and some influencing factors involved in RLC praxes, are specific to RLC in China.

Regarding the methods, the supply-demand and effectiveness evaluation index systems (which are influenced by the author's academic background and field survey experiences in rural China) constructed in this study are reasonable on the basis of its theoretical analysis and might be used as a reference in other similar studies, but are not universally applicable. Another shortcoming is that this study has not gone into the minutiae of the potential functions that each land type may have. For example, in addition to the maintenance function, ecological land may also provide functions such as education and tourism.

In the case study, Dongheng and Jinzhuang represent only two types of villages in the eastern plains of China; namely, modern rural areas undergoing rapid urbanisation and traditional agricultural areas dominated by grain and vegetable production. Thus, the study does not apply to all of China's rural areas, especially with regard to some mountainous and hilly areas. Second, this study only analyses the decade of rapid development of RLC in two villages, but the needs for RLC may vary at different stages of rural development. This implies that land use morphologies and structures in different periods (such as the early period, rapid development period, mature period, decline period, and/or revival period) need to be further investigated since it would be useful to provide new insight into the RLC processes in diverse places. Moreover, analyses at different scales may yield different results; for instance, the two modes may undergo mutual conversion at different scales (see Section 8.4). Besides, due to a lack of availability of some data, this study failed to consider the impact of topographic changes, such as the hills in Dongheng, on the corresponding land use area. Although some unobtained data, such as topography and the development of piano enterprises, might have enriched the results further, the unobtained data would not have substantially affected the results. Furthermore, although this study attempts to include all relevant factors in evaluating the impact of RLC on village development, there may be some discrepancy between the calculated result and the actual situation. This is due to the fact that some data are derived from the subjective judgments of villagers and that assessment or verification is lacking. For example, the income they provide may often be lower than the actual amount due to a mentality of self-protection (Jiang et al., 2021). However, these facts suggest that the effects of RLC on village development may be far more complicated than explained in this study.

11.3.2 Further research

The limitations mentioned above suggest pathways of further development for improving the research into land consolidation and rural development in terms of theoretical analysis and case studies.

First, villages of different types and locations will have differentiated prospects in globalisation and rapid urbanisation. From a multi-type or micro-level perspective, more discussion on the relationship between village development and RLC which has diverse types and intensities is necessary (Jiang et al., 2022). In addition, the development paths of rural vitalisation and land consolidation are diverse and complex, all of which are non-linear evolutionary processes under the combined effect of multiple factors and show a high degree of heterogeneity worldwide (Asiama et al., 2021; Callesen et al., 2022; Holmes, 2006; Long et al., 2022). It would therefore be meaningful to summarise the regularity of multifunctional development and vitalisation of various types of villages in different regions. This is because it helps to look at villages where the evolutionary process and its influencing factors are more complex than land consolidation alone.

Then, given the complexity of the relationship between land use and rural development, there is a need to quantify the coupling and synergistic relationship between the RLUFs supply-demand and rural development based on regional differences. It is well known that data are often the basis of research. Therefore, the relevant index systems representing the multifunctionality of rural areas and evaluating the impact of RLC on rural development can be further improved via data mining, in order to improve the scientificity and accuracy of the evaluation. In order to build solid, reliable, and scientific data sources for future studies, long-term, dynamic, and continuous databases concerning RLC, land use, and rural development, based on methods such as remote sensing images, big data, fixed-point observation, field investigation, and document consultation, could be established for research units or case areas at different spatial-temporal scales in representative areas (Jiang et al., 2022; Jiang et al., 2021).

Moreover, in terms of arrangements for land consolidation projects, the advantages of existing land policies and the interests of different stakeholders, especially farmers, should be fully considered in the implementation of land consolidation projects to promote the combination of bottom-up and top-down

approaches. Thus, based on the analysis of the supply-demand relationship of RLUFs at different spatial scales, scenario analysis can be adopted for different land use patterns to provide a scientific basis to adjust the land use structure to meet local or regional development (Jiang et al., 2022). In this scenario analysis, policy support, the demands of different stakeholders, and local resource endowments need to be analysed in combination. Furthermore, the lag effect of land consolidation on rural vitalisation (Ge et al., 2019; Shan et al., 2019) should be considered in further research.

11.4 Concluding remark

Although hundreds of articles have been written on the relationship between land consolidation and rural development, there is a lack of systematic comparative studies of this relationship at the micro level. The village is the basic social-economic unit of rural areas of many countries and regions and the basic site of the implementation of RLC projects, rural multifunctionality therefore usually starts at the village level. This thesis provides a theoretical model for analysing the relationship between RLC and RV at the village level. It involves both a conceptual and a measurement, which have been both tested and elaborated on in two case studies. The above study can serve as a reference point for further research on the relationship between land use and rural development in developing regions. However, what works in one place does not necessarily work elsewhere. Therefore, other developing places have the opportunity to learn from China's experience in rural land consolidation, as well as from that of developed countries, but any international and cross-regional transfer of experiences in rural development should not entail a 100% translation of the system, but rather be a modified system made to suit the local context.

Further, in view of the impact of lockdowns due to COVID-19 as well as the role of RLC in helping to strengthen resilience to the impact of COVID-19 in the two case areas, RLC needs to be given more meaning and purpose in the context of global public security and appropriate land consolidation projects could be undertaken to increase local resilience to cope with potential lockdowns and food insecurity resulting from other future emergencies.

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Appendix

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Appendix A

Outline of interviews with village cadres

关于中国土地利用与乡村发展研究的问卷调查

（村干部问卷）

Semi-structure interview with village officials on local land use and development

为贯彻落实中央农业农村优先发展的战略方针，探索乡村振兴的实现路径，中科院乡村地理研究团队与宁波诺丁汉大学合作拟开展中国乡村发展与土地利用情况的问卷调查，本次调查采用匿名的方式且不对外公布，但您的意见将作为学术研究和政策制定的重要参考依据，请您在百忙之中予以支持。

感谢您的积极参与！

In order to promote the implementation of the strategy of prioritising the development of agriculture and rural areas proposed by the Chinese central government, and to facilitate the realisation of rural vitalisation, the Agricultural Geography and Rural Development Research Team of IGSNRR and the University of Nottingham Ningbo jointly conduct a survey on rural development and land use. Your participation in the survey is voluntary. You are able to withdraw from the survey at any time and to request that the information you have provided is not used in the project. Any information provided will be confidential. Your identity will not be disclosed in any use of the information you have supplied during the survey. Your opinions will serve as an important reference for academic research and policy formulation. Furthermore, this research project has been reviewed according to the ethical review processes of the IGSNRR and the University of Nottingham Ningbo.

Thank you for agreeing to participate in this survey!

Rural Development and Land Use Research Group,
Institute of Geographical Sciences and Natural Resources Research,
Chinese Academy of Sciences

1. 村庄地址：___乡（镇）____村，距乡镇____里，距县城___里，距省会城市____公里，村庄地形为：____（1.平原，2.丘陵，3.山地，4.盆地）。

1. Village address: ____Village (Community), ____Township (Town); ____ km away from the town centre, ____ km away from the county centre, and ____km away from the provincial capital. The main topography in the village is (are) ____ (1. Plain, 2. Hill, 3. Mountains, 4. Basins).

2. 村庄总人口数：____人，常住人口：____人，劳动力人口：____，农业劳动力人口：____人，老年人口：____，大学生人数：____

2. The total population in the village: ____; the permanent population: ____; the number of laborers: ____; the number of agricultural laborers: ____, the number elderly population: ____; and the number of college students: ____.

3. 本村人均年收入约为：____万元，村民主要收入来源为：____；村集体集体经济年收入约为：____万元，主要来源为：_____。

3. The annual per capita income of the villagers: ___ thousand RMB, and the main source of their income: _____; the annual income of the village collective: _____ thousand RMB, and the main sources: _____.

4. 本村主要产业为：_____；农业结构：_____；有没有特色产业：_____。

4. The main industries of this village are: _____. Agricultural structure: _____. Are there any featured industries here? If so, what are they? ____

5. 村庄耕地数量：____亩，其中水田：____亩，旱地：____亩，林地：_____亩，人均耕地：____亩，土地流转规模：____亩，主要流转方式是：_____；规模经营农户：_____户，大概规模为：_____。

5. The amount of farmland in the village: __mu, of which paddy field: _mu, dry land: ___mu, and woodland: _ mu. Per capita farmland area: __mu. Scale of land transfer: __ mu, the main transfer method is: __. How many major agricultural production households: __, and how much land they operate: __

6. 是否开有农用地整治？具体有哪些内容？资金来源？新增耕地多少？有哪些成效？

6. Has the village carried out agricultural land consolidation? If so, what were involved? What's the funding source? How much farmland was added via agricultural land consolidation? What do you think of the results?

7. 本村农业生产哪些环节实现了机械化操作？哪些环节依然需要人工？当前，本村从事农业生产的劳动力主要类型是什么？本村农业生产有哪些典型的组织形式（例如：农忙外出人员返回、短期雇佣、互助合作等）

7. Which aspects of agricultural production in this village have been mechanised? Which aspects still require manual work? At present, what are the main types of labourer engaged in agricultural production in this village? What are the typical organisational forms of agricultural production in the village (such as the return of migrant workers during busy farming seasons, short-term employment, as well as the mutual assistance and cooperation.)

8. 本村现有宅基地_____宗，村集体成员现在是否还能申请宅基地？___（1.是，2.否），若可，需要给村集体缴纳_____元。本村宅基地富余还是紧缺：_____，本村空废房屋_____栋，一年中闲置半年以上房屋_____栋，在农村“一户多宅”的有____户，在城里买房，农村仍有住房的有_____户。

8. There are_____ homesteads in this village. Can young members of the village collective apply for new homesteads now? _____ (1. Yes, 2. No). If possible, they need to pay _____RMB to the village collective for the new homestead application. There are_____ empty and abandoned dwellings in this village, How many dwellings are left unoccupied for more than six months a year? How many households have two dwellings in the village?
How many households have bought apartments in the urban areas and still have a dwelling in the village?

9. 本村是否进行过宅基地整治？采用何种模式？资金主要来源于哪里？整治多少宗宅基地？是否对农户进行补偿，补偿方式是怎么样的？新增耕地多少亩？有哪些成效？

9. 1) Has the village carried out the residential land consolidation? 2) If so, what were involved? 3) What's the funding source? 4) How many old homesteads were demolished and/or reclaimed? 5) Whether to compensate the villagers? 6) If so, in what way? 7) How much farmland was added through residential land consolidation? 8) What do you think of the results?

10. 本村生产、生活、生态空间发生了哪些显著变化？有哪些公共文化空间？（如：老年活动中心、乡村图书室、文娱广场、戏台等）

10. 1) What are the significant changes in the production, living and ecological spaces in the village? 2) What public cultural spaces (e.g. activity centre, library, square, and cultural stage) are available in the village now?

11. 本村是否进行过工矿用地整治？有哪些具体整治内容？资金主要来源于哪里？整治后的土地用途是什么？新增耕地多少亩？有哪些成效？

11. 1) Has the village carried out industry and mining land consolidation? 2) If so, what were involved? 3) What's the funding source? 4) What has the consolidated land been used for or what will it be used? 5) How much farmland was added from industry and mining land consolidation? 6) What do you think of the results?

12. 本村是否进行过土地征收？征收地块主要为哪些用地类型？采取哪种方式进行补偿？土地征收后"拆迁户"生计有什么影响？后续政府/村集体有哪些稳定居民生计的措施？是否发生过冲突事件？征地耗时多久？

12. 1) Has there been any land acquisition in the village? 2) What types of land are mainly acquired? 3) What forms of compensation were adopted? 4) What's the impact on the livelihoods of the "relocated households" after land acquisition? 5) What subsequent measures have been taken by the government/village collective to stabilise the livelihoods of these residents? 6) Have there been incidents of conflict during the land acquisition process? 7) How long did the land acquisition take in total?

13. 本村是否有集体经营性建设用地入市？入市几宗？具体地块有哪些，原用途是什么？入市价格多少？收益如何分配了？

13. 1) Has any collectively-owned commercial construction land entered the land market? 2) If so, how many plots have had been leased or traded? 3) Where are these plots located in and what were their original uses? 4) At what price were they traded or rented out? 5) How were the benefits distributed or will be distributed?

14. "新冠"疫情对本村居民及村集体生产生活带来哪些影响？是否影响了农业生产？是否影响了劳动力外出务工，多少人因此滞留农村？是否影响了本村居民的非农生产？是否有本村人从城市返回本村避疫？

14. 1) What impact does "COVID-19" have on the production and living of the villagers and the village collective? 2) Has it affected the agricultural production in the village? 3) Has it affected the migrant work of villagers? 4) If so, how many people are stranded in the village as a result? 5) Has it affected the non-agricultural production of the villagers? 6) Has the development of land consolidation played any role in mitigating the impact of the "COVID-19"?

Appendix B

The questionnaire with village officials

不同年份村庄社会经济发展状况

Statistical table of village-level data in different years

	2010	2015	2020
人口数量（人） Total population			
耕地面积（亩） The total area of farmland (mu)			
耕地机械化率（%） Agricultural mechanisation level (%)			
平均粮食亩产(斤/亩) Average yield per mu per year (kg/mu)			
工矿用地面积(公顷) Area of industry and mining (ha)			
平均住房面积（平方米） Average housing size (m^2)			
木质、土坯住房比例（%） The ratio of wood and adobe housing (%)			
平均收入(元) Per capita income of villagers (RMB)			
高中及以上比例（%） The ratio of villagers with high school or above (%)			
垃圾集中收集率（%） Centralised garbage collection rate (%)			
图书室、展览馆、文化广场等面积(m^2) The area of cultural facilities such as the library, exhibition hall, and cultural squares (m^2)			
祠堂、庙宇、景点等数量 The number of ancestral halls, temples, attractions, etc.			
医务室、学校、银行等数量和面积 Number and area of public service facilities such as health carter, schools, and banks			
第一产就业人数比例(%) The ratio of villagers employed in the primary sector			
第二产就业人数比例 (%) The ratio of villagers employed in the secondary sector(%)			
第三产就业人数比例 (%) The ratio of employment in the tertiary sector (%)			
本村企业数量 Number of enterprises in the village			

Appendix C

The interview with rural households

关于中国土地利用与乡村发展研究的问卷调查

（农户问卷）

Interview with villagers on local land consolidation and household development

为贯彻落实中央农业农村优先发展的战略方针，探索乡村振兴的实现路径，中科院乡村地理研究团队与宁波诺丁汉大学合作拟开展中国乡村发展与土地利用情况的问卷调查，本次调查采用匿名的方式且不对外公布，但您的意见将作为学术研究和政策制定的重要参考依据，请您在百忙之中予以支持。

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Thank you for agreeing to participate in this survey!

Rural Development and Land Use Research Group,
Institute of Geographical Sciences and Natural Resources Research,
Chinese Academy of Sciences

家庭基本信息 (Family basic information)			
家庭常住人口 (Family resident population)		家庭劳动力人口 (Family labour population)	
成员 1 (Number 1)		**成员 2 (Number 2)**	
性别 (Gender)		性别 (Gender)	
年龄 (Age)		年龄 (Age)	
受教育水平 (Years of education)		受教育水平 (Years of education)	
工作地点 (Workplace)		工作地点 (Workplace)	
工作类型 (Type of job)		工作类型 (Type of job)	
成员 3 (Number 3)		**成员 4 (Number 4)**	
性别 (Gender)		性别 (Gender)	
年龄 (Age)		年龄 (Age)	
受教育水平 (Years of education)		受教育水平 (Years of education)	
工作地点 (Workplace)		工作地点 (Workplace)	
工作类型 (Type of job)		工作类型 (Type of job)	
成员 5 (Number 5)		**成员 6 (Number 6)**	
性别 (Gender)		性别 (Gender)	
年龄 (Age)		年龄 (Age)	
受教育水平 (Years of education)		受教育水平 (Years of education)	
工作地点 (Workplace)		工作地点 (Workplace)	
工作类型 (Type of job)		工作类型 (Type of job)	
成员 7 (Number 7)		**成员 8 (Number 8)**	
性别 (Gender)		性别 (Gender)	
年龄 (Age)		年龄 (Age)	
受教育水平 (Years of education)		受教育水平 (Years of education)	
工作地点 (Workplace)		工作地点 (Workplace)	
工作类型 (Type of job)		工作类型 (Type of job)	
成员 9 (Number 9)		**成员 10 (Number 10)**	
性别 (Gender)		性别 (Gender)	
年龄 (Age)		年龄 (Age)	
受教育水平 (Years of education)		受教育水平 (Years of education)	
工作地点 (Workplace)		工作地点 (Workplace)	
工作类型 (Type of job)		工作类型 (Type of job)	
家庭主要收入来源 (Main sources of household income)			
家庭日常主要消费地点(The main daily consumption place)			
教育、食品的开销占比 (Costs for education and food, respectively)			
是否加入了新农合 (Have your family join the New Rural Co-operative Medical System)			

农户对于村庄土地整治的看法
Questions related to the implementation of land consolidation

1. 你们村的土地整治项目总体而言是否改善了您的农业生产条件？（1.是，2.否）。如果有，从哪些方面得到了改善（可多选）（1.增加耕地面积，2.耕地平整度，3.田间道路，4.灌溉条件，5.方便机械化作业，6.土质改善，7.减少旱涝灾害，8.其他）

1. Have the RLC projects in your village improved your agricultural production conditions? (1. Yes, 2. No). If yes, which aspects have been improved (multiple choices) (1. Increase the area of farmland, 2. The flatness of farmland, 3. Paths in the field, 4. Irrigation conditions, 5. Facilitate mechanised operations, 6. Improvement of soil quality, 7. Reduction of drought and flood disasters, 8. Others)

2. 土地整治项目是否增加了您的农作物产量？是否优化了种植结构？

2. Have RLC projects increased your grain yields? Has your planting structure been optimised? (1. Yes, 2. No)

3. 农用地整治后土地主要用于什么目的？政府/村集体是否有后续的产业配套？（1.是，2.否）。如果是，具体配套了什么产业？如果没，为什么？

3. What were the main purposes for which the land is used after agricultural land consolidation? Has the government/village provided industrial support? (1. Yes, 2. No). If yes, what did they provided? If not, why?

4. 本村是否有开展宅基地整治？如果有，宅基地整治是否实现以下成效？（1.改善人居环境，2.促进土地集约利用，3.保障粮食安全，4.生活富裕，5.乡风文明）

4. Has your village carried out residential land consolidation? If yes, has the implementation of residential land consolidation achieved the following results? (1. Improvement of the living environment, 2. Promotion of the intensive use of land, 3. Food security, 4. Live in a prosperous life, 5. Refined rural civilisation)

5. 本村是否开展了工矿用地整治？如果开展了，给您的家庭带了什么影响？

5. Has your village carried out industrial and mining land consolidation? If so, what impact has it had on your family?

6. 整治项目是否改善了您的生活条件？（1.是，2.否）。如果是，从哪些方面得到了改善（可多选）（1.村容村貌，2.基础设施，3.增产增收，4.解放劳动力，5.民主参与，6.其他）。如果没有，为什么？

6. Has the RLC projects improved your living conditions? (1. Yes, 2. No).
If yes, which aspects have been improved (multiple choices)
(1. Village appearance, 2. Infrastructure, 3. Increases in agricultural production and income, 4. Have more time for non-agricultural jobs, 5. Democratic participation in village in village affairs, 6. Other)
If not, why?

7. 您和您的家人是否参与到了村里的土地整治项目中？（1.是，2. 否）如果有参与，你们是以何种形式参与？参与了多久？如果没有参与，为什么？

7. Have your family participated in any RLC projects in the village?
(1. Yes, 2. No).
If yes, in what form and for how long? If not, why?

8. 土地整治的项目开展是否造成了负面影响？（1.是，2.否）。如果是的，造成了哪些负面影响（可多选）（1.植被破坏，2.水土流失，3.干群矛盾，4.邻里矛盾，5. 其他） 如果没有是因为？

8. Has the implementation of the land consolidation had a negative impact? (1. Yes, 2. No). If so, what were the negative impacts (multiple choices)
(1. Destruction of vegetation, 2. Soil erosion, 3. Contradictions between village cadres and ordinary villagers, 4. Contradictions between neighbours, 5. Others_____)
If no, why?

靳庄村农户发展状况调查表 **(Statistical table of household-level data in different years for Jinzhuang Village)**			
	2010	2015	2020
家庭住房结构 Building structure of the dwelling			
家庭住房总面积及分布(m^2) The total area and distribution of family dwellings (m^2)			
家庭人均收入 Per capita income (RMB/Year)			
耕地承包面积（亩） Contracted farmland area			
田地块数 Number of farmland plots			
耕地出租面积（亩） The rental area of farmland			
租金（元/年） Rent (RMB/Year)			
几人从事大棚西红柿 How many people engaged in greenhouse tomato cultivation			
大棚面积（亩） The area of greenhouse (mu)			
粮食亩产（kg/亩） Grain yield (kg/mu)			
农业生产机械化率（%） Agricultural mechanisation (%)			
每亩化肥用量（kg/亩） The amount of fertiliser per mu (kg/mu)			
14 岁以上会做农活人数 Number of people over 14 who can do farm work			
农业纯收入(元) Net agricultural income (RMB)			
非农收入(元) Non-agricultural income (RMB)			
使用天然气、电等清洁能源的比例多少（%） To what extent are clean energy sources such as natural gas and electricity used in daily life? (%)			
村卫生环境满意度（1-100 分） Satisfaction with the quality of the village's environment (1 to 100 points)			
对于土地整治实施满意度（1-100 分） Satisfaction with the implementation of land consolidation (1 to 100 points)			

东衡村农户发展状况调查表 (Statistical table of household-level data in different years for Dongheng Village)			
	2010	2015	2020
家庭住房结构 Building structure of the dwelling			
家庭住房总面积及分布(m^2) The total area and distribution of family housing (m^2)			
家庭人均收入 Per capita income (RMB/Year)			
承包地面积（亩） The area of contracted farmland area			
田地块数 Number of farmland plots			
耕地出租面积（亩） The rental area of farmland			
租金（元/年） Rent (RMB/Year)			
几人从事种植业 How many people engaged in grain production			
粮食亩产（kg/亩） Grain yield (kg/mu)			
农业生产机械化率（%） Agricultural mechanisation (%)			
每亩化肥用量（kg/亩） The amount of fertiliser per mu (kg/mu)			
几人从事养殖业 How many people engaged in aquaculture			
养殖面积（亩）和年收入（元） Area (mu) and income (RMB) of aquaculture			
几人从事村里的钢琴园上班 How many people work in the Piano Park			
14 岁以上会做农活人数 Number of people over 14 who can do farm work			
农业纯收入(元) Net agricultural income (RMB)			
非农收入(元) Non-agricultural income (RMB)			
使用天然气、电等清洁能源的比例多少（%） To what extent are clean energy sources such as natural gas and electricity used in daily life? (%)			
村卫生环境满意度（1-100 分） Satisfaction with the quality of village's environment (1 to 100 points)			
对于土地整治实施满意度（1-100 分） Satisfaction with the implementation of RLC (1 to 100 points)			

Appendix D

Parts of this thesis have been published in the following peer reviewed journal articles:

Jiang, Y., Long, H., Ives, C. D., Deng, W., Chen, K., & Zhang, Y. (2022). Modes and practices of rural vitalisation promoted by land consolidation in a rapidly urbanising China: A perspective of multifunctionality. *Habitat International*, 121, 102514. DOI: 10.1016/j.habitatint.2022.102514

Jiang, Y., Tang, Y., Long, H., & Deng, W. (2022). Land consolidation: A comparative research between Europe and China. *Land Use Policy*, 112, 105790. DOI: 10.1016/j.landusepol.2021.105790

Jiang, Y., Long, H., Tang, Y., Deng, W., Chen, K., & Zheng, Y. (2021). The impact of land consolidation on rural vitalization at village level: A case study of a Chinese village. *Journal of Rural Studies*, 86, 485-496. DOI: 10.1016/j.jrurstud.2021.07.004

Jiang, Y., Long, H., & Tang, Y. (2021). Land consolidation and rural vitalization: A perspective of land use multifunctionality. *Progress in Geography*, 40(3), 487-497. (in Chinese) DOI: 10.18306/dlkxjz.2021.03.012

Long, H., Qu, Y., Tu, S., Zhang, Y., & **Jiang, Y**. (2020). Development of land use transitions research in China. *Journal of Geographical Sciences*, 30(7), 1195-1214. DOI: 10.1007/s11442-020-1767-y