Case Study Report

Evaluation and optimization of community resilience in Yellow River floodplain area:

A case study of Lizhuang resettlement new town in Xinxiang City

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Abstract

For the purpose of preventing flooding from the Yellow River, Lizhuang Town of Xinxiang, Henan Province, China, has been gradually implementing relocation and resettlement since 2018. During this process, we researched the social resilience of the resettlement community. A series of comparative analyses revealed improvements and shortcomings before and after the relocation and resettlement. The results of questionnaire surveys of the resettlement community in Lizhuang Town showed that while restoring the ecological resilience of relocation sites, more attention should be paid to improving the economic diversity, life service facilities, and local cultural identity in resettlement community. To address mentioned above shortcomings of the resilience, four major strategies were proposed, including ecological restoration of the former site, industrial upgrading, public service enhancement and cultural identity of the new site.

Keywords

Resilient Planning, Yellow River Floodplain Area, Community Resilience, Practice

1. Introduction

Under the policy support of flood control and risk avoidance resettlement in Lizhuang Town of Xinxiang City (Figure 1), 18 villages originally located in the Yellow River flood embankment were relocated to the new area outside the embankment. The living conditions of the 5 villages relocated and resettled in the first phase have been significantly improved. In this context, it is worth to restore and improve the ecological resilience of the former village sites, and to explore how to further enhance the community resilience in the resettlement new town.

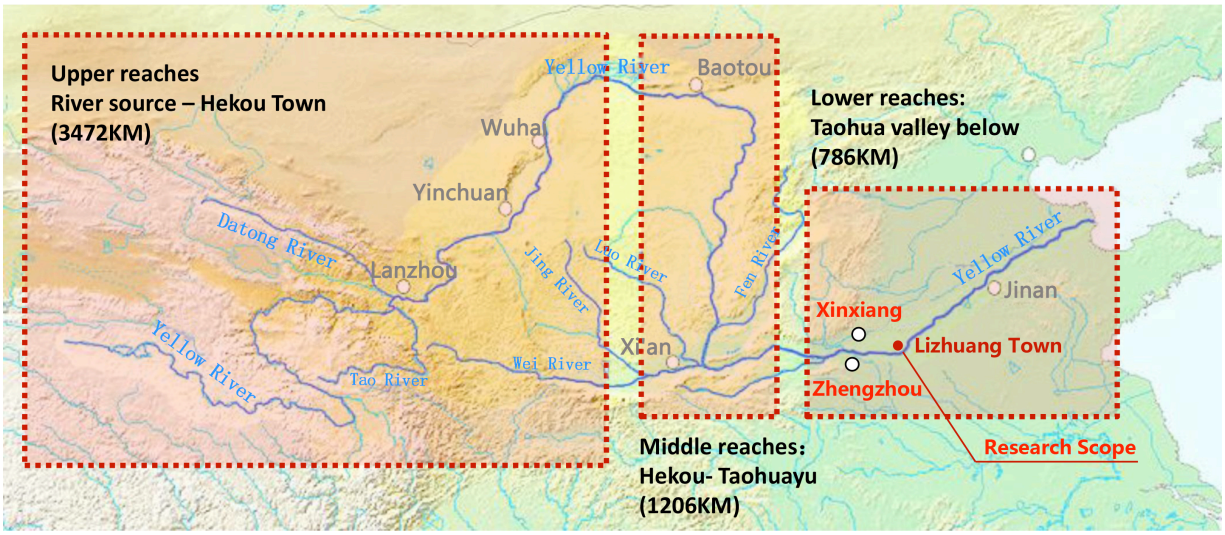

Figure 1. Location Analysis. Source: Authors.

Research on strategies and suggestions for the Yellow River Floodplain Area is mainly comprised of three aspects: industrial development strategy, land use strategy, and relocation and resettlement strategy. Jia et al. (2015), Ren et al. (2007), Zhang et al. (2017) and Bai et al. (2013) proposed strategic suggestions for industrial development of the floodplain area, including the main strategies of strengthening industrial infrastructure, adjusting industrial structure, and promoting urbanization of the floodplain. Wang et al. (2011) and Zhang et al. (2008) mainly explored land use strategy along the Yellow Floodplain area, and proposed suggestions for soil protection. And in a study on resettlement strategies of floodplain areas, Sheng et al. (2015) summarized the types of resettlement.

It can be seen that current research on the Yellow River floodplain area mainly focuses on land use patterns and industrial dilemmas of the floodplain area, but the number of studies on relocation strategies is minimal. And their work just focused on the development of macro relocation policies but has not researched the situation of the relocated settlements from town or community level. In fact, the relocation strategies only addressed the basic safety of residents, while the subsequent community resilience assessment and optimisation strategies deserve further exploration, such as the ecosystem restoration of the Yellow River floodplain area, the provision of infrastructure and public services in the resettlement community, the solidarity and self-governance of the resettlement community, and the economic diversity of the resettlement community.

Due to this, the concept of a resilient city is applicable to the Yellow River floodplain area and it makes sense to assess community resilience in relation to migrant communities. The study of resilient city originated in the field of ecology. Holling C S (1973) introduced the concept of resilience into the field of ecology in 1973, using it to define the properties of natural ecosystems to repair themselves and maintain the stability of ecosystems. Since the 1990s, the concept of resilience has been gradually extended from the field of natural ecology to that of human ecology, and has become the basis of resilient city research. The concept of resilience was gradually expanded from an ecological perspective to four aspects include ecological, engineering, social and economic. Resilient city emphasises the ability of urban systems to maintain normal performance and to gather resources to cope with challenges despite external disturbances (Paton D, Johnston D, 2001).

Based on literature review and field surveys, large amounts of data were collected from historical statistics, questionnaires, site survey, satellite imagery, etc. We further used scenario prediction and GIS analysis methods to carry out the research. Based on the research results of Lizhuang New Town, we analysed the resilience level of the new town's resettlement community in three aspects: the economic

and industrial categories of the new town, the rationing of public service facilities for residents, and the cultural cohesion. And we also examined the ecological conservation of the former site of Lizhuang Town. To address the shortcomings of the resilience of the former and new resettlement communities of Lizhuang in Xinxiang, we proposed four main strategies in terms of ecological restoration of the former site, industrial upgrading, improvement of public services and cultural identity of the new site.

2. Methods and data

2.1. Case selection

In case to study community resilience in Yellow River floodplain area, Lizhuang Town, Fengqiu County, Xinxiang City were selected as the research object of typical settlements for relocation.

The first is the dual representation of the geographical location and historical sites. Specifically, in 1855, the Yellow River flooded, and it was diverted at Tongwaxiang, located in the southeast of Lizhuang Town. The Yellow River that once flowed eastward into the sea turned to flow northeastward at that point. The second is the representative of ecological resources for its unique and sensitive ecological environment. The large-scale tidal flats left by the Yellow River diversion provided a habitat for a variety of birds, creating a National Nature Reserve for Birds of the Yellow River Wetland in Xinxiang, Henan, near the former town of Lizhuang. The third is, when the research was carried out, Lizhuang Town was a key poverty alleviation target. Under the dual background of risk avoidance and poverty alleviation in the Yellow River floodplain area, Lizhuang Town implemented a one-off resettlement project for poverty alleviation, which is representative in Xinxiang City.

In summary, based on the specificity of geographical location, unique historical sites, superior ecological resources, and the positioning of relocation and resettlement pilots, Lizhuang Town deserves to be the subject of study. And it is possible to provide a reference for the diversified development of living space in the Yellow River floodplain area of Xinxiang City.

2.2. Comparative analysis of images

On the basis of field investigations and literature data, we found that the area of natural wetland in the Yellow River floodplain area in Xinxiang City declined sharply, making the natural reserves difficult to fully protect. The comparison showed that the natural ecological space in Lizhuang Town was mainly concentrated along the banks of the main channel of the Yellow River and exists in the form of tidal flats, but a large amount of tidal flats were artificially transformed into cultivated land.

Based on the Google Earth satellite image in November 2018, the land analysis map was produced. Compared with the 2014 land use map in the study area, 82.8% of the tidal flats were converted to cultivated land. In general, the tidal flats originally distributed along the main channel of the Yellow River in the form of a belt were divided into several pond wetlands. The scale of the wetlands along the main channel was severely reduced and the continuity of the wetlands was interrupted (Figure 2). The former site of Lizhuang Town was close to the boundary of the nature reserve, making the artificial transformation of the tidal flats easily affect the bird habitat (Figure 3). Moreover, successive years of agricultural cultivation may consume soil fertility, leading to threats to soil conservation, especially in areas where sandy loam was relatively densely distributed.

Figure 2. Arable land adjacent to the main channel of the Yellow River. Source: Authors.

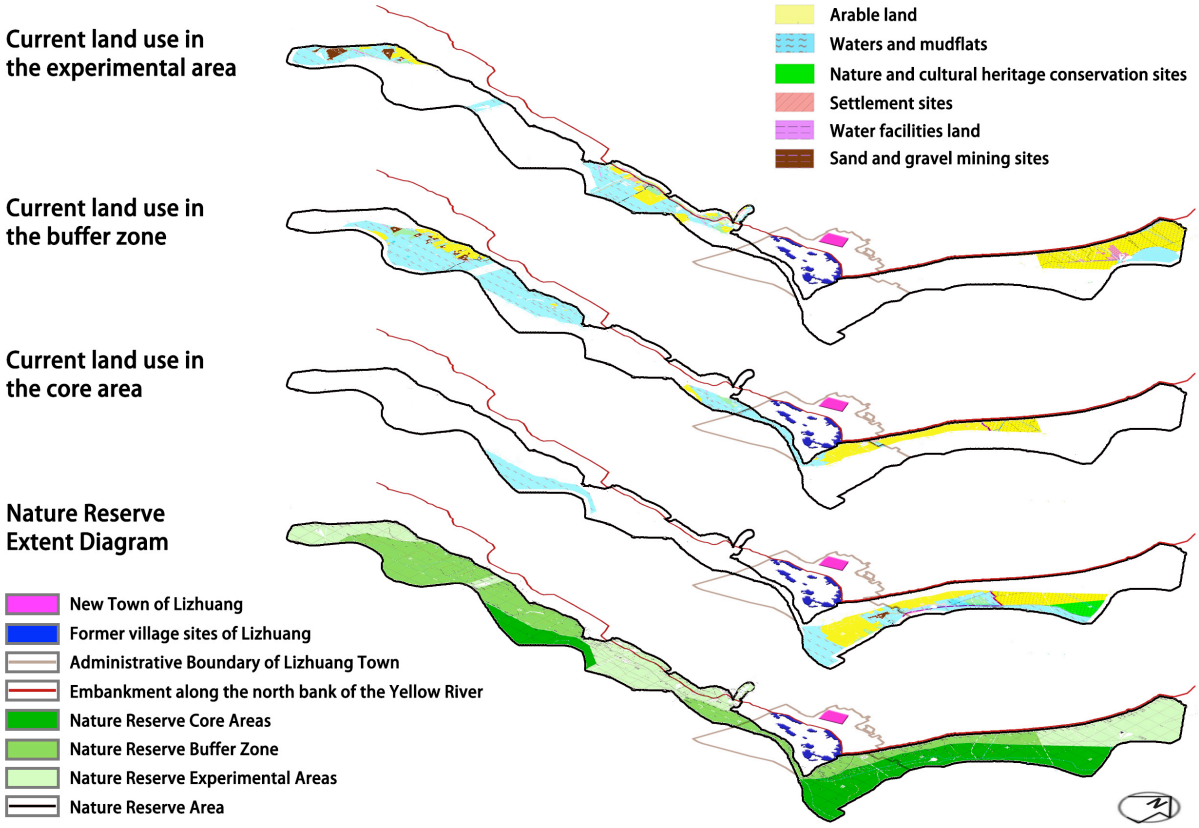

Figure 3. Scope of Xinxiang Nature Reserve in axis side view. Source: Authors.

In recent years, the degree of human intervention in the Yellow River floodplain area of Lizhuang has expanded, resulting in the overlap of the protection scope of the nature reserve and the scope of farmland, and increasing the vulnerability of the floodplain area ecosystem. With residents' relocation, the implementation path of ecological restoration around the former site of Lizhuang Town needs to be explored urgently.

2.3. Questionnaire and results

In order to understand the development of the community in Lizhuang New Town, we further carried out a questionnaire survey. We hoped to get information about residents' satisfaction with living space, the improvement of residents' economic conditions, and their demands for future living space from the questionnaire survey.

The survey was carried out in the first batch of 5 villages relocated and rebuilt on a pilot basis, including the 5 villages of Zhangzhuang, Yaozhuang, Xueguozhuang, Guantai, and Nancao, with a total of 2053 households and 7634 people. We commissioned local government staff to randomly distribute 100 questionnaires on a household basis, and 88 were collected. Finally, 75 valid questionnaires were obtained, which accounted for approximately 3.7% of the total number of households.

The survey on Lizhuang New Town showed the following characteristics.

Firstly, the diversity and flexibility of economic categories were not improved after the migration. The survey showed that 85% of the resettled residents were still agricultural laborers (Figure 4). Nearly 40% of the resettled households' income came from farming and nearly 50% came from working in other cities (Figure 5). When faced with the constraints of income bottlenecks, respondents cited lack of capital and lack of access as the main factors and lack of skills as a secondary factor (Figure 6). Similarly, for help with employment, the top option for respondents was help with job contacts and loans, followed by technical training and employment information (Figure 7). The low level of education of the respondents was a reason for the limitation of employment. Among the respondents, more than 40% had a junior secondary education and more than 30% had a senior secondary education, while none of the respondents had obtained a bachelor's degree or higher (Figure 8). The above analysis suggested that land transfer, collective operation and large-scale production may be a major way to increase farmers' returns and reduce the risks of decentralised farming. However, the fundamental way to promote better living conditions for the people in the Yellow River floodplain area may be to improve their educational attainment and stimulate a variety of employment thinking, which in turn will trigger opportunities for the residents of the area to seek differentiated industrial development.

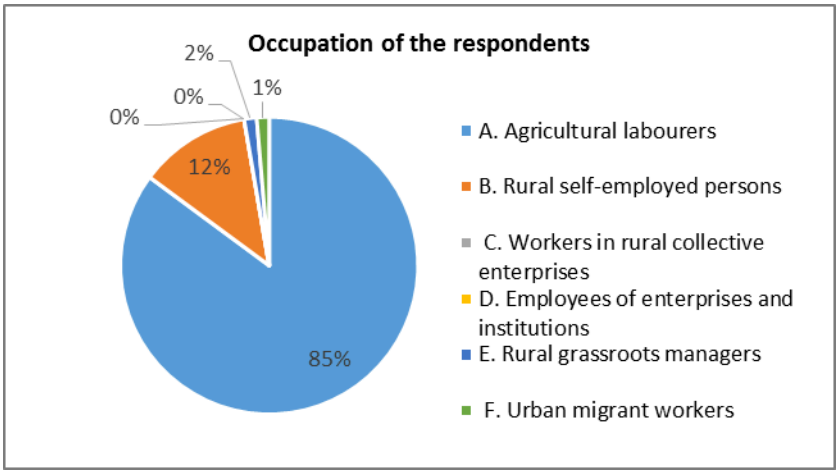

Figure 4. Occupation of the respondents. Source: Authors.

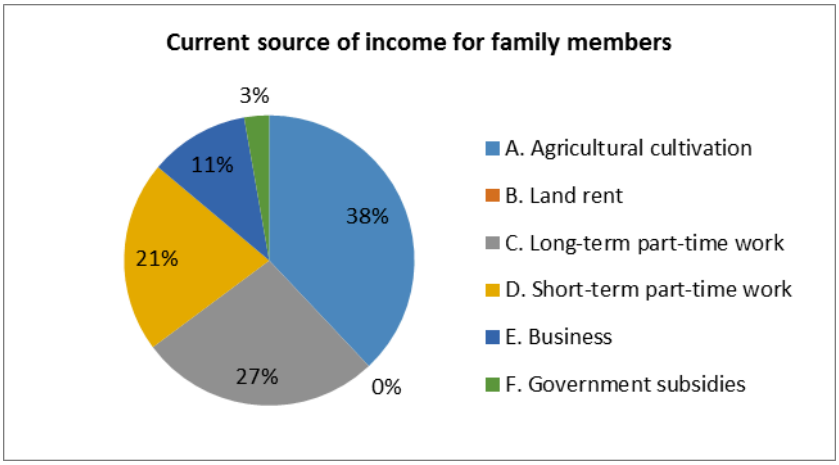

Figure 5. Current source of income for family members. Source: Authors.

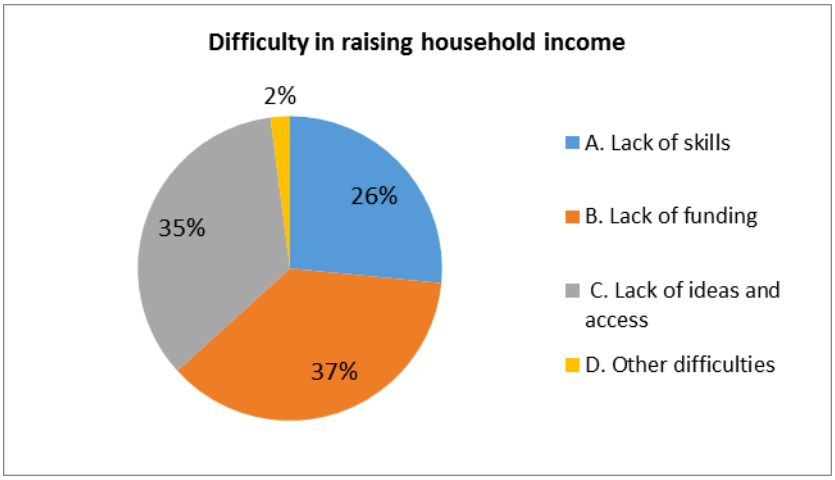

Figure 6. Difficulty in raising household income. Source: Authors.

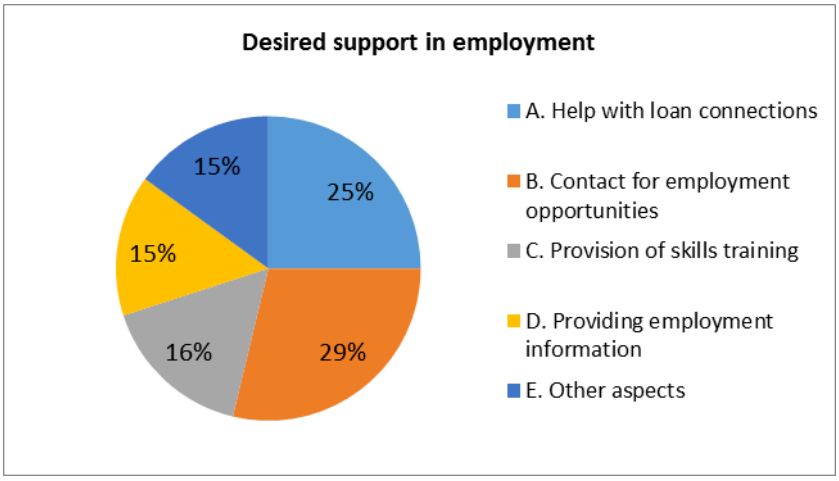

Figure 7. Desired support in employment. Source: Authors.

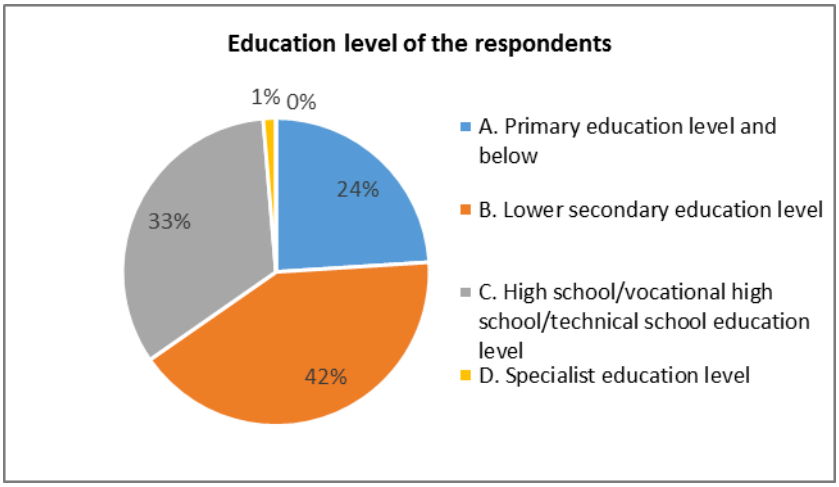

Figure 8. Education level of the respondents. Source: Authors.

Secondly, the growing aspiration for a better life among the out-migrated residents had raised the demand for production and living service facilities. In terms of public service facilities, respondents generally had a higher awareness of educational facilities and medical facilities, followed by awareness of parks and green spaces (Figure 9). However, respondents held low perceptions of cultural facilities, sports facilities and elderly facilities, creating higher expectations of such facilities (Figure 10). In addition, there was a high demand from residents for grain drying space and farm equipment storage. And 70% of the farmers felt that the remoteness of the resettlement area from their fields was inconvenient for farming (Figure 11). More than 90% of cultivators needed to use bicycles, electric bikes, motorbikes or farm vehicles to reach the fields (Figure 12). The fall behind in the construction of public service facilities in the new resettlement communities had left residents with inadequate living and production support facilities in the short term. Therefore, it is necessary to advance the sequence of approval and construction of public service facilities in the future approval and construction of resettlement communities or even residential areas in general. Some places (e.g. Beijing) already required the completion of ancillary facilities in residential areas before the construction of residential buildings reached 75% completion.

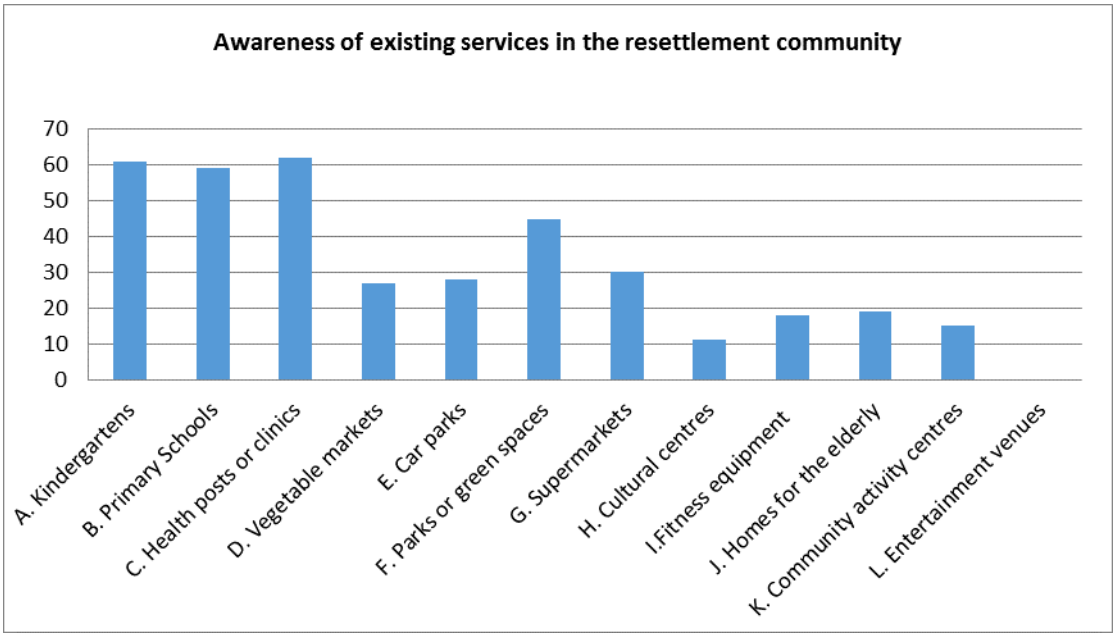

Figure 9. Awareness of existing services in the resettlement community. Source: Authors.

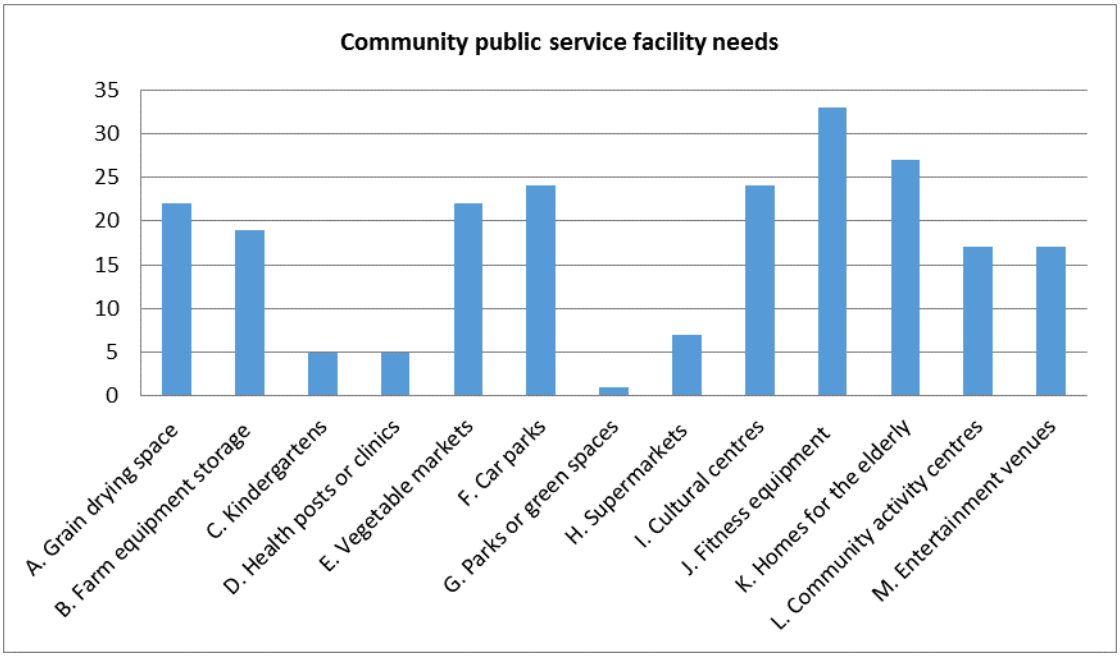

Figure 10. Resettlement community public service facility needs. Source: Authors.

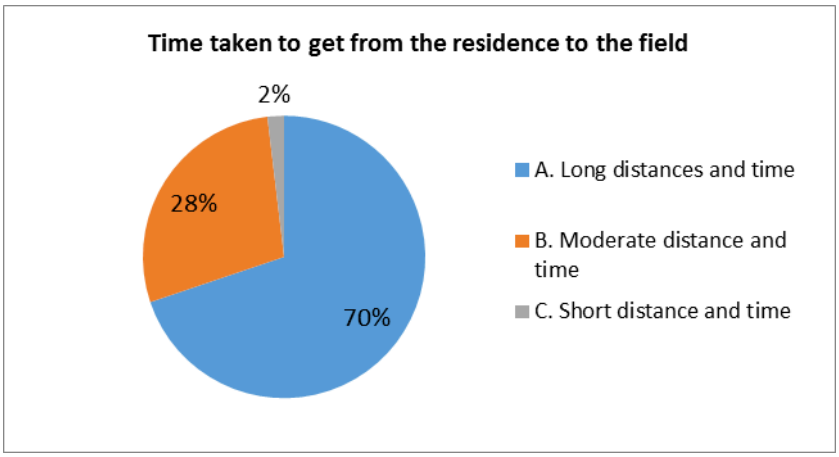

Figure 11. Time taken to get from the residence to the field. Source: Authors.

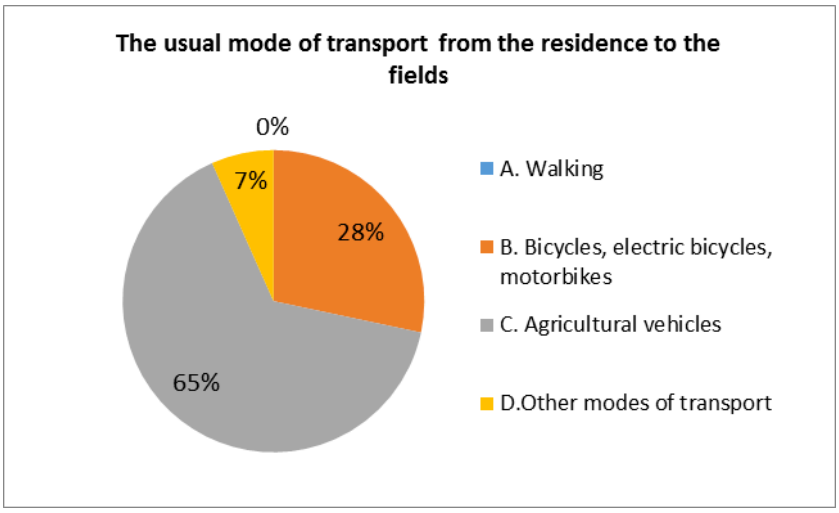

Figure 12. The usual mode of transport from the residence to the fields. Source: Authors.

Thirdly, the historical and cultural significance of the community itself had not been widely recognized and fully explored, and the residents' concept of community identity deserved to be enhanced. The cultural resources of communities in the Yellow River floodplain area were always closely linked to the fundamental cultural lineage of the Mother River of China. Specifically, the history of flood management represented the most prominent cultural feature of the floodplain area, a traceable local cultural root, but one whose value was poorly perceived by its locals. For example, the geography and history of the Yellow River, represented by the site where the embankment breach occurred at Tongwaxiang in 1855, was not widely known by the local population. Another example is the "Cao Gang Danger Prevention Project", located on the west side of Li Zhuang Town, which has the typical feature of a "hanging river on the ground", allowing a direct view of the main stream of the Yellow River from the embankment. However, the cultural value of the project was neglected as it was not sufficiently illustrated by text and illustrations. The splendid cultural resources of the Yellow River floodplain area were out of touch with the productive life of the local people under the influence of a series of problems of insufficient perception of value and poor protection and maintenance. This resulted in a reduction in the residents' sense of hometown pride and cultural cohesion.

3. Discussion

The results of this analysis show that it is necessary not only to improve the ecological resilience of the former site of Lizhuang in the Yellow River floodplain area, but also to improve the community resilience of the new town of Lizhuang. Therefore, we proposed four main strategies focus on resilience improvement applicable to the villages in Yellow River floodplain area: moderately restore the ecological function of the former site waterfront, open up the industrial cooperation path within and outside the floodplain area, flexibly arrange and increase the production and living service facilities, give full play to the cultural advantages to promote community identity. It is hoped that this paper will provide a good reference for urban spatial development planning of other parts of the Yellow River floodplain area and for further analysis and study of urban spaces in other regions of China in the future.

3.1. Moderately restore the ecological function of the former site waterfront

To reduce anthropogenic impacts within the core protected area of the nature reserve, we suggested to reduce arable land and restore mudflats. It is hoped that the originally separate mudflat wetland patches will be connected into a line and initially form a coherent mudflat ecosystem. And organic crop cultivation is encouraged within the non-core area.

3.2. Open up the industrial cooperation path within and outside the floodplain area

On the basis of the above, we proposed to expand the industrial chain and form an industrial linkage operation of "organic production inside the embankment and deep processing of secondary production outside the embankment". And it can further expand the function of experience and visitation in the process of agricultural production and deep processing, forming a linkage development of three industries. To achieve it, the first step is to produce green and pollution-free agricultural products within the floodplain area, while laying out further processing sites on the periphery of the floodplain area near the embankment to complete the linkage from the primary to the secondary industries. The second step, with the completion of the deep processing of the agricultural products, is to sell them to the outside world on the one hand and to spread the visibility of the origin through the products on the other. In the third step, with the gradual maturation of the industrial chain, the local characteristic industries represented by the green industry will also gradually be formed, and the landscape advantages of the Yellow River and the local industrial characteristic advantages will work together to promote the development of "agriculture and tourism" and "industry and tourism" in the region, completing the

expansion of the secondary industry to the tertiary industry. The expectation is that the whole process will be combined with vocational skills training to expand multiple employment pathways for local residents.

3.3. Flexibly arrange and increase the production and living service facilities

Lizhuang New Town needs to speed up the efficiency of the construction of public service facilities. It is also recommended that the standard of public service facilities allocation should be raised through the formulation of appropriate policies. It is hoped that in other similar relocation and resettlement projects, provisions will be made to ensure that public services are well equipped and functioning before the handover of the resettlement dwellings.

After demolition, the village sites located in the non-core areas of the nature reserve will be reclaimed. This type of site had a high waterproof platform with relatively good road access, which was less prone to flooding and more easily accessible to the outside world. Considering that it is difficult to reclaim land for building sites to meet the standards of quality and high-yielding grain fields, it is advisable to select appropriate former village waterproof platform to serve as material storage space, grain drying sites, high points for views of the landscape and observatories for mudflat birds.

3.4. Give full play to the cultural advantages to promote community identity

Research on urban social resilience suggested that social systems or communities had the ability to learn from their experiences in dealing with shocks external to the system through self-organised learning, adapting to potential risks and external trends, improving disaster prevention measures and contributing to the solid development of the area (Subcommittee on Disaster Reduction, 2003). As residents become more aware of their own culture, it is believed that their enthusiasm for spreading local culture will also gradually increase. With this, the residents will gradually develop a sense of improving their environment and promoting neighbourhood harmony, all of which will aid the unity and autonomy of the residents of the Yellow River floodplain area.

Therefore, we proposed the strategy of "integration of resources" to shape the cultural characteristics of the Yellow River floodplain area and to raise the level of protection and visibility of cultural resources along the Yellow River. Secondly, it is recommended that the Yellow River culture be promoted through the strategy of "combining conservation and development", and that the preservation and transmission of cultural resources be promoted. With such a concept, the cultural advantages of the Yellow River floodplain area will serve the sustainable development along the Yellow River.

4. Acknowledgements and Research Funding

This study is supported by Natural Science Foundation of China (Project Approval No. 51978050); The Science and Technology Program of Ministry of Housing and Urban-rural Development of the People's Republic of China (No. 2020-k-194).

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