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Assessment of Community Resilience for Planned Resettlement in the Yellow River Floodplain Area and Promotion Strategies: A Case Study of Lizhuang Town, Fengqiu County

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Contents

The Yellow River “Mother River”

上游：河源—贵德

upstream：

River source - Quide

中游：贵德至孟津

Middle reaches

Quide - mengjin

下游：郑州桃花峪以下

Lower reaches:

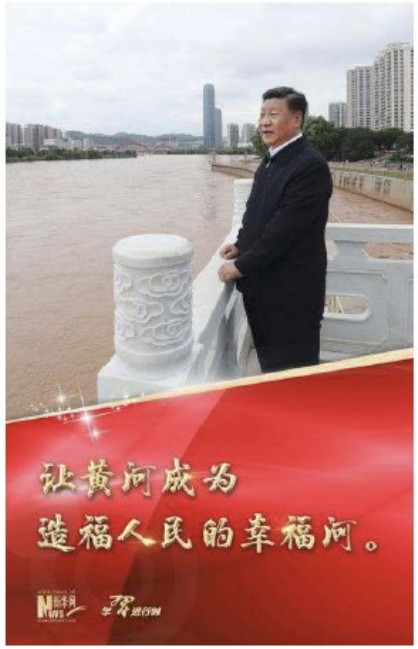
Taohua valley below

The Floodplain Area of the Yellow River: Flood Discharging Function vs. Development Demand

Between the main channel and the Yellow River dike on both sides, the total area is about 3101 square kilometers.

Government-led Whole-village Resettlement

The Resettlement Plan for Residents of the Yellow River Floodplain Area in Henan Province came into effect in 2017, with a total investment of 14.407 billion RMB, to relocate 243,200 people out of the whole villages in low-lying terrain facing flood risks in 3 years.



The concept of community resilience

- **Community resilience**, focusing on the capabilities of a system to resist impacts, to remain stability, to recover from disasters, and to adapt to new changes at local and individual scales (Cimellaro G P ,et al， 2010; 彭翀, 等, 2017), is of practical significance in response to the vulnerabilities and inadaptation faced by resettled communities.
- **Self-acting:** it has inherent redundancy, robustness, rapidity, connectivity and flexibility (刘佳燕, 沈毓颖, 2017), relying on self-organization capacity building rather than external assistance (Norris et al., 2008).
- **Procedural:** the process of associating a series of capabilities and functions with a positive trajectory of adaptation after disturbance, is long-term capacity building rather than short-term emergency response (Cutter et al., 2008).
- **Requiring resource/capital:** it requires the support of various material and corresponding social resources, social capital, information, etc (Miller, 2020). Community is not only a static engineering unit, but also an organic system bearing dynamic connection network.

Assessment ideas of community resilience and their applications

- **Process-based perspective:** construct a model to examine networks and changes concerning joint actions of the subjects at each stage of coping with impacts, such as CRNH, CDRC, CDRF, DROP, etc.; some tools focus on key resources and major infrastructures in the process, such as RM and RI , often applied to specific disaster scenarios.
- **State-based perspective:** design frameworks, indices, index systems, and other assessment tools identifying resource, capital, and capacity elements, such as CDRI, BRIC, The PEOPLE resilience Framework), The Localized Disaster-resilience Index, CCRAM, and the Norris Community Resilience Model. The Norris Community Resilience Model covers a collection of indicators for social, economic, natural/environmental/ecological, physical/infrastructural, and institutional dimensions at the community level, as well as learning, preparedness, and coping capacities at the individual level; it takes into account system integration and diversity of elements, and is suitable for comparing development differences, and provides quantitative support for specific resilience studies.

Research Objectives

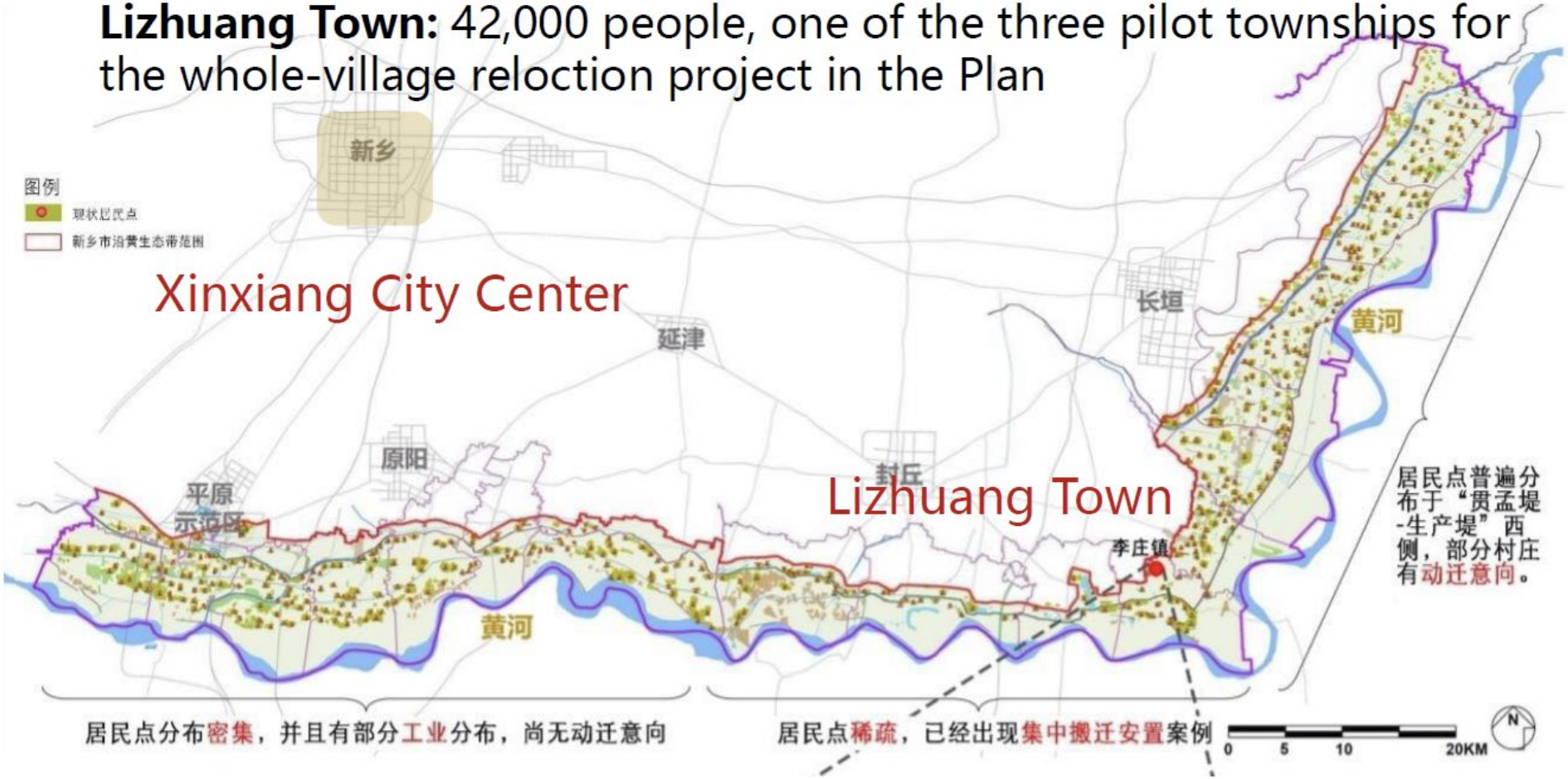
- A resilience assessment framework for planned resettled communities in the Yellow River floodplain area
- Key indicators of resilience for resettled communities
- Changes and shortages in each dimension of resilience
- Strategies for resilient resettlement for the case study area

02 ASSESSMENT OF COMMUNITY RESILIENCE

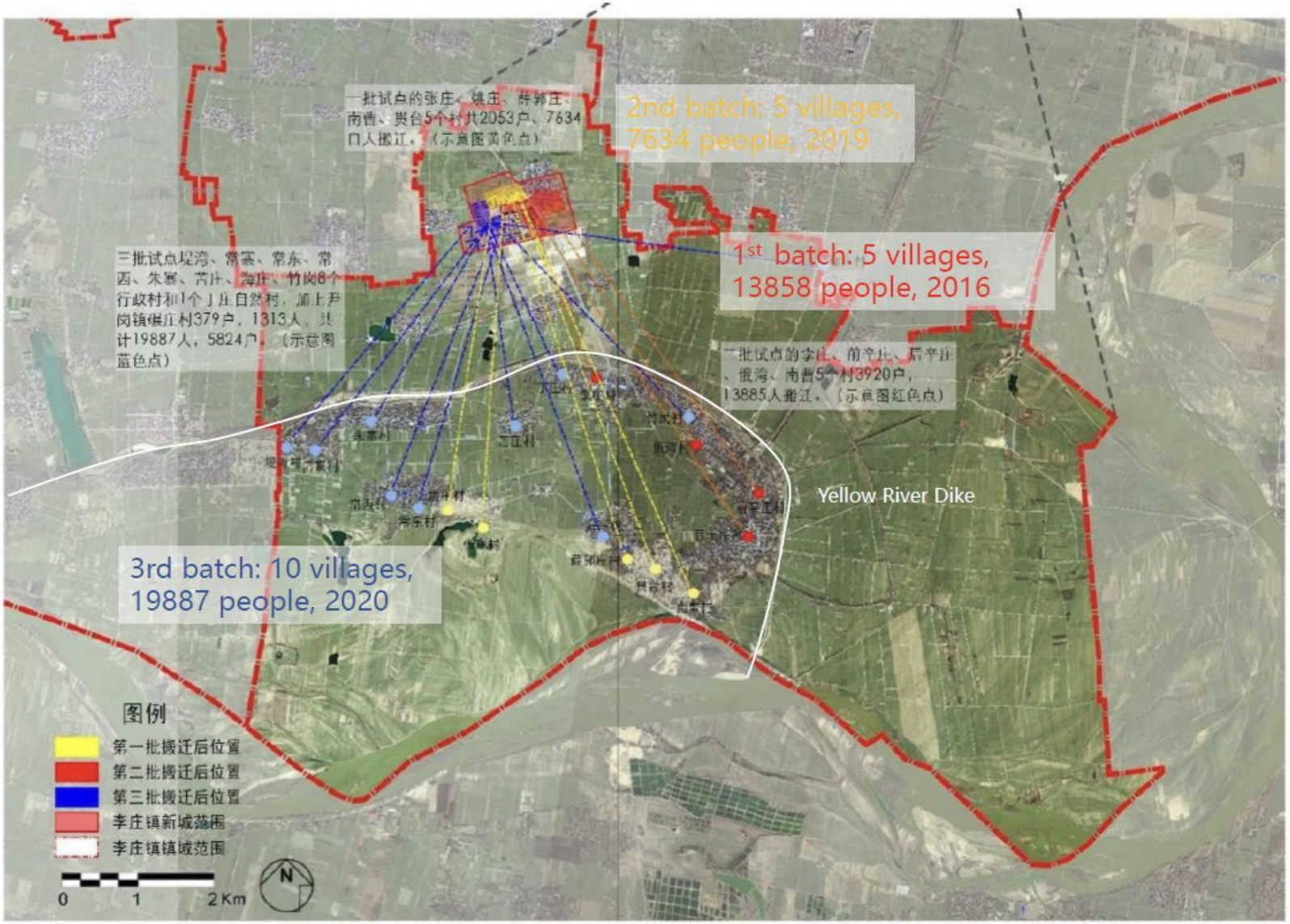
Case Study Area: Lizhuang Town

Xinxiang section: 1,006 km^2, 153 km, covering more than 570,000 people in 509 settlements in 21 townships

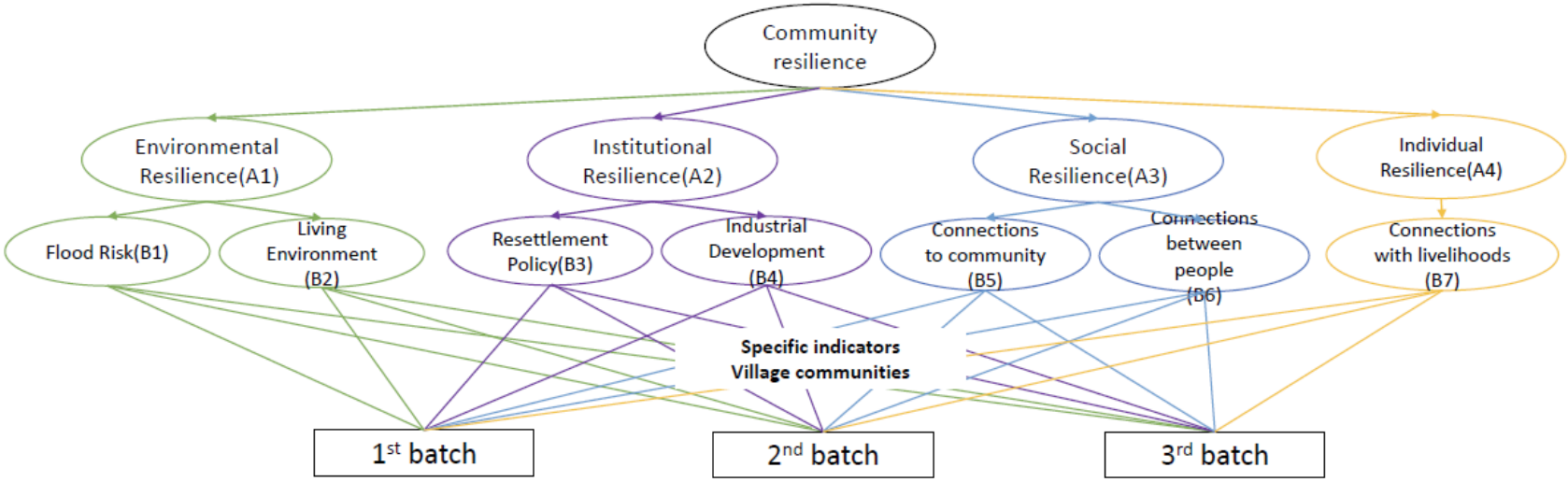
Lizhuang Town: 42,000 people, one of the three pilot townships for the whole-village reloction project in the Plan



20 Villages Resettled in 3 Batches



Index system



- Cutter, et al., 2008; Norris, et al., 2008; Sharifi,2016; 梁宏飞, 2017; Miller, 2020
- **Environmental resilience:** Flood Risk, Living Environment
- **Institutional resilience:** Resettlement Policy, Industrial Deveolopment
- **Social resilience:** Connections to community, Connections between people
- **Individual resilience:** Connections with livelihoods

Dimension	Sub-dimension	Indicator	Unit	Relevance	Description	Data source
Environmental Resilience (A1)	Flood Risk (B1)	Flood protection standard (C1)	(m^3/s)	+	The flood protection level obtained from the simulation of inundation line analysis is of high standard with strong resistance, and the inside of the embankment is higher than the outside	GIS Analysis
		Eco-redundant space (C2)	m^2	+	Quality of fallowed beaches, short-term calculation of beach reclamation area, long-term calculation of NDVI or NDWI index, good quality buffer	
		Number of resources for shelter (C3)	term/per	+	Shelter locations and supplies are always available in sufficient quantities to cope with the impact of good capacity	
		Emergency evacuation time (C4)	Min	-	Network analysis simulation to get out of the beach / safety evacuation time, the shorter the time the more flexible, one-way evacuation within 15 minutes is appropriate	
		Population density (C5)	per/m2	-	The ratio of resident population to land area, the higher the density the less flexible	
	Living Environment (B2)	Housing structure quality (C6)	Rating (1-5)	+	Structural quality rating high resistance, steel mixed structure better than masonry (brick and earth) structure better than simple structure	Combined scoring
		Quality of housing facilities (C7)	Rating (1-5)	+	The higher the quality rating of facilities such as water, electricity, heating, gas, communication and building elevators, the higher the rating	
		Municipal infrastructure conditions (C8)	Rating (1-5)	+	Water, electricity, heating, gas, communication, lighting, garbage, sanitation and other facility conditions rating	
		Road traffic facilities conditions (C9)	Rating (1-5)	+	High capacity of road system, high density of road network with good connectivity and high efficiency, perfect and reliable facilities such as storage of agricultural tools, buses and cabs	
		Quality of public space (C10)	Rating (1-5)	+	Adequate number of public spaces for recreation, fitness and socializing per capita, farmer's bookstore, red and white hall and other facilities with good adaptability	
		Landscape greening quality (C11)	Rating (1-5)	+	Good redundancy with sufficient green area per capita for landscaping	
institutional resilience (A2)	Resettlement Policy (B3)	Information transparency and communication efficiency (C12)	Rating (1-5)	+	High degree of public disclosure and effective information delivery of key information on relocation and resettlement, and good adaptability	Combined scoring
		Housing and Public Service Affordability (C13)	Rating (1-5)	+	High affordability and adaptability of property fees and other public services	
		Effectiveness of land transfer reclamation (C14)	Rating (1-5)	+	Land transfer subsidies and reclamation for large-scale, intensive and industrialized operation with high returns and good adaptability	
		Enterprise support efforts (C15)	Rating (1-5)	+	Enterprises participate in the construction and operation of the project, absorbing a high degree of resettlement residents' employment and good adaptability	
		Government low insurance efforts (C16)	Rating (1-5)	+	Relocation and resettlement-related subsidies and low-income subsidies are strong and adaptable	
		Use of financial instruments (C17)	Rating (1-5)	+	Various ways to obtain low-interest loans related to relocation and resettlement, with good robustness	
		Alternative solutions (C18)	Rating (1-5)	+	Relocation and resettlement can choose the time, subsidy method and housing selection plan, and the flexibility is good	
	Industrial Development (B4)	Primary production value (C19)	million	-	High output value of primary production, strong dependence and inflexibility of industrial development	Government Reports
		The proportion of secondary production and tertiary production (C20)	%	+	High proportion of non-agricultural employment and output value, high potential for industrial development transformation and good adaptability	
		Employment rate and job opportunities (C21)	Positions/person	+	High employment rate and potential employment opportunities, good adaptability	
		Employment and Entrepreneurship Training (C22)	Persons/year	+	The annual average employment and entrepreneurship training provided by the government and enterprises covers a large number of people and is well adapted	
Social Resilience (A3)	Connections to Community (B5)	Accessibility of health care services (C23)	Rating (1-5)	+	High accessibility and adaptability of health services per capita	Resident Questionnaire
		Accessibility of children's education (C24)	Rating (1-5)	+	High accessibility and adaptability of school education services per capita	
		Public safety satisfaction (C25)	Rating (1-5)	+	High satisfaction with external environment and order stability, early warning and disaster education, and good adaptability	
		Public health satisfaction (C26)	Rating (1-5)	+	High satisfaction and adaptability to public health management such as water, food, medicine, public sanitation, epidemic prevention and control	
		Cultural heritage identity (C27)	Rating (1-5)	+	High identity and adaptability of collective tangible cultural heritage or intangible cultural value transmission	
		Sense of Community Belonging (C28)	Rating (1-5)	+	The psychological state of belonging to the community collective in the process of transformation from villagers to urban residents, a strong sense of belonging, strong community ties, and good coordination	
	Connections between people (B6)	Grassroots communication and problem solving attitude (C29)	Rating (1-5)	+	Good evaluation of the attitude of grassroots cadres in handling the work of the relocated masses and good adaptability	Resident Questionnaire
		Level of voluntary participation in public affairs (C30)	Rating (1-5)	+	High level of motivation and actual participation of members in public affairs on a voluntary basis and good adaptability	
		Equity of access to resources (C31)	Rating (1-5)	+	High level of recognition and adaptability to the fairness of access to government and business support resources and results	
		Degree of neighborhood familiarity (C32)	Rating (1-5)	+	Large multiplier of neighborhood size and degree of mutual understanding, care and trust between members	
		Degree of family intimacy (C33)	Rating (1-5)	+	Large multiplier of family size and degree of mutual understanding, care and trust among members	
Individual toughness (A4)	Connections with livelihoods (B7)	Aging level (C34)	%	-	the proportion of the elderly population aged 65 and above, with a high degree of poor adaptability	Government Reports / Resident Questionnaire
		Deposit and Income Level (C35)	RMB/household/year	+	Total household savings and annual income, good ability to cope with shocks with sufficient funds	
		Revenue Sources (C36)	Kind/household	+	Good ability to cope with shocks with diversified sources of household income, better to have multiple employment than farming than no income	
		Cultivation radius (C37)	m	-	Distance from the place of residence to the farmland, long radius production and lifestyle maintenance difficulties, poor adaptability	
		Cost of living (C38)	RMB/household/year	-	Household expenses to maintain basic food, clothing, shelter and transportation, high cost production lifestyle maintenance difficulties, poor adaptability	
		Convenience of life (C39)	Rating (1-5)	+	Maintain the convenience level of basic food, clothing, housing and transportation with high convenience and good transformation ability	
		Employment, life learning ability (C40)	Rating (1-5)	+	High level of education and learning ability with good adaptability	
		Level of physical health (C41)	Rating (1-5)	+	High level of physical health and good adaptability	
		Mental health level (C42)	Rating (1-5)	+	High level of mental health with good adaptability	

Data sources

- **Top-down:** data of flooding risk and industrial development, such as population, hydrological conditions, settlement layout, road network, production value etc., were collected from local GIS and government reports from 2014-2021
- **Bottom-up:** data of resettlement policy and living environment were collected through tripartite scoring of experts, government, and residents, and additional interviews with some cadres and residents.
- Data on local-scale social resilience and individual resilience indicators were collected through an investigation in mid-2021 for the residents completed resettlement, covering about 5% population of Lizhuang New Town.

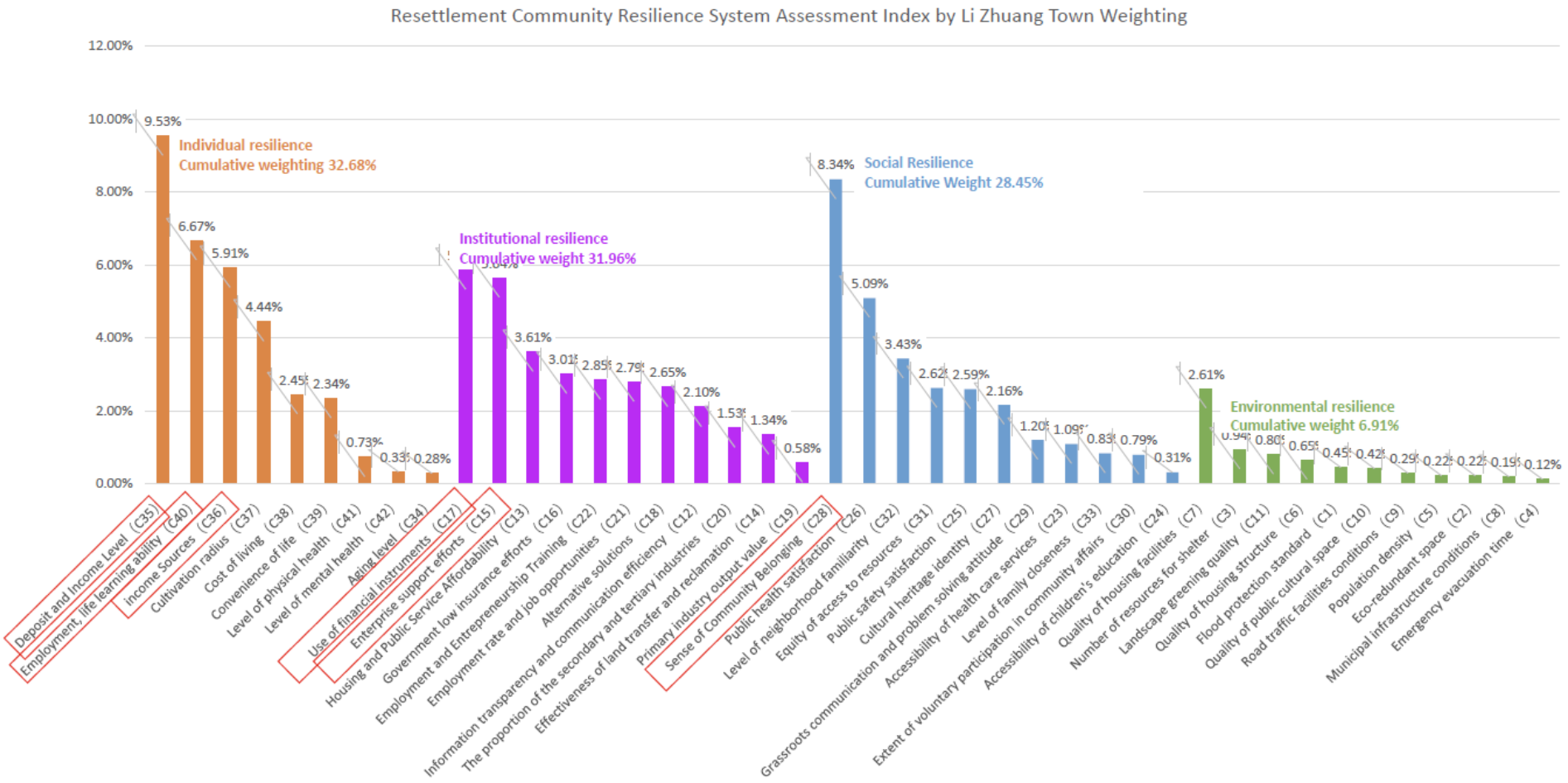
Assessment Methods

The entropy weighting method (entropy weight method) objectively assigns weights by evaluating the amount of information reflected by the degree of variation of indicators. The larger the variation of the index value, the smaller the information entropy and the larger the weight, and vice versa.

TOPSIS (technique for order-preference by similarity to ideal solution) method ranks the solutions according to the similarity of ideal solutions and compares the difference between different solutions and ideal solutions. The normalized original matrix is searched for the optimal and inferior solutions, and the distance and closeness between each solution and the optimal and inferior solutions are calculated. The closer the solution is to the ideal solution, the better the evaluation is, and vice versa, the worse.

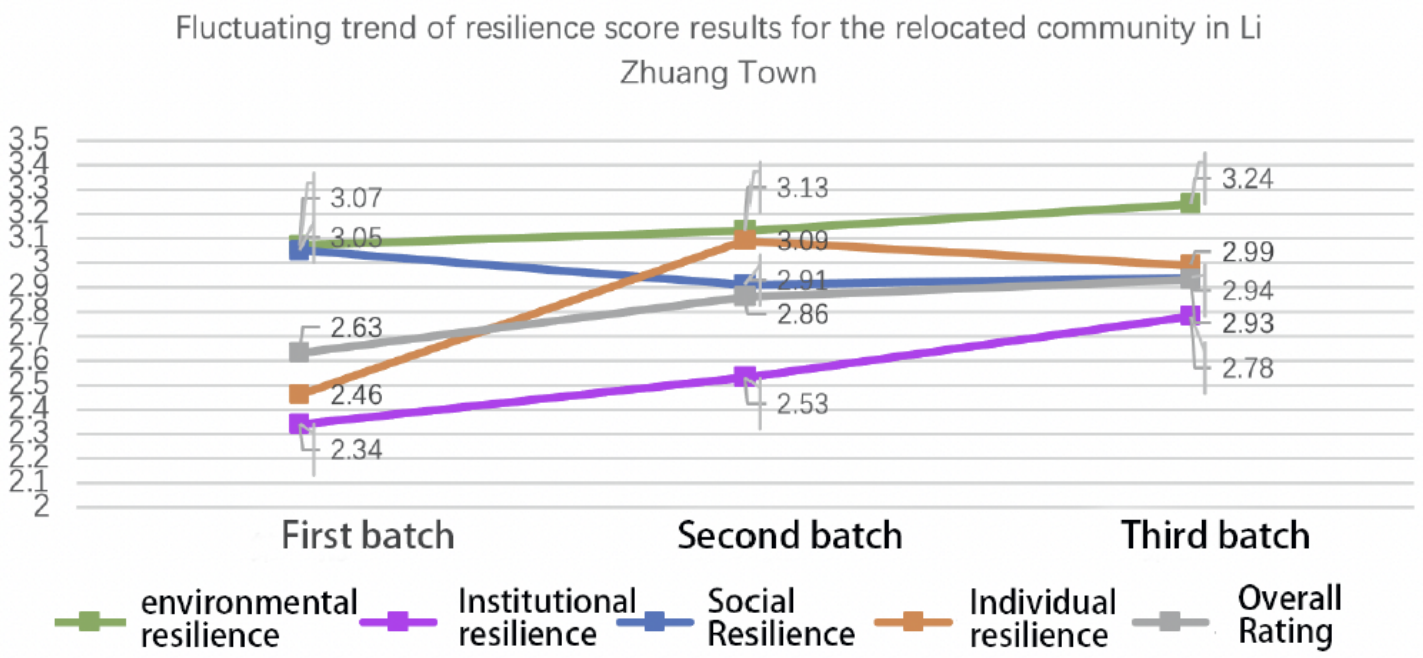
03 EMPIRICAL RESULTS

The Sort of Index Weight



Changes in Environmental and Institutional Resilience

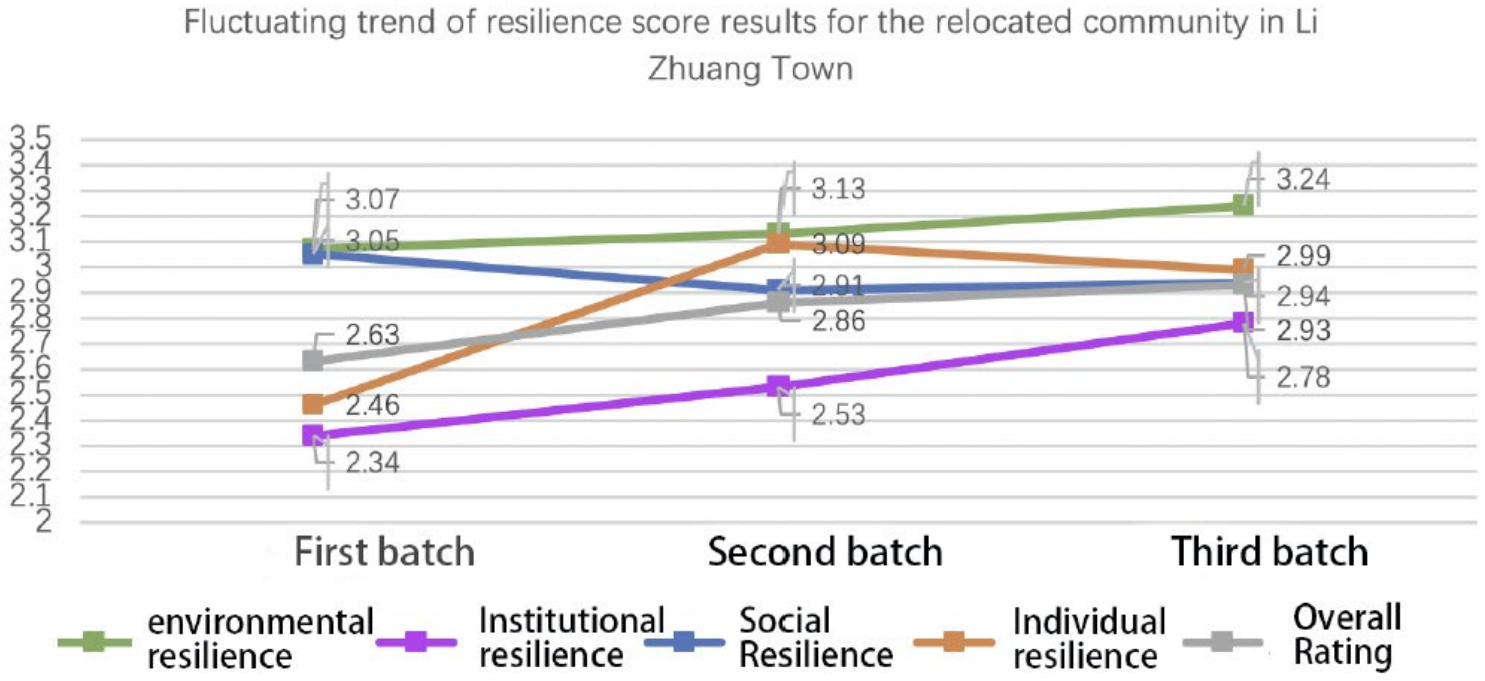
The environmental resilience level of the resettled communities was the highest and increased steadily, while the institutional resilience level was the lowest with the largest growth.



Dimension	Sub-dimension	Indicator	First batch	Second batch	Third batch	Average value
Environment Resilience (A1)	Flooding Risk (B1)	Flood protection standard (C1)	3.45	3.59	3.60	3.55
		Eco-redundant space (C2)	2.72	2.79	2.83	2.78
		Number of resources for shelter (C3)	3.30	3.21	3.33	3.28
		Emergency evacuation time (C4)	4.29	4.31	4.44	4.34
		Population density (C5)	3.22	3.36	3.49	3.36
	Living Environment (B2)	Housing structure quality (C6)	3.49	3.60	3.87	3.65
		Quality of housing facilities (C7)	2.72	2.79	3.05	2.86
		Municipal infrastructure conditions (C8)	3.29	3.46	3.38	3.38
		Road traffic facilities conditions (C9)	3.90	3.92	3.88	3.90
		Quality of public space (C10)	3.13	3.16	3.19	3.16
		Landscape greening quality (C11)	3.49	3.59	3.39	3.49
Institutional Resilience (A2)	Resettlement Policy (B3)	Information transparency and communication efficiency (C12)	2.86	3.11	3.39	3.12
		Housing and Public Service Affordability (C13)	2.24	2.30	2.70	2.41
		Effectiveness of land transfer and reclamation (C14)	2.74	2.94	2.55	2.74
		Enterprise support efforts (C15)	2.17	2.33	2.84	2.45
		Government low insurance efforts (C16)	2.19	2.10	2.24	2.18
		Use of financial instruments (C17)	1.99	2.38	2.69	2.35
		Alternative solutions (C18)	3.09	3.17	3.07	3.11
	Industrial Development (B4)	Primary production value (C19)	3.19	3.37	3.40	3.32
		The proportion of secondary production and tertiary production (C20)	2.51	2.59	2.90	2.67
		Employment rate and job opportunities (C21)	2.21	2.44	2.79	2.48
		Employment and Entrepreneurship Training (C22)	2.00	2.37	2.48	2.29
Social Resilience (A3)	Connections to Community (B5)	Accessibility of health care services (C23)	2.91	3.13	3.29	3.11
		Accessibility of children's education (C24)	3.69	3.59	3.60	3.63
		Public safety satisfaction (C25)	3.49	3.42	3.86	3.59
		Public health satisfaction (C26)	2.97	3.08	2.64	2.90
		Cultural heritage identity (C27)	2.36	2.61	2.78	2.58
		Sense of Community Attachment (C28)	3.17	2.58	2.54	2.76
	Connections between people (B6)	Grassroot communication and problem solving attitude (C29)	3.03	3.02	3.43	3.16
		Extent of voluntary participation in community affairs (C30)	3.14	3.14	3.21	3.16
		Equity of access to resources (C31)	2.89	2.92	3.56	3.12
		Degree of neighborhood intimacy	3.08	2.89	2.77	2.91
		Degree of family intimacy (C33)	3.12	3.39	3.44	3.31
Individual Resilience (A4)	Connections with livelihoods (B7)	Aging level (C34)	2.82	2.91	2.84	2.85
		Deposit and Income Level (C35)	2.56	3.72	2.78	3.02
		Revenue Sources (C36)	2.02	3.00	3.05	2.69
		Cultivation radius (C37)	3.32	2.65	2.46	2.81
		Living cost (C38)	2.26	2.15	2.51	2.31
		Convenience of life (C39)	3.86	3.60	3.80	3.75
		Employment, life learning ability (C40)	2.13	2.68	2.86	2.56
		Physical health (C41)	3.30	3.42	3.40	3.37
		Mental health (C42)	3.49	3.63	3.64	3.59

Changes in Social and Institutional Resilience

Social resilience and individual resilience levels fluctuated, indicating challenges in community integration and individual adaptation to changes in working and living styles.



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		Population density (C5)	3.22	3.36	3.49	3.36
	Living Environment (B2)	Housing structure quality (C6)	3.49	3.60	3.87	3.65
		Quality of housing facilities (C7)	2.72	2.79	3.05	2.86
		Municipal infrastructure conditions (C8)	3.29	3.46	3.38	3.38
		Road traffic facilities conditions (C9)	3.90	3.92	3.88	3.90
		Quality of public space (C10)	3.13	3.16	3.19	3.16
		Landscape greening quality (C11)	3.49	3.59	3.39	3.49
Institutional Resilience (A2)	Resettlement Policy (B3)	Information transparency and communication efficiency (C12)	2.86	3.11	3.39	3.12
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		Revenue Sources (C36)	2.02	3.00	3.05	2.69
		Cultivation radius (C37)	3.32	2.65	2.46	2.81
		Living cost (C38)	2.26	2.15	2.51	2.31
		Convenience of life (C39)	3.86	3.60	3.80	3.75
		Employment, life learning ability (C40)	2.13	2.68	2.86	2.56
		Physical health (C41)	3.30	3.42	3.40	3.37
		Mental health (C42)	3.49	3.63	3.64	3.59

Overall Changes in Community Resilience

Batch	Environmental Resilience (A1)			Institutional Resilience (A2)			Social Resilience (A3)			Individual resilience (A4)			Overall resilience posting progress (C)	Ranking
	$D_{A1}+$	$D_{A1}-$	C_{A1}	$D_{A2}+$	$D_{A2}-$	C_{A2}	$D_{A3}+$	$D_{A3}-$	C_{A3}	$D_{A4}+$	$D_{A4}-$	C_{A4}		
1	0.52	1.41	0.73	1.33	1.55	0.54	1.04	2.01	0.66	1.56	1.45	0.48	0.60	3
2	0.47	1.47	0.76	1.14	1.74	0.60	1.19	1.86	0.61	0.92	2.09	0.69	0.68	2
3	0.35	1.58	0.82	0.89	1.99	0.69	1.15	1.90	0.62	1.02	1.99	0.66	0.71	1

04 PROMOTION STRATEGIES

Preliminary Suggestions

- Strategy 1: Strengthening state insurance
- Strategy 2: Promoting enterprise support
- Strategy 3: Maintaining local trust

STRATEGY 1 Strengthening state insurance

Individual savings and income level, as an important community resilience indicator, reflects the financial ability to bear the cost of resettlement.

Financial instruments are necessary for resettled families to pull through.

STRATEGY 2 Promoting enterprise support

Enterprise support was the driving force to improve the resilience level of the 2nd batch, which could provide job and training opportunities to improve residents' learning abilities for new jobs and life.

STRATEGY 3 Maintaining local trust

Considering the psychological difficulties to leave one's homeland, the sense of community attachment is an important resilience element for resettled residents.

Conclusions

- The overall resilience level of 3 batches of communities improved, with savings and income and sense of community attachment etc. being important indicators of resilience.
- The environmental resilience level of the resettled communities was the highest and increased steadily, while the institutional resilience level was the lowest with the largest growth, mainly affected by the reinforcing enterprise support.
- Social resilience and individual resilience levels fluctuated, indicating challenges in community integration and individual adaptation to changes in working and living styles.
- Therefore, resilient development strategies for resettled communities in the Yellow River floodplain area are put forward, including strengthening state insurance, promoting enterprise support and maintaining local trust.

Take-away?

- **Expand the assessment object:** the empirical study is supplemented by the context of the resettlement of the Yellow River floodplain area
- **Refine the assessment scale:** village is taken as the survey unit and community or batch as the assessment unit
- **Integrate the assessment data:** data from GIS, government report, experts and residents scoring can be combined. The dynamic of assessment is partly considered to some extent in terms of comparing 3 batches of communities and embedding process indicators. Long-term monitoring and feedback are still needed for the software resilience dimensions in the long run.

THANKS ATTENTION!

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Assessment of Community Resilience for Planned Resettlement in the Yellow River Floodplain Area and Promotion Strategies: A Case Study of Lizhuang Town, Fengqiu County

- **Abstract**: The resilient transformation of resettlement communities is of great significance to high quality development of the Yellow River basin. This paper constructs community resilience assessment index for planned resettlement from four dimensions of environmental resilience, institutional resilience, social resilience and individual resilience, to comprehensively evaluate and analyze the community resilience level of 20 villages in three resettled batches from 2016 to 2020 in Lizhuang Town, Fengqiu County, Henan Province with entropy weight and TOPSIS methods. It is found that the overall resilience level of the three batches of communities improved, with savings and income and sense of community attachment etc. being important indicators of resilience. The environmental resilience level of the resettled communities was the highest and increased steadily, while the institutional resilience level was the lowest with the largest growth, mainly affected by the reinforcing enterprise support. Social resilience and individual resilience levels fluctuated, indicating challenges in community integration and individual adaptation to changes in working and living styles. Therefore, resilient development strategies for resettled communities in the Yellow River floodplain area are formulated and put forward, including strengthening state guarantee, promoting enterprise support and maintaining local trust.

- **摘要**：黄河流域高质量发展背景下，迁建社区的韧性转型对于黄河滩区长治久安具有重要意义。以河南省封丘县李庄镇2016—2020年三批迁建社区20个村为例，从环境、制度、社会、个体四个维度构建社区韧性评估指标体系，应用熵权TOPSIS方法进行综合分析评估。研究发现，存款与收入水平、社区归属感等是相对重要的韧性要素。三批迁建社区总体韧性水平提升，其中，环境韧性水平最高且稳步提升；制度韧性水平最低但提升幅度最大，主要受到企业帮扶的积极影响；社会韧性和个体韧性水平波动，表明社区整合与个体适应生产生活方式变化等方面存在挑战。从而在加强国家长期保障、促进企业帮扶带动、延续社会关系纽带方面提出更具韧性的迁建发展策略。

- **Keywords**: Planned Resettlement; Yellow River Floodplain Area; Community Resilience; Entropy Weight and TOPSIS Methods

- **关键词**：迁建；黄河滩区；社区韧性；熵权TOPSIS

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