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A Study on the Mechanism of the Impact of Rural Habitat on Rural Development in the Upper Reaches of the Minjiang River

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Abstract: *In order to explore the influence mechanism of rural human settlement environment on rural development, this paper constructs the evaluation index system of rural human settlement environment quality from five dimensions: living conditions, infrastructure, public service, ecological environment and social culture. The evaluation index system of rural development level was constructed from three dimensions of production, life and ecology. Multiple regression model was used to test the influence of rural human settlement environment quality on rural development level. Finally, structural equation model was used to explore its influence mechanism. The results show that: (1) The quality of rural human settlements in the study area has a significant promoting effect on the level of rural development from 2013 to 2020. (2) There are significant differences in the influence of various elements of rural human settlements on the rural development level. The three dimensions of living conditions, infrastructure and ecological environment have direct promoting effects on the rural development level, and the path coefficients are 0.24, 0.5 and 0.36, respectively. The two dimensions of public service and social culture play an indirect role in promoting rural development. To some extent, the results can provide scientific decision-making basis for rural human settlement environment improvement and rural sustainable development in the upper reaches of the Minjiang River.*

Keywords: *rural habitat quality; Level of rural development; Multiple regression analysis; structural equation modeling; Upper reaches of Minjiang River Area*

1. Introduction

Habitat refers to the surface space that is closely linked to people's survival activities, which is an important reflection of economic and social development and the living standards of the residents [1]; the countryside is a complex system consisting of social, economic, environmental and other elements, and it is the spatial carrier of people's production and life [2]. It is widely recognized that the rural habitat is a phenomenon of the interaction of natural, economic, social and cultural environmental elements generated by farmers' life and activities, and is a dynamic system, the transformation and evolution of its functions are not only affected by its intrinsic law, but also due to the impact of policies, human destruction and other factors and exhaustion [3-6].

The upper reaches of the Minjiang River are located in the transition zone from the Tibetan Plateau to the Sichuan Basin, with the watershed located at latitude 30°45′31″N-33°9′21″N, longitude 102°35′20″E-103°56′57″E, and the total length of the main stream is 337 km, with a watershed area of about 24,650 km², which includes Lixian County, Heishui County, Wenchuan County, Maocheng County, Songpan County, Dujiangyan County, and other areas of Sichuan [7], with a total area of 24,783 km² and a population of 38,350,000 people [8].

2. Research Methods and Data Processing

This study combines the current status of related research at home and abroad and the actual situation in the upper reaches of Minjiang River, follows the principles of systematicity, representativeness and operability, and on this basis, establishes a system of evaluation indicators for the quality of rural habitat environment and the level of rural development; among them, the quality of rural habitat environment starts from the dimensions of the hard and soft environments. Specifically, 21 evaluation indicators were

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selected to characterise the hard environment in four dimensions: living conditions, infrastructure, public services and ecological environment; and three evaluation indicators were selected to characterise the soft environment in the socio-cultural dimension, as shown in table 1; all of these indicators are positive, except for the "amount of chemical fertiliser applied per hectare of arable land", which is a negative indicator.

The level of rural development is measured by 17 evaluation indicators selected from the three dimensions of production, living and ecological functions corresponding to the three living spaces, all of which are positive indicators, as shown in Table 2.

Table 1: Rural habitat quality evaluation index system and weighting values

First-Level Indicators	Second-Level Indicators
living conditions	Housing area per capita (m²)
	Proportion of households that have completed relocation (%)
	Proportion of households completing construction of new homes in Tibetan areas (%)
	Proportion of households completing latrine renovation (%)
Infrastructure	Share of villages that have completed the installation of street lights on main roads (%)
	Access to formed villages(%)
	Proportion of communes with access to counties within one hour(%)
	Completion of rural power grid renovation Share of townships completing rural power grid renovation(%)
	Cable television coverage(%)
	Broadcast coverage(%)
public services	Share of communes with kindergartens and nurseries(%)
	Pupil-teacher ratio in primary schools(%)
	Proportion of villages with libraries and cultural rooms(%)
	Share of communes with hospitals and health centres(%)
	Number of beds in medical and health institutions (number)
	Proportion of communes with homes for the aged and day-care centres(%)
	Number of general shops or supermarkets with a business area of 50 square metres or more (number)
ecological environment	Area of planted forests (ha)
	Fertiliser application per hectare of arable land (number)
	Waste disposal rate (%)
	Centralised sewage treatment rate (%)
social culture	Number of public interest film shows (number)
	Number of performances for the benefit of the people in the countryside under the auspices of culture (number)
	Rate of settlement of disputes (%)

2.1 Multiple regression models

This study selected production (y_1), living (y_2), ecology (y_3) as dependent variables to characterise the level of rural development; living conditions (x_1), infrastructure (x_2), public service facilities (x_3), ecological environment (x_4), social culture (x_5) as independent variables to measure the quality of rural habitat, and verify the relationship between the quality of rural habitat and the level of rural development through multiple regression analysis. The expression of the multiple linear regression model is:

$$y = B_0 + B_1 x_1 + B_2 x_2 + \ldots B_k x_k + \epsilon$$

In the formula.B_0 .B_1 .B_2 .B_k are the parameters of the model;ϵ is the error term.

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Table 2: Indicator system for evaluating the level of rural development and weighting values

First-Level Indicators	Second-Level Indicators
production	Cultivated land per capita (ha)
	Food production per capita (tonnes)
	Meat production per capita (tonnes)
	Per capita gross value of agricultural, forestry, animal husbandry and fishery production (yuan)
	Effective irrigation rate(%)
living	GDP per capita (yuan)
	Engel's coefficient for rural inhabitants
	Per capita disposable income of rural residents (yuan)
	Proportion of pupils and teachers in compulsory education(%)
	Average number of village health centres per 10,000 people (number)
	Average number of mobile phones per 100 population (number)
	Total average road mileage per 100 population (kilometres)
ecology	Sanitary latrine coverage (%)
	Utilisation rate of manure from large-scale livestock and poultry farming(%)
	Air quality excellence rate(%)
	Forest cover(%)
	Total area of closed forests (ha)

2.2 Structural equation modelling

The structural equation model constructed in this study mainly describes the relationship between five influencing factors, namely, living conditions, infrastructure, public services, ecological environment and social culture, and the level of rural development. The five latent variables are all unique values obtained through the standardised values and weights of the secondary indicators, at which point the error of measurement is 0, and the model can be used for path analysis. Structural equation modelling is used to explore the mechanism of the influence of the quality of rural habitat on the level of rural development (see Figure 2), and to propose theThe following assumptions were made.

H1: Residential conditions have a positive impact on the level of rural development

H2: Infrastructure has a positive impact on the level of rural development;

H3: Public services have a positive impact on the level of rural development;

H4: Ecology has a positive effect on the level of rural development;

H5: Socio-cultural has a positive impact on the level of rural development;

H6: Interaction between the dimensions of human settlements

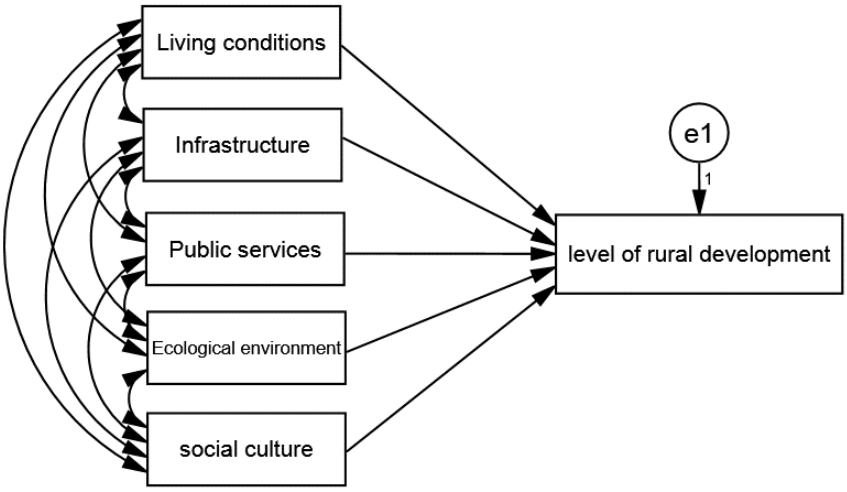

Figure 1: Path simulation of factors influencing the level of rural development

The model is shown in Figure 1, the correlation coefficients between the dimensions of rural habitat quality are represented by double arrows, and e1 represents the residual value; the path coefficients of each dimension on the level of rural development are represented by single arrows. Where the path

ISSN 2616-5783 Vol.7, Issue 2: 1-6, DOI: 10.25236/AJHSS.2024.070201

coefficient is the factor loading between the two ends of the single arrow, the beginning end of the arrow is the cause, the end to which the arrow points is the effect, and the factor loading represents the strength of its effect.

3. Results and analyses

3.1 Rural habitat quality contributes to rural development

Results of multiple regression analysis are shown in Table 3. The F-test values of the three models are 1.320 (sig=0.279) for production, 7.654 (sig=0.000) for living and 6.175 (sig=0.000) for ecology. The specific results are: ① The coefficient of influence of living conditions on life and ecology is 0.27 and 0.29 respectively, indicating that the improvement of living conditions contributes to the improvement of living and ecological level, which in turn promotes the development of the countryside. ② The impact coefficient of infrastructure on life is 0.36, indicating that the improvement of infrastructure can create good living conditions for villagers, increase the well-being of villagers' entrepreneurship and employment, and directly promote rural development. (iii) The impact coefficient of public services on life is -0.55, the impact coefficient on ecology is 0.51, and the impact onproduction has not passed the test, indicating that the impact of public services on rural development is not clear. ④ The impact coefficient of ecological environment on life is 0.32, indicating that the improvement of ecological environment is conducive to enhancing the living standard of rural residents, thus promoting rural development. ⑤ The coefficient of influence of social culture on production, life and ecology is not tested, indicating that social culture has no direct and significant influence on the level of rural development. Through multiple regression analysis, it is found that the quality of rural habitat environment has a certain promotion effect on rural development, but the way and intensity of the influence of each dimension of habitat environment on rural development are different. Therefore, it is necessary to continue to analyse the interrelationships between the dimensions of the rural human environment and their influence mechanisms on rural development.

Table 3: Results of multiple regression analyses of the quality of the human environment affecting rural development

variant	Dependent variable: production			Dependent variable: life			Dependent variable: ecology		
	Standardised coefficient	T-value	significance	Standardised coefficient	T-value	significance	Standardised coefficient	T-value	significance
living conditions	-0.26	-1.52	0.14	0.27**	2.14	0.04	0.29**	2.21	0.03
infrastructure	0.36	1.64	0.11	0.36**	2.18	0.04	0.17	0.96	0.34
public service	-0.10	-0.41	0.69	-0.55**	-3.04	0.00	0.51**	2.69	0.01
ecological environment	0.03	0.19	0.85	0.32**	2.52	0.02	0.18	1.30	0.20
sociocultural	0.08	0.47	0.64	-0.15	-1.19	0.24	0.15	1.16	0.25
	R^2=0.16 F=1.32			R^2=0.53 F=7.65			R^2=0.48 F=6.18		

3.2 Rural habitat quality has a multidimensional impact on the level of rural developmen

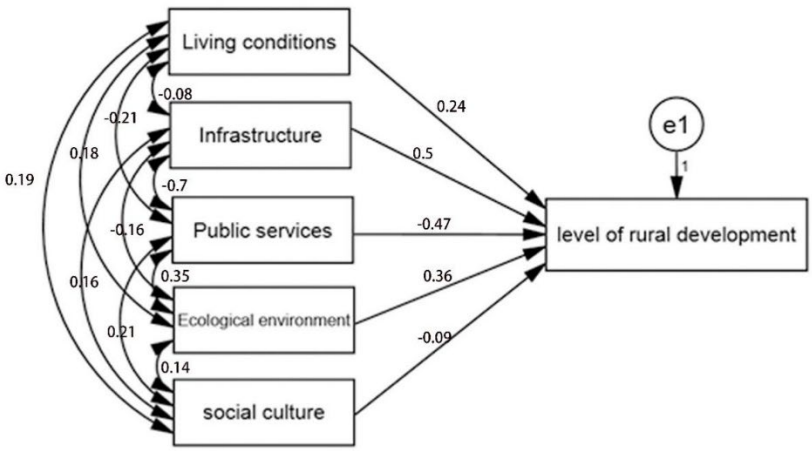

Figure 2: Path simulation of factors influencing the level of rural development (standardised)

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The results of the structural model show (see Table 4) that there are differences in the way and extent of the influence of the various dimensions of the quality of the rural human environment on the level of rural development: ① There is a direct and significant positive impact of living conditions on the level of rural development, with a path coefficient of 0.24, which is in line with the results of regression analyses in Table 4, and H1 is established. This shows that the improvement of rural residents' living conditions will have a direct impact on rural development. (ii) Infrastructure has a direct and significant positive impact on the level of rural development, with a path coefficient of 0.5,

Table 4: Structural model parameter estimation result

variable relationship	Standardised coefficient value	CR	P-value
Living conditions → level of rural development	0.24	1.91	0.06
Infrastructure → level of rural developmen	0.50	3.01	***
Public services → level of rural development	-0.47	-2.61	0.01
Ecological environment → level of rural development	0.36	2.81	0.01
social culture → level of rural development	-0.09	-0.74	0.46
Living conditions ↔ Infrastructure	-0.08	-0.53	***
Living Conditions ↔ Public Services	-0.21	-1.26	***
Living conditions ↔ Ecology	0.18	1.11	***
Living Conditions ↔ Socio-Cultural	0.19	1.18	***
Infrastructure ↔ Public services	0.70	3.58	***
Infrastructure ↔ Ecology	-0.16	-0.98	***
Infrastructure ↔ Socio-cultural	0.16	0.98	***
Public Services ↔ Ecology	-0.35	-2.09	***
Public Service ↔ Socio-Cultural	0.21	1.30	***
Ecology ↔ Socio-cultural	-0.14	-0.84	***

which is significantly greater than the other variables, and is consistent with the results of therural development. (iii) Public services have a significant impact on the level of rural development, but the path coefficient is -0.47, H3 does not hold. ④ The ecological environment has a direct significant positive impact on rural development, with a path coefficient of 0.36, which coincides with the results of the analyses in Table 4, indicating that the improvement of the ecological environment in the countryside can improve the appearance of the countryside, thus laying a solid foundation for the development of the countryside. ⑤ There is no direct significant effect of social culture on the level of rural development, and H5 is not valid. ⑥ From Table 4, it can be seen that there is a significant effect between the dimensions of the habitat environment, and H6 is valid. To sum up, living conditions, infrastructure and ecological environment have a direct promotion effect on rural development, analysis in Table 4, indicating that H2 holds. This shows that the strengthening of infrastructure is a key part of the work to improve the quality of rural habitat, the use of policy guidance, and actively build and improve infrastructure, will have a direct impact on while public services and social culture have an indirect promotion effect on rural development.

4. Conclusion and discussion

Multiple regression analysis shows that the quality of rural human settlement environment has a significant impact on the level of rural development, and the relevant hypothesis is put forward, combined with structural equation model and tested. The results show that the improvement of living conditions, infrastructure and ecological environment has laid the foundation for rural development. Thus, farmers' production and living standards can be improved, thus promoting the improvement of farmers' production and living standards. In rural areas, carrying out cultural activities can enrich the spiritual wealth of villagers, and then stimulate the inner power of rural development.

In general, the upper reaches of the Minjiang River are inhabited by Tibetan, Qiang, Han and Hui ethnic groups, and are also part of the Tibetan areas in four provinces of China, which are 14 concentrated and consecutive areas of extreme poverty. The geographical conditions of this region are very difficult, and the basic ability of self-development is poor, and the ability to attract external investment is weak. Therefore, the promotion of human settlement environment remediation actions in the upper reaches of the Minjiang River should follow the overall requirements of the central human settlement environment remediation, combine with the actual rural development in the upper reaches of the Minjiang River, adapt to local conditions, promote the transformation of rural industries, and finally realize the coordinated and sustainable development of rural human settlement environment and rural development.

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By measuring the quality of rural human settlement environment and the level of rural development in the upper reaches of the Minjiang River from 2013 to 2020, this study explored the mechanism of the impact of rural human settlement environment quality on the level of rural development through in-depth research, and clarified the key to human settlement environment improvement and rural development in the upper reaches of the Minjiang River. It can analyze the factors affecting the quality of human settlements and the level of rural development in each dimension, find out the contribution degree of each element, and propose key points for rural human settlements improvement and rural development. To explore the key points of rural human settlements in the study area, effectively solve the problem of "dirty, messy and bad" rural human settlements in the study area, and provide a reference for rural human settlements in the new era and improve the level of rural development.

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