

# Digital Empowerment to Resolve the Hollow Population in Rural Areas of Heilongjiang Province

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**Abstract.** Against the backdrop of urban-rural dualism and the popularization of internet big data, with the development of social economy and the continuous acceleration of urbanization, the problem of rural population hollowing out has gradually emerged. In order to solve the social situation of low-income and low-quality living, a large number of rural labor force has flooded into cities with high per capita LEP rates, resulting in the outflow of rural population. To curb the phenomenon of rural population hollowing out, this article uses big data to analyze the current situation of rural population, economy, and grassroots service governance. It is supported by the calculation of population hollowing out rate, and jointly explores the causes of rural population hollowing out in Heilongjiang Agricultural Province, China, and proposes targeted solutions. Discovering the phenomenon of rural population hollowing out caused by the coupling effect of multiple factors through digital empowerment.

**Keywords:** Rural areas; Hollow population; Digital empowerment

## 1 Introduction

The rapid urbanization process in China has made young labor force more inclined to move to economically developed cities to change the current situation of low income and low living standards, resulting in a continuous decrease in population and productivity in rural areas. The population presents a structure of "two ends are large, and the middle is small", which seriously restricts the pace of rural development and affects the stability of social relations. Therefore, the urgent issue of "hollowing out" rural population is related to the further implementation of national strategies. In this context, this article takes Heilongjiang Province, a major agricultural province in China, as an example to conduct research on rural population hollowing out, in order to gain a detailed understanding of the current situation of rural population hollowing out in Heilongjiang Province. By searching and summarizing data on various levels of rural population, economy, public service infrastructure, and labor in Heilongjiang Province, relevant equity ratios are calculated, By calculating the degree of hollowing out of rural population in Heilongjiang Province from the perspective of labor mobility, it was found through overall analysis that the hollowing out of rural population in Heilongjiang Province is gradually increasing. Further analyze the reasons for the hollowing out of rural population through the calculation results of the data. In the context of the development of big data, digitization not only promotes economic development and industrial transformation, but also provides opportunities to respond to new practices in rural governance challenges.<sup>[1]</sup> This article proposes corresponding solutions to the causes of hollowing out

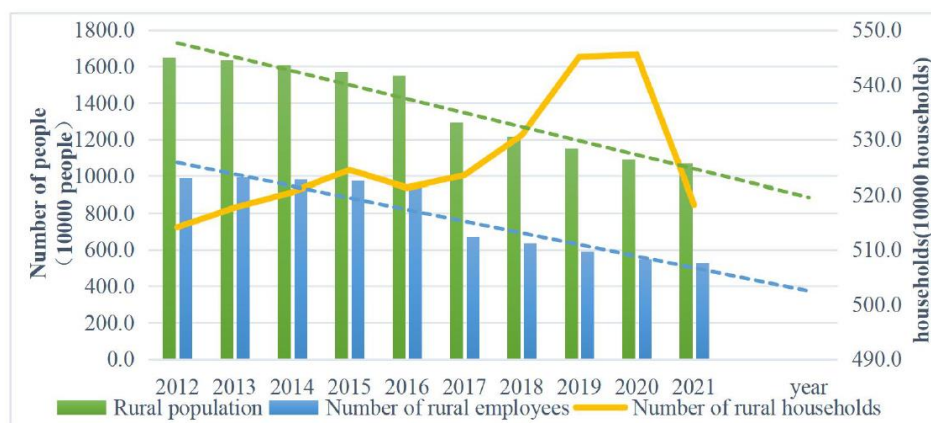
rural population in Heilongjiang Province through digital empowerment methods, in order to better promote the return of rural population in Heilongjiang Province.

## 2 Analysis of the Current Situation of Rural Development in Heilongjiang Province

### 2.1 Analysis of the current situation of hollowing out rural population in Heilongjiang Province

#### 2.1.1 Rural Population Mobility in Heilongjiang Province

From the data collected in the Statistical Yearbook of Heilongjiang Province (Figure 1), it can be seen that the number of rural permanent residents and labor resources in Heilongjiang Province is decreasing year by year. In terms of the number of rural households, affected by the COVID-19 in 2019, the number of rural households increased temporarily, but on the whole, it is still in the trend of shrinking.



**Figure 1** Basic Situation of Rural Areas in Heilongjiang Province over the Years

According to the comparison and corresponding proportion calculation of urban and rural population changes from 2017 to 2021 in the Heilongjiang Statistical Yearbook (Table 1), it can be seen that the urban and rural population in Heilongjiang Province has been decreasing year by year, with a total population decrease of 2.74 million people from 2017 to 2021. Under the trend of total population loss and urbanization rate of permanent residents in Heilongjiang Province increasing year by year (from 56.9% in 2012 to 65.7%), the proportion of urban population in the province has increased from 61.9% to 65.7 in five years, and the proportion of rural population has decreased to 34.3. Compared to the same period last year, rural population loss is more severe.

**Table 1** Historical Flow of Urban and Rural Population in Heilongjiang Province

| Time(year) | total population (10000 people) | town                      |            | village                   |            |
|------------|---------------------------------|---------------------------|------------|---------------------------|------------|
|            |                                 | Population (10000 people) | proportion | Population (10000 people) | proportion |
| 2017       | 3399.0                          | 2104.0                    | 61.9       | 1295.0                    | 38.1       |
| 2018       | 3327.0                          | 2111.3                    | 63.5       | 1215.7                    | 36.5       |
| 2019       | 3255.0                          | 2103.4                    | 64.6       | 1151.6                    | 35.4       |
| 2020       | 3171.0                          | 2080.5                    | 65.6       | 1090.5                    | 34.4       |
| 2021       | 3125.0                          | 2052.8                    | 65.7       | 1072.2                    | 34.3       |

### 2.1.2 Specific manifestations of hollowing out rural population in Heilongjiang Province

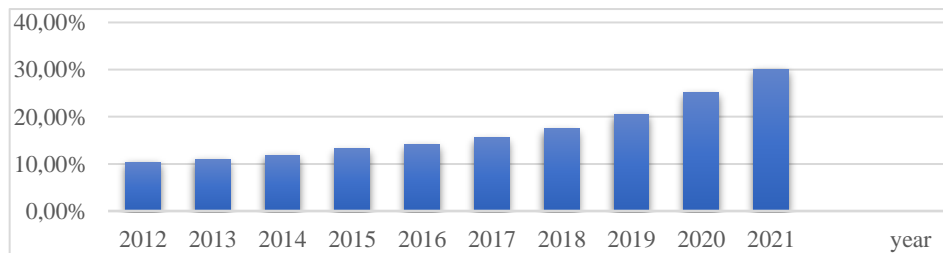
In terms of measuring the degree of rural population hollowing out, there is no unified standard in the academic community. The factors that affect rural population hollowing out are complex and diverse, among which the most direct influencing factor is the outflow of rural population. Therefore, this study will use the ratio of provincial foreign labor force to rural employed labor force as the indicator of rural population hollowing out from the perspective of labor force self transfer.

$$\text{Population hollowing rate} = \left(1 - \frac{P_1}{P_w}\right) \times 100\% \quad (1)$$

Among them:  $P_1$  represents the working population in a certain rural province

$P_w$  represents the working population in a certain rural area

By summarizing the rural population flow data of Heilongjiang Province from 2012 to 2021 and using the above formula(1),the hollowing out of rural population in Heilongjiang Province from 2012 to 2021 was plotted(Figure 2). Although the labor force population indicator is only one aspect of measuring rural hollowing out, overall, the degree of rural population hollowing out can also be reflected from the flow of labor force. The hollowing out of rural areas in Heilongjiang Province is showing a gradual upward trend.



**Figure 2** Degree of hollowing out of rural population in Heilongjiang Province

## 2.2 Development of Rural Economy in Heilongjiang Province

The total output of agriculture, forestry, animal husbandry, and fishing in rural areas of Heilongjiang Province has been increasing year by year, ranking tenth among all rural provinces in China. At the same time, the comprehensive machinery rate for crop cultivation and harvest has been increasing year by year. The total power of agricultural machinery in

Heilongjiang Province has increased from 60.60% nationwide in 2018 to 64.14%, ranking fourth in the country. The advantages of modern development of machinery are prominent, greatly liberating agricultural productivity, but the economic transformation and upgrading of Heilongjiang Province is relatively slow, The structure of the first, second, and third industries is imbalanced(Table 2), and the innovation of models promoting economic development is weak. Under the comprehensive effect of the convergence of agricultural industrial structure, the existing advantages of agricultural resources have been eliminated, which not only leads to imbalanced development between regions, but also has a negative impact on the sustainability and steady development of the overall rural economy.<sup>[2]</sup>

**Table 2** Contribution rate of three industries in Heilongjiang Province to regional GDP

|      | primary industry | Secondary industry | tertiary industry |
|------|------------------|--------------------|-------------------|
| 2016 | 22.0             | 15.6               | 62.4              |
| 2017 | 17.5             | 15.4               | 67.1              |
| 2018 | 19.2             | 15.3               | 65.5              |
| 2019 | 14.0             | 20.9               | 65.1              |
| 2020 | 74.7             | 93.6               | -68.3             |
| 2021 | 27.5             | 20.7               | 51.8              |

### 2.3 Rural Governance Services in Heilongjiang Province

On the one hand, the infrastructure, technical conditions, and talent team strength of compulsory education, township medical institutions, and nursing homes in rural areas of Heilongjiang Province are lower than the national level. There are many prominent problems with basic public services in rural areas of Heilongjiang Province,<sup>[3]</sup> such as the low level of public health services. Township clinics and clinics in Heilongjiang Province rank 20 in rural provinces nationwide, accounting for less than 3% of the country. On the other hand, due to the geographical environment of Heilongjiang Province, the distribution of rural areas is not concentrated, resulting in weak linkage between the upper and lower levels of governance, significant spatiotemporal variability in the demands and feedback of related farmers, uneven distribution of horizontal government supply resources, and weak correlation between economic development benefits; The vertical actual arrangement cannot be perfectly integrated with the actual situation, and the communication and coordination levels are relatively cumbersome.

## 3 The Causes of Hollow Rural Population in Heilongjiang Province

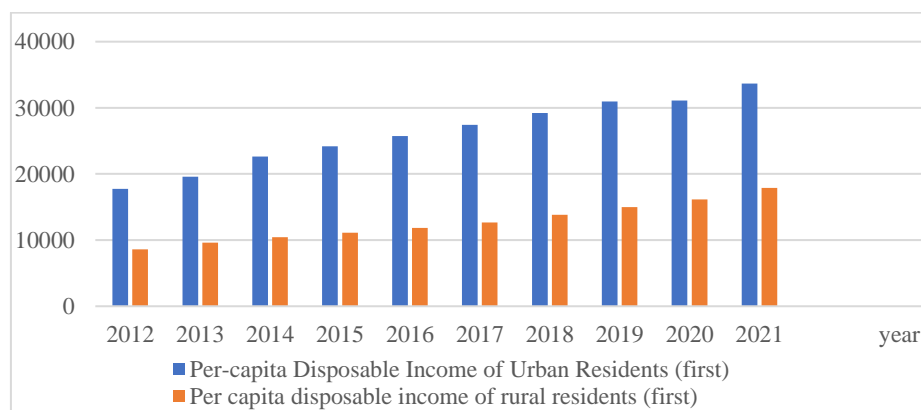
### 3.1 Loss of Economic Factors

On the one hand, the current development of rural agriculture in Heilongjiang Province has incorporated high-tech agricultural equipment, which has led to the large-scale liberation of some labor forces. In addition, the development structure of the secondary and tertiary industries in Heilongjiang Province is imbalanced, and the ability of rural collective economic organizations to drive industrial development is weak,<sup>[4]</sup> which has constrained the development of rural economy in Heilongjiang Province to some extent. According to

scholars' research, more population growth is associated with higher LFP rates in urban areas, which may indicate that population outflow is caused by a strong economy, and those who are willing to relocate are more motivated to work. On the contrary, the estimated impact on population growth in rural areas is negative.<sup>[5]</sup> The momentum of rural economic development in Heilongjiang Province is weaker than that of urban economic development, and the development of rural employment may be lower than that of urban areas. The prospects for rural development are difficult to predict, leading to a continuous increase in the trend of farmers going out to work, and the outflow of rural population from Heilongjiang Province.

### 3.2 Constraints of urban-rural dual structure

On the one hand, there is a dual structure between urban and rural areas in Heilongjiang Province, with imbalanced allocation of resources between urban and rural areas. In order to achieve rapid economic development, the proportion of resources invested in urban and rural areas is different, which makes it impossible to fundamentally solve the urban-rural differentiation. At the same time, the quality differentiation of education and medical talents between urban and rural areas seriously restricts rural development. At the same time, the increase in unequal distribution of agricultural capacity continues to trigger an outflow of poverty from rural to urban areas.<sup>[6]</sup> On the other hand, the per capita disposable income of rural residents has been increasing year by year (Figure 3), but there is still a significant difference compared to the per capita disposable income of urban residents. The average wage gap between migrant workers and urban workers will continue to widen,<sup>[7]</sup> and the overall level will still be lower than the national rural level. Among them, the per capita disposable income of rural residents is lower than the national per capita disposable income of 1041.6 yuan, and the consumption expenditure of farmers is lower than 690.6 yuan. The ranking of rural provinces in China is still at the lower middle level. The coupling of multiple factors has led to the "hollowing out" of rural population.



**Figure 3** Comparison of per capita disposable income between urban and rural areas in Heilongjiang Province

### 3.3 Low level of labor force

According to the data from the third agricultural census in Heilongjiang Province (Table 3), the proportion of young rural labor force is relatively small, with a large proportion of middle-

aged and elderly people, and the overall educational level is relatively low. Due to the insufficient ability and vitality to drive the economic development of our hometown, and under the influence of external pressure, the rural population in Heilongjiang Province has suffered a serious loss.

**Table 3** Rural Labor Force Levels in Heilongjiang Province

| Gender/age composition ratio of rural labor force |      | Composition ratio of education level of rural labor force |      |
|---------------------------------------------------|------|-----------------------------------------------------------|------|
| male                                              | 55.7 | Never attended school                                     | 1.9  |
| female                                            | 44.3 | primary school                                            | 35.8 |
| Age 35 and below                                  | 19.5 | middle school                                             | 52.2 |
| Age 36-54 years old                               | 53.6 | Composition ratio of education level of rural labor force | 7.8  |
| Age 55 and above                                  | 26.9 | Never attended school                                     | 12.3 |

### 3.4 Weak linkage of governance services

Heilongjiang Province has a vast land and abundant resources, and the distribution of rural areas is not concentrated, resulting in weak linkage between the upper and lower levels of governance. The demands and feedback of related farmers have significant temporal and spatial variability. The actual arrangements in the later stage cannot be perfectly integrated with the actual situation, and there are also certain blind spots in the supervision of rural grassroots cadres. At the same time, although digital governments have been established at the current stage and network integration services are very common, influenced by farmers' culture and concepts, the network service process cannot be understood and still follows offline processes, unilaterally forming a social phenomenon of difficult rural services.

## 4 Digital Empowerment: Solutions to Hollow Rural Population in Heilongjiang Province

### 4.1 Digital Agglomeration of Rural Capital and Development of Industrial Economy

Based on the diverse and dispersed geographical characteristics of rural villages in Heilongjiang Province, a digital information sharing platform is established. In the process of empowering urban-rural industrial integration through the digital economy, rural basic information infrastructure construction is guided by funds, with agricultural support funds as the main force for rural industrial development, government guarantees and insurance as leverage, and data elements as information transmission tools, and multiple entities share and jointly build information.<sup>[8]</sup> At the same time, attracting investment to develop local industries in rural areas, vigorously promoting the e-commerce economy model relying on the Internet, breaking through barriers to urban-rural connections, and introducing talents who understand technology and can develop into rural areas. When the rural economy stabilizes and

employment and income levels increase, rural population outflow can be effectively suppressed.

#### **4.2 Digital integration of public services to reduce urban-rural disparities**

Firstly, strengthen the construction of digital infrastructure, improve the popularization of rural networks and the application of internet related technologies. Secondly, establish a "cloud mutual assistance" platform to promote peer-to-peer video assistance in the current situation of significant medical and educational disparities between urban and rural areas in Heilongjiang Province. Utilizing the characteristics of the network's cross temporal and spatial media, we will coordinate the equalization of resource allocation between urban and rural areas through technology. Finally, increasing the openness of resource allocation in government e-government can balance the unreasonable allocation of urban and rural resources caused by non necessity.

#### **4.3 Digital Driving Talent Construction and Stimulating Endogenous Motivation**

On the one hand, strengthening human capital investment in the digital era, utilizing technologies such as big data cloud processing to analyze the actual needs of talent retention, in order to improve the government's talent introduction policies and stimulate talent's enthusiasm for rural construction. On the other hand, strengthen the cultivation of local talents. Establish a sound mechanism for cultivating digital talents in rural areas, and help farmers acquire the necessary knowledge online through online and remote education. The government has established a reward mechanism to encourage them to participate in knowledge and skills training, and to stimulate the endogenous motivation of rural labor.

#### **4.4 Digital construction service system to improve governance level**

The level of rural governance is the foundation for ensuring the quality of life of farmers. In terms of rural governance services in Heilongjiang Province, the government should continue to optimize the grassroots governance structure, strengthen the supervision of grassroots cadres, solve the problem of village decentralization, send grassroots cadres to the countryside in turns to inspect governance, achieve linkage between superiors and subordinates, and ensure the implementation of policies. At the same time, the government should carry out the construction of digital rural areas, establish an integrated service system for handling affairs, provide convenient procedures for farmers, reduce their travel, and improve governance efficiency. Establish an anonymous service hotline for villagers to facilitate the reception of farmers' voices and opinions. At the same time, the government collaborates with social forces to construct a digital rural construction model based on the "Three Persistences and Three Guarantees". Establish a simple, convenient, and easily operated network service mini program APP, allowing farmers to fully enjoy the convenience of digital governance.

## **5 Conclusion**

The hollowing out of rural population is a process caused by the large outflow of rural population and the insufficient age and labor level of rural left behind groups, leading to the decline of basic functions such as rural comprehensive economy, society, and culture. The

reasons for the hollowing out of rural population are complex and varied. Based on data analysis of rural population mobility and basic information in Heilongjiang Province, China, the real reasons for the outflow of rural population are explored through the calculation of the hollowing out formula of rural population from the perspective of labor force population self transfer. It has been found that the loss and hollowing out of rural population in Heilongjiang Province are influenced by the constraints of the province's economic factors, the existence of a dual urban-rural structure, the low level of labor force, and insufficient governance and service capabilities. To address the continuous evolution of rural population hollowing out, in addition to the implementation of policy documents, digital means are also needed to assist. By empowering rural capital through digital means, we aim to develop a suitable business economy, integrate public services, reduce urban-rural disparities, promote talent development, stimulate their endogenous motivation, and enhance governance through digital technology and the construction of service systems. Make the digital economy and digital government complement each other and work together to promote the development of rural economy, society, culture, talent, etc., suppress the occurrence of inducing factors, and reduce the occurrence of rural population hollowing out.

## References

- [1] Qiu Zeqi, Li Youjun, Xu Wanting. Digitalization and Changes in Rural Governance Structure [J]. Journal of Xi'an Jiaotong University (Social Science Edition), 2022, 42 (02): 74-84.
- [2] Wang Feifei Research on Regional Differences in Rural Economic Development in Heilongjiang Province [D]. Jilin University, 2019.
- [3] Liu Ping, Guo Hongyu. Issues and Countermeasures of Basic Public Service Supply in Rural Areas of Heilongjiang Province under the Rural Revitalization Strategy [J]. Economic Research Guide, 2021 (02): 14-16.
- [4] Zhu Zhimeng, Song Zhibin, Liu Yanxia. The adverse effects, causes, and governance strategies of hollowing out rural industries: A case study of Heilongjiang Province [J]. Agricultural Economy and Management, 2022 (06): 67-77.
- [5] Stephens, Heather M, and J. Deskins. Economic trees and labor market participation [J] American Journal of Agricultural Economics, 2018100 (5): 1336-1356.
- [6] Thomas B, Robert S. The rural exodus and the risk of Europe [J] Journal of Economic Growth, 2022-27 (3).
- [7] Dandan Zhang. The Evolution of the wave gap between rural immigrants and the urban labor force in Chinese cities [J] Australian Journal of Agricultural and Resource Economics, 2020,64 (1).
- [8] Yao Yuchun, Zhang Jiashi, Zhao Sitong. Implementation Mechanism, Realistic Dilemmas, and Policy Optimization of Digital Economy Empowering Urban Rural Integration Development [J]. Economic Review, 2022 (12): 50-58.