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Rural Public Investment and Benefit in Sichuan's Hilly and Mountainous Areas

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Abstract Using representative sampling survey data, we take the case of roads, domestic water, irrigation facilities, clinics and schools, to give an overview of the status quo of rural public investment in Sichuan's hilly and mountainous areas in the period 2005–2008; conduct comprehensive analysis of public investment benefit, from the status quo of supply and demand, social benefit and villagers' satisfaction. The results show that the social benefit arising from the construction of road projects is good, while the social benefit arising from the construction of irrigation facilities is poor; the matching effect of supply and demand of public investment is poor, especially for the investment in irrigation facilities; on the whole, villagers' satisfaction with public investment has been promoted, but most of the villagers are still unsatisfied with the current irrigation facilities. The major capital source of rural public investment is from the government, but from the perspective of the villagers' demand, we should further increase the public financial input.

Key words Rural public investment, Social benefit index, Evaluation of supply and demand, Satisfaction

Rural infrastructure, as the foundation and prerequisite of rural economic and social development, is the focus of the new rural construction that has drawn the most attention. The Central Document No. 1 in 2008 made it clear that we will gradually improve the level of rural basic public services, including raising the level of compulsory education in rural areas, enhancing the capacity of the rural basic medical services, vigorously developing rural public transport, continuing to improve rural living environment, establishing and improving the rural social security system, *etc.* The Central Document No. 1 in 2011 carried out full deployment of the water conservancy work for the first time.

Public investment in rural areas plays an important role in ensuring ceaseless and balanced economic development, promoting social harmony. At present, China's rural public investment is largely oriented toward the provision of public goods, including roads, education, health services, drinking water, communications and other public service facilities that are of great significance to the development of rural areas^[1]. Studies have shown that rural public investment contributes to poverty alleviation and promoting the growth of agricultural output^[2]; the increase in public investment can bring job growth^[3]. The public investment construction projects is closely linked to the public interest. The implementation of the project should not only focus on its economic benefits, but also pay more attention to its social benefits. The benefits of public investment is both

related to whether the central policy can really be implemented, and related to whether the farmers can really benefit.

Sichuan Province is a typical agricultural province, and the agricultural population accounts for 75.26% of the population in whole province. The contradiction between the construction of agricultural infrastructure and sluggish development of the public service system in rural areas is particularly prominent, and the demand for investment is huge. In recent years, the funds input into Sichuan's rural infrastructure construction rises on the whole, but the total input remains low, and the annual fluctuations are big, with poor stability^[4]. In addition to the complex topography, the construction is difficult. The overall level of rural infrastructure lags behind (especially the level of irrigation and water conservancy facilities), has become the bottleneck of rural economic and social development in Sichuan Province. Sichuan Province is a large mountainous province, and the area of hilly and mountainous areas exceeds 90% of Sichuan's total area^[5]. Sluggish economic development and great difficulty in the implementation of public investment result in low level of infrastructure and public facilities construction, further constraining the development of hilly and mountainous areas. Therefore, conducting research on the benefit of rural public investment project in Sichuan's hilly and mountainous areas is of great significance. The past researches on rural public investment mainly explored the relationship between public investment and economic growth, or between infrastructure investment and economic growth, taking the entire country as the scale^[6–8]; analyzed the status quo and quality of public investment^[9–11]; studied the factors influencing public investment^[12]; discussed the degree of satisfaction with public facilities, willingness to invest in public facilities, and the influencing factors^[13–14], *etc.* In general, there is a shortage of empirical re-

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searches specifically on rural public investment in the hilly and mountainous areas. On the basis of analyzing the status quo of rural public investment in the Sichuan's hilly and mountainous areas, we take the case of roads, domestic water, irrigation facilities, clinics and schools that are closely related to the villagers' life, to research the comprehensive benefit of public investment, from social benefit, matching of supply and demand, villagers' satisfaction.

1 Data source and research methods

1.1 Data source and survey methods The data used for the analysis are from the sampling survey data on investment in rural public goods in Sichuan Province, derived by the Agricultural Policy Research Center, the Chinese Academy of Sciences and Institute of Mountain Hazards and Environment, the Chinese Academy of Sciences, in 2005 and 2008. As to the selection of the sample counties, all counties in the entire province are sequenced according to per capita industrial output value and divided into 5 groups; 1 sample county is randomly selected from each group. Using the same method, the towns in each sample county are sequenced according to per capita industrial output value; after being divided into two groups, 1 town is randomly selected from each group, and 10 sample towns are randomly selected from the entire province in total. Similarly, 2 villages are randomly selected from each sample town, and 20 villages are surveyed in total in the entire province. According to the landscape type of each sample village, 20 sample villages are divided into 12 hilly villages and 5 mountain villages. The participatory interviews in the form of questionnaire with the village cadres and peasants, are carried out respectively in each village. In 2005, only 8 peasant households were randomly selected for survey from each village, and 160 questionnaires were called back in total. When paying a return visit to the sample villages in 2008, 12 peasant households were randomly selected from each village on the basis of the original 8 households; the number of households interviewed increased to 20, and 400 questionnaires were called back in total.

1.2 Evaluation indicators and methods for benefit of rural public investment project There are mainly three kinds of methods for measuring the benefits of public projects in rural areas: the first is to reflect the benefits through economic, ecological and other output indicators concerning investment in various rural projects; the second is to score and evaluate the benefits of investment in projects by the independent assessment agencies; the third is to judge or sequence the benefits condition of investment in projects, demand and supply, and satisfaction by the direct beneficiaries. This study uses the third method, reflecting the benefit satisfaction of the final beneficiaries of rural public investment projects – the villagers and village cadres. Therefore, we conduct analysis from 3 aspects (the supply and demand of investment in the projects of roads, domestic water, irrigation facilities, clinics and schools; social benefit; the degree of villagers' satisfaction with various facilities.

The social benefit of public investment is measured using the social benefit index. The calculation method is to conduct

sequencing and scoring according to villagers' judgment on social benefit of each project, and then divide the sum at the village level by the number of villagers in the sample villages, to get the social benefit index of implementation of each project in the sample villages. Each villager holds that the number of projects implemented in the village is different, so it is not simple to score the projects implemented in each village. Here we mainly use the method of Liu Chengfang, *et al.* to deal with the villagers' sequencing of social benefit of public investment projects^[11]. Taking the case of road project, if one villager ranks the road first, then the social benefit of road is 100 points. The calculation method for other rankings is as follows: assuming that N projects are implemented in one village during the period of survey, the villagers rank the benefit of road project n_i – th, then the score of social benefit of road project is as follows: $100 \times (N - n_i + 1) / N$. If the villagers hold that there are many road projects implemented in the village and rank different road projects in different positions, the score of each road project is first calculated and then averaged, which is the evaluation score of benefit of the road project; the calculation method of social benefit index of the other four types of projects is similar.

As to the analysis of demand and supply of public investment, we conduct comparison analysis using the index of farmers' willingness to invest and the actual investment during the period of survey, to assess the benefit of implementation of five categories of projects in recent years, from perspective of farmers' needs. Farmers' willingness to invest is based on the following data. Assuming that the village has 50 000 yuan, the villagers prioritize the investment results of 5 types of public projects, and calculate the index of willingness to invest of various types of public investment projects in the sample villages, respectively. The calculation method is to assign value of 1, 0.8, 0.6, 0.4, 0.2 points to 5 order numbers (1, 2, 3, 4, 5), respectively, and thus change the qualitative evaluation into quantitative evaluation. The concrete calculation formula is as follows: the index of willingness = (the proportion of order 1 villagers $\times 1$ + the proportion of order 2 villagers $\times 0.8$ + the proportion of order 3 villagers $\times 0.6$ + the proportion of order 4 villagers $\times 0.4$ + the proportion of order 5 villagers $\times 0.2$) $\times 100$.

As to the analysis of villagers' satisfaction with various facilities, four-level qualitative judgment (very satisfied, satisfied, do not know, not satisfied) is used to calculate the index of the villagers' satisfaction with facilities within the village in the sample villages. The calculation method is as follows: the index of satisfaction = (the proportion of villagers who are very satisfied with the facilities $\times 1$ + the proportion of villagers who are satisfied with the facilities $\times 0.75$ + the proportion of villagers who do not know the facilities $\times 0.50$ + the proportion of villagers who are not satisfied with the facilities $\times 0.25$) $\times 100$.

2 Results and analysis

2.1 Status quo of rural public investment in Sichuan Province The survey results show that the villages in Sichuan's hilly and mountainous areas have many investment activities in the period 2005 – 2008. 80 public investment pro-

jects are implemented in 20 sample villages in total, an average of 4 projects each village. Each village has at least one project, and the number of project in some villages is up to 10. In terms of total amount of capital, the capital used by the sample villages for 5 types of public investment was 18.531 1 million yuan in the period 2005 – 2008, 0.926 6 million yuan per village; 72.75% of the capital was used for road and bridge construction, and nearly 20% of the funding was used for construction of domestic water facilities (Table 1). Each village's investment is also concentrated in the roads and domestic water. 95% of the sample villages have carried out investment in domestic water, 75% of the sample villages have carried out investment in roads, and few villages invest in irrigation facilities, schools and clinics.

The sources of funding of public investment are classified, to analyze various sources of project funding. In terms of the number of projects, 40% of the projects are funded by the village itself; 32.5% of the projects are funded by the village and government; 27.5% of the projects are funded by the government alone. This also means that the village needs to provide part of or all supporting funds for 72.5% of the projects. In terms of project scale, the scale of project funded by the gov-

ernment is large, followed by the scale of project jointly funded by the government and village; the scale of project funded by the village is small. In terms of total amount of funds, the government bears 58.41% of public investment, and the proportion of fund raised by villages is 41.59% (Table 2). It can be seen that the rural infrastructure construction in Sichuan's hilly and mountainous areas has obtained the government's financial investment and strong support, but the village still bears a large portion.

Table 1 The number and scale of public investment project in the period 2005 – 2008

| Project Type | Number of projects | Scale of projects 10 ⁴ yuan per project | Share in total amount of capital//% |
|-----------------------|--------------------|--|-------------------------------------|
| Roads and bridges | 49 | 28.09 | 72.75 |
| Domestic water | 21 | 17.43 | 19.75 |
| Irrigation facilities | 5 | 6.17 | 1.66 |
| Schools | 3 | 34.53 | 5.59 |
| Clinics | 2 | 2.25 | 0.24 |
| Total (average) | 80 | 23.46 | 100.00 |

Table 2 Public investment with different sources of funding

| Project Type | Solely funded by the government | | Separate fund-raising by villages | | Co-financing by government and villages | | The proportion of fund raised by villages % | The proportion of fund offered by government % |
|-----------------------|---------------------------------|--|-----------------------------------|--|---|--|---|--|
| | Number of projects | Scale of projects 10 ⁴ yuan per project | Number of projects | Scale of projects 10 ⁴ yuan per project | Number of projects | Scale of projects 10 ⁴ yuan per project | | |
| Roads and bridges | 12 | 45.04 | 23 | 15.32 | 14 | 33.62 | 46.94 | 53.06 |
| Domestic water | 6 | 31.33 | 5 | 7.04 | 10 | 14.29 | 30.16 | 69.84 |
| Irrigation facilities | 2 | 2.43 | 1 | 6.00 | 2 | 10.00 | 49.92 | 50.08 |
| Schools | 2 | 48.00 | 1 | 7.60 | | | 7.34 | 92.66 |
| Clinics | | | 2 | 2.25 | | | 100.00 | 0.00 |
| Total (average) | 22 | 37.70 | 32 | 12.20 | 26 | 24.37 | 41.59 | 58.41 |

2.2 Benefit evaluation of public investment project

2.2.1 Social benefit. The survey data show that the benefit brought by the projects of roads, clinics and domestic water is good. The social benefit index of road project is 75.64; the social benefit index of clinics is 72.95; the social benefit index of domestic water is 71.06; the social benefit index of schools and irrigation facilities is 61.47 and 59.67 respectively, slightly poor.

At the same time, there are also differences in the social benefit of public investment projects with different size of funds. The project scale is divided into 7 groups: < 20000 yuan; 20 000 – 100 000 yuan; > 100 000 – 200 000 yuan; > 200 000 – 300 000 yuan; > 300 000 – 500 000 yuan; > 500 000 – 1 000 000 yuan; > 1 000 000 yuan. By calculating the average social benefit of these 5 types of projects in each group, we find that benefit shows the linear increase along with the increase in the size of invested funds (Fig. 1), possibly because the greater the size of project funds, the more the people benefit from the investment, the greater the importance attached to the project in the process of construction, the better the social benefit re-

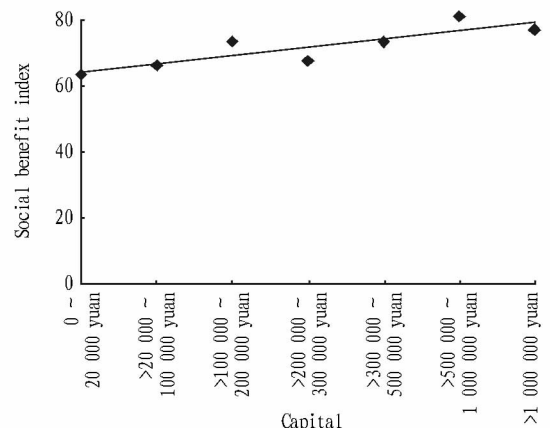


Fig. 1 Social benefit curve of projects with different capital scale

flected. This law is also present in various types of investment projects, that is, the social benefit index of road project, domestic water project, irrigation facilities project, clinics and schools is calculated according to different size of funds, and

with increase in the size of funds, the social benefit index is on the high side. However, in terms of survey data of the sample villages, the rural public investment projects in Sichuan's hilly and mountainous areas are mainly concentrated in small-scale investment projects, and the capital scale of 56.41% of these projects is below 100 000 yuan. Therefore, in order to further enhance the social benefit of rural public investment projects in Sichuan's hilly and mountainous areas, we should strengthen supervision and management on small-scale projects from now on.

2.2.2 Evaluation of demand and supply. In the 2005 survey, if the village has 50 000 yuan, the researchers ask the respondents to sequence the 5 investment projects (road construction; school construction; irrigation facility construction; drinking water facility construction; clinics construction). The index of willingness to invest of various projects is calculated, indicating that rural road construction project is what the farmers need most urgently (Fig. 2). The bad road conditions in hilly and mountainous areas seriously hamper the regional development and the improvement of the income of rural residents, which makes the villagers have the highest expectations of road improvement. It is followed by the construction of irrigation facility. In the period 1998 – 2004, the number of irrigation facilities invested by Sichuan Province ranked first in China^[15], but due to the irreplaceable role that the irrigation facility played to agricultural production, it still failed to better meet the villagers' needs. The next is the domestic water facility inseparable from the villagers' lives. In the past few years, the drinking water facility in Sichuan Province was greatly improved^[16], but the villagers still had some expectations on the investment in it. The final one is the construction of schools and clinics.

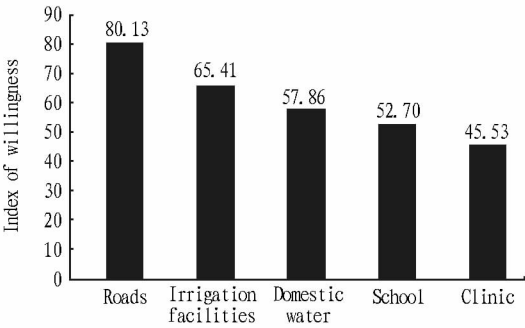


Fig.2 Index of willingness to invest in 2005

Taking village as unit, we calculate the willingness index of the above five projects. The analysis indicates that the domestic water has better met the villagers' needs, and all villages have invested in it except one. In 95% of villages, the willingness index of road project is in the top two, of which 70% of villages rank it in the first position, that is, these villages believe that the road is the project that needs the investment most; in practice, only 75% of villages invest in the road. In terms of irrigation facility, there are 3 villages most in need of investment, but only 1 village has invested in it; there are 8 villages ranking it second, but only one village has invested in it, too. The actual number of villages investing in the school project is equal to

the number of villages with high willingness index, but in reality it fails to well meet the villagers' needs, because only one village implements the school project that the villagers need most; other villages that need to invest do not invest, but the villages that do not need to invest invest. In addition, in terms of domestic water and clinics, there is also the phenomenon that villagers not really in need of investment invest in them in reality (Table 3).

Table 3 Matching of public investment supply and demand

| Project type | The number of villages with the highest index of willingness | The number of villages with the index of willingness ranking second | The number of villages actually investing |
|-----------------------|--|---|---|
| Roads | 14 | 5 | 15 |
| Irrigation facilities | 3 | 8 | 5 |
| Domestic water | 1 | 6 | 19 |
| Schools | 2 | 1 | 3 |
| Clinics | 0 | 0 | 2 |

Through the matching analysis of supply and demand, it indicates that apart from domestic water in Sichuan's hilly and mountainous areas, several other types of investment have not yet met the villagers' needs. In the future, it is necessary to further investment, and pay more attention to differences in villagers' needs for a variety of service facilities, in order to improve the benefit of the project.

2.2.3 The villagers' satisfaction with various facilities. By comparing the results of the two surveys, we can find that the overall satisfaction with public investment is increased from 57.03 to 60.19. There are increase and decrease in the satisfaction with the single investment project; the satisfaction with domestic water, roads and clinics is increased to a certain extent; the satisfaction with the other two public investment projects declines (Table 4). The satisfaction with domestic water is increased most, an increase of 9.81, which is closely linked with the fact that 95% of villages actively invested in it during the period 2005 – 2008. In terms of roads, 75% of villages have at least one project each, and the average investment size is relatively large, which to a large extent makes the villagers more satisfied with roads. The satisfaction with clinics is also increased to a certain extent. In the past few years, there was less investment in clinics, and only 2 villages invested in this. But the villagers' satisfaction with it is improved, which may to some extent arise from the rural cooperative medical care system emerging in recent years, making the villagers more easy and convenient to see a doctor. The farmers' satisfaction with the other two investment projects declines to some extent. During the two surveys, we can find that despite a certain amount of investment in irrigation facility, the villagers' satisfaction with it is the lowest, lower than in 2005, which may be due to the fact that the undulating terrain in hilly and mountainous areas makes it difficult to construct irrigation facility; there is still no irrigation facility in many places, having not funda-

mentally changed the farmers' fate of "subsistence relying on weather". In terms of the construction of schools, the decline in the satisfaction may be due to the fact that the policy of re-pealing and merging a large number of rural primary and secondary schools is implemented; many schools in mountainous areas are abandoned, making it inconvenient for the children in the village to go to school.

Table 4 Index of satisfaction with each project in 2005 and 2008

| Project type | The year 2005 | The year 2008 |
|-----------------------|---------------|---------------|
| Domestic water | 59.69 | 69.50 |
| Roads | 57.66 | 63.94 |
| Clinics | 57.34 | 62.25 |
| Schools | 59.06 | 58.19 |
| Irrigation facilities | 51.41 | 47.06 |
| Average | 57.03 | 60.19 |

3 Conclusions

(i) In the sample villages, the rural public investment in recent years is satisfactory, both from the total amount of funds and the number of projects. In general, the government's financial investment is predominant, but the villages are still burdened with a large proportion of investment, which should be noted.

(ii) As to the projects implemented in the sample villages, the social benefit generated to each village is different. The road project has the greatest social benefit, followed by clinics and domestic water; the school project has poor social benefit, and irrigation facility has the poorest social benefit, that is, the villagers are not satisfied with the existing investment in irrigation, so the investment should be increased in it. At the same time, we find that the social benefit of public investment project increases with the increase in the size of funds.

(iii) The five types of projects implemented in the sample villages poorly match the villagers' willingness to invest. Apart from domestic water, all other investment projects fail to better meet the needs of the villagers, especially the investment in irrigation facility.

(iv) The overall satisfaction of farmers in Sichuan's hilly and mountainous areas with the public investment is increased, but the extent is not large. Apart from domestic water, the villages not satisfied with several other facilities also account for a large proportion, indicating that there is still much room for improvement in rural public services in Sichuan's hilly and mountainous areas, and the improvement in irrigation facility particularly necessary, because it is always the project that the villagers are not satisfied with.

In the process of future construction of public facilities in rural areas, we should further increase investment; based on the wishes of the villagers, invest in the projects that the villagers need; focus on adjusting the proportion of government investment funds, so as to effectively play the role of the government's public finance, and promote the overall efficiency of public investment projects. At the same time, in the context of the central government comprehensively deploying the water conservancy work, we should focus on strengthening the infra-

structure construction of irrigation facility in the hilly and mountainous areas.

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