The Analysis of Dominance Degree of Land Use in Irrigation District——A Case Study of Jinghuiqu Irrigation District in Shaanxi Province

ZHOU Lu-hong[1*] , **LI Ya-ni**[2] , **WANG Xiao-feng**[1]

1. College of Earth Science and Land Resources，Chang'an University，Xi'an 710054，China；2. Tourism & Hotel Management Department，Shunde Polytechnic，Shunde 528333，China

Abstract　According to the remote sensing interpretation data in study area，statistics and the data concerning agricultural land classification of Shaanxi Province，on the basis of degree of dominance of land use，taking Jinghuiqu Irrigation District as an example，this paper adopts benefit-cost analysis method and the method of degree of dominance of land resources per capita to conduct analysis on degree of dominance of land. The results show that in study area，the ratio of cost and benefit of farmland is 1.5，with relative big value，indicating that farmland is the dominant land resource in Jinghuiqu Irrigation District；the abundance of land resources in study area is 0.73，the combination index of land resources is 2.3，and degree of dominance of land resources per capita is 0.32，indicating that the combination index of land resources in study area is relatively big，while degree of dominance of land resources per capita is relatively small，which shows that in study area，the combination of all kinds of land resources is in a poor state，with poor supporting ability. In view of the status quo that the combination of all kinds of land resources is in a poor state，with poor supporting ability in Jinghuiqu Irrigation District，the corresponding policy suggestions are put forward as follows：first，strictly implement the central policy and protect farmland resources；second，adjust land use structure and strive to promote benefit；third，make rational planning of land resources and take the road of sustainable development；fourth，take the irrigation district as the unit and establish use class and price standard of land in irrigation district.

Key words　Dominance degree of land resources，Benefit-cost，Degree of dominance of land resources per capita，Jinghuiqu Irrigation District

Amid 0.122 billion hm² of farmland in China，the irrigation area is 0.058 billion hm²，accounting for 48% of total area of farmland in China. In the irrigated land，the annual gain output accounts for 75% of total grain output in China，which creates favorable conditions for stable development of agricultural production，food security，economy and society in China.

However，with the increase of population，rapid development of economy，quickened process of urbanization，and the increasing shortage of land resources，the rational use of land resources in irrigation district becomes important. The analysis of degree of dominance of land resources in irrigation district is aimed at determining degree of dominance of land resources and degree of dominance of combination of land resources in irrigation district，in order to provide basis for the adjustment of land use structure in irrigation district.

1　The overview of study area

Jinghuiqu Irrigation District，located in the middle of central Shaanxi plain，east to Shichuan River，south to Jinghe River and Weihe river，west to control project at the starting part of Jinghuiqu，north to Lu Village，is in 108°34′34″ −109°21′35″ E，34°25′20″ −34°41′40″ N. Jinghuiqu Irrigation District spans 70 kilometers from east to west，and spans 22 kilometers from south to north，with the total area of 1 288.54 square kilometers. Jinghuiqu Irrigation District is one of the great irrigation ar-

eas in Shaanxi Province，which diverts water and builds dam in Jinghe Valley in Zhangjiashan of northeastern Jingyang County. It irrigates 96 thousand hm² farmland in Jingyang County，Gaoling County，Sanyuan County，Lintong County，Yanliang County and Fuping County of Weinan City，Xianyang City and Xi'an City for 7 decades，and it plays an important role in promoting socio-economic development of Shaanxi Province.

2　Data source and research method

2.1　Data source　This data comes from three aspects as follows：firstly，according to the remote sensing data of Jinghuiqu Irrigation District in Shaanxi Province in 2005，we get the data concerning land use type and area in study area after interpreting and analyzing the remote sensing data of Jinghuiqu Irrigation District in Shaanxi Province；secondly，according to statistical data of land use in Shaanxi Province，we get the statistical data of land use in Xianyang City in 2005；thirdly，according to the classification standard of agricultural land of Shaanxi Province，we get output and input data concerning specified crops in study area.

2.2　Research method　Dominant land resources refer to the land resources whose use benefit is prominently greater than the use benefit of the same type of land resources in other regions and use benefit of other land resources in local regions. Dominant land resources play the role of promoting socio-economic development in the region and the use of this type of land resources can promote positive development of economy and society within the region. Dominance of land resources is the superiority degree of a certain type of land resource on quantity，quality，and use benefit relative to other resources within

the region[1]. This research mainly adopts benefit-cost analysis method and dominance of land resources per capita method to analyze the dominance of use of various kinds of land resources in irrigation district.

2.2.1 Benefit-cost analysis method. Dominance of the land resources reflects the ratio of benefits of land resources development and utilization, and costs of land resources development and utilization, namely that dominance of land use is equal to the ratio of benefits of land resources use and costs of land resources use. This value comprehensively reflects the dominance of land resources use in the region, and the larger the ratio, the greater the dominance, and the smaller the ratio, the smaller the dominance.

2.2.1.1 The concept of benefit and cost. The benefit of land resources use in irrigation district refers to the value generated in the process of land use, which is mainly the direct value, such as the product of land use-the value of direct benefits of crops. Here it mainly refers to the benefit of tangible substance that can be measured by currency. The cost of land resources use in irrigation district is the value of labor and materials in the process of land use.

2.2.1.2 The calculation method of benefit and cost. The relevant standards of benefits and costs in the process of calculation should be consistent, that is, we must use the identical price level, interest rates, risk factors and so on. In the process of land use, these benefits and costs are in the whole period of use, and take place in different time, with different expression forms. For the convenience of calculation, we should convert benefits and costs in the process of land use into present value, and adopt appropriate discount rate, so as to make the results of benefits and costs accurate.

2.2.2 The calculation of degree of dominance of land resources per capita in irrigation district. Dominance of land resources per capita is calculated as follows.

First, the number of each type of land resource ownership per capita in irrigation district (A_i) is calculated.

Second, the index of number of each type of land resource ownership per capita in irrigation district (X_i) is calculated; X_i is the ratio of the evaluation unit of owning amount per capita and the upper unit of owning amount of the same type of resource per capita, namely $X_i = A_i/D_i$.

Third, the overall index of land resources per capita in irrigation district (K) is calculated, namely the abundance of land resources as follows:

$$K = \sqrt[n]{X_1 X_2 X_3 \cdots X_n} = (\prod_{i=1}^{n} X_i)^{\frac{1}{n}} \tag{1}$$

In the above expression, $X_1, X_2, \cdots, X_n$ represents the index of number of n types of land resources ownership per capita in evaluation unit respectively.

Fourth, the combination index of land resources σ is calculated.

Combination index, namely the standard deviation, reflects the spatial combination state of land resources use. The greater the combination index, the poorer the combination state of each type of land resource in evaluation district; the smaller the combination index, the better the combination state of each

type of land resource in evaluation district and the greater the dominance of land resources use.

$$\sigma = [\sum (X_i - \overline{X})^2/n]^{1/2} \tag{2}$$

In the above expression, $\overline{X} = (X_1 + X_2 \cdots + X_n)/n$.

Fifth, the dominance of land resources per capita G is calculated.

Dominance of land resources per capita is proportional to the overall index K of owning amount per capita, and is inversely proportional to the combination index of resources S, namely:

$$G = K/S \tag{3}$$

3 The results and analysis

3.1 Benefit-cost analysis of Jinghuiqu Irrigation District

The estimation of benefits and costs of land resources use is complicated work, and there are plenty of land resources types in Jinghuiqu Irrigation District. The simplest method is that we estimate the benefits and costs according to the market prices at the time, in order to reflect the real value of land resources. Now we take farmland resources as an example to conduct explanation.

According to technical standards of classification of agricultural land in Shaanxi Province, Jinghuiqu Irrigation District is in Weihe Plain of Central Shaanxi. According to the standard farming system in farming area, the specified crops in Jinghuiqu Irrigation District are winter wheat and summer corn, getting three crops a year. We conduct estimation on the income and cost of specified crops. The income includes the annual average yield, the annual average benefits, the annual average straw yield and benefit and so on. The cost is the production expense of seed, fertilizer, pesticide, manure, labor input, irrigation input and so on, which can be seen in Table 1 and 2.

According to Table 1 and 2, the total benefit of farmland resources in Jinghuiqu Irrigation District in 2005 is 22 521.45 yuan/hm² and the total input of farmland resources in Jinghuiqu Irrigation District in 2005 is 15 030 yuan/hm². According to Article 126 in *Property Law*, the contract term of farmland is 30 years and the capitalization rate of farmland is calculated at 6%, then we get results as follows.

The total benefit of farmland in 30 years is that

$$\frac{22\ 521.45}{6\%} \times \left[1 - \frac{1}{(1 + 6\%)^{30}} \right] = 310\ 004 \text{ yuan/hm}^2;$$

The total cost of farmland in 30 years is that

$$\frac{15\ 030}{6\%} \times \left[1 - \frac{1}{(1 + 6\%)^{30}} \right] = 206\ 885.4 \text{ yuan/hm}^2. \text{ The}$$

ratio of the benefits and costs of farmland is 1.5, with relative great value, indicating that farmland is the dominant land resources in Jinghuiqu Irrigation District. Then the ratio of the benefits and costs of other farmland also can be calculated in the similar manner.

3.2 The degree of dominance of land resources per capita of Jinghuiqu Irrigation District

As Jinghuiqu Irrigation District is subordinate to different administrative areas, it is difficult to gather demographic statistics. In 1997, the population in Jinghuiqu Irrigation District was 1.180 4 million. According to the natu-

ral population growth rate in Xianyang City（3.75‰）[2], by calculation, the total population in Jinghuiqu Irrigation District in 2005 was as follows：

118.04 × (1 + 3.75‰)8 = 1.216 3 million people. In 2005,

the population of Xianyang City reached 4.98 million[3]. According to the area of various types of land resources in 2005 in Xianyang City[4], we get the area of land type per capita in 2005 in Xianyang City. The results are shown in Table 3.

Table 1　The output of specified crops in Jinghuiqu Irrigation District in 2005

Specified crops	Grain output kg/hm²	Grain benefit yuan/kg	Straw output kg/hm²	Straw benefit yuan/hm²	Total benefit yuan/hm²
Winter wheat	8 250	1.428 2	8 850	885	12 667.65
Spring corn	9 000	1.008 2	13 050	780	9 853.80

Table 2　The input of specified crops in Jinghuiqu Irrigation District in 2005　　　　　　　　　　　　　　　　　　Yuan/hm²

Specified crops	Seed	Fertilizer	Pesticide	Mechanized farming expense	Labor forces	Irrigation	Total input
Winter wheat	375	1 500	105	1 350	1 800	1 500	6 630
Spring corn	345	1 200	105	1 350	3 900	1 500	8 400

Table 3　The calculation of degree of dominance of land resources per capita in Jinghuiqu Irrigation District in 2005

Land use type	Land area hm²	Land area per capita/hm²/person	Land area of Xianyang City in 2005/hm²	Land area per capita of Xianyang City in 2005/hm²/person	X_i
Farmland	58 529	0.048 121	385 522.9	0.077 414	0.62
Woodland	20 499	0.016 854	206 755.6	0.041 517	0.41
Land for residential areas and mining	19 313	0.015 878	101 331.4	0.020 348	0.78
Garden plot	10 018	0.008 236	122 938.6	0.024 686	0.33
Transportation use land	8 449	0.006 946	5 606.54	0.001 126	6.17
Grassland	7 735	0.006 359	23 333.63	0.004 685	1.36
Other land	3 794	0.003 119	122 514.5	0.024 601	0.13
Land for waters and water conservancy	517	0.000 425	1 897.44	0.000 381	1.12

By calculation, K (The abundance of land resources in Jinghuiqu Irrigation District in Shaanxi Province) = 0.73; S (The combination index of land resources in Jinghuiqu Irrigation District in Shaanxi Province) = 2.3; G (The dominance of land resources per capita) = 0.32. As the combination index of land resources is relatively big, while the dominance of land resources per capita is relatively small, indicating that in Jinghuiqu Irrigation District of Shaanxi Province, the combination of all kinds of land resources is in a poor state, with poor supporting ability.

4　Countermeasures and suggestions

According to the above analysis, in terms of land use, the main objective of Jinghuiqu Irrigation District in Shaanxi Province is to use land resources rationally, so the corresponding suggestions are put forward as follows.

4.1　Strictly implement the central policy and protect farmland resources　October 14, 2003, *The Decision of the CPC Central Committee on Several Important Issues Concerning the Perfection of Socialist Market Economic Structure* was adopted by the Third Plenary Session of the 16th CPC Central Committee, which advanced that we should strictly implement the central policy and protect farmland resources. It is an important decision which can ensure food security, protect farmers' benefit and promote the benefit of land use. Only by ensuring certain quantity and quality of arable land, can we ensure stable food yield, so the protection of arable land is an important means of ensuring food security; land is the means of production, and land is also the means of subsistence. In parti-

cular, the farmland, as important basis for development of agriculture, is critical for farmers, so the protection of arable land, as an important means of maintaining rural stability, is essential to protecting the interests of farmers; after strictly protecting arable land, we can limit the non-agricultural use of farmland, promote non-agricultural construction to promote land use efficiency when using land, promote non-agricultural construction to save and use land intensively, and promote comprehensive use benefit of land[5]. Therefore, Jinghuiqu Irrigation District in Shaanxi Province should pay attention to the following aspects. First, we should take irrigation district as unit, establish relevant policies concerning the protection of arable land resources in irrigation district, and set up the red line of farmland resources in irrigation district. Second, we should correctly handle the relationship between occupation of the land for construction use and protection of arable land. When the local areas need to occupy farmland for development, it can use non-agricultural land as far as possible. In particular, we should protect the irrigated land in irrigation district, so that the arable land resources in irrigation district can be protected to meet the demand of regional development for agricultural products growth.

4.2　Adjust land use structure and strive to promote benefit　Irrational land use structure is the hidden factor impacting rational and intensive use of land resources, which can be easily overlooked, so we should establish a concept of high-efficiency use of land resources, and transform blindly pursuing the maximization of use benefit of single plot to pursuing the optimization of function of holistic land structure in the region[6]. Jinghuiqu Irrigation District in Shaanxi Province should adopt

the method of combining economic leverage and administrative measures, so as to gradually realize the protection of arable land, transformation of low-yielding fields and expansion of irrigation area. In practice, we should take the following measures as follows.

First, we should adjust the proportion of land use between grain crops and cash crops in irrigation district, and increase the proportion of land use of cash crops with great market demand when the grain can ensure the market supply in irrigation district.

Second, we should adjust the land use structure in irrigation district, reduce the proportion of saline land and bare land, promote the proportion of farmland and garden plot, shut down industrial enterprises that pollute the environment, and free land for the development of modern agricultural service industry.

Third, we should adjust the internal structure of various crops, and increase the land use area of dominant crops with high yield and great benefit based on the market demand.

4.3　Make rational planning of land resources and take the road of sustainable development　Through a comprehensive survey on land resources status in Jinghuiqu Irrigation District in Shaanxi Province, we should predict the land use demand of each sector, classify the regions and land use areas, adjust land use structure and land use layout, and propose the idea of further development of irrigation district. Through the optimal allocation of land resources, we should rationally use land resources, effectively protect land resources, and formulate land use planning in order to coordinate urban-rural production and living use land and urban-rural development use land.

4.4　Take the irrigation district as the unit and establish use class and price standard of land in irrigation district
In the process of land use, price will become a critical factor. Land resources departments conducting management on land level and the price of land is an important means[7]. Jinghuiqu Irrigation District should establish sound system of land use levels and price of land, which can regulate land use, protect the interests of farmers and ensure the smooth implementation of national construction. In Jinghuiqu Irrigation District of Shaanxi Province, the land resources belong to several counties, and the land levels and price standards are evaluated by all counties

respectively, with inconvenient use, so we should take Jinghuiqu Irrigation District in Shaanxi Province as an entity, in order to evaluate levels and price of land use in the irrigation district, and cultivate holistic market of land in irrigation district. If we do not use the same rating and price standards of land use, it will not be conducive to promoting rapid cultivation of land market and it will hinder the pace of the rational use of land in irrigation district, which will make it difficult to realize rational use of land. So we should refer to relevant national regulations, conduct evaluation on the price of land use right in irrigation district, and establish benchmark land price system of land use right in irrigation district. This approach directly regards the land use right in irrigation district, an object, as a research objective, and regards the land use right in irrigation district as an independent type of land use right. According to the market conditions of land in irrigation district, we should establish our own price system, and use this price system to guide and regulate the market.

References

[1] WU CF, PAN WC. Theories and methods of Territorial Planning [M]. Beijing: Science Press, 2003: 220 –221. (in Chinese).

[2] LI FW. Xianyang wins the award of population and family planning work [EB/OL]. (2009 –02 –27). http://www.sn.xinhuanet.com/2009 –02/27/content_15811880.htm. (in Chinese).

[3] Xianyang China. The Sample Survey of 1% Population in Xianyang, 2005: the city's resident population is 4.98 million[EB/OL]. (2006 –04 –24). http://www.xianyang.gov.cn/channel_1/2006/0424/74988.html. (in Chinese).

[4] Department of Land and Resources of Shaanxi Province, Data set of land use in Shaanxi Province, 2005[M]. [s.n.]: 2005. (in Chinese).

[5] WU KN, DU XQ, LIU YW, *et al.* Application of agricultural land classification in the selection of road line[J]. Journal of Anhui Agricultural Sciences, 2011, 39(8): 4787 –4789, 4795. (in Chinese).

[6] ZHEN JH, CHEN S, GUO YC. Studies on the assessment for land use intensification potentiality of industrial field in Baotou[J]. Economic Geography, 2001, 24(2): 250 –253. (in Chinese).

[7] ZHAO L, ZHEN XQ. Evaluation method based on multi – factors within the county land classification – a case study of Changqing District of Jinan[J]. Journal of Anhui Agricultural Sciences, 2008, 36(2): 716 –718. (in Chinese).

rural informatization to their parents, so as to improve farmers' awareness of rural informatization and demand for informatization. Fourth, we should give full play to role of information workers in rural areas in transmitting and disseminating information. Fifth, the grass-roots government should work out medium-and-long-term planning of information-based training for farmers in the township, and regularly conduct the training of related information-based knowledge for farmers, in order to promote their information awareness and information acquisition skills. Increase in farmers' awareness of information and consumer demand for information will inevitably promote the development of rural informatization, and lay good foundation for the expansion of agricultural industrial chain.

References

[1] ZHU L, ZHU J. Expansion strategy of agricultural industrial chain of suburban villages and towns in the process of urbanization[J]. Journal of Anhui Agricultural Sciences, 2011, 37(26): 16379 –16381. (in Chinese).

[2] ZHANG MY, ZHANG XP. On choosing the agent of the agricultural industry chain from the perspective of dice game playing[J]. Anhui Agricultural Sciences, 2009, 37(1): 397 –399. (in Chinese).

[3] WANG J. Analysis of construction of agricultural industry chain[J]. Northern Economy, 2009, 24(7): 94 –95. (in Chinese).

[4] Science and Technology Information Institute, Chinese Academy of Agricultural Science. Theory and practice of rural informatization [M]. Beijing: China Agricultural Science and Technology Press, 2010: 53. (in Chinese).