Fuzzy Immigration Risk Analysis and Assesent of the Water Conservancy and Hydropower Projects

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Abstract   On the basis of identifying the characteristic variables which is about immigration risk of the water conservancy and hydropower projects, an index system involving the characteristic variables of immigration risk is established. At the same time, a mathematical model for fuzzy evaluating the immigration risk of the water conservancy and hydropower projects is established. It offers reasonable theoretical basis and decision-making approach to the immigrations of the water conservancy and hydropower projects.
Key words   Immigration risk identification; An index system; Fuzzy risk assessment

1 Introduction

The immigration risk of the water conservancy and hydropower projects is that due to the construction of the water conservancy and hydropower projects, it brings the uncertainty and the consequences which is included in the losses of individual and social events. The immigration risk is potential forms and auspices of the social problems. If it is not deal with these risks and immigrants, the social stability of resettlement is not retained. So the immigration risk evaluating of the water conservancy and hydropower projects is a form of quantitative analysis according to immigrants suffering different strengths of the possibility of disasters. Establishing an index system and evaluation model is the most basic and important method in the research of risk evaluating. In the article, according to identifying the immigration risk of the water conservancy and hydropower projects, it will explore an index system and evaluation model of immigration risk of the water conservancy and   hydropower projects.

2 Water Conservancy and Hydropower Projects Immigration Risk Identification

Water Conservancy and Hydropower Projects immigration risk identification formation and development of general out by number of characteristic variables realizable, the determination of migration as characteristic variables risk indicator, they are both independent, but related; they reflect the characteristics of affairs, but also dynamic process migration information. Water Conservancy and Hydropower Projects immigration risk identification is on the immigrants' risk of characteristic variables to identify and carry out scientific classification, to provide the scientific basis for immigration risk identification. These risk variables showed:

2.1 Social, economic risk

2.1.1 Economic risk

Economic risk is the biggest risk facing the Water Conservancy and Hydropower Projects immigration. It also contributed to falling living standards the main reason for migration; it refers to the possibility of migration loss of economic life and adverse consequences. Its outstanding performance in: (1) Reduction of land and a decline in soil; (2) Sideline income (Here refers to income from crops other than income) reduction; (3) Production and living expenses increase. This is most evident in focus on resettlement of reservoir resettlement, most important thing is water, electricity, gas and buy food spending increase; (4) loss of enjoyment of the rights of public property and services, for the migrants, In particular, poor rural migrants, and no relocation of villagers loss of the opportunity to shared collective property, infrastructure, public services, is losing the opportunity to develop.

2.1.2 Social Risk

The immigration social risk of Water Conservancy and Hydropower Projects is the uncertainty caused by the life and production changes, the original loss of social resources, relationships and the destruction of traditional customs and culture and other social factors. This risk was mainly due to insufficient capacity of the local environment must be created by the relocation, The main factors causing this risk in the following areas:(1) The disintegration of social network, Relocation makes long-established network of neighborhood friends destruction;(2) The destruction of traditional customs and culture, relocation made immigrants abandon the many symbolic markers(such as graves) and the

broad sense of family attachment(such as mountains, rivers, etc), cut off their past physical and psychological contact;(3) The impact of religious traditions(mainly ethnic minority areas). Religion is closely related with the geographical and cultural, The migrant resettlement on the one hand will cause the loss of religious relics (such as the Tibetan Baita), this will stirred resentment and resistance immigrants. On the other hand will produce and resettlement of residents of the religious contradictions and conflicts. So under the present immigration practice, related to minority immigrants are generally not taken place a relocation;(4) Regulatory risk, regulatory risk as immigration laws and regulations, formulation and revision of the actual situation behind the changes, resettlement plan rules adopted are the rules adopted do not reflect reality, and thus cause losses to the uncertainty of immigrants, specification due to lack of immigration laws, caused a large number of migrants remaining issues

2.2 Environmental risks

The immigration Environmental risks refers to Water Conservancy and Hydropower Projects construction on the natural resource damage and the immigration of Water Conservancy and Hydropower Projects resettlement uncertainty on the transition to the development of natural resources caused by migration losses. The risk caused by two main factors: first is Blind construction of hydropower projects. If the preliminary evaluation is not sufficient hydropower project under construction on the blind, vulnerable to the destruction of the ecological environment construction; second is transition of natural resources development, as Insufficient environmental capacity of Settlement, is bound to development of natural resources to accommodate more immigrants, so Forest vegetation and other natural resources destroyed, The original ecological balance is broken.

2.3 Population risk

The immigration Population risk of Water Conservancy and Hydropower Projects refers to the uncertainty of population factors to project the social risks, mainly constituted by the three: first is Population pressure risk; second is Population structure risk; third is Quality of the population risk

2.4 Resource risk

The immigration resource risk of Water Conservancy and Hydropower Projects refers to works to the uncertainty of natural resource use To project the risks of social and economic development mainly in ;first is the risk of land resources, And serious water pollution, water quality deterioration, water supply and demand has become an increasingly prominent; second is The risk of land resources, Increasing soil erosion; third is The risk of forest resources, destruction of the forest's regeneration, project significantly reduced the forest cover; fourth is The risk of mineral resources, Works to geographical location and natural environment not suited to mineral exploration, Indiscriminate exploitation of mineral resources will cause great damage.

2.5 Construction risk

Water Conservancy and Hydropower Projects construction risk refers to Construction project in need of a large number of water conservancy facilities for carrying water、Storage and transportation of water, The quality of any single project out of the question, will affect the overall project, It will work in the economic and social development inconvenience; second, flood control.

3 The Immigration Risk of Water Conservancy and Hydropower Projects Index and Quantization

Table 1　Immigration Risk Characteristics Variables Index

Target layer	Program level	Program level
Immigration comprehensive risk	Economic risk	Land soil
		Sideline income
		Expenditure
		Public property rights
	Social Risk	Network of relationships
		Customs and culture
		Religious traditions
		Regulatory risk
	Environmental risks	
	Population risk	
	Resource Risk	
	Project Risk	

The immigration risk of Water Conservancy and Hydropower Projects index Construction（Target layer，Program level，Program level）Reference home and abroad all kinds of integrated risk index system，Characteristic variables for the immigration risk of Water Conservancy and Hydropower Projects，build immigration risk of Water Conservancy and Hydropower Projects integrated risk index system，it consists of goal, rule, and programs for layers. Target layer namely immigration risk Water Conservancy and Hydropower Projects comprehensive evaluation; the Criteria layer consists of five areas namely socio-economic, environment, population, resources, project risk assessment; Criteria layer was only development on socio-economic risk level, There were four factors for each.

As the impact of all kinds of characteristic variables on Overall risk migration is not the same. so, Fuzzy comprehensive evaluation requirement to quantify the relative importance of characteristic variables, That is, to determine their weight. Weighted score to percentile(Weights and for 1). Assessment at all levels based weight matrix to:

$$w_{economy} = \begin{pmatrix} 0.3 & 0.3 & 0.2 & 0.2 \end{pmatrix}$$
$$w_{community} = \begin{pmatrix} 0.2 & 0.4 & 0.25 & 0.15 \end{pmatrix}$$
$$w_{economy.and.community} = \begin{pmatrix} 0.6 & 0.4 \end{pmatrix}$$
$$w_{comphensive.evaluation.} = \begin{pmatrix} 0.4 & 0.2 & 0.3 & 0.05 & 0.05 \end{pmatrix}$$

We assess all kinds of immigration risk characteristic, Generally risk assessment of each characteristic variable is divided into low grade, low, normal, high, high five levels. The evaluation of five levels and 1. Immigration risk posed characteristic variables such evaluation matrix R. if characteristic variables of the evaluation results;

$$R_{land} = \begin{pmatrix} 0.2 & 0.4 & 0.3 & 0.1 & 0 \end{pmatrix}$$
$$R_{sideline} = \begin{pmatrix} 0.3 & 0.4 & 0.3 & 0 & 0 \end{pmatrix}$$
$$R_{\exp enditure} = \begin{pmatrix} 0.1 & 0.4 & 0.4 & 0.1 & 0 \end{pmatrix}$$
$$R_{public.property} = \begin{pmatrix} 0.1 & 0.3 & 0.5 & 0.1 & 0 \end{pmatrix}$$
$$R_{relationship} = \begin{pmatrix} 0 & 0.2 & 0.7 & 0.1 & 0 \end{pmatrix}$$
$$R_{custom} = \begin{pmatrix} 0.3 & 0.5 & 0.2 & 0 & 0 \end{pmatrix}$$
$$R_{religion} = \begin{pmatrix} 0.2 & 0.6 & 0.2 & 0 & 0 \end{pmatrix}$$
$$R_{legislation} = \begin{pmatrix} 0.1 & 0.4 & 0.3 & 0.2 & 0 \end{pmatrix}$$
$$R_{environment} = \begin{pmatrix} 0.4 & 0.5 & 0.1 & 0 & 0 \end{pmatrix}$$
$$R_{population} = \begin{pmatrix} 0 & 0.1 & 0.3 & 0.5 & 0.1 \end{pmatrix}$$
$$R_{resource} = \begin{pmatrix} 0 & 0.2 & 0.6 & 0.2 & 0 \end{pmatrix}$$
$$R_{project} = \begin{pmatrix} 0 & 0.1 & 0.7 & 0.2 & 0 \end{pmatrix}$$

Such as the evaluation of land soil, 20% said very low risk, 400% of people think that low-risk, 30% believed that the general risk, 10% of people think that high-risk, no one thinks very high risk.

4 Fuzzy Mathematical Model in the Immigration Risk of Water Conservancy and Hydropower Projects

Soil from the land, sideline income, expenditure, public property rights of the economic risk evaluation matrix for the characteristic variables：

$$R_{economy} = \begin{pmatrix} 0.2 & 0.4 & 0.3 & 0.1 & 0 \\ 0.3 & 0.4 & 0.3 & 0 & 0 \\ 0.1 & 0.4 & 0.4 & 0.1 & 0 \\ 0.1 & 0.3 & 0.5 & 0.1 & 0 \end{pmatrix}$$

Multiplied by the corresponding weight vector，obtained the Evaluation of economic risk result;

$$B_{economy} = W_{economy} \bullet R_{economy}$$

$$= \begin{pmatrix} 0.3 & 0.3 & 0.2 & 0.2 \end{pmatrix} \bullet \begin{pmatrix} 0.2 & 0.4 & 0.3 & 0.1 & 0 \\ 0.3 & 0.4 & 0.3 & 0 & 0 \\ 0.1 & 0.4 & 0.4 & 0.1 & 0 \\ 0.1 & 0.3 & 0.5 & 0.1 & 0 \end{pmatrix}$$

$$= \begin{pmatrix} 0.19 & 0.38 & 0.36 & 0.07 & 0 \end{pmatrix}$$

Similarly：

$$B_{community} = W_{community} \bullet R_{community}$$

$$= \begin{pmatrix} 0.2 & 0.4 & 0.25 & 0.15 \end{pmatrix} * \begin{pmatrix} 0 & 0.4 & 0.7 & 0.1 & 0 \\ 0.3 & 0.4 & 0.2 & 0 & 0 \\ 0.2 & 0.4 & 0.2 & 0 & 0 \\ 0.1 & 0.3 & 0.3 & 0.2 & 0 \end{pmatrix}$$

$$= \begin{pmatrix} 0.185 & 0.45 & 0.315 & 0.05 & 0 \end{pmatrix}$$

Further socio-economic risk Evaluation Matrix；

$$B_{socio-economic} = W_{socio-econmic} \bullet R_{socio-econmic}$$

$$= \begin{pmatrix} 0.6 & 0.4 \end{pmatrix} * \begin{pmatrix} 0.19 & 0.38 & 0.36 & 0.07 & 0 \\ 0.185 & 0.45 & 0.315 & 0.05 & 0 \end{pmatrix}$$

$$= \begin{pmatrix} 0.188 & 0.408 & 0.342 & 0.062 & 0 \end{pmatrix}$$

So，the immigration risk of Water Conservancy and Hydropower Projects in sum of Evaluation Matrix：

$$B_{comprehensive.evaluation} = W_{comprehensive.evaluation} \bullet R_{comprehensive.evaluation}$$

$$= \begin{pmatrix} 0.4 & 0.2 & 0.3 & 0.05 & 0.005 \end{pmatrix} * \begin{pmatrix} 0.188 & 0.408 & 0.342 & 0.062 & 0 \\ 0.4 & 0.5 & 0.1 & 0 & 0.1 \\ 0 & 0.1 & 0.3 & 0.5 & 0.1 \\ 0 & 0.2 & 0.3 & 0.5 & 0.1 \\ 0 & 0.1 & 0.7 & 0.2 & 0 \end{pmatrix}$$

$$= \begin{pmatrix} 0.16 & 0.31 & 0.31 & 0.19 & 0.03 \end{pmatrix}$$

The results show that the immigration risk of Water Conservancy and Hydropower Projects, low, low, normal, high, very high proportions were 16%, 31%, 31%, 19%, 3%. This means that the risk of Hydraulic Engineering immigration is relatively low. In fact, the comprehensive evaluation value is only 0.38, It ranged between a low and the general risk, If the characteristic variables of the risk assessment level is very low, low, normal, high, very high level as a vector of five：

$$C = \begin{pmatrix} 2 & 1 & 0 & -1 & -2 \end{pmatrix}$$

Fuzzy Comprehensive Evaluation Value：

$$E = B_{composite} \bullet C^T$$

$$= \begin{pmatrix} 0.16 & 0.31 & 0.31 & 0.19 & 0.03 \end{pmatrix} * \begin{pmatrix} 2 \\ 1 \\ 0 \\ -1 \\ -2 \end{pmatrix}$$

$$= 0.38$$

From the evaluation we know，The risk of Water Conservancy and Hydropower Projects，engineering risk minimization, followed by social and economic risk, What is the resource risk, the biggest risk is the population and the environment.

5 Conclusions

This indicates that the migration process of Water Conservancy and Hydropower Projects, the immigration issue, the Chinese government given high priority, done a lot of positive and effective work. Meanwhile, local governments at all levels conscientiously implemented and carried out a series of central government on the resettlement policies, All levels of government continues to strengthen preparatory work and implementation of immigration supervision and management. Practice in immigration work, local conditions around the active exploration, our government has created many unique resettlement mode, However, the government also led to extensive damage of natural resources, increased population pressure on land resettlement. In short, the Water Conservancy and Hydropower Projects of construction migration is an unavoidable problem. It is a political, economic, social, population, resources, environment and engineering technology and more complicated systems project, it exists a high risk. Therefore, construction of hydropower projects, the need to strengthen the immigration risk analysis, evaluation, monitoring, prevention and control work.

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