The Evaluation Framework for Social Stability Risk

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Abstract. In recent years, people have attached great importance to the development of social stability risk assessment for risk management. In this paper, we analyzed the background of social stability risk assessment, and also analyzed the common methods of feature extraction and evaluation classification. The next step is to conduct an empirical study of social stability risks. We hope to obtain a social stability risk situation that can truly reflect major projects, so that the management department can make appropriate countermeasures.

Keywords: Social stability risk; Feature extraction; Pattern recognition.

1. Introduction

Social stability risk assessment refers to major decisions, important policies, reform measures, and construction projects that are closely related to the interests of the people. Before major projects are formulated or approved for implementation, we need to conduct systematic investigations, scientific forecast analysis and assessment, and develop risk response strategies and plans for factors that may affect social stability. The social stability risks that may arise during the implementation of the project can better ensure the smooth implementation of major issues. Therefore, before implementing major issues closely related to the vital interests of the people, we should conduct a social stability risk assessment. Social stability risk assessment is an institutional measure to prevent social risks. Scientific assessment methods are needed to assess the risks that may affect social stability, and to take effective preventive measures against possible risks. The social stability risk assessment mainly includes three aspects: risk assessment index system, risk assessment model and risk assessment method. In the social stability risk assessment work, the three are indispensable, and jointly play the role of identifying, assessing and preventing risks. The index system of social stability risk assessment is the core and foundation of social stability risk assessment. The scientific nature of the indexes system determines the validity and authenticity of the assessment results.

2. Related Research

At present, the rapid development of economy has led to the construction of a series of major projects. The public incidents are also on the rise. On the one hand, large-scale major projects lead to the increasingly complex social problems in order to meet the needs of human material life and economic development. On the other hand, the construction of major projects also poses potential social stability risks, which threatens the existing living conditions of some people and leads to public crises and project failures. Researchers need to explore and analyze social stability risk assessments, including research criteria, assessment models, etc. Some departments do not pay enough attention to policy evaluation, and cannot correctly view the relationship between social stability risk assessment and reform and development, and only use it as a tool of maintaining stability. The policy risk assessment mechanism is imperfect and many projects lack legal constraints. Although major policy risk assessment practices are noticed, the scope is too broad, the regulations are too general, and the flexibility of assessment work is too large. Therefore, in some places, the development of major policy risk assessments is only in the form, and the status of the assessment subject is not clear. In the social stability risk assessment of major projects, any assessment subject has its own specific identity, and the objectivity of assessment has its own limitations. Therefore, who will assess the objectivity and impartiality that will greatly affect the assessment results. After years of practice, the social stability risk assessment of major projects has gradually entered the stage of standardized

development. However, there is still a great disagreement between the academic community and the actual workers on the risk assessment index system. This situation has seriously affected the social stability risk assessment. We urgently need to make a unified and clear definition of these indexes. By analyzing the spirit of relevant policy documents, we maybe understand the social stability risk assessment index system for major projects. In order to decide the weight of the social stability risk index more objective and scientific, a method of calculating the weight of the index based on mathematical statistics is proposed. Using the survey method, the sample data is collected and selected to meet the requirements of the research sample, and a variety of mathematical methods are synthesized. The statistical method analyzes and counts the screening result data, determines the index weight, and carries out the example calculation to obtain the weight of each social stability risk index, which makes the objective science and universality of the social stability risk assessment have a great degree improve. Under the premise of constructing the evaluation index system and determining the weight of the index system, the risk evaluation level is set and then the evaluation is established. The membership matrix of each level of the evaluation object, and the fuzzy mathematics is introduced, combined with the neural network, and finally can realized by the programming language [1-5].

3. Evaluation Framework

3.1 Feature Extraction

Most researchers use the analytic hierarchy process and fuzzy mathematics evaluation method to evaluate and analyze the social stability risk of major projects. These evaluation models generally need to manually set the weight of the evaluation indexes. Obviously, these subjective factors must have a certain impact on the evaluation results. At the same time, if we directly use the original indexes for evaluation, considering the relevance of these evaluation indexes, the results of such evaluations of social stability risk assessment are often not ideal. So, we need to perform effective feature extraction from the original features.

(1) Principal component analysis method. Principal component analysis (PCA) is a commonly used dimensionality reduction technique [6]. We can ensure that the dimensionality of a linear manifold is found and a data representation based on the form of orthogonal component factors is generated. If the data is in a nonlinear manifold, the PCA cannot find the embedded architecture.

We assume that there are n samples and p variables, the sample set matrix is defined as follows

$$X_{n\times p}=\begin{bmatrix} x_{11} & \cdots & x_{1p} \\ \cdots & \cdots & \cdots \\ x_{n1} & \cdots & x_{np} \end{bmatrix} \tag{1}$$

In order to determine the number of indexes of the main components. We first calculate the index eigenvalues and eigenvectors, then calculate the variance contribution rate and the cumulative variance contribution rate with

$$e(m)=\lambda_i \Big/ \sum_i^p \lambda_i \, , E(m)=\sum_i^m \lambda_j \Big/ \sum_i^p \lambda_i \tag{2}$$

Therefore, the number of principal components is selected depending on the cumulative variance contribution rate. We can determine this parameter according to the actual situation.

Finally, we calculate the index feature vector $U_{n\times p}=[u_1,u_2,...,u_p]$,and obtain the principal component information of the index as follow:

$$Z_{n\times p} = X'_{n\times m} U_{m\times p} \tag{3}$$

(2) Locality preserving projections method. Locality preserving projections (LPP) method can effectively reduce the dimensionality of nonlinear manifolds [7]. The mapping is established according to the nearest neighbor graph. The advantage is that the method can also provide an projection matrix. Given a set of points in a high dimensional space, we try to find a transformation matrix to map these points to another set of points in a low dimensional space.

We can get the projection matrix by solving the following minimization criterion function:

$$A_{opt} = arg\ \min_{A}\left[\sum_{ij}\left\|y_i - y_j\right\|^2 W_{ij}\right] = arg\ \min_{A}\left[\sum_{ij}\left\|A^T x_i - A^T x_j\right\|^2 W_{ij}\right] \tag{4}$$

The above formula can be easily converted into the following eigenvalue solving problem,

$$XLX^T a = \lambda XDX^T a \tag{5}$$

Let the column vectors $a_1, a_2, ..., a_d$ be the solutions of the above formula, ordered according to their eigenvalue $\lambda_1, \lambda_2, ..., \lambda_d$, then the embedding y_i is computed by the formulation:

$$y_i = A^T x_i, A = [a_1, a_2, ..., a_d] \tag{6}$$

Finally, we can use the above formula to extract effective information from the original social stability risk index information. Of course, in addition to this, there are many ways to accomplish this task [8].

3.2 Risk Evaluation

The results of social stability risk assessment need to be deterministic analysis. At present, the social stability risk assessment of major projects mainly uses the weighted summation of each index to determine the level of risk. The evaluation process involves too many subjective factors. Objective and accurate social stability risk assessment conclusions are the key to ensuring scientific major projects in the early stage of major projects, which can provide effective major projects support for decision makers. Social stability risk assessment is a multi-index evaluation system, so we seek a mathematical method to achieve an accurate assessment of social stability risks.

(1) Entropy weight extension model. A social stability risk assessment method based on entropy weight extension matter-element model is proposed. This method constructs the correlation function by using the entropy as the weight of the objective evaluation project risk assessment index [9].

The entropy of the social stability can be obtained

$$H_i = -\frac{1}{\ln(K)}\left[\sum_{k=1}^{K} f_{ik} \ln(f_{ik})\right] \tag{7}$$

The risk comprehensive correlation value is calculated with

$$K_j(v) = \sum_{k=1}^{K} w_i k_j \ln(v_i) \tag{8}$$

In the end we can calculate the level of social stability risk with

$$G = \arg \max_{j=1,2,...,N} K_j(v) \tag{9}$$

(2) The neural network models. The neural network is an error correction learning algorithm consisting of forward propagation and back propagation [10]. The input signal is transmitted from the input layer to the hidden layer and the output layer through the action function. The output layer is the linear weighted combination of the output of the hidden layer function:

$$y_i = \sum_{i=1}^{m} \omega_{ij} \varphi_i(x), i = 1,2,...p \tag{10}$$

The output value is normalized, and the largest is the category of the node after normalization:

$$g_l(x,\theta_l) = \frac{\exp y_j(x,\theta_l)}{\sum_{j=1}^{J} \exp y_j(x,\theta_l)} \tag{11}$$

Finally, we can judge the classification of risk according to the maximum possibility of the output function. In addition to this, there are many methods of discrimination. The typical one is the support vector machine model. The method is based on statistical learning theory and structural risk minimization principles. We can use the support vector machine to evaluate the social stability risk without setting too many parameters [11].

4. Summary

Social stability risk assessment for major projects is the new management theory and mechanism. We must study the social stability risk assessment mechanism for major projects. This paper studies the assessment framework for social stability risks. There are two aspects involved, the first is feature extraction, and the second is model construction. We have summarized some common methods and hope to provide technical support for social stability risk assessment.

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