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Study on the estimation system of construction project cost

Lingzhi Zhang
Chongqing College of Electronic Engineering, Chongqing, 400074, (CHINA)

ABSTRACT

With the actual cost of construction project being limited by many traditional ideas and systems, the prospect of the building industry in the market is not appreciable enough. The key to realize the long term development of this industry lies in the cost estimation of construction projects. Focusing on the analysis of the dynamic prediction model of the cost of construction projects, the paper would induct from it the patterns of these projects and dissect the significance of dynamic prediction of cost to the construction projects. The approach of this study follows a pattern as "finding the problem-analyzing the problem-solve the problem". In term of finding the problem, it focuses on the analysis of the related elements that affect the actual cost of the construction project. In analyzing the problem, it adopts BP neural network to establish the model for the cost of the project. In solving the problem, on the basis of the two former stages, it will establish the dynamic prediction model of the cost during the construction. Several factors will be taken into special consideration, such as the cost information, the program schedule and the investments, so as to help the prediction of the cost and the reasonable control of the cost.

KEYWORDS

Construction project; Actual cost; Dynamic prediction; structural system.

INTRODUCTION

With the rapid developing economy and the increasing population, the demands for infrastructure construction grow, and this tendency also brings the standards of construction projects higher and higher. In case of China's building industry, the cost estimation of construction project is a vital task, which predetermines whether the construction can be carried out. Rising with China's advancing economic state is the scale and the quantity of the building industry projects. Besides, the growing population also pushes the expansion of the infrastructure construction. In term of the long-term development of the building industry, the key factor is that whether its technique and capability could meet the needs of social development. Down to the concrete procedures of the construction, it needs to monitor and control every detail of the project. The actual cost of the project holds the key position in the construction. Being the major aspect of the supervision and control of the project cost, its estimation has two main methods: the static prediction and the dynamic prediction of the actual cost. Based on the static prediction, the dynamic prediction of cost complies with the market reality and the related regulations, and conducts logical and feasible estimations of each step of the construction project. The procedure of this study will be directed at the analysis of the actual cost of the construction projects and carries the discussion of it economic indicators.

ANALYSIS OF THE ACTUAL CONSTRUCTION COST

Estimation of construction cost

The estimation of construction cost of a project depends mainly on the information platforms of the cost department for the desired cost information and the progress of the project in actual practice. The factor deserving attention is the cost of the equipments and the raw materials. In addition, the related project cost data needs consideration. The theoretical basis and technical support of the prediction should be based on the BP neutral network on basis of all these, a scientific and feasible model of the actual cost of construction project can be established. Still, any emerging problems should be solved with adequate measures in time, so that during the construction, the estimation of the cost is in line with the actual situation and stay scientific and feasible.

With research data in this paper coming from the exited cost information, the study, by using the BP neural network, analyzes and estimates the cost of the project in the next month, and compares the outcome with the initial plan. Ensuring the values of project, the study also provides logical solutions to the exceeded part of the cost. Figure 1 is the illustration of the dynamic control of the cost of construction project.

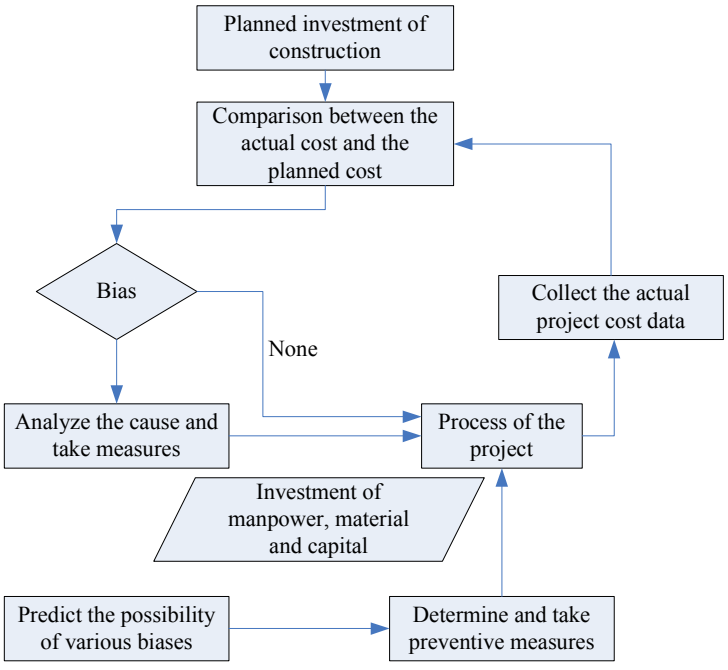

Figure 1 : Illustration of the dynamic control of the cost of construction project

During the estimation of the project, the possible variation of each procedure of the construction needs to be thoroughly analyzed to reach a logical and feasible cost estimation. Further to be predicted are the states and possible problems of the project in various periods of time (every year, month and quarter), and solutions should be proposed to guarantee the smooth progress of the whole project. Adopting the recent years' cost control information and the BP neural network, the study estimate the actual cost of construction project to break through the traditional construction cost system. In the process of the construction, the estimation of the actual cost is based on the project contract. The contract is the pretext

for the estimation. The estimation in practical construction is to supervise and control the cost of each procedures of the project.

To establish the BP neural network model, first it needs to conduct a comprehensive analysis and estimation of the authentic situation of the construction project, with representative project data as its reference. The focus of the analysis should be the cost, the price, the trend of the change and the features of the project itself and other factors[1].

Estimation of the actual cost of construction project

In the building industry, the estimation of actual cost is a key step, as it has direct significance toward the supervision and control of the project's implementation process[2]. The dynamic estimation of the cost of construction project demands a comprehensive grasp of the project's specific information and related cost information. This knowledge can only be acquired from the platforms of the related fields[3]. Next it uses the scientific evaluation method to evaluate the factors such as the construction environment and the market prices of the building materials. Factors in the environment that directly influence the construction are, for example, nature environment, the policies concerning the project and others[4]. Lastly, the investment stature and the construction personnel's influence on the project should also be taken into consideration. In the meantime, the related project cost data needs consideration. The theoretical basis and technical support of the prediction should be based on the BP neural network on basis of all these, a scientific and feasible model of the actual cost of construction project can be established. Figure 2 is the control principle under the traditional cost control model.

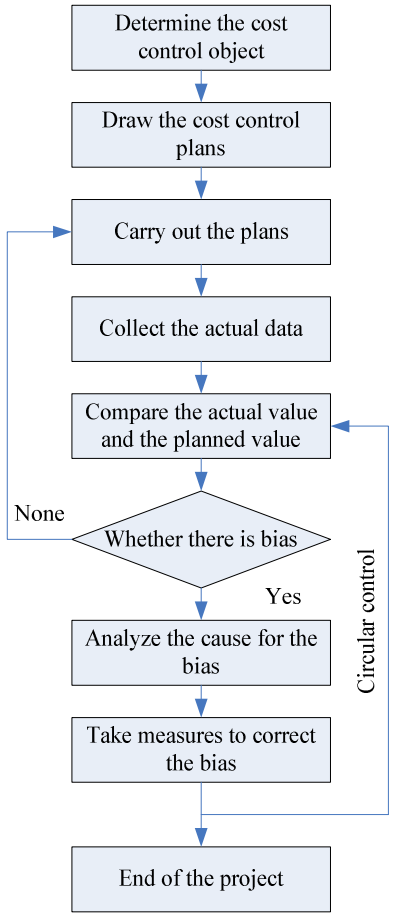

Figure 2 : Control principles under the traditional cost control model

To break through the traditional construction cost system, it needs to estimate the actual cost of construction project. In the process of the construction, the estimation of the actual cost should be based on the project contract. The contract is the pretext for the estimation. The estimation in practical construction is to supervise and control the cost of each procedures of the project. After turning over the cost estimation of the construction project, the control outcome of the cost can then be thoroughly researched. The estimation of the actual cost in this study is based mainly on the recent years' cost control information as reference. The BP neural network model is adopted to conduct the cost estimation. In the actual process, a comparison between the estimated information and the existed plan will be conducted to determine the actual value of the project. Still, any emerging problems should be solved with adequate measures in time, so that during the construction, the estimation of the cost is in line with the actual situation and stay scientific and feasible.

STRUCTURE DESIGN OF THE DYNAMIC ESTIMATION MODEL DURING THE CONSTRUCTION PROJECT

BP neural network model's frame

BP network algorithm, being called the back propagation algorithm in the area of expertise, is BP algorithm in this paper. BP neural network frame contains mainly the input layer, the hidden layer and the output layer[6]. Figure 3 shows the relation between the inner parts of this structure.

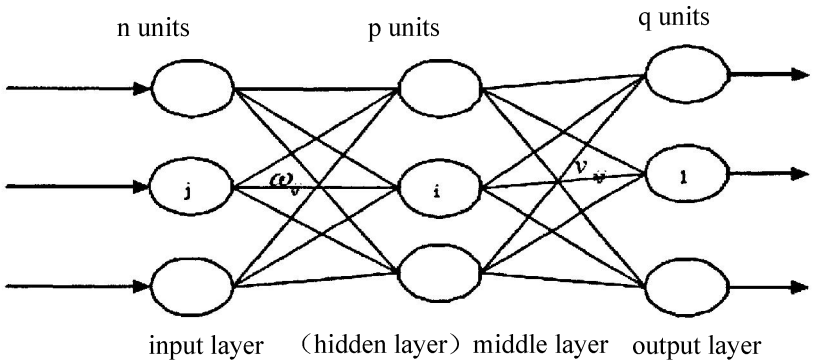

Figure 3 : Relation between the inner parts of The BP network structure

Design of the BP neural network for dynamic model of project cost

To establish the BP neural network model, first it needs to conduct a comprehensive analysis and estimation of the authentic situation of the construction project, with representative project data as its reference. The focus of the research should be the cost, the price, the trend of the change and the features of the project itself and other factors. The main purpose of the BP neural network is to establish two difference dimensional nonlinear mapping[7]. From this, the factors that influence the project cost and its actual situations should be considered to determine the total cost of the project. The estimation of construction cost of a project depends mainly on the information platforms of the cost department for the desired cost information and the progress of the project in actual practice. The factor deserving attention is the cost of the equipments and the raw materials. In addition, the related project cost data needs consideration. The theoretical basis and technical support of the prediction should be based on the BP neutral network from the analysis above, we could conclude that to acquire the information for the estimation, it is vital to establish a feasible dynamic model. The neural network model is adopted in this paper to conduct the estimation of the actual cost of construction project. Figure 4 shows the relationship between the material usage and the project cost.

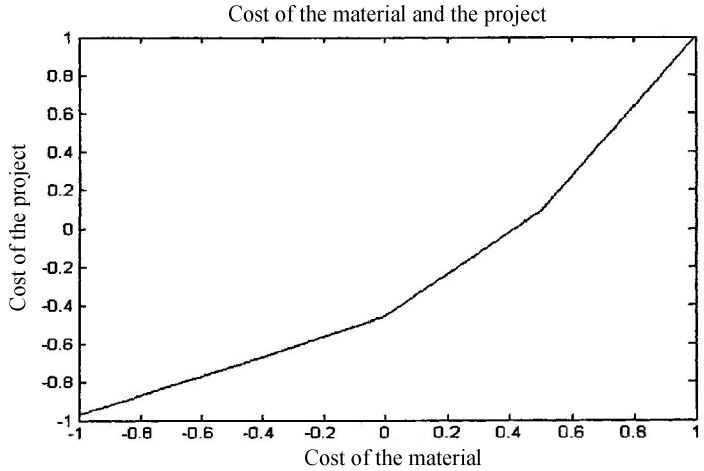

Figure 4 : Relationships between the material usage and the project cost

In this paper's research, the BP neural network is used to create the respective data model to provide some theoretical foundation to the project's construction, with the actual cost as the mathematical mapping of the model.

Since the reform and opening-up, with the rising power of our economy, the scale and the quantity of the building industry keep rising. Besides, the growing population also pushes the expansion of the infrastructure construction to the prosperity in the market economy. In term of the long-term development of the building industry, the key factor is that whether its technique and capability could meet the needs of social development. Down to the concrete procedures of the

construction, it needs to monitor and control every detail of the project. The actual cost of the project holds the key position in the construction.

The main purpose of the BP neural network is to establish two difference dimensional nonlinear mapping. In the actual cost estimation in this paper, the influence vector of the construction project m is set to 3, the core material's cost n is 1, and between m and n there is a mapping relation. Set m as the input parameter of the BP neural network, then n is the output parameter, the m-dimensional space is marked as R^m, the bounded subset in this space is A; on the other hand, the respective n-dimensional space is marked as R^n. The mapping relation existing in the BP neural model is shown as $F: A \subset R^m \to R^n$. On the basis of these, the input vector of BP neural network is determined as the features of the construction cost, with the cost information as its output vector, and the mapping relation is created. Figure 5 shows the basic working principle of the dynamic management model of the BP neural network.

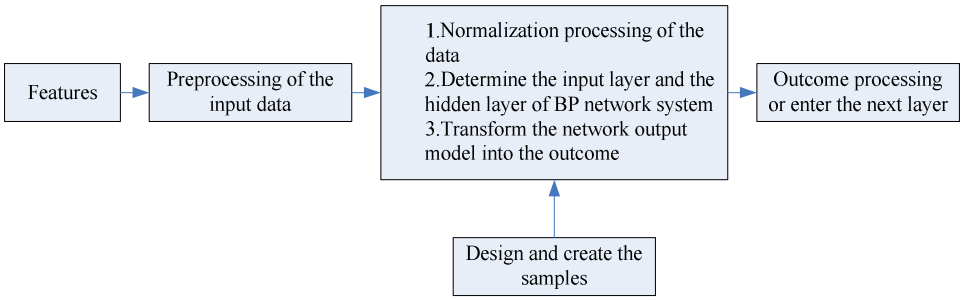

Figure 5 : Basic working principle of the dynamic management model of the bp neural network

Features of the network model of construction cost estimation

BP neural network model is adopted in this paper to conduct the estimation of construction cost. Its main features are concluded as the following:

(1)BP network model has a strong nonlinear mapping ability. One of the most protruding features of this model is that it can establish random accuracy to approach its nonlinear function.

(2)In the model the data could be parallel processed in a distributed way. As the data in the BP network has its own features, it should be processed in a distributed way in line with the distribution feature, so as to rising the information's fault tolerance.

(3)BP network has a strong self-adaptive ability. The input and the output values in the BP network have their patterns and are adept to fit into the environment.

(4)It has strong data integration ability. BP neural network mainly process two kinds of information, namely the directing information and the quantitative information, each has distinct features. BP network can conduct proper processing to their numerical values and marks.

Estimation of the cost of construction project

The paper will estimate the project's cost with the established neural network. The weights of the input value and the neuron network are respectively w_{ij} and v_{jt}, their respective threshold value are θ_j and γ_t. The concrete procedures of the BP network's estimation are as the following:

(1)First, calculate out the input and output vector in the project, which are $[S]_p$ and $[B]_p$. The related function is:

$$[S]_p = [A]_n \square [W]^T_{n\times p} - [\theta]_p \quad \textbf{(1)}$$

$$[B]_p = f([S]_p) \quad \textbf{(2)}$$

(2)Then the unit output vector $[C]_q$ and $[Y]_q$ will be processed, the calculation procedure is:

$$[C]_q = [B]_p \square [V]^T_{n\times p} - [Y]_q \quad \textbf{(3)}$$

$$[Y]_q = f([C]_q) \quad \textbf{(4)}$$

$[Y]_q$ means the final dynamic estimation of the construction project's cost.

CONCLUSIONS

The estimation of the actual cost is vital in the construction project. Cost estimation is the main factor in the construction project's cost supervision and control. The dynamic estimation is based on the static estimation. Combining the realities of China's market economy, the logical prediction of the project cost is conducted. With the perfection of our socialism system, the building industry has undergone significant development. Being the major aspect of the supervision and control of the project cost, its estimation has two main methods: the static prediction and the dynamic prediction of the actual cost. BP neural network system is adopted in this paper to conduct the estimation of construction cost. Its main features are used to conduct the dynamic estimation of the construction project's cost. Based on the static prediction, the dynamic prediction of cost complies with the market reality and the related regulations, and conducts logical and feasible estimations of each step of the construction project.

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