Application of BIM Technology in High-rise Green Building Engineering

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Abstract: In order to improve the construction schedule information control and management ability of high-rise green building project, this paper studies the application of BIM Technology in high-rise green building project. Through the construction of the statistical template function of the high-rise green building construction progress information control, using the method of template feature matching and panel data analysis, the descriptive statistical analysis of the high-rise green building construction progress information is carried out, using BIM information feature analysis method, the adaptive optimization control of the high-rise green building progress information is carried out, and the model of the high-rise green building progress information is extracted The quantitative optimization control model of high-rise green building construction progress information is established based on the financing analysis of high-rise green building progress information, the fusion parameter estimation of high-rise green building construction progress information control is carried out based on the artificial intelligence learning method, and the control process of high-rise green building construction progress information is optimized by the similar transformation method Control features in. The simulation results show that the method has high precision and strong adaptability for the construction progress information control of high-rise green building projects, and improves the construction progress information control and construction progress information management ability of high-rise green building projects.

1. Introduction

BIM Technology, that is, building information model, is a new data model technology first proposed by Autodesk in 2002 [1]. Green building refers to the use of scientific and reasonable technical means in construction projects to optimize the allocation of energy resources, play the role of energy conservation, vigorously promote clean energy, reduce pollutant emissions, and effectively protect the natural environment. At present, it is difficult to meet the requirements of green building design simply by relying on subjective experience. In the green building design, scientific application of BIM Technology, on the one hand, can quickly and effectively carry out data calculation, on the other hand, can carry out dynamic simulation, comprehensive analysis of building related performance, so as to improve the quality of green building design [2].

Project progress information refers to the total progress information of the fixed assets investment estimated or actually expended by the construction project [3]. In real life, due to the diversity and complexity of construction projects, the control and management process of construction progress information is more complex. The control and management of construction project progress information is the primary task of construction enterprises. In the process of controlling and managing the progress information of the construction project, the construction enterprise shall take various control and management measures on the basis of ensuring the quality of the construction project, and ensure that all control and management measures can penetrate into all stages of the construction project. In order to achieve good economic benefits, construction enterprises must do a good job in the control and management of construction project progress information [4,5].

Based on the analysis of the progress information data of high-rise green building project, a BIM technology-based control model of the construction progress information of high-rise green building project is proposed. The model adopts the information feature analysis and fusion technology to carry out the adaptive optimization control of the progress information of high-rise green building project, extracts the fuzzy related feature quantity of the progress information of high-rise green building project, and adopts Similarity transformation method. In order to realize the self-adaptive evaluation of the progress information of high-rise green building project, the control process of the construction progress information of high-rise green building

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project is optimized and tested. Finally, through the simulation test analysis, the superiority of this method in improving the progress information budget control ability of high-rise green building project is verified.

2. Panel data analysis and progress information constraint parameters

2.1. Panel data analysis

Using the method of template feature matching and panel data analysis, the progress information of high-rise green building project is analyzed by descriptive statistics. Taking financing amount, leverage ratio and profit as constraint parameters, a fuzzy parameter model for the progress information of high-rise green building project is established [6]. The standardized function of high-rise green building project schedule information prediction is as follows:

$$V_i = \frac{X^i_{\max} - X^i}{X^i_{\max} - X^i_{\min}} \tag{1}$$

Under the optimization of construction progress information minimization, the progress information prediction function of high-rise green building progress information is obtained. Through industrial structure adjustment, the construction progress information control of high-rise green building project is carried out, and the panel parameter fusion characteristic quantification set of the construction progress information control of high-rise green building project is obtained as follows:

$$\min \quad Z(\tilde{\mathbf{f}}, \hat{\mathbf{f}}, \mathbf{q}^{\mathbf{w}}) = \sum_{a\in A}\int_0^{x_a} [t_a(x_a) + v_a]dx + \frac{1}{\tilde{\theta}}\sum_{w\in W}\sum_{k\in K^w} \hat{f}_k^w \ln \hat{f}_k^w + \frac{1}{\tilde{\theta}}\sum_{w\in W}\sum_{k\in K^w} \tilde{f}_k^w \ln \tilde{f}_k^w - \sum_{w\in W}\int_0^{q^w} D^{-1}(w)dw \tag{2}$$

Under the progress information control of the high-rise green building project, through changing the capital structure, the progress information of the high-rise green building project is optimally adjusted[7]. Under the background of low-carbon economy development, the game function of the progress information evaluation of the high-rise green building project is recorded as follows:

$$\sum_{k\in K^w} \hat{f}_k^w = \eta^w q^w,\ w \in W \tag{3}$$

Based on the construction material progress information and labor progress information of the whole construction process, the financing analysis of the high-rise green building project progress information is carried out, and the quantitative optimization control model of the high-rise green building project progress information is established. The lever ratio distribution level function of the high-rise green building project construction progress information control is expressed as:

$$b_{ni}(0;\lambda) = \begin{cases} \frac{1}{2}, & i = 0,1, \\ 0, & i \neq 0,1, \end{cases} \tag{4}$$

$$b'_{ni}(0;\lambda) = \begin{cases} -\frac{3+\lambda}{2}, & i = 0, \\ \frac{3+\lambda}{2}, & i = 1, \\ 0, & i \neq 0,1, \end{cases} \tag{5}$$

$$b''_{ni}(0;\lambda) = \begin{cases} 3 - \frac{\pi^2}{4}(n-2) + 3\lambda, & i = 0, \\ \frac{\pi^2}{4}(n-2) - 3 - 3\lambda, & i = 1, \\ 0, & i \neq 0,1, \end{cases} \tag{6}$$

Under the quantitative recursive analysis, the construction progress information control of high-rise green building project is carried out, combined with panel data analysis and regression analysis method, the progress information constraint and characteristic analysis of high-rise green building project are carried out to improve the budget control ability of high-rise green building project progress information[8].

2.2. Engineering progress information constraint parameters

By using the method of BIM information characteristic analysis, the adaptive optimization control of high-rise green building progress information is carried out, and the constraint parameters of budget control of high-rise green building project progress information are established by combining the game control method with the least progress information and the best quality.

$$\begin{cases} \upsilon_s = \left\| X_s - \sum_{i=1}^{n} \omega_i X_i \right\|_2^2, s = 1, \ldots, n \\ \omega_s = \dfrac{\dfrac{1}{\dfrac{\upsilon_s}{\sum_{j=1}^{n} \upsilon_j} + \lambda}}{\sum_{j=1}^{n} \dfrac{\upsilon_s}{\sum_{j=1}^{n} \upsilon_j} + \lambda}, s = 1, \ldots, n \end{cases} \quad (8)$$

Combined with the progress information control method, the adaptive optimization of the budget control of the high-rise green building project progress information is carried out, and the progress information control of the high-rise green building project progress information is carried out with the fuzzy quantitative analysis method. The optimal decision function of the budget control of the high-rise green building project progress information is obtained by the statistical analysis method.

$$\pi_{MD}^{A_1} = \frac{(\beta c_n - c_r)^2}{8\beta(1-\beta)} + \frac{(1-c_n)^2}{8} - \frac{B(1-c_n)^2}{A^2 - 8B} \quad (9)$$

Therefore, the constraint parameter model of the budget control of the high-rise green building project progress information is constructed, and the fuzzy progress information constraint method is adopted to evaluate and make the decision of the high-rise green building project progress information, and to improve the budget control ability of the high-rise green building project progress information[9].

3. Optimization of the project construction progress information control model

3.1. Analysis of bim informatization characteristics

On the basis of the above-mentioned statistical template function for constructing the construction progress information control of high-rise green building projects, the construction progress information control model of high-rise green building projects is designed. This paper proposes the construction progress information control model of high-rise green building projects based on BIM technology. Based on the artificial intelligence learning method, the fusion parameter estimation of the construction progress information control of high-rise green building projects is carried out, and the characteristic quantity of progress information distribution of high-rise green building projects is obtained:

$$G_{k+1} = P_{k+1|k}^{xz} (P_{k+1|k}^{z})^{-1} \quad (10)$$

According to the statistical distribution set of high-rise green building progress information, calculate the error covariance matrix:

$$P_{k+1|k+1} = P_{k+1|k} - G_{k+1} P_{k+1|k}^{z} G_{k+1}^{T} \quad (11)$$

Setting n_z as the measurement feature set of high-rise green building progress information, the statistical vector dimension of high-rise green building progress information is analyzed, and the correction function $\rho(k)$ is used for state correction to obtain the adjustment factor φ_k of high-rise green building progress information monitoring, namely:

$$\varphi_k = L^{-1} \sum_{j=k-L+1}^{k} \tilde{z}_j \tilde{z}_j^{T} - (P_{k+1|k}^{z} + R_k) \quad (12)$$

Then the statistical characteristic of φ_k high-rise green building progress information factor satisfies n_z distribution with χ^2 degree of freedom. At different times, k, q_k, Q_k, r_k sum values are different. The fuzzy evaluation set of high-rise green building progress information adaptive prediction is S, $\{v_1, \ldots, v_M\}$ represents the high-rise green building progress information set, and obtains the state estimation values $\hat{q}_{k+1}, \hat{Q}_{k+1}, \hat{r}_{k+1}$ of high-rise green building progress information, which are described as:

$$\hat{r}_{k+1} = (1-d_k)\hat{r}_k + d_k [z_{k+1} - m^{-1} \sum_{i=1}^{m} h_{k+1}(X_{i,k+1|k}, u_{k+1})] \quad (13)$$

$$\hat{R}_{k+1} = (1-d_k)\hat{R}_k + d_k [\tilde{z}_{k+1} \tilde{z}_{k+1}^{T} - m^{-1} \sum_{i=1}^{m} (Z_{i,k+1|k}^{*} - \hat{z}_{k+1|k})(Z_{i,k+1|k}^{*} - \hat{z}_{k+1|k})^{T}] \quad (14)$$

According to unbiased estimation theory, the budget control result of high-rise green building project progress information is unbiased. BIM information fusion method is adopted to carry out budget control and adaptive evaluation decision of high-rise green building project progress information.

3.2. Output of project construction progress information control

The fuzzy assignment scheduling set of high-rise green building project progress information is constructed,

and the differential scheduling of high-rise green building project progress information is realized by combining the block sparse expression method. The estimated information quantity of state characteristics of high-rise green building project progress information is obtained as follows:

$$\hat{q}_{k+1} = (1-d_k)\hat{q}_k + d_k[\hat{x}_{k+1|k+1} - m^{-1}\sum_{i=1}^{m} f_{k+1}(X_{i,k|k}, u_k)] \quad (15)$$

$$\hat{Q}_{k+1} = (1-d_k)\hat{Q}_k + d_k[G_{k+1}\tilde{z}_{k+1}\tilde{z}_{k+1}^T G_{k+1}^T + P_{k+1|k+1} - m^{-1}\sum_{i=1}^{m}(X_{i,k+1|k}^* - \hat{x}_{k+1|k})(X_{i,k+1|k}^* - \hat{x}_{k+1|k})^T] \quad (16)$$

The method of association fusion is adopted to identify the progress information characteristics of high-rise green building projects, the fuzzy association degree characteristics of the progress information of high-rise green building projects are calculated, F-test analysis is carried out, and the distribution threshold of the progress information of high-rise green building projects is set. When $H_2 < H_0$, H_0 indicates that the construction progress information control of high-rise green building projects meets the convergence conditions, and a characteristic analysis model of the progress information of high-rise green building projects is constructed. The quantitative characteristic distribution set of the progress information of high-rise green building projects is as follows:

$$\max Z = \sum_{i=1}^{m}\sum_{j=1}^{m} x_{ij}c_{ij} \quad (17)$$

$$st = \sum_{j=1}^{m} x_{ij} \quad (18)$$

$$st = \sum_{i=1}^{m} x_{ij} \quad (19)$$

$$x_{ij} = 1, st = 0, \text{or}, 1 \quad (20)$$

Wherein, $x_{ij} = 1$ represents the distribution coefficient of market correlation characteristics and is designed as a fuzzy rule set for high-rise green building project Construction progress information control. $x_{ij} = 0$ represents the effective conditional probability of high-rise green building project Construction progress information control under BIM information scheduling mode and is set as a training sample set. $x_{ij} = -1$ represents the statistics of high-rise green building project progress information. Based on the above analysis[10], a construction progress information control model is established and the implementation process is shown in Figure 1.

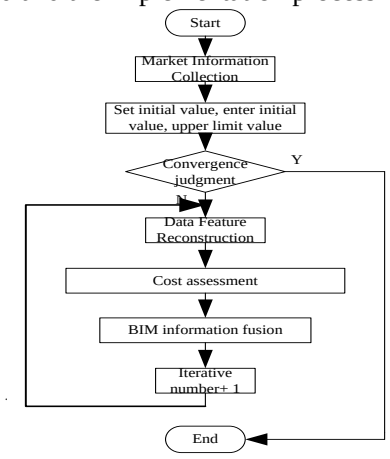

Figure 1 Optimization of the implementation flow of the algorithm

4. Results

In order to verify the application performance of the method in realizing the construction progress information control of high-rise green building projects, experimental analysis is carried out, BIM information design of the state budget control of the progress information of high-rise green building projects is carried out in Simulink, an INVITE parameter set is set to judge the convergence of the progress information evaluation of high-rise green building projects, the data set size of the panel data sampling of the progress information of high-rise green building projects is set to 2000, the sampling time interval is 0,58s, and the statistical time length is 1200. The descriptive statistical analysis results of the construction progress information control of high-rise green building projects are shown in Table 1.

Table 1 Statistical analysis results of high-rise green building progress information

Correlation coefficient	x_1	x_2	x_3	x_4	x_5	x_6
x_1	1	0.547	0.324	0.578	0.878	0.678
x_2	0.455	1	0.545	0.656	0.776	0.767
x_3	0.434	0.654	1	0.765	0.566	0.767
x_4	0.556	0.543	0.687	1	0.465	0.668
x_5	0.435	0.432	0.465	0.656	1	0.656
x_6	0.556	0.456	0.565	0.665	0.556	1

According to the above descriptive statistical analysis results on the construction progress information control of high-rise green building projects. **T**he BIM information characteristic analysis method is adopted to carry out the adaptive optimization control of the high-rise green building project progress information and realize the construction progress information control. The results are shown in figure 2.

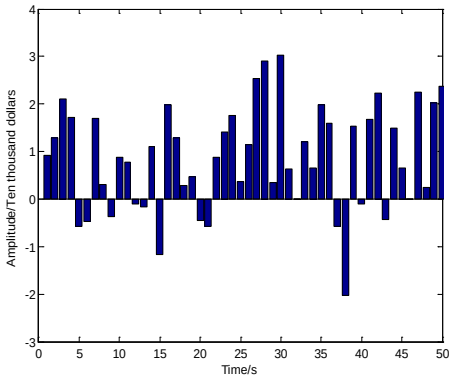

Figure 2 Data identification results

According to the analysis of figure 3, BIM information fusion level and budget control accuracy of high-rise green building project progress information evaluation using this method are higher, and the accuracy of project Construction progress information control using different methods is tested. the comparison results are shown in figure 4. According to the analysis of figure 4, the accuracy probability of high-rise green building project Construction progress information control using this method is higher.

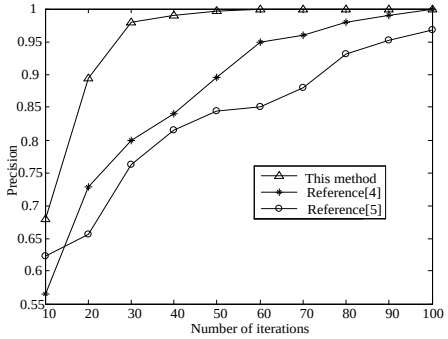

Figure 3 Comparison of accuracy in Construction progress information control of high-rise green building projects

5. Discussion

At present, the control measures of high-rise green building construction progress information ignore the scientific and reasonable pricing of project progress information, and the effect of progress information control is not ideal. The actual inferior materials even affect the quality of the project due to the price reduction. The whole process progress information management and control actually requires the project progress information management personnel to implement the whole process progress information management, track the whole process of the project from project approval, feasibility analysis, project design, construction to completion acceptance, so that the progress information control runs through the whole process of the project construction, so as to improve the project efficiency. In addition, the whole process of progress information management is not only to prevent investment overrun, but also to promote the construction, construction and design units to strengthen management, so that the limited human, material and financial resources can be fully utilized, so as to

obtain the best economic benefits and social welfare. The construction unit shall make a reasonable price for the project progress information and construction scheme, and then make an objective evaluation on the quotation of the construction unit. From the total quotation to the single quotation, the construction process shall be comprehensively reviewed. Select the construction team with advanced construction scheme and practical and reasonable construction progress information. A comprehensive and detailed review of the project progress information in the early bidding process will make the project progress information management work in the construction stage more efficient and control the quality and progress information risks.

6. Conclusions

Using the information characteristic analysis and fusion technology, the information control of the construction progress of high-rise green building project is carried out. Based on BIM Technology, this paper proposes a budget control model for high-rise green building project progress information, constructs a statistical template function for the budget control of high-rise green building project progress information, uses template feature matching and panel data analysis methods for descriptive statistical analysis, and uses BIM information feature analysis method for adaptive optimal control of high-rise green building project progress information In order to realize the self-adaptive evaluation of the progress information of the high-rise green building project, the fuzzy correlation characteristic quantity of the progress information of the high-rise green building project is extracted, and the similar transformation method is used to optimize the control process of the budget of the high-rise green building project. The results show that the method has high accuracy and good adaptability in the budget control of the progress information of high-rise green building projects, improves the budget control and construction progress information management ability of the progress information of high-rise green building projects, and has a good application value in the budget control of the progress information of construction projects.

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