forecasted data is anastomosed with the tested data, so the model can be used in the construction.

4 Conclusions

According to the calculation and analyses that we have done, the gray system forecast model GM (1, 1) can be used in the fore-cast and control the brace axes force of the base hollow in construction process. It can reflect well the engineering fact. It has guidance and practicality value to the information construction of the base hollow.

## CONSULTING LITERATURE

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**UDC 622**

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# INVESTMENT EVALUATION OF CIVIL ENGINEERING PROJECT

**1** Civil building scale investment normal technical and economic result quota evaluation .

Technical and economic evaluation is the most important part of the project feasibility evaluation. In order to make the policy-making correct and scientific, bearing capacity of investment plan varying with various of external condition changes and relevant probability distribution should be known about. The correct policy-making rules and methods under risk should be mastered. Therefore, a series of contingent analysis will be made in terms of technology and economy to ensure the reasonableness and correctness of evaluation.

**1.1** Static quota appraisal

**1.1.1** Investment payback period

$$\sum_{t=0}^{T_P} NB_t = \sum_{t=0}^{T_P} (B-C)_t = K$$

where: K-civil building investment total

$B_t$-income of the tth year

$C_t$-expenditure of the tth year(mainly include maintenance cost and tendance cost)

$NB_t$-net income of the tth year

$NB_t = B_t - C_t$

$T_p$-investment payback period or $T_p$ is expressed by the typical formula:

$$T_P = T - 1 + \frac{\text{The absolute value of the accumulative net present cost of the (T - 1)year}}{\text{Net present cost of the Tth year}}$$

Where: $T$-the total years that the accumulative net present cost are greater than or equal zero

Appraisal Criterion:

Suppose $T_b$ is the standard investment payback period:

If $T_p \le T_b$, then the scale investment is feasible,

If $T_p > T_b$, then the scale investment is unfeasible

**1.1.2** Investment profit rate

$$R = \frac{NB}{K}$$

Where, $K$-total scale investment cost, $K = \sum_{t=0}^{m} K_t$

$K_t$-Investment cost of the tth year

$m$-the total years of investment

$NB$-profit of the normal year

$R$-investment profit rate

Appraisal Criterion:

Suppose $R_b$ is the investment revenue rate

If $R \ge R_b$, then the investment is acceptable

If $R < R_b$, then the investment is denied.

**1.2** Dynamic quota appraisal

**1.2.1** Net present value

$$NPV = \sum_{t=0}^{n} (CI - CO)t\left(1 + i_o\right)^{-t}$$

$$= \sum_{t=0}^{n} (CI - K - CO')t\left(1 + i_o\right)^{-t}$$

where, $Co_t$-cash expenditure of the tth year

$CI_t$-cash income of the tth year

$K_t$-investment expenditure of tth year

$CO'_t$ –cash expenditure that doesn't include the $K_t$ of the tth year

$$CO'_t = CO_t - K_t$$

n- the management total years of the investment project

$i_0$ – standard earning ratio

Appraisal Criterion

If $NPV \geq 0$, then the project is feasible

If $NPV<0$, then the project is not acceptable

**1.2.2** Net annual value

$$NAV=NPV(A/P, i_0, n)= \sum_{t=0}^{n}(CI-CO)_t(1+i_0)^{-t}(A/P, i_0, n)$$

Where $(A/P, i_0, n)$ – cost payback coefficient

Appraisal Criterion

If $NAV \geq 0$, then the project is feasible in the economic result

If $NAV<0$, then the project is not unfeasible in the economic result

**1.2.3** Internal rate of the return

Internal rate of return is expressed with the following equation.

$$NPV(IRR)=\sum_{t=0}^{n}(CI-CO)_t(1+IRR)^{-t}=0$$

Appraisal Criterion

Suppose $i_0$ *is* standard earning ratio

If $IRR \geq i_0$, then the project in the economy effect is acceptable

If $IRR < i_0$, then the project is not acceptable

**1.2.4** Dynamic Investment payback period

$$\sum_{t=0}^{T^*_P}(CI-CO)_t(1+i_0)^{-t}=0$$

where $T^*_P$ – dynamic investment payback period(year)

Appraisal Criterion

Suppose $T_b$ is the standard dynamic payback period

If $T^*_P \leq i_0$, then the project is acceptable

If $T^*_P > i_0$, then the project is unfeasible

**2**. Fuzzy comprehensive appraisal

In civil building scale investment feasible evaluation, many factors are easy to be found and their boundary lines is not clear. Although the policy-making aim is explicit and detailed, it hasn't been acknowledged and has some fuzzcness. Therefore, fuzzy theory will be carried out in the comprehensive appraisal.

Foundation of the evaluation quota system

| | | |
|---|---|---|
| evaluation quota system | Technical quota ($V_1$) | effect of flat surface and space $V_{11}$ |
| | | coefficient of usable floor area $V_{12}$ |
| | | room decoration $V_{13}$ |
| | | physics function $V_{14}$ |
| | | safe function $V_{15}$ |
| | | architectural art $V_{16}$ |
| | Economic benefit quota ($V_2$) | cost $V_{21}$ |
| | | profit $V_{21}$ |
| | Social effect quota ($V_3$) | Environment element $V_{31}$ |
| | | Degree of demand and content $V_{32}$ |

**2.2** Determine set of elements

$$V=\{V_1, V_2, V_3\}$$

where $V_1=|V_{11}, V_{12}, V_{13}, V_{14}, V_{15}, V_{16}|$

$V_2=|V_{21}, V_{22}|$ $\quad V_3=|V_{31}, V_{32}|$

2.3 Found set of weighting

$$A=(a_1, a_2, a_3)$$

$$A_1=(w_{11}, w_{12}, w_{13}, w_{14}, w_{15}, w_{16})$$

$$A_2=(\beta_{21}, \beta_{22})$$

$$A_3=(\gamma_{31}, \gamma_{32})$$

2.4 Found set of evaluation

$$V=|V_1, V_2, V_3, V_4|$$

where: $\{V_1, V_2, V_3, V_4\}$ correspond to

$$\{\text{best}, \text{better}, \text{feasible}, \text{unfeasible}\}$$

**2.5** Find judgement matrix

$$R=\begin{bmatrix} r_{11} & r_{12} & r_{13} & r_{14} \\ r_{21} & r_{22} & r_{23} & r_{24} \\ \cdots & \cdots & \cdots & \cdots \\ r_{101} & r_{102} & r_{103} & r_{104} \end{bmatrix}_{10\times4}$$

where: $$R_1=\begin{bmatrix} r_{11} & r_{12} & r_{13} & r_{14} \\ r_{21} & r_{22} & r_{23} & r_{24} \\ \cdots & \cdots & \cdots & \cdots \\ r_{61} & r_{62} & r_{63} & r_{64} \end{bmatrix}_{6\times4}$$

$$R_1=\left[r_{ij}\right]_{j=1\sim4}^{i=7\sim8} \qquad R_3=\left[r_{ij}\right]_{j=1\sim4}^{i=9\sim10}$$

2.6 Fuzzy comprehensive appraisal

$$B=A \bullet R$$

where: $R=\begin{bmatrix} A_1 \cdot R_1 \\ A_2 \cdot R_2 \\ A_3 \cdot R_3 \end{bmatrix}$

Then, B=$(a_1, a_2, a_3)$ R=$(b_1, b_2, b_3, b_4)$

where, $b_j = \bigvee_{i=1}^{m} (a_i \wedge r_{ij})$ (j=1,2)

In the end ,the last evaluation is determined according to the rule of the maximum subordinate degree.

**3.** Conclusion

Civil building scale investment is an economic and social conduct. Therefore , when we evaluate its feasibility, no matter the primary investment or the step investment should be analyzed and evaluated in the feasibility of technical as well as comprehensive effect. This makes the investment dependent and get the anticipated aim. In this paper, the three methods of evaluation can be used in practice and the result is simple and objective.

As the length of the paper, the specific example is no longer given.

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