

# Research on the operational capital management performance of real estate enterprises under the background of high-quality developmen

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**Abstract.** Taking Vanke Real Estate as the research object, this study uses entropy weight method and grey relational analysis to quantitatively evaluate its working capital management performance from three dimensions: profitability, riskiness, and liquidity. The results show that during the period from 2021 to 2023, Vanke ranks behind Poly in terms of comprehensive grey relational degree ranking, indicating inferior working capital management performance compared to Poly. Based on the above analysis results, this study provides insightful suggestions for optimizing the working capital management strategies of real estate companies. It serves as a theoretical reference for improving the working capital management performance of real estate enterprises and promoting their high-quality development.

**Keywords:** high-quality development; operating capital; management performance.

## 1. Case Introduction and Model Construction

### 1.1 Case Introduction

China Vanke Co., Ltd. was established in 1984 and is a comprehensive enterprise group primarily engaged in real estate development. The company covers various sectors including real estate development, property services, residential leasing, and has expanded into industries such as commercial properties, long-term rental apartments, logistics warehousing, hotels and resorts, as well as education. The company is listed on the Shenzhen Stock Exchange with A-share abbreviation of Vanke A (000002) and H-share abbreviation of Vanke Enterprise (02202.HK). Additionally, as an advocate for sustainable development, Vanke actively adopts new financing tools and models to adapt to market changes and demands.



## 1.2 Construction of performance evaluation index system for operational capital management of listed real estate companies

This study constructs an evaluation index system for the operational capital management performance of listed real estate companies from three aspects: profitability, riskiness, and liquidity. Please refer to Table 1 for details.

Table 1. Construction of Performance Evaluation Index System for Operational Capital Management of Listed Real Estate Companies

Content of evaluation	Indicator name	Indicator formula	Nature of indicators
Profitability	Sales gross profit margin	$= ((\text{Operating revenue} - \text{Operating costs}) / \text{Operating revenue})$	Positive indicator
	Net profit margin for sales	$= \text{Net profit} / \text{Operating revenue}$	Positive indicator
Riskiness	Cash flow to current liabilities ratio	$= \text{Net cash flow from operating activities} / (\text{Current liabilities} - \text{Advance receipts})$	Positive indicator
	Interest turnover ratio	$= (\text{Net profit} + \text{income tax} + \text{interest expense}) / \text{interest expense}$	Positive indicator
Liquidity	Procurement channel operating capital turnover period	$= 360 \times (\text{inventory} + \text{prepaid accounts} - \text{accounts payable and notes payable}) / \text{revenue}$	Reverse indicator
	Turnover period of production channel operating funds	$= 360 \times (\text{Inventory} + \text{Other receivables} - \text{Employee salaries and benefits payable} - \text{Other payables}) / \text{Operating revenue}$	Reverse indicator
	Turnover period of marketing channel operating funds	$= 360 \times (\text{Finished goods inventory} + \text{accounts receivable and notes receivable} - \text{advance receipts} - \text{payable taxes}) / \text{operating revenue}$	Reverse indicator
	Operating cycle of working capital turnover	$= \text{Turnover period of working capital for procurement channels} + \text{turnover period of working capital for production channels} + \text{turnover period of working capital for marketing channels}$	Reverse indicator

## 1.3 Building an evaluation model

### 1.3.1 Sample selection and data sources

The data used in this study mainly come from the audited annual reports of two real estate companies, Poly Real Estate and Vanke Real Estate, spanning from 2021 to 2023. Considering that annual data is more comprehensive and reliable compared to mid-term data, annual data was chosen for the sample. In addition, these two companies are large in scale and can generally represent the operational conditions and development trends of real estate enterprises in China. Therefore, the conclusions regarding working capital management performance will also provide certain guidance and reference for the development of real estate enterprises in our country.

### 1.3.2 Entropy weighting method is used to calculate the weighted values of each indicator

this study applies the entropy weighting method to determine the weights of each indicator and selects data from two real estate companies in 2023 as examples.

Firstly, the indicators are standardized in order to improve the comparability of the data, as each indicator has different meanings and units. Additionally, this study selects two types of evaluation

indicators: positive indicators and negative indicators. The standardization process is conducted using formulas 2.1 and 2.2.

Positive evaluation index processing formula:

$$U_{ij} = \frac{X_{ij} - \min(X_{1j}, X_{2j}, \dots, X_{nj})}{\max(X_{1j}, X_{2j}, \dots, X_{nj}) - \min(X_{1j}, X_{2j}, \dots, X_{nj})} \quad (2.1)$$

Formula for handling negative evaluation indicators:

$$U_{ij} = \frac{\max(X_{1j}, X_{2j}, \dots, X_{nj}) - X_{ij}}{\max(X_{1j}, X_{2j}, \dots, X_{nj}) - \min(X_{1j}, X_{2j}, \dots, X_{nj})} \quad (2.2)$$

Among them,  $U_{ij} \in [0, 1]$ , and the normalized results of the entropy weight method are shown in Table 2.

Table 2. Standardized results of entropy weight method for the indicator values in 2023  
Secondly, calculate the proportion of the j-th indicator of the i-th company to the sum of all

	Poly	Vanke
Sales gross profit margin	0.6478	1.0000
Net profit margin for sales	1.0000	0.9370
Cash flow to current liabilities ratio	1.0000	0.7399
Interest turnover ratio	0.7902	1.0000
Procurement channel operating capital turnover period	1.0000	0.6755
Turnover period of production channel operating funds	0.6391	1.0000
Turnover period of marketing channel operating funds	1.0000	0.7202
Operating cycle of working capital turnover	0.7857	1.0000

companies' j-th indicators, using formula 2.3 as shown in table 3.

$$P_{ij} = \frac{U_{ij}}{\sum_{i=1}^n U_{ij}}, \quad (i = 1, 2, 3, \dots, n, j = 1, 2, \dots, m) \quad (2.3)$$

Table 3. Statistical Results of Proportion Indicators for Poly and Vanke in 2023

	Poly	Vanke
Sales gross profit margin	0.3931	0.6069
Net profit margin for sales	0.5163	0.4837
Cash flow to current liabilities ratio	0.5747	0.4253
Interest turnover ratio	0.4414	0.5586
Procurement channel operating capital turnover period	0.5969	0.4031
Turnover period of production channel operating funds	0.3899	0.6101
Turnover period of marketing channel operating funds	0.5813	0.4187
Operating cycle of working capital turnover	0.4400	0.5600

The third step is to calculate the entropy value of the j-th indicator using the logarithmic principle. The data processing formula is shown in Equation 2.4, and the results of data processing are shown in Table 4.

$$E_j = -k \sum_{i=1}^n P_{ij} \ln(P_{ij}) \quad (2.4)$$

Among them,  $k > 0$  and  $k = 1 / \ln n$ .  $E_j \geq 0$ . In order to make  $E_j$  meaningful, it is assumed that  $P_{ij} \ln(P_{ij}) = 0$  when  $P_{ij} = 0$ .

Table 4. Entropy value statistics for Poly and Vanke indicators in 2023

Indicators	Entropy valueEij	Indicators	Entropy valueEij
Sales gross profit margin	0.6108	Procurement channel operating capital turnover period	0.6146
Net profit margin for sales	0.6313	Turnover period of production channel operating funds	0.6095
Cash flow to current liabilities ratio	0.6216	Turnover period of marketing channel operating funds	0.6197
Interest turnover ratio	0.6255	Operating cycle of working capital turnover	0.6252

The fourth step is to calculate the weights of each attribute, as shown in formula 2.5.

$$W_j = \frac{1 - E_j}{\sum_{j=1}^n (1 - E_j)} \quad (2.5)$$

Among them, when  $1 - E_j = 0$ , the  $j$ -th attribute can be deleted and its weight set to 0. The data processing results are shown in Table 5.

Table 5. Weighted Statistics of Poly and Vanke Indicators from 2021 to 2023

Target layer	Element layer	Indicator level	Weight		
			2021	2022	2023
Performance of working capital management	Profitability	Sales gross profit margin	0.0793	0.1196	0.1279
		Net profit margin for sales	0.0771	0.1166	0.1212
	Riskiness	Cash flow to current liabilities ratio	0.1731	0.1292	0.1244
		Interest turnover ratio	0.1775	0.1167	0.1231
	Liquidity	Procurement channel operating capital turnover period	0.0863	0.1176	0.1267
		Turnover period of production channel operating funds	0.1368	0.1182	0.1284
		Turnover period of marketing channel operating funds	0.1345	0.1650	0.1250
		Operating cycle of working capital turnover	0.1352	0.1171	0.1232

According to the weight statistics table in Table 5, the numerical values of eight indicators for Poly and Vanke real estate companies from 2021 to 2023 were adjusted based on their respective weights. The adjustment results are shown in Table 6 (Table 6 only displays the numerical values of eight indicators for both real estate companies after being adjusted by weights in 2023).

Table 6. Adjusted weighted values for Poly and Vanke's performance indicators in 2023

	Poly	Vanke
Sales gross profit margin	0.0144	0.0250
Net profit margin for sales	0.0116	0.0090
Cash flow to current liabilities ratio	0.0011	0.0003
Interest turnover ratio	0.9123	1.2187
Procurement channel operating capital turnover period	-22.7386	-10.5188
Turnover period of production channel operating funds	148.1008	72.5191

Turnover period of marketing channel operating funds	-1.4804	6.5583
Operating cycle of working capital turnover	118.5814	65.8405

### 1.1.3 Evaluation process of grey relational analysis method

First, we need to construct an evaluation matrix. Assuming there are  $m$  evaluation indicators and  $n$  objects to be evaluated, the set of evaluation indicators is denoted as  $A = (A_1, A_2, A_3, \dots, A_m)$ , and the set of objects to be evaluated is denoted as  $B = (B_1, B_2, B_3, \dots, B_n)$ . The value of  $A_i$  corresponding to  $B_j$  is represented as  $V_{ij}$  in the matrix  $V$ .

$$V = (V_{ij})_{m \times n} = \begin{bmatrix} & B_1 & B_2 & \dots & B_n \\ A_1 & X_{11} & X_{12} & \dots & X_{1n} \\ A_2 & X_{21} & X_{22} & \dots & X_{2n} \\ \dots & \dots & \dots & \dots & \dots \\ A_m & X_{m1} & X_{m2} & \dots & X_{mn} \end{bmatrix} \quad (2.6)$$

The original text states: 'This article consists of 2 companies and 8 evaluation indicators. Based on the weighted indicator data and formula 2.6, an evaluation matrix is formed.

$$V_{8 \times 2} = \begin{bmatrix} 0.0144 & 0.025 \\ 0.0116 & 0.009 \\ 0.0011 & 0.0003 \\ 0.9123 & 1.2187 \\ -22.7386 & -10.5188 \\ 148.1008 & 72.5191 \\ -1.4804 & 6.5583 \\ 118.5814 & 65.8405 \end{bmatrix}$$

The second is the determination of the comparison sequence and the reference sequence. The comparison sequence refers to various factors that affect system behavior, and each evaluation indicator of the evaluated object constitutes this comparison sequence. The comparison sequences used in this article are as follows:

$$V_1 = (0.0144, 0.0116, 0.0011, 0.9123, -22.7386, 148.1008, -1.4804, 118.5814)$$

$$V_2 = (0.025, 0.009, 0.0003, 1.2187, -10.5188, 72.5191, 6.5583, 65.8405)$$

The reference sequence is constructed based on the optimal indicator value. In the forward index, a higher numerical value is better, and the optimal value is the maximum value of each indicator. For reverse indicators, a lower numerical value is better, and the optimal value is the minimum value of each indicator. According to the selection criteria for these optimal values, we can determine the reference sequence  $V_0$ , which is a set of best values  $V_0 = (V_{01}, V_{02}, V_{03}, \dots, V_{0j})$ . Among the eight indicators in this article, gross profit margin, net profit margin, cash flow-to-debt ratio and interest turnover ratio are forward indicators; while purchase channel working capital turnover period, production channel working capital turnover period, marketing channel working capital turnover period and operating activity working capital turnover period are reverse indicators. Therefore, the reference sequence in this article is  $V_0 = (0.025, 0.0116, 0.0011, 1.2187, -22.7386, 72.5191, -1.4804, 65.8405)$ .

Thirdly, dimensionless processing is applied. Formulas 2.7 and 2.8 are used in this paper to perform dimensionless processing on each indicator.

$$R_{ij} = \frac{Z_{ij} - \min Z_{ij}}{\max Z_{ij} - \min Z_{ij}} \quad (2.7)$$

$$R_{ij} = \frac{\max Z_{ij} - Z_{ij}}{\max Z_{ij} - \min Z_{ij}} \quad (2.8)$$

Among them,  $R_{ij} \in [0, 1]$ , the dimensionless processing results are shown in Table 7.

Table 7. Dimensionless processed reference and comparison sequences for Poly and Vanke in 2023

	R0	R1	R2
M1	1	0.6478	1.0000
M2	1	1.0000	0.9370
M3	1	1.0000	0.7399
M4	1	0.7902	1.0000
M5	1	1.0000	0.6755
M6	1	0.6391	1.0000
M7	1	1.0000	0.7202
M8	1	0.7857	1.0000

The fourth is the calculation of grey correlation degree. Grey correlation coefficient is an expression of relevance in grey theory, which compares the distance between a sequence and a reference sequence at different points. The larger the correlation coefficient, the higher the degree of correlation between two indicator sequences. According to grey theory, let  $V_0=(V_{01},V_{02},V_{03},\dots,V_{0j})$  be the reference sequence and  $V_i=[X_{i1},X_{i2},\dots,X_{ij}]$  be the comparative sequence. If  $K_{ij}$  represents the correlation coefficient, then it can be calculated using formula 2.9.

$$K_{ij} = \frac{\min_i \min_j |R_0 - R_{ij}| + \lambda \max_i \max_j |R_0 - R_{ij}|}{|R_0 - R_{ij}| + \lambda \max_i \max_j |R_0 - R_{ij}|} \quad (2.9)$$

In this case,  $\lambda$  is the resolution coefficient, where  $\lambda \in [0,1]$ . Generally speaking, the resolution decreases as the resolution coefficient decreases. It is usually taken as 0.5. Due to differences between each evaluation index and the optimal reference sequence, it can be represented as a difference sequence denoted by  $\Delta_{ij} = |R_{ij} - R_{0j}|$  ( $i=1,2,3; j=1,2,\dots,8$ ).

The fifth step is to calculate the degree of correlation between each evaluation unit and rank them accordingly. In order to facilitate comprehensive comparison, it is necessary to process the correlation coefficients by calculating the degree of association between each evaluation unit and then sorting them according to their level of correlation.

$$\delta = \frac{1}{n} \sum_{j=1}^n K_{ij} \quad (2.10)$$

Among them,  $i=1, 2, 3$ . The grey correlation degree and ranking of profitability, riskiness, and liquidity for sample real estate enterprises in the years 2021-2023 are shown in Table 8.

Table 8. Grey correlation and ranking of profitability, risk, and liquidity for Poly and Vanke from 2021 to 2023

Year	real estate enterprises		profitability	Riskiness	Liquidity
2021	Poly	Grey correlation degree	0.6667	0.3412	0.6126
		Sorting	2	2	2
	Vanke	Grey correlation degree	0.8162	1.0000	0.7322
		Sorting	1	1	1
2022	Poly	Grey correlation degree	0.8323	1.0000	0.8836
		Sorting	2	1	1
	Vanke	Grey correlation degree	0.9820	0.7199	0.7750
		Sorting	1	2	2
2023	Poly	Grey correlation degree	0.7933	0.8522	0.8202
		Sorting	2	1	1
	Vanke	Grey correlation degree	0.9440	0.8289	0.8119
		Sorting	1	2	2

## **2. Analysis of Results**

From 2021 to 2023, the rankings of comprehensive grey correlation are as follows: Poly Group and Vanke, in descending order. Vanke's performance is relatively worse than that of Poly Group, indicating a greater distance between Vanke's operational capital management efficiency and the optimal indicator set. Furthermore, from a longitudinal perspective, the liquidity correlation ranking of Vanke's operational capital is also poor, further illustrating its poor management efficiency in operational capital.

## **3. Conclusion and Recommendations**

Based on the grey correlation analysis, this article examines the operational fund management performance of Vanke Real Estate. The study reveals that from 2021 to 2023, in terms of comprehensive grey correlation degree ranking among Poly and Vanke, Vanke ranks lower than Poly, indicating a relatively poor performance in operational fund management. It is found that unreasonable occupation of operational funds, mismatch between business expansion and capital flow, low turnover efficiency of operational funds, and weak awareness of operational fund management are the reasons for Vanke's poor liquidity. Based on these findings, the following suggestions are proposed in this article:

### **3.1 Avoid unreasonable occupation of operating funds, improve the efficiency of operating fund turnover and strengthen control and management of working capital**

Real estate companies should establish a financial budget management system related to procurement, production, and marketing before project development, and implement dedicated budgets. They should fully consider the amount of funds invested in various channels and production factors to ensure sufficient liquidity and controllable turnover period for each channel, avoiding misuse of corporate funds. Comprehensive research should be conducted before project development to formulate reasonable development plans and arrange procurement schedules properly to avoid mismatches between development and demand. Attention should also be paid to housing construction progress, fund inflow and inventory turnover period while emphasizing the quality of housing construction since good housing quality is one of the key factors in shortening the turnover period of marketing channels. In addition, timely recovery and replenishment of working capital are particularly important. Accounts receivable management needs to be strengthened, along with establishing sound measures for sales collection speed acceleration.

### **3.2 Promote business expansion and coordinate with cash flow, emphasizing the management of business processes**

When expanding their business, real estate companies should analyze the characteristics and patterns of their own operational capital management to understand the working capital requirements and turnover periods in relevant business processes. They should also regulate these factors in conjunction with internal development strategies, project development processes, and budget mechanisms. By properly allocating funds for procurement, production, and marketing channels based on investment and turnover situations, they can ensure smooth business operations while avoiding excessive use of funds in each channel. This approach not only ensures good liquidity of operational capital but also promotes coordination between operational capital management and corporate operations while mitigating liquidity risks.

### **3.3 Establish a sound supervision and evaluation system for operating funds, and improve institutional arrangements for managing operating funds**

Corporate liquidity crises often stem from issues in the management of operating funds. Real estate companies should establish sound risk management mechanisms based on the liquidity of operating funds, enhance risk awareness, adopt effective risk warning mechanisms, identify

potential financial risks, and build a fund risk warning system [6]. Based on a comprehensive assessment of business processes, various channels for fund management and potential risks should be identified and dynamically adjusted and updated.

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