

CEO Equity Incentives and Digital Transformation Performance: Resource Misallocation Risk Through the Lens of Dynamic Capabilities Theory

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Abstract: In the wave of enterprise digital transformation, CEO equity incentives are widely used to promote the transformation process. However, this measure may bring the risk of resource mismatch. Based on the dynamic capability theory, this paper takes the listed companies on the Shanghai and Shenzhen A-share markets from 2015 to 2023 as samples and empirically explores the relationship between CEO equity incentives and the risk of resource mismatch in digital transformation. The study finds that there is an inverted U-shaped relationship between CEO equity incentives and the risk of resource mismatch; dynamic capabilities play a partial mediating role in this relationship; and the investment in technological innovation and the degree of market competition respectively moderate the relationships between CEO equity incentives and dynamic capabilities, and between dynamic capabilities and the risk of resource mismatch. This research provides a theoretical basis and practical guidance for enterprises to rationally design CEO equity incentive plans and reduce the risk of resource mismatch in digital transformation.

Keywords: CEO Equity Incentives; Digital Transformation; Risk of Resource Mismatch; Dynamic Capability Theory

1. Introduction

Digital transformation has become a crucial strategic choice for enterprises to gain a competitive edge in the digital economy era. By applying digital technologies, enterprises can optimize business processes, innovate business models, and improve operational efficiency, thus better adapting to the rapidly changing market environment. During the digital transformation

of enterprises, the CEO, as the core decision-maker, has a decisive impact on the effectiveness of the transformation through their enthusiasm for promoting the transformation and the quality of their decisions.

To encourage CEOs to actively promote digital transformation, many enterprises have implemented equity incentive measures. Equity incentives aim to closely align the personal interests of CEOs with the long-term interests of the enterprise. Theoretically, this can prompt CEOs to be more proactive in investing resources to promote digital transformation. However, in practice, after implementing CEO equity incentives, some enterprises have not achieved the expected results in digital transformation. Instead, resource mismatch phenomena have occurred, such as over-investing in digital technologies without effectively integrating them into business processes, or neglecting organizational change and talent cultivation during the transformation process, resulting in resource waste.

The dynamic capability theory emphasizes an enterprise's ability to integrate, build, and reconfigure resources to adapt to environmental changes in a complex and volatile environment. In the context of digital transformation, an enterprise's dynamic capabilities are crucial for effectively allocating resources and achieving transformation goals. CEO equity incentives may affect the dynamic capabilities of enterprises, and thus influence the risk of resource mismatch during the digital transformation process. Currently, the relationship between CEO equity incentives and the risk of resource mismatch in digital transformation, as well as the mechanism of action of dynamic capabilities in this process, have not been fully studied. An in-depth exploration of these issues has important

theoretical and practical significance for enterprises to rationally design equity incentive plans and improve the success rate of digital transformation.

2. Theoretical Basis and Research Hypotheses

2.1 Dynamic Capability Theory

The dynamic capability theory was proposed by Teece, Pisano, and Shuen. This theory holds that an enterprise's competitive advantage does not solely depend on static resource endowments. More importantly, it lies in the enterprise's ability to integrate, build, and reconfigure internal and external resources in a dynamic environment. During the digital transformation process, enterprises face challenges such as rapid technological updates and changing market demands. Dynamic capabilities can help enterprises quickly identify digital transformation opportunities, rationally allocate resources, and timely adjust strategies to meet the needs of transformation.

As the core figure in enterprise strategic decision-making, the CEO's decisions and actions have a key impact on the formation and development of an enterprise's dynamic capabilities. CEO equity incentives will change the decision-making motivation and behavior patterns of CEOs, thereby affecting the construction and exertion of an enterprise's dynamic capabilities, and ultimately acting on the resource allocation efficiency during the digital transformation process.

2.2 CEO Equity Incentives and the Risk of Resource Mismatch

When the CEO's shareholding ratio is low, equity incentives can effectively stimulate the enthusiasm and creativity of the CEO. From the logic chain of "incentive - effort - performance", equity incentives make the CEO expect that their personal interests are closely related to the benefits after the success of the enterprise's digital transformation. This prompts the CEO to be more proactive in collecting market information and identifying digital transformation opportunities. At this time, the CEO will strive to integrate internal and external resources of the enterprise and rationally plan digital transformation projects to maximize the enterprise value, thus reducing the risk of resource mismatch.

However, when the CEO's shareholding ratio is

too high, some negative effects may occur. On the one hand, a high shareholding gives the CEO greater control in the enterprise, which may lead to more conservative decision-making. The CEO may pay excessive attention to the preservation of their own wealth and be cautious about digital transformation projects with high risks, missing some transformation opportunities and causing resource idleness or insufficient allocation. On the other hand, excessive equity incentives may trigger self-interested behavior of the CEO. In order to pursue a short-term increase in the stock price, the CEO may over-invest in projects that can boost performance in the short term but have no substantial help for the long-term digital transformation of the enterprise, resulting in an increase in the risk of resource mismatch. Based on this, the hypothesis is proposed:

H1: There is an inverted U-shaped relationship between CEO equity incentives and the risk of resource mismatch in digital transformation.

2.3 The Mediating Role of Dynamic Capabilities

At a low level of equity incentives, in order to obtain more equity returns, the CEO will actively use their professional knowledge and leadership skills to strengthen the research on market trends and timely capture new opportunities brought about by digital transformation. For example, by cooperating with technology companies, advanced digital technologies can be introduced, and organizational change within the enterprise can be promoted to optimize business processes, enabling the enterprise to quickly adapt to the digital environment. Such proactive actions help to enhance the enterprise's dynamic capabilities, making it more efficient in the resource allocation process and thus reducing the risk of resource mismatch.

As the level of equity incentives continues to increase, within a certain stage, the CEO still has a strong motivation to promote the enterprise to enhance its dynamic capabilities. However, when the equity incentives exceed a certain threshold, as mentioned above, the CEO may exhibit conservative decision-making or self-interested behavior. These behaviors will hinder the improvement of the enterprise's dynamic capabilities, making it difficult for the enterprise to adjust its resource allocation strategy in a timely manner according to market changes, thereby increasing the risk of resource

mismatch. Based on the above analysis, the hypothesis is proposed:

H2: Dynamic capabilities play a mediating role between CEO equity incentives and the risk of resource mismatch in digital transformation.

2.4 The Moderating Role of Investment in Technological Innovation

Investment in technological innovation is one of the important ways for enterprises to enhance their dynamic capabilities. In enterprises with high investment in technological innovation, abundant R&D resources enable the enterprise to absorb and apply new technologies more quickly, enhancing its perception and response capabilities to digital transformation opportunities. At this time, the positive promoting effect of CEO equity incentives on dynamic capabilities will be amplified. Even if the CEO's shareholding ratio is high, due to the enterprise's strong technological innovation strength and active innovation atmosphere, the CEO has more confidence to promote digital transformation projects and will not hinder the improvement of dynamic capabilities due to excessive conservatism, thus further reducing the risk of resource mismatch.

Conversely, in enterprises with low investment in technological innovation, limited R&D funds and technical talents restrict the enterprise's exploration and application of new technologies, and it is more difficult to enhance the enterprise's dynamic capabilities. Even if equity incentives are implemented, when the CEO promotes digital transformation, they may find it difficult to effectively enhance the enterprise's dynamic capabilities due to the lack of technical support. This weakens the promoting effect of equity incentives on dynamic capabilities, and the risk of resource mismatch is relatively high. Based on this, the hypothesis is proposed:

H3: Investment in technological innovation positively moderates the relationship between CEO equity incentives and dynamic capabilities. That is, the higher the investment in technological innovation, the stronger the promoting effect of CEO equity incentives on dynamic capabilities, and the lower the risk of resource mismatch.

2.5 The Moderating Role of the Degree of Market Competition

In a highly competitive market environment, enterprises face huge survival pressure and must

continuously enhance their dynamic capabilities to maintain their competitiveness. At this time, CEO equity incentives prompt the CEO to pay more attention to the long-term development of the enterprise and actively promote the enterprise's digital transformation to improve resource allocation efficiency. Even if the CEO's shareholding ratio is high, the pressure of market competition will prevent the CEO from slacking off. They will continue to strive to enhance the enterprise's dynamic capabilities to meet the challenges of competitors, thus effectively reducing the risk of resource mismatch.

In an environment with a low degree of market competition, enterprises face less competitive pressure and have a relatively loose survival space. This may lead to a lack of urgency in the CEO's decision-making. Even if equity incentives are implemented, the CEO may have insufficient motivation to enhance the enterprise's dynamic capabilities. When the CEO's shareholding ratio is high, conservative decision-making or self-interested behavior is more likely to occur, making it difficult to enhance the enterprise's dynamic capabilities and increasing the risk of resource mismatch. Based on the above analysis, the hypothesis is proposed:

H4: The degree of market competition positively moderates the relationship between dynamic capabilities and the risk of resource mismatch. That is, the higher the degree of market competition, the more significant the role of dynamic capabilities in reducing the risk of resource mismatch.

3. Study Design

3.1 Data Collection and Sample Selection

The listed companies on the Shanghai and Shenzhen A-share markets from 2015 to 2023 were selected as the research sample. To ensure the reliability and validity of the research results, the samples were screened as follows: First, samples of ST and *ST companies were excluded. These companies usually face financial difficulties or other abnormal situations, and their operating behaviors and financial data may deviate greatly, which will affect the accuracy of the research conclusions. Second, samples of listed companies in the financial industry were excluded. The financial industry has unique business models, regulatory requirements, and financial characteristics,

which are quite different from other industries and are not suitable for unified research. Finally, samples of companies with missing key data were excluded to ensure the integrity and continuity of the data. After screening, annual observations of 1,500 enterprises were finally obtained.

The financial data and corporate governance data of listed companies mainly come from the CSMAR database and the Wind database. Data related to digital transformation were obtained through text analysis and data extraction from enterprise annual reports, official websites, and industry reports. The measurement of dynamic capabilities involves multiple indicators, and some data were obtained through detailed analysis and collation of enterprise innovation activities and market expansion activities.

3.2 Variable Definition

Explained Variable: Risk of Resource Mismatch (Mismatch). Drawing on existing research, the data envelopment analysis (DEA) method was used to calculate the resource allocation efficiency of enterprises, and then the risk of resource mismatch was measured. The lower the resource allocation efficiency, the higher the risk of resource mismatch. In the specific calculation process, the fixed assets, current assets, number of employees, etc. of the enterprise were selected as input indicators, and operating income, net profit, etc. were selected as output indicators. The DEA model was used to calculate the resource allocation efficiency scores of each enterprise. After taking the reciprocal of these scores and standardizing them, the risk of resource mismatch indicator was obtained.

Explanatory Variable: CEO Equity Incentives (Equity_Incentive). The ratio of the number of shares held by the CEO at the end of the year to the total number of shares of the enterprise was used to measure the level of CEO equity incentives. This indicator can directly reflect the CEO's shareholding ratio in the enterprise and embody the intensity of equity incentives.

Mediating Variable: Dynamic Capabilities (DC). An evaluation index system for dynamic capabilities was constructed from three

dimensions: perception capabilities, integration capabilities, and reconfiguration capabilities. Perception capabilities were measured by indicators such as the accuracy of the enterprise's prediction of market trends and the speed of identifying new technologies; integration capabilities were measured by indicators such as the collaboration efficiency between internal departments of the enterprise and the degree of resource sharing; reconfiguration capabilities were measured by indicators such as the timeliness of the enterprise's strategic adjustment and the effectiveness of organizational structure change. The principal component analysis method was used to synthesize these indicators to obtain a comprehensive score of dynamic capabilities.

Moderating Variables: Investment in Technological Innovation (R&D_Invest). The proportion of the enterprise's R&D investment in operating income was used to measure the level of investment in technological innovation. This indicator reflects the enterprise's emphasis on technological innovation and the intensity of resource investment. Degree of Market Competition (Competition). The Herfindahl-Hirschman Index (HHI) was used to measure the degree of market competition. The smaller the HHI index, the higher the degree of market competition; conversely, the lower the degree of market competition.

Control Variables: Referring to existing research, enterprise size (Size), asset-liability ratio (Lev), profitability (ROE), ownership concentration (Top1), board size (Board_Size), as well as annual dummy variables (Year) and industry dummy variables (Industry) were selected as control variables. Enterprise size was expressed as the natural logarithm of total assets; the asset-liability ratio was the ratio of total liabilities to total assets; profitability was measured by return on equity; ownership concentration was expressed as the shareholding ratio of the largest shareholder; and board size was expressed as the number of board members.

3.3 Model Specification

To test Hypothesis H1, the following model was constructed:

$$\text{Mismatch}_{i,t} = \alpha_0 + \alpha_1 \text{Equity_Incentive}_{i,t} + \alpha_2 \text{Equity_Incentive}_{i,t}^2 + \sum_{j=1}^n \lambda_j \text{Control}_{j,i,t} + \text{Year} + \text{Industry} + \varepsilon_{i,t}$$

Among them, $\text{Mismatch}_{i,t}$ represents the resource misallocation risk of the i -th enterprise

in year t , Equity_Incentive is the CEO equity incentive level of the i -th enterprise in year t ;

Control is a series of control variables; α_0 is a constant term; α_1 , α_2 , and γ are regression coefficients; Year and Industry are annual dummy variables and industry dummy variables respectively; $\mu_{i,t}$ is a random error term. If it is significantly positive, or significantly negative, then hypothesis H1 is supported.

$$DC_{i,t} = \beta_0 + \beta_1 \text{Equity_Incentive}_{i,t} + \sum_{j=1}^n \gamma_j \text{Control}_{j,i,t} + \text{Year} + \text{Industry} + \mu_{i,t}$$

Among them, $DC_{i,t}$ is the dynamic capability of the i th enterprise in year t ; β_0 is a constant term; β_1 and γ_j are regression coefficients; $\mu_{i,t}$ is a random error term. If significant, proceed to the third

$$\text{Mismatch}_{i,t} = \eta_0 + \eta_1 \text{Equity_Incentive}_{i,t} + \eta_2 DC_{i,t} + \sum_{j=1}^n \theta_j \text{Control}_{j,i,t} + \text{Year} + \text{Industry} + \xi_{i,t}$$

Among them, $DC_{i,t}$ is a constant term; η_1 is a regression coefficient; ϵ is a random error term. If η_2 is significant, and the absolute value of the coefficient of η_1 is smaller than the absolute value of the coefficient of α_1 in model (1), it indicates that dynamic capability plays a

$$DC_{i,t} = \beta_0 + \beta_1 \text{Equity_Incentive}_{i,t} + \beta_2 R\&D_Invest_{i,t} + \beta_3 \text{Equity_Incentive}_{i,t} \times R\&D_Invest_{i,t} + \sum_{j=1}^n \gamma_j \text{Control}_{j,i,t} + \text{Year} + \text{Industry} + \mu_{i,t}$$

If β_3 is significantly positive, it means that technological innovation investment positively regulates the relationship between CEO equity

$$\text{Mismatch}_{i,t} = \eta_0 + \eta_1 DC_{i,t} + \eta_2 \text{Competition}_{i,t} + \eta_3 DC_{i,t} \times \text{Competition}_{i,t} + \sum_{j=1}^n \theta_j \text{Control}_{j,i,t} + \text{Year} + \text{Industry} + \xi_{i,t}$$

If η_3 is significantly negative, it indicates that the degree of market competition positively regulates the relationship between dynamic capabilities and resource misallocation risk, supporting hypothesis H4.

4. Empirical Analysis

4.1 Descriptive Statistics

Descriptive statistics were performed on the main variables. The results showed that the mean value of the risk of resource mismatch (Mismatch) was 0.45, and the standard deviation was 0.21, indicating that there were certain differences in the risk of resource mismatch among different enterprises. The mean value of CEO equity incentives (Equity_Incentive) was 0.08, indicating that the average shareholding ratio of CEOs in the sample enterprises was relatively low, but the maximum value reached

To test Hypothesis H2, a mediating effect model was constructed in three steps. First, Model (1) was estimated to test the total effect of CEO equity incentives on the risk of resource mismatch. Second, Model (2) was constructed to test the impact of CEO equity incentives on dynamic capabilities:

step. Construct model (3) to test the impact of dynamic capability on resource misallocation risk, and incorporate CEO equity incentives into the model:

mediating role between CEO equity incentives and resource misallocation risk, supporting hypothesis H2.

To test hypothesis H3, the following moderation effect model is constructed:

incentives and dynamic capabilities, supporting hypothesis H3. To test hypothesis H4, the following regulatory effect model is constructed:

0.35, showing a large individual difference. The mean value of dynamic capabilities (DC) was 0.05, and the standard deviation was 0.18, reflecting that the levels of dynamic capabilities among enterprises were uneven. The mean value of investment in technological innovation (R&D_Invest) was 0.06, and the standard deviation was 0.04, indicating that the differences in investment in technological innovation among enterprises were relatively small. The mean value of the degree of market competition (Competition) was 0.12, and the standard deviation was 0.05. This shows that there are certain differences in the market competition environment of the sample enterprises. The descriptive statistical results of other control variables are basically consistent with existing research.

4.2 Benchmark Regression Results

Table 1. Regression Results Between Factors

Vanables	Test 1	Test 2	Test 3	Test 4	Test 5
	MI	DC	RD	MI	EI

	β	t	β	t	β	t	β	t	β	t
Equity Incentive	0.528***	59.33	0.289**	2.77			0.323***	2.64	0.324***	3.64
Equity Incentive ²	(-0.463)***	(-30.25)	0.230**	(-3.58)			0.324***	3.64	0.325***	4.64
CEO	0.356***	3.811	0.132**	2.15	0.015**	0.803	0.005**	0.521	0.006**	1.521
DC	(-0.136)**	3.681								
RD* cen			0.356**	0.005						
Growth	(-0.002)***	(-4.26)	-0.12	(-0.90)	0.069**	1.72	0.023*	1.105	0.024*	2.105
Lev	0.112***	28.84	0.123	(-23.24)	0.556***	6.56	0.327***	7.56	0.328***	8.56
Inszie	(-0.019)***	(-16.63)	-0.001	(-0.06)	0.879	49.7	0.589	41.342	82.095	122.848
Industry	control	control	control	control	control	control	control	control	control	control
Year	control	control	control	control	control	control	control	control	control	control

Note: DT stands for digital transformation, LEV stands for the proportion of independent directors, and Lnszie stands for enterprise size.

The regression analysis of model (1) shows that the coefficient of the first-order term of CEO equity incentive (Equity_Incentive) is significantly positive, and the coefficient of the second-order term is significantly negative. This indicates that the CEO equity incentive and the risk of resource mismatch in digital transformation have an inverted U-shaped relationship. When the CEO's shareholding ratio is low, equity incentives can reduce the risk of resource mismatch; as the shareholding ratio increases, after exceeding a certain threshold, equity incentives will lead to an increase in the risk of resource mismatch, and hypothesis H1 is verified.

4.3 Results of the Mediation Effect Test

According to the mediation effect test steps, model (1) is first regressed to obtain the total effect of CEO equity incentives on resource mismatch risk. Then, model (2) is regressed. The results show that the coefficient of CEO equity incentives on dynamic capabilities is significantly positive, indicating that CEO equity incentives can improve the dynamic capabilities of enterprises. Then, model (3) is regressed. The results show that the coefficient of dynamic capabilities on resource mismatch risk is significantly negative, and the absolute value of the coefficient of CEO equity incentives is smaller than the absolute value of the corresponding coefficient in model (1). This shows that dynamic capabilities play a partial mediating role between CEO equity incentives and digital transformation resource mismatch risks, and hypothesis H2 is supported.

4.4 Results of the Moderating Effect Test

Model (4) is regressed. The coefficient of the interaction term between technology innovation investment (R&D_Invest) and CEO equity incentives (Equity_Incentive) is significantly

positive, indicating that technology innovation investment positively regulates the relationship between CEO equity incentives and dynamic capabilities. In enterprises with higher investment in technological innovation, CEO equity incentives have a stronger effect on promoting dynamic capabilities, and thus can more effectively reduce the risk of resource mismatch. Hypothesis H3 is verified. Model (5) is regressed, and the coefficient of the interaction term between dynamic capabilities (DC) and market competition (Competition) is significantly negative, indicating that market competition positively regulates dynamic capabilities and resource mismatch risks. Hypothesis H4 is verified.

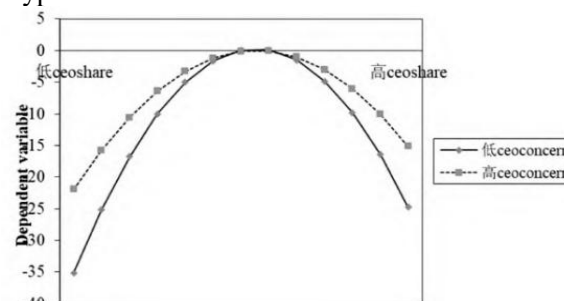


Figure 1. Moderating Effect and Degree of Regulation Results

5. Research Conclusions

This study uses Shanghai and Shenzhen A-share listed companies from 2015 to 2023 as samples. Based on the theory of dynamic capabilities, it deeply explores the relationship between CEO equity incentives and the risk of resource mismatch in digital transformation, and obtains the following core conclusions: First, CEO equity incentives and resource mismatch risk show an inverted U-shaped relationship. When the CEO's shareholding ratio is low, equity incentives play a positive incentive role, prompting the CEO to actively promote digital transformation, optimize resource allocation,

and reduce mismatch risk; but when the shareholding ratio is too high, negative effects appear, and conservative decision-making or self-interested behavior leads to an increase in resource mismatch risk. Second, dynamic capabilities play a partial mediating role in the relationship between the two. Under low equity incentive levels, CEOs actively improve the company's dynamic capabilities and efficiently allocate resources in order to obtain more benefits; as the incentive level increases, after exceeding a certain threshold, CEO behavior changes hinder the improvement of dynamic capabilities, thereby increasing the risk of resource mismatch. Third, technological innovation investment and market competition level play a moderating role respectively. Technological innovation investment positively regulates the relationship between CEO equity incentives and dynamic capabilities. High investment strengthens the role of incentives in promoting dynamic capabilities and further reduces the risk of resource mismatch. The degree of market competition positively regulates the relationship between dynamic capabilities and resource mismatch risks. When competition is fierce, in order to maintain competitiveness, CEOs actively use equity incentives to enhance dynamic capabilities and effectively reduce mismatch risks.

6. Management Suggestions

Based on the above research conclusions, in order to help companies reasonably design CEO equity incentive plans and reduce the risk of resource mismatch in digital transformation, the following management suggestions are put forward:

At the enterprise level, the CEO equity incentive plan should be accurately designed. The CEO shareholding ratio should be reasonably set to avoid being too high or too low. The shareholding ratio can be dynamically adjusted by regularly evaluating the company's strategic goals, development stages and industry characteristics to ensure that while motivating the CEO to actively promote digital transformation, possible negative behaviors can be avoided. Incorporate key indicators of digital transformation into the equity incentive assessment system, such as the application effect of digital technology and the degree of business process optimization, to guide the CEO to focus on the quality of transformation rather than

simply pursuing short-term interests. At the same time, increase investment in technological innovation, establish a sound R&D management system, attract and cultivate technological innovation talents, and enhance the company's technological innovation capabilities. Use technological innovation to strengthen the role of equity incentives in promoting dynamic capabilities, help enterprises allocate resources efficiently, and promote digital transformation.

From the perspective of industry associations, they should actively play the leading role of the industry. Build an industry exchange platform, organize enterprises to share successful experiences and lessons learned from digital transformation, promote mutual learning among enterprises, and improve the digital transformation level of the entire industry. Formulate industry norms and best practice guidelines to provide standardized references for enterprise digital transformation, help enterprises clarify their direction, and reduce the risk of resource mismatch. In addition, promote enterprises in the industry to strengthen technological innovation cooperation, integrate industry resources, jointly overcome technical difficulties in digital transformation, enhance the overall technological innovation capabilities of the industry, and strengthen the positive relationship between equity incentives and dynamic capabilities.

Government departments need to improve the policy support system. Introduce policies such as tax incentives and fiscal subsidies to encourage enterprises to increase investment in technological innovation, reduce enterprise innovation costs, enhance enterprise technical strength, and thus optimize the effect of equity incentives. Strengthen the construction of digital economic infrastructure, improve the level of infrastructure such as network communications and data centers, and provide a good external environment for enterprise digital transformation. Improve the market competition mechanism, strengthen market supervision, crack down on unfair competition, and create a fair and orderly market competition environment. By increasing market competition pressure, companies are encouraged to actively improve their dynamic capabilities under equity incentives, reduce the risk of resource mismatch, and promote the healthy development of corporate digital transformation.

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