

Research on the Influence of Executive Internal Alliance on Innovation Performance of Enterprises

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Abstract: Based on the data of Shanghai and Shenzhen A-share listed companies in China from 2011 to 2022, this paper studies the relationship between internal alliance of senior executives and corporate innovation performance. The research shows that the degree of internal alliance of senior executives has a significant promoting effect on enterprise innovation performance. The support of senior executives and directors enables the CEO to have greater decision-making autonomy in the corporate decision-making process. This internal alliance stimulates the CEO's need to bring a sense of accomplishment and dignity through work, and makes him pay more attention to the long-term development of the company, thus promoting corporate innovation. It is also found that ownership concentration has a negative moderating effect on the promotion effect of intra-executive alliance on enterprise innovation performance, while the dual role of CEO has a significant positive moderating effect. This study enriches the literature on intra-executive alliance based on the data of domestic enterprises, explores a new direction to improve the innovation performance of enterprises, and provides some new ideas for improving the governance system of listed companies, enhancing market competitiveness, and ensuring the sustainable development of enterprises.

Keywords: Executive alliance, Innovation performance, Ownership concentration.

1. Introduction

In today's increasingly tense international situation, the world political and economic pattern is constantly changing, foreign economic fluctuations have a certain impact on our economy, complex and changeable economic conditions lead to unstable market demand, market competition is increasingly fierce. In this context, how to obtain unique differential advantages, win a place and stand firm in the increasingly fierce market environment, has become the core issue faced by each enterprise. In this regard, many scholars and entrepreneurs have reached a unified suggestion - innovation. In a dynamic and competitive business environment, innovation has become a key factor in the success of most companies to improve performance and stay viable, it can help companies gain new capabilities, enter new businesses, improve profitability and promote economic growth. At present, China is in a new era of socialist development and a critical period of great rejuvenation. In the face of increasingly complex international situation and intensifying global competition, it is bound to improve the level of independent innovation. As an important part of the national innovation system, the innovation activities and performance of enterprises have been widely concerned.

Innovation is of great significance to the enterprise itself, and it is the key factor to determine whether the enterprise can achieve sustainable development in the future and maintain its dominant position. As the result of innovation, innovation performance is the common focus of theoretical and practical circles. How to improve innovation performance is also the core issue of strategic management. In the innovation process of a company, the executive team is a group that plays a direct role, constituting the main alliance of individuals responsible for the management of the company, especially in the formulation and implementation of the change strategy, and they determine the next various innovative activities of the company by making decisions, which are often influenced by

the internal relationships of the executives. Therefore, from the perspective of intra-executive alliance, this paper explores the relationship between executive alliance and innovation performance through theoretical analysis and empirical research.

According to the high-level echelon theory, as the actual decision makers and leaders of innovation activities, the characteristics of the senior management team will affect the innovation behavior and performance results of the enterprise. The internal alliance of senior executives based on the employment relationship will form a top management team with the CEO as the core, thus stimulating the CEO's need to bring a sense of accomplishment and dignity through work, making him pay more attention to the long-term development of the enterprise, avoid opportunistic behavior, reduce earnings management, and promote enterprise innovation. At the same time, the CEO's connections with other executives and directors can reduce the cost of coordinating activities and communication among them, which may affect the company's innovation performance. In order to verify the existence of this positive relationship, this paper discusses it and uses a regression model to test the collected data.

2. Literature Review and Hypothesis Development

2.1. Literature Review

Since the CEO is the ultimate corporate decision maker and has the explicit legal power to direct the company's behavior, many literatures identify the CEO as the key figure influencing the company's operational decisions [1]. However, the CEO's actions and decisions are subject to oversight by board members [2, 3] and other senior executives [4, 5]. In addition, important corporate decisions, such as investment decisions, often require coordination or acquiescence among other executives and directors. Therefore, the relationship between the CEO and other executives and directors of the

company is also considered as a factor affecting the business decision of the company, because such connection weakens the monitoring and increases the cooperation [6].

Connections between CEOs and other executives or directors typically include hometown ties, alumni ties, and age. It can be classified into three categories: demographic characteristics, external social relations and employment relations. Fracassi [7] found that the supervisory role of the board of directors over senior executives would be weakened due to its connection with the CEO. Faley [8] showed that the more well-connected the CEO is, the more R&D investment the company will make and the more patents it will obtain. The research results of Khanna [6] show that the employment-based internal alliance of senior executives increases the possibility of fraud in the company and weakens the possibility of fraud being discovered. However, the internal alliance formed by other reasons such as educational background has no significant effect on the fraud behavior of enterprises. Xiaoyu Li [9] found that the impact of CEO internal relevance on the performance of private enterprises is significantly inverted U-shaped. Balsam [12] found that the connection between CEO and senior executives has a positive impact on the company in promoting cooperation and communication.

Enterprise innovation performance refers to the result or output of an enterprise after innovation activity or innovation behavior. Whether innovation can obtain output commensurate with its input and whether innovation output will help enterprise operation is closely related to the development prospect of an enterprise. Therefore, the research on innovation performance mainly takes innovation performance as the outcome variable and studies the antecedent variable that has an impact on it. At present, the existing research is mainly carried out from two aspects: external factors, including government policies and market environment, and internal factors, including corporate behavior and executive characteristics.

The research of Waegenaere [14] shows that for multinational corporations, R&D activities will be affected by different tax laws and systems in different countries. If the domestic tax rate is high, the innovation investment of the company is likely to be reduced. According to the study of Santoro [15], establishing connections with stakeholders will facilitate enterprises to absorb heterogeneous resources, promote product innovation and improve innovation performance. The research results of Ya'nan Wang and Wentao Dai [16] show that internal control, as an enterprise's own governance mechanism, can restrain and slow down the problem of information asymmetry within the enterprise and reduce agency costs, which is conducive to enterprise innovation. Zhiguang Li [17] found that academic founders showed the best innovation performance by obtaining relatively more equity financing.

Taking a comprehensive view of the above literatures, the existing research on the influencing factors of enterprise innovation performance mainly focus on the social level, corporate governance, and personal characteristics of managers. Due to the availability of data, the need for manual data collection and sorting, and the high time cost, there are few literatures to study the alliance between CEO and other executives and directors, and a few research directions on the alliance among executives mainly focus on M&A performance, business performance, etc., and the research on enterprise innovation is relatively scarce. As one aspect of the

informal system, the research on the influence of the executive alliance on the innovation and its mechanism cannot be ignored.

Therefore, this paper considers the impact of the internal alliance formed by the CEO of listed companies, the executives hired, and the directors nominated on the company's operating results, examines their role in the innovation performance of listed companies based on the significance of corporate innovation in the economic entity, and explores the mechanism of the impact of the internal alliance of senior executives on the innovation performance of enterprises.

2.2. Hypotheses Development

According to the reciprocity norm theory, when a person is appointed as a senior executive by the CEO or proposed to be nominated to the board of directors, he may have a sense of gratitude to the CEO. Because the CEO appoints senior executives, or participates in the initial appointment of directors, the recommended executives and directors will most likely not question or oppose the CEO's decision, so they will be more loyal to the CEO. Based on the psychological support of the CEO's decision, more dedication to complete the instructions issued by the CEO. At the same time, the CEO has strong stability and cohesion by appointing or nominating a team of executives and directors with similar characteristics.

In addition, the top echelon theory holds that the top management team can more effectively influence the strategic choice and organizational performance results than the individual top managers. In a complex and dynamic environment, the top management team is embedded in the strategic environment and strategic choice, and has an important impact on strategic behavior and strategic choice through the ability and cognition of the collective team and the mutual influence among team members. The employment-based internal alliance of senior executives can help improve the communication efficiency and decision-making efficiency of the management, reduce the communication cost, improve the homogeneity of the senior management team, and lead to greater decision-making power of the CEO. Based on the above analysis, this paper proposes the following hypothesis:

H1: The internal alliance of senior executives can promote the innovation performance of enterprises

According to the principal-agent theory, small and medium-sized shareholders pay more attention to the development of the enterprise and participate more in the operation decision-making of the enterprise than the major shareholders who hold the majority shares. From the perspective of executives' sense of identification with the goal of maximizing corporate value, with the increase of the voice of the largest shareholder, the autonomy of the executive team to make and implement innovation decisions is weakened, resulting in the decline of executives' subjective recognition of their decision-making status. At this time, due to the lack of consensus on the decision-making power of executives, the allocation of enterprise resources will be affected, which may lead to a blind state of innovation activities. In view of this, this paper proposes the following hypothesis:

H2: The degree of ownership concentration will weaken the promotion effect of internal alliance of senior executives on enterprise innovation performance

Because innovation can improve the competitiveness of enterprises, but R&D investment is uncertain, and it takes a

long time to obtain benefits, so when faced with complex issues of opportunities and challenges, there are often different opinions between the chairman and the general manager. When the two roles are integrated, the conflict caused by these differences can be reduced. In the two-in-one enterprise, the decision resistance of the CEO is reduced, and the support of the appointed senior executives and directors is obtained, which greatly reduces the opposition to the innovation decision, speeds up the efficiency of the adoption and implementation of the innovation decision, and thus improves the level of innovation performance. Therefore, hypothesis 3 is proposed as follows:

H3: The integration of the two positions will enhance the promotion role of the internal alliance of senior executives on the innovation performance of enterprises

3. Data and Variables

3.1. Innovation Performance of Enterprises

This paper refers to the studies of Xinsheng Cheng [18] and Xuesong Li [19]. Considering that the patent authorization time is relatively long, it may be more reasonable to measure the number of patent applications to reflect the progress of the enterprise's innovation activities in the current period, and the invention patents can more effectively reflect the substantive innovation achievements of the enterprise. Therefore, the natural logarithm (PA) of the number of invention patent applications plus one is used as an indicator to measure the innovation performance of an enterprise. The higher the PA value, the higher the innovation performance of the enterprise, that is, the higher the innovation level.

3.2. Executive Internal Alliances

Referring to the research methods of Xu [11] et al, this paper uses the proportion of the total number of hired executives and nominated directors during the tenure of CEO as an indicator to measure the degree of alliance within executives. Due to the late introduction of CEO into China, many companies with a long operating time have not set up this position. Therefore, in this paper, for companies without a CEO position, the position of "CEO" is given priority, followed by the position of "general manager". The value range of explanatory variable is [0, 1]. The larger the value, the greater the proportion of appointing senior executives and nominating directors during the tenure of CEO, and the higher the degree of alliance within the executives.

3.3. Regulating Variable

Ownership concentration: This paper uses the proportion of the number of shares held by the largest shareholder to the total share capital (Top1) as the measurement index of ownership concentration; Dual roles of CEO: Dual roles of CEO refer to the situation in which the CEO concurrently serves as the chairman of the board of directors of an enterprise. In this paper, the dual roles are incorporated into the model as a moderating variable for regression. When the chairman concurrently serves as the CEO of an enterprise, the variable is 1, otherwise it is 0.

3.4. Control Variable

With reference to the research of Xuchao Wang [20] and Yaojia Tang [21], ten control variables are selected in this paper: firm Size (Size): the natural logarithm of the firm's total assets; Asset-liability ratio (Lev): total liabilities/total

assets; Net profit rate on total assets (ROA): net profit/total assets; Operating Cashflow: measured by the ratio of net cash flows generated from operating activities to total assets at the end of the period; Total assets turnover (ATO): sales revenue/average total assets; Board size: the number of directors at the end of the period; Ratio of independent directors (Indep): the ratio of the number of independent directors to the number of directors at the end of the period multiplied by 100%; The proportion of top ten shareholders (Top10): the proportion of the number of top ten shareholders in the total number of shares; Company listing time (ListAge): the logarithm of the current year minus the year of the company listing plus 1; Management shareholding ratio (Mshare): the proportion of the total number of management shareholding in the total number of shares multiplied by 100%.

3.5. Sample and Descriptive Statistics

The main research content of this paper is the impact of intra-executive alliance on enterprise innovation performance. Due to the outbreak of financial crisis in 2008, considering the availability and completeness of data, this paper selects China's Shanghai-Shenzhen A-share listed companies from 2011 to 2022 as samples, and treats the samples as follows according to research needs: (1) Remove companies with ST and *ST; (2) Exclude sample companies in the financial industry classified according to the 2012 version of the CSRC Industry classification standard; (3) Remove the samples with missing values of relevant variables; (4) Eliminate samples with abnormal conditions such as insolvency; (5) In order to mitigate the impact of outliers on regression results, all continuous variables were curtailed at 1% and 99% levels. Finally, 21937 valid observations were obtained. The innovation performance data used in this paper came from the China Research Data Service Platform (CNRDS), and the internal alliance of senior executives measured the proportion of the number of people who hired senior executives and nominated directors during the tenure of CEO. The data used were from the (CSMAR) database and were manually calculated and collated. All other data are from Guotai 'an database.

This paper first makes descriptive statistics on the collected and sorted sample data to understand the basic situation of the variables used in the research, such as explained variables, explanatory variables and control variables. Table 1 shows descriptive statistics for the main variables.

According to the statistical results, the maximum value of PA is 5.624, indicating that the enterprises with the highest innovation performance applied for 276 invention patents in this year, while the minimum value is only 0 and the standard deviation is 1.379, further indicating the disparity in innovation performance among different enterprises. At the same time, the mean value of innovation performance is 1.126. The innovation level of the enterprises in the selected sample is generally low, and the number of invention patents applied by most enterprises is 0-1, and only a small part of enterprises with high innovation performance are applied for. The average value of FTEA is 0.489, indicating that 48.9% of listed companies have ceos hiring executives and nominating directors, which means that nearly half of listed companies have such employt-based alliance relationship, indicating that it is of practical significance to study it. The average value of Top1 is 33%, indicating that the shareholding ratio of the largest shareholder of the sample enterprises is generally high

and the equity is relatively concentrated. The Dual average is 0.249, indicating that 24.9% of listed companies have both chairman and CEO. After analysis, the statistical results of the selected variables belong to the normal range.

Table 1. Summary statistics

Variable	sample	mean	sd	min	max
PA	21937	1.126	1.379	0.000	5.624
FTEA	21937	0.489	0.271	0.000	1.000
Top1	21937	0.330	0.146	0.081	0.732
Dual	21937	0.249	0.432	0.000	1.000
Size	21937	22.475	1.267	20.104	26.408
Lev	21937	0.448	0.198	0.069	0.887
ROA	21937	0.035	0.063	-0.227	0.216
Cashflow	21937	0.049	0.066	-0.137	0.242
ATO	21937	0.654	0.448	0.085	2.678
Board	21937	8.598	1.704	5.000	15.000
Indep	21937	37.535	5.354	33.330	57.140
Top10	21937	0.550	0.147	0.225	0.889
ListAge	21937	2.482	0.535	1.386	3.367
Mshare	21937	9.598	15.710	0.000	60.819

4. Empirical Analysis

4.1. Empirical Results

Table 2. Impact of internal alliances on Innovation Performance

	(1)	(2)
	PA	PA
FTEA	0.114*** (0.031)	0.080*** (0.030)
Size		0.293*** (0.010)
Lev		-0.059 (0.053)
ROA		1.340*** (0.152)
Cashflow		0.479*** (0.134)
ATO		0.112*** (0.020)
Board		0.043*** (0.007)
Indep		0.006*** (0.002)
Top10		-0.483*** (0.062)
ListAge		-0.287*** (0.019)
Mshare		0.004*** (0.001)
_cons	1.071*** (0.017)	-5.271*** (0.228)
Control	No	Yes
Industry	Yes	Yes
Year	Yes	Yes
r2	0.178	0.250
N	21937	21937

Note: *** indicates a significance level of 1%, ** indicates a significance level of 5%, * indicates a significance level of 10%, the

same below

In order to test hypothesis 1, this paper conducts regression analysis on sample data, and the regression results are shown in Table 2. Among them, (1) is the regression result of examining the relationship between the internal alliance of senior executives and innovation performance based on the control industry and year without considering the control variables, and (2) is the regression after adding the control variables. According to the regression results, there is a significant positive correlation between intra-executive alliance and enterprise innovation performance at the level of 1%, and the regression coefficient decreases after the addition of control variables, while the fit degree increases, indicating that with the enhancement of intra-executive alliance, the innovation performance of enterprises will also be relatively improved, which verifies hypothesis 1.

4.2. Adjustment Effect Test

Table 3. Regression result

	(1)	(2)
	PA	PA
FTEA	0.078*** (0.030)	0.105*** (0.030)
Top1	0.350*** (0.078)	
FTEA×Top1	-0.697***	
Table 3. (continued)		
	(1)	(2)
	PA	PA
	(0.215)	
Dual		-0.095*** (0.020)
FTEA×Dual		0.314*** (0.071)
Size	0.293*** (0.010)	0.291*** (0.010)
ROA	1.321*** (0.152)	1.339*** (0.152)
Lev	-0.063 (0.053)	-0.056 (0.053)
Cashflow	0.486*** (0.134)	0.474*** (0.134)
ATO	0.107*** (0.020)	0.110*** (0.020)
Board	0.044*** (0.007)	0.041*** (0.007)
Indep	0.006*** (0.002)	0.007*** (0.002)
Top10	-0.717*** (0.079)	-0.485*** (0.062)
ListAge	-0.292*** (0.019)	-0.296*** (0.019)
Mshare	0.004*** (0.001)	0.004*** (0.001)
_cons	-5.254*** (0.227)	-5.210*** (0.228)
Industry	Yes	Yes
Year	Yes	Yes
r2	0.251	0.251
N	21937	21937

Table 3 shows the regression results after incorporating the adjustment variables into the model. Columns (1) and (2) are the regression results that take ownership concentration and integration of two jobs as the adjustment variables, respectively. The coefficients of intra-executive alliance in the model are both positive and significant at 1% level, further verifying hypothesis 1 in this paper. From the data in column 2, the regression coefficient of the product interaction term (FTEA×Top1) of intra-executive alliance and ownership concentration is -0.697, which is significant at the 1% level, indicating that the strengthening of ownership concentration will significantly inhibit the positive impact of intra-executive alliance on the innovation performance of enterprises, which verifies hypothesis 2. As can be seen from the regression results in column 3, the coefficient of FTEA×Dual (=0.314, $p<0.01$) between CEO dual job integration and intra-executive alliance passed the 1% significance level test and was positive, indicating that the dual job integration has a significant promoting effect on the impact of intra-executive alliance on enterprise innovation performance, which verifies hypothesis 3.

4.3. Robustness Test

In order to ensure the robustness of the research results, the robustness of the sample data and the model was tested by replacing the explained variables, and the endogeneity test was conducted by propensity matching score (PSM).

4.3.1. Replace the Explained Variable

In this paper, the natural logarithm of the total number of patent applications plus one is selected as the measurement index of innovation performance of listed companies, and the regression results obtained after it is substituted by the regression model of primary effect and regulatory effect are shown in Table 4. In the second column of the regression results of the main effect model, after replacing the innovation performance measurement indicators, the coefficient between the intra-executive alliance and innovation performance is significantly positive at the level of 5%, indicating that the intra-executive alliance has a significant positive impact on innovation performance, which verifies hypothesis 1. The third and fourth columns show the regression results of the two moderating effects respectively. Among them, the interaction coefficient between intra-executive alliance and ownership concentration is -0.862, which passes the significance level test of 1%, indicating that ownership concentration has a significant negative impact on the promotion effect of intra-executive alliance on innovation performance. The coefficient of the interaction term between the alliance within senior executives and the combination of the two roles is significantly positive at the level of 1%, indicating that the combination of the two roles has a significant positive impact on the promotion of the innovation performance of the enterprise. This result is consistent with the above regression results, which proves that the results of this study are robust.

Table 4. Regression result

	(1)	(2)	(3)
	PA1	PA1	PA1
FTEA	0.072**	0.070**	0.108***
	(0.036)	(0.036)	(0.036)
Size	0.297***	0.298***	0.295***
	(0.012)	(0.012)	(0.012)
ROA	1.511***	1.487***	1.511***
	(0.183)	(0.183)	(0.183)
Lev	-0.050	-0.056	-0.045
	(0.064)	(0.064)	(0.064)
Cashflow	0.790***	0.798***	0.782***
	(0.161)	(0.161)	(0.161)
ATO	0.146***	0.139***	0.142***
	(0.024)	(0.024)	(0.024)
Board	0.055***	0.057***	0.053***
	(0.008)	(0.008)	(0.008)
Indep	0.006***	0.006**	0.006***
	(0.002)	(0.002)	(0.002)
Top10	-0.320***	-0.644***	-0.323***
	(0.074)	(0.094)	(0.074)
ListAge	-0.446***	-0.454***	-0.459***
	(0.024)	(0.024)	(0.024)
Mshare	0.006***	0.007***	0.006***
	(0.001)	(0.001)	(0.001)
Top1		0.484***	
		(0.093)	
FTEA×Top1		-0.862***	
		(0.257)	
Dual			-0.135***
			(0.024)
FTEA×Dual			0.450***
			(0.085)
_cons	-4.731***	-4.709***	-4.645***
	(0.258)	(0.258)	(0.259)
Industry	Yes	Yes	Yes
Year	Yes	Yes	Yes
r2	0.294	0.295	0.295
N	21937	21937	21937

4.3.2. Endogeneity Test

In order to alleviate the endogeneity problems caused by sample selection, propensity matching score (PSM) was used for testing. The results are shown in Table 5. After propensity matching, the correlation coefficient between intra-executive alliance and enterprise innovation performance is 0.222, which is significant at 1% level, indicating that intra-executive alliance still has a significant promoting effect on enterprise innovation performance.

Table 5. Regression result

	(1)	(2)
	PA	PA
FTEA	0.235*** (0.084)	0.222*** (0.080)
Size		0.249*** (0.032)
ROA		1.795*** (0.434)
Lev		-0.051 (0.155)
Cashflow		0.431 (0.377)
ATO		0.104 (0.066)
Board		0.044* (0.023)
Indep		0.008 (0.006)
Top10		-0.584*** (0.181)
ListAge		-0.308*** (0.058)
Table 5. (continued)		
	(1)	(2)
	PA	PA
Mshare		0.002 (0.002)
_cons	1.031*** (0.031)	-4.255*** (0.740)
Industry	Yes	Yes
Year	Yes	Yes
r2	0.177	0.236
N	2467	2467

5. Conclusions

Innovation plays an important role in promoting the high-quality development of China's economy and is the driving force for the long-term sustainable development of enterprises. It is the top priority to increase investment in R&D and innovation to promote the high-quality development of manufacturing enterprises. This paper takes the relevant data of Shanghai and Shenzhen A-share listed companies in China from 2011 to 2022 as research samples, and explores the relationship between the intra-executive alliance formed based on employment relationship and the enterprise innovation performance through empirical testing. The research finds that the intra-executive alliance has a significant promoting effect on the enterprise innovation performance. After introducing moderating variables, it is found that higher ownership concentration will weaken the positive impact of intra-executive alliance on innovation performance, while the combination of two positions has a positive impact on the promotion of intra-executive alliance on enterprise innovation performance.

According to the research conclusion of this paper and combined with the reality of our country, the following suggestions are put forward: First, in the process of hiring executives, enterprises should appropriately relax the restrictions on CEOs and give CEOs appropriate freedom and power to set up senior management teams within a certain range, so as to enhance the sense of belonging of CEOs to the enterprise and improve the cohesion and stability of the senior management team. At the same time, proper supervision and vigilance should be maintained on the behavior of the senior

management team. Second, a high degree of ownership concentration should be avoided, the proportion of shares held by major shareholders should be diluted relatively, the shares of other legal persons and even individuals in the company should be increased, the share concentration should be reduced appropriately, and the share incentive plan should be formulated so that the company's executives and employees can also hold some shares, so as to bind the interests of executives and the company more closely. It helps the senior management team to strive for the future development of the company. In order to make more innovation investment, improve their competitiveness, stand out in the cruel market competition environment, seize the opportunity to promote the sustainable development of enterprises.

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