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A Study on the Impact of Restricted Stock Incentives for Core Employees on Corporate Innovation Performance: Analysis of the Mediating Effect of Research & Development Investment

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ABSTRACT

Innovation drives economic progress, with enterprises serving as the primary agents of innovation and talent as the foundation of enterprise innovation. Core personnel are directly engaged in enterprise research and development (R&D) activities and the implementation of R&D programs. Restricted stock incentives, as an internal incentive mechanism, can significantly enhance innovation among core employees. Using firm-year panel data, this study employs a fixed-effects model, supplemented by robustness checks and bootstrap mediation tests. It examines A-share listed companies in China from 2014 to 2024 to investigate the influence of restricted stock incentives for core employees on enterprise innovation performance and the potential mechanisms involved. The results indicate that restricted stock incentives (RSIs) for core employees are positively associated with substantive, strategic, and overall innovation performance. RSIs also promote R&D investment, which partially mediates their association with innovation performance. The positive effects are more pronounced among firms in eastern regions and state-owned enterprises. This study contributes to the literature on equity incentives and innovation by identifying R&D investment as an important transmission mechanism and demonstrating that the effectiveness of RSIs varies across organizational and regional contexts. The findings provide practical implications for managers and policymakers seeking to design equity-based incentive systems that support long-term innovation and sustainable corporate development.

1. Introduction

Long-term competitiveness, increased productivity, and economic growth are fundamentally driven by innovation [1, 2]. Corporate innovation is essential to China's economic transition, where innovation-led development has emerged as a strategic objective. Businesses often struggle to align employee incentive programs with long-term value creation and sustain innovation-oriented

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behavior because innovation activities are characterized by high uncertainty, lengthy development cycles, substantial resource commitments, and information asymmetry [3, 4]. To address these issues, restricted stock incentives (RSIs) have become an important governance tool. RSIs can reduce agency conflicts, discourage short-termism, and encourage engagement in high-risk, high-return innovative activities by linking employee wealth to future business performance [5, 6]. Nevertheless, most existing research has focused on executive stock incentive programs, with limited attention given to key technical and business personnel who actively participate in research and development (R&D) and innovation activities and play an important role in converting innovation inputs into innovation outputs [7].

Three gaps in the literature motivate this investigation. First, previous research frequently treats equity incentives as a homogeneous group, providing limited evidence on the specific benefits of restricted stock incentives relative to other incentive instruments [8, 9]. Second, despite the important role that core personnel plays in knowledge development, technological problem-solving, and innovation implementation, the innovation effects of RSIs specifically allocated to these employees remain poorly understood. Third, although equity incentives have been linked to innovation outcomes, the specific mechanisms underlying this relationship remain unclear. In particular, little is known about how these incentives influence R&D capital and personnel investment [10]. Furthermore, although substantive and strategic innovation have different technological and economic implications, prior research has often relied on aggregate patent measures and seldom distinguished between these forms of innovation [11].

Thus, this study addresses the following research questions: (1) Do RSIs for core employees improve firms' substantive innovation, strategic innovation, and overall innovation performance? (2) Do RSIs affect firms' investments in R&D personnel and capital? (3) Do investments in R&D personnel and capital mediate the relationship between RSIs and innovation performance? and (4) Do these relationships differ across ownership types and regional contexts? This study uses firm and year fixed-effects models, mediation analysis, and multiple robustness tests to examine these questions using panel data from Chinese A-share listed firms between 2014 and 2024 [12]. By examining both direct and indirect relationships, the study provides a more comprehensive understanding of how incentive design affects resource allocation and innovation outcomes.

A company's ability to compete and achieve sustainable growth depends substantially on innovation. Understanding the effectiveness of restricted stock incentives in promoting innovation remains an important but unresolved issue, particularly in emerging economies, where such incentives have become increasingly prevalent in corporate governance. To address this gap, this study investigates the relationship between restricted stock incentives and corporate innovation. From a practical perspective, the study provides managers, investors, and policymakers with evidence on how equity-based incentives can promote innovation. Methodologically, it uses firm-level panel data to examine both the direct effect of restricted stock incentives on innovation and the mechanisms underlying this relationship. This study makes three contributions. First, it extends the literature on equity incentives by examining restricted stock incentives as a distinct incentive mechanism rather than treating equity incentives as homogeneous. Second, it shifts attention from executives to core employees, thereby demonstrating how innovation-relevant human capital influences corporate innovation outcomes. Third, it links incentive design to firms' internal resource allocation processes by identifying R&D capital investment and R&D personnel investment as important mechanisms linking RSIs to innovation performance [13]. The results also advance understanding of how organizational and institutional contexts affect the effectiveness of equity-based incentive programs.

The remainder of the paper is structured as follows. Section 2 reviews the literature and develops the hypotheses. Section 3 presents the data, variables, and methodology. Section 4 reports the empirical findings. Section 5 discusses the findings. Section 6 concludes the study.

2. Literature Review and Hypothesis Development

2.1 Literature Review

Recent studies have increasingly emphasized the significance of executive incentives, governance structures, and strategic decision-making in shaping long-term business performance. Developments in financial analytics and investment evaluation have improved understanding of how businesses and investors allocate resources under conditions of uncertainty [14, 15]. Organizations operating in highly competitive and digitally transformed environments are under increasing pressure to establish governance frameworks that improve resilience, adaptability, and sustained value creation [16]. These developments have increased scholarly interest in how managerial choices affect the long-term strategic outcomes of organizations.

The corporate governance literature has identified executive compensation as an important mechanism for aligning managerial decisions with shareholder interests. According to [17], equity-based compensation influences managerial risk-taking behavior, particularly in situations characterized by agency conflicts and weak institutional constraints. Similarly, [18, 19] proposed that well-designed executive remuneration incentives can encourage investments that create long-term organizational value while reducing managers' short-term focus. Collectively, these findings indicate the importance of incentive structures in shaping managerial decisions concerning strategic investments and forward-looking business activities.

Innovation is one of the most significant long-term strategic investments that businesses can undertake. However, the substantial uncertainty, lengthy payback periods, and increased risk associated with innovation activities may deter managers whose incentives are primarily tied to short-term performance goals. From this perspective, restricted stock incentives may strengthen the alignment between managerial and shareholder interests by linking managerial wealth to future firm value, thereby encouraging greater commitment to innovation-related investments. While earlier research has examined executive incentives in relation to risk-taking, environmental, social, and governance (ESG) performance, valuation, and strategic decision-making [20], little is known about whether and how restricted stock incentives actually foster corporate innovation. Therefore, by examining the relationship between restricted stock incentives and corporate innovation, this study contributes to the growing literature on governance and incentive design and advances understanding of how compensation structures affect firms' long-term value-creation strategies.

2.2 Theoretical Analysis and Hypotheses

2.2.1 Restricted Stock Incentives for Core Employees and Corporate Innovation Performance

Corporate innovation is characterized by high uncertainty, long development cycles, and substantial investments in financial and human capital. As innovation activities rely heavily on core employees who create and apply knowledge, effective incentive mechanisms are important for sustaining innovation performance [21]. Prior studies generally suggest that equity-based incentives promote innovation by aligning employee interests with long-term organizational objectives [22, 23]. However, existing evidence remains inconclusive regarding the magnitude of these effects and the mechanisms through which they operate. The theoretical framework is presented in Figure 1.

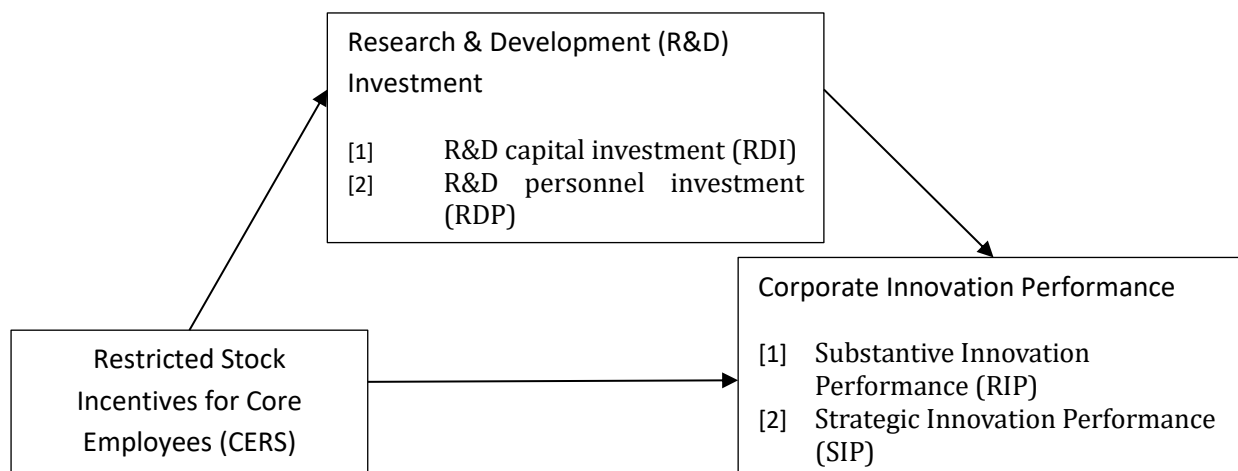


Fig. 1. Theoretical Framework

Agency theory suggests that innovation activities are particularly vulnerable to incentive misalignment because employees bear the costs and risks of innovation, while shareholders capture much of the resulting benefits [24]. RSIs can mitigate this problem by linking employee wealth to future firm value and encouraging long-term commitment to innovation activities [8, 25]. Human capital theory further suggests that innovation depends on the accumulation of firm-specific knowledge and technical expertise, which requires sustained investment and long-term incentives [26].

Innovation outcomes are heterogeneous and are commonly classified into substantive innovation (invention patents) and strategic innovation (utility model and design patents) [27, 28]. Liet *al.*, [29] show that restricted stock incentives for core employees can foster innovation through investment in firm-specific knowledge. Extending this evidence, the present study examines whether the effects of RSIs differ between substantive and strategic innovation. Substantive innovation reflects uncertain, exploratory, and long-horizon technological development, whereas strategic innovation reflects incremental improvements and shorter innovation cycles. Accordingly, RSIs may operate through different mechanisms: by reducing risk aversion and encouraging long-term exploratory R&D for substantive innovation, and by strengthening commitment, knowledge sharing, and sustained effort for strategic innovation. This distinction extends prior research beyond the general RSI-innovation relationship by explaining how incentive alignment translates into different innovation outcomes. The study therefore examines substantive, strategic, and total innovation separately. Building on agency theory and human capital theory, this study argues that restricted stock incentives positively influence both substantive and strategic innovation, although through different behavioral mechanisms. For substantive innovation, RSIs primarily reduce employees' risk aversion and encourage long-term exploratory R&D. For strategic innovation, RSIs enhance organizational commitment, facilitate knowledge sharing, and sustain participation in incremental innovation activities. These differences justify treating the two innovation outcomes separately rather than assuming a homogeneous innovation response. Nevertheless, limited evidence exists regarding the innovation effects of RSIs allocated specifically to core employees and the mechanisms underlying these effects.

Although both substantive and strategic innovation are important to firms' innovation potential, they differ substantially in technological complexity, risk profile, resource requirements, and expected return period. Therefore, RSIs are not expected to affect both types of innovation through the same behavioral mechanisms.

Substantive innovation, as measured by invention patents, is characterized by original technological advances, greater scientific uncertainty, longer development cycles, and large irreversible R&D investments. Employees who participate in substantive innovation face a higher probability of project failure, while the benefits of such efforts are often delayed. From an agency-theoretic perspective, these features create substantial intertemporal incentive problems because employees bear current effort costs, while rewards from innovation accrue only in the future. Restricted stock incentives help mitigate this problem by tying employees' personal wealth to the future value of the firm, thereby making them more likely to pursue risky exploratory research with long-term payoffs.

Strategic innovation, in contrast, is usually embodied in utility model and design patents and involves incremental improvement, process optimization, product refinement, and market responsiveness. Compared with substantive innovation, strategic innovation involves shorter development horizons, less technological uncertainty, and more continuous communication across operational teams. In this context, RSIs mainly promote employees' organizational commitment, information exchange, and continued participation in incremental improvement efforts rather than stimulating high-risk exploratory research. Thus, the motivational mechanism operates through greater persistence of effort and continuous organizational learning rather than risk-taking behavior.

Thus, although restricted stock incentives are expected to have a positive effect on both types of innovation, the underlying mechanisms differ. RSIs are expected to promote substantive innovation primarily by reducing employees' risk aversion and strengthening their long-term innovation orientation, whereas their effect on strategic innovation is expected to operate mainly through greater organizational commitment, collaboration, and continuous process improvement. Distinguishing these mechanisms provides a stronger theoretical basis for examining substantive and strategic innovation outcomes separately.

Based on the preceding theoretical and literature analysis, this study proposes the following hypotheses.

Hypothesis 1a. Restricted stock incentives for core employees have a positive effect on firms' substantive innovation performance.

Hypothesis 1b. Restricted stock incentives for core employees have a positive effect on firms' strategic innovation performance.

Hypothesis 1c. Restricted stock incentives for core employees have a positive effect on firms' total innovation performance.

2.2.2 The Mediating Role of R&D Investment

In addition to employee incentives, firms' resource allocation decisions, particularly those related to R&D capital and personnel, affect innovation performance [30, 31]. Previous research generally indicates that R&D investment is a major determinant of innovation performance; however, the benefits of such investment depend on the extent to which personnel are motivated to participate in innovation activities and use resources effectively [32]. This suggests a close relationship between R&D investment and incentive mechanisms.

RSIs can affect R&D investment through several channels. First, by aligning employees' objectives with long-term firm value, RSIs can increase their willingness to engage in risky and resource-intensive innovation, thereby improving the expected returns on R&D investment [24]. Second, by improving collaboration between management and core staff, RSIs may reduce agency conflicts and increase managers' willingness to allocate resources to innovation projects with longer payback periods [33]. These mechanisms suggest that firms may be more inclined to increase investment in innovation-related resources when they provide stronger RSIs to core employees.

R&D investment comprises both financial and human resources [30]. R&D personnel investment represents the human capital devoted to knowledge production and technological advancement, whereas R&D capital investment represents the financial resources allocated to innovation activities. Existing research indicates that both dimensions play an important role in determining innovation performance because they facilitate the transformation of innovative ideas into concrete products [10, 34]. Therefore, by encouraging greater investment in R&D resources, RSIs may indirectly improve innovation performance.

Although previous research has linked equity incentives to innovation and R&D activities, RSIs granted to core employees may influence innovation performance through both R&D capital investment and R&D personnel investment. Accordingly, this study proposes the following hypotheses:

Hypothesis 2a. Restricted stock incentives for core employees increase firms' R&D capital investment.

Hypothesis 2b. Restricted stock incentives for core employees increase firms' R&D personnel investment.

Hypothesis 3a. R&D capital and personnel investments partially mediate the positive relationship between restricted stock incentives for core employees and substantive innovation performance.

Hypothesis 3b. R&D capital and personnel investments partially mediate the positive relationship between restricted stock incentives for core employees and strategic innovation performance.

Hypothesis 3c. R&D capital and personnel investments partially mediate the positive relationship between restricted stock incentives for core employees and total innovation performance.

2.3 Contextual Heterogeneity

Institutional and economic conditions influence the effectiveness of incentive mechanisms. Equity-based incentives are more likely to generate favorable innovation outcomes in regions with well-developed markets, strong innovation environments, and robust protection of property rights [4, 6]. Similarly, ownership structure is an important consideration. RSIs may generate stronger marginal responses in state-owned firms, where administrative constraints and relatively weak baseline incentives are often prevalent, by creating more market-oriented incentive alignment [13].

2.4 Research Gap

Although recent research suggests that equity-based incentives may promote organizational innovation, several important gaps remain. Most previous studies treat equity incentives as a homogeneous governance mechanism and pay limited attention to the distinctive characteristics and innovation effects of restricted stock incentives as a separate incentive instrument [6, 17, 20]. First, little is therefore known about whether RSIs produce different innovation outcomes from other forms of equity compensation [7, 13].

Second, most prior research has focused on top executives, while core technical and business personnel who directly engage in R&D activities and develop firm-specific knowledge important to innovation have generally received limited attention [7, 24]. This executive-centric perspective provides an incomplete account of the role of equity incentives in innovation performance.

Third, innovation has often been measured using aggregate patent counts, without distinguishing between substantive and strategic innovation despite their differences in technological complexity, uncertainty, and expected returns [24, 25]. Therefore, it remains unclear whether RSIs influence these two forms of innovation through different behavioral mechanisms [25, 27].

Fourth, while equity incentives have been associated with improved innovation performance, the role of resource allocation in this relationship remains insufficiently understood. In particular, limited

empirical evidence is available on the mediating roles of R&D capital investment and R&D personnel investment [10, 30, 34].

Finally, few studies have examined the extent to which the effectiveness of RSIs varies across institutional contexts and ownership structures, particularly in emerging economies such as China, where regional differences and state ownership may affect the effectiveness of equity-based incentives [4, 6, 13].

To address these gaps, this study develops an integrated framework to examine the effects of restricted stock incentives for core employees on substantive, strategic, and overall innovation performance, as well as the mediating roles of R&D capital and personnel investment and the heterogeneous effects of regional development and ownership structure. This study extends the equity incentive literature by focusing on core employees rather than executives, distinguishing between different forms of innovation, and examining the mechanisms through which RSIs affect organizational innovation.

3. Methodology

This study examines the impact of restricted stock awards for core employees on corporate innovation performance among firms listed on China's A-share market. The research design, conceptual definitions, variable construction, and empirical methods are systematically presented following established research on innovation and corporate governance [21]. Firm-level data were collected from publicly available equity incentive plans, annual reports, the China Stock Market & Accounting Research Database (CSMAR), the R&D investment information from the RESSET Financial Research Database (RESSET), and patent information from the China Research Data Services Platform (CNRDS). These datasets have been widely employed and validated in previous empirical research on equity incentives and corporate innovation [22, 23].

Financial enterprises, Special Treatment (ST) and *ST firms, and companies with incomplete disclosures are excluded from the sample, which consists of publicly traded firms that employed restricted stock incentives for core employees during the study period. Restricted stock incentives for core employees are measured as the proportion of the total number of restricted stock incentives granted to core technical personnel during the period relative to the total number of restricted stock incentives granted during the same period.

This measure is designed to capture the allocation structure of equity incentives rather than the absolute monetary value of compensation. Specifically, it reflects the extent to which firms prioritize core technical employees within their restricted stock incentive plans. Since innovation activities are largely generated and implemented by technical personnel, the proportion of restricted shares allocated to these employees provides a useful indicator of a firm's strategic emphasis on incentivizing innovation-related human capital. Therefore, the measure focuses on the relative distribution of restricted stock incentives across employee groups rather than the overall size of the incentive program.

Invention patents (substantive innovation), utility/design patents (strategic innovation), and total patent counts are three patent-based indicators commonly employed in the literature [24, 25] to assess innovation performance. Following established Chinese innovation research, invention patents are used as a proxy for substantive innovation, whereas utility and design patents are used as proxies for strategic innovation. This classification reflects differences in examination standards, technological complexity, and expected innovative content. However, the distinction should be interpreted with caution, as not all invention patents necessarily represent high-quality innovation, while some utility patents may embody substantial technological contributions. To address skewness, the patent variables are winsorized at the 1st percentile. Two mediators commonly used in

innovation research are considered: R&D personnel investment and R&D capital investment [10]. R&D personnel investment is measured as the proportion of R&D personnel to total employees, while R&D capital investment is measured as R&D expenditure divided by revenue.

The conventional three-step mediation procedure is retained only for descriptive purposes to characterize the potential mechanisms. Bootstrap mediation analysis is then performed to rigorously assess whether the indirect effects through R&D capital and R&D personnel investment are statistically significant, with bias-corrected confidence intervals reported for the indirect effects [26].

3.1 Data Sources

The study utilizes panel data from A-share listed companies in China spanning 2014 to 2024. A predetermined data-screening procedure was applied to ensure the validity and representativeness of the final sample.

First, financial enterprises were excluded because of their distinct innovation patterns, accounting regulations, and regulatory environment, which make them less comparable with non-financial enterprises.

Second, all ST and *ST companies were excluded. These companies generally exhibit abnormal financial conditions and atypical audit opinions and are legally restricted from implementing equity incentive plans under the Measures for Administering Equity Incentive Plans of Listed Companies. Given the operational constraints that prevent these firms from participating in restricted stock schemes, including them in the study would compromise sample comparability.

Third, observations with missing values for key variables, including R&D personnel investment, R&D capital investment, innovation performance, and major financial indicators, were removed to avoid measurement inconsistencies.

Fourth, to improve the robustness of the empirical findings and reduce the influence of extreme outliers, all continuous variables were winsorized at the 1% level.

Following these sample-selection procedures, 3,739 raw observations were selected from the database of equity incentive grant details based on criteria including the unique ID number of the equity incentive event, whether the underlying asset of the equity incentive was restricted stock, and whether the plan was actually implemented. After removing the companies with only one observation, as well as the observations with missing values for the dependent, control, and mediating variables, we ultimately obtained an unbalanced panel of 1,021 companies from 2014 to 2024, comprising 2,469 valid observations. Because information on restricted stock incentives is subject to selective disclosure and given the aforementioned screening criteria, the final sample was limited to 2,469 valid observations. The exclusions followed established regulatory and methodological criteria to ensure that the final sample was representative of A-share listed companies that were actively operating and capable of innovation during the study period. The 1,021 companies had implemented restricted stock incentive plans multiple times and therefore had two or more observations. Specifically, 708 companies had two observations, 232 had three, 58 had four, 15 had five, 6 had six, and 2 had seven observations. A total of 1,021 valid cross-sectional companies, comprising 2,469 observations, were included in the estimation, providing sufficient statistical power. Although the dataset is an unbalanced panel, every firm included in the regression has observations for at least two periods. Thus, fixed-effects estimations are unlikely to result in a significant reduction in the sample size due to the model itself, and the effect of the core explanatory variables can be identified from within-firm changes over time.

The China Stock Market & Accounting Research Database (CSMAR) provided firm characteristics, financial information, and control variables; the RESSET Financial Research Database (RESSET) provided information on R&D investment; and the China Research Data Services Platform (CNRDS)

provided patent information. The use of these established databases helps ensure the accuracy of the variables and the reliability of the empirical findings.

3.2 Variable Selection

(1) Dependent variable

The dependent variable is corporate innovation performance, measured by the enterprise's innovation output in terms of patents. Patent data provide a relatively objective and comprehensive measure of innovation, reflecting both innovation productivity and technological progress. The total number of registered patents for each firm, including invention, utility model, and design patents, serves as an indicator of overall innovation performance in this study [35, 36]. Corporate innovation performance is further categorized into two distinct types: substantive innovation, measured by the number of invention patents, and strategic innovation, measured by the number of utility model and design patents. The theoretical basis for this distinction is that substantive innovation generally involves more advanced and technologically intensive forms of technical progress, whereas strategic innovation emphasizes incremental developments aimed at increasing patent output or entering new markets.

(2) Independent variable

This study identifies core employees based on regulatory criteria and corporate disclosure standards. Specifically, core employees are those who (i) hold key technical or business positions directly related to R&D, product development, or technological activities; (ii) are explicitly identified as core technical or core business personnel in firms' equity incentive plan disclosures; and (iii) possess firm-specific human capital that is important for maintaining competitive advantage. This classification is consistent with prior research emphasizing the central role of knowledge-intensive employees in innovation activities.

RSIs are selected as the focal equity incentive mechanism because they provide employees with conditional ownership rights linked to future firm performance, thereby encouraging long-term commitment and value-creating behavior [6, 7]. The principal explanatory variable, Restricted Stock Incentives for Core Employees (CERS), is measured as the proportion of restricted shares granted to core employees relative to the total number of restricted shares granted in a given year [13, 29]. Unlike value-based measures that capture the absolute intensity of equity compensation, CERS reflects the relative allocation of incentives within the firm and indicates the extent to which innovation-related employees are prioritized in the incentive scheme.

This measure is particularly suitable for the present study because the objective is to examine the strategic allocation of equity incentives rather than the absolute size of compensation packages. By conditioning on total restricted stock grants, CERS captures the extent to which firms assign greater incentive weight to core employees relative to other eligible participants, such as senior executives or non-core staff. This relative-allocation perspective is particularly relevant in the Chinese institutional context, where equity incentive plans are subject to regulatory constraints and substantial cross-firm variation in grant size [3, 29]. Nevertheless, CERS reflects the allocation structure of incentives rather than their monetary intensity. Consequently, firms with similar CERS values may differ in the total amount of restricted stock granted, a limitation that should be considered when interpreting the results.

(3) Mediating variable

The mediating variable is R&D investment, which represents the financial and human resources that firms devote to innovation activities. Since innovation requires substantial investment in both human and technological capabilities, R&D investment is conceptualized as comprising two related dimensions [30]. The first dimension is R&D personnel investment, measured as the proportion of

total employees engaged in R&D. This measure reflects the firm's capacity to develop and maintain the human capital required for innovation. The second dimension, R&D capital investment, is measured as the ratio of R&D expenditure to operating revenue. Considering these two dimensions together makes it possible to examine how restricted stock incentives affect firms' commitment of resources to innovation and, consequently, their innovation performance. From both theoretical and empirical perspectives, core employees may influence the formulation and implementation of R&D strategies because they directly affect innovation performance through decision-making processes and resource allocation.

(4) Control Variables

The analysis uses several control variables that have been consistently identified in the literature to isolate the effects of R&D investment and RSIs on corporate innovation performance. The model accounts for firm size, asset-liability ratio, operating income growth rate, equity concentration, return on assets, board size, proportion of independent directors, and leadership duality, consistent with prior research [31]. These factors capture differences in firms' capabilities, corporate governance, resource availability, and decision-making processes that may confound the estimated relationships. All variables and their corresponding measurement methods are presented in Table 1.

Table 1
Main Variables and Definitions

Variable type	Name	Abbreviation	Description
Dependent variable	Substantive innovation performance	RIP	LN (1 + number of invention patents filed in the year)
	Strategic Innovation Performance	SIP	LN (1 + number of total non-invention patents filed in the year)
	Total innovation performance	TIP	LN (1 + number of patents filed in the year)
Independent variable	Restricted Stock Incentives for Core Employees	CERS	Total number of restricted stock incentives granted to core technical professionals in the current period / total number of restricted stock incentives granted in the current period
	Enterprise size	SIZE	LN (total assets)
	Asset-liability ratio	LEV	Ratio of total liabilities to total assets
	Operating income growth rate	GROWTH	(Current-year operating income – previous-year operating income) / (previous-year operating income)
Control variables	Equity concentration	OWNER	Proportion of shares owned by the largest shareholder relative to the total shares
	Return on assets	ROA	Proportion of net profit to total assets
	Board size	DIR	LN (Number of directors on the board)
	Proportion of independent directors	INDIR	Ratio of independent directors to total board members
	Duality of positions	DUALE	Equals 1 if the chairman and general manager are the same person; otherwise, equals 0.
Mediating variable	R&D personnel investment	RDP	Proportion of personnel engaged in R&D activities relative to the total workforce
	R&D capital investment	RDI	Ratio of R&D expenditure to operating revenue

3.3 Model Specification

Given the panel structure of the data, F-tests and Hausman tests were first conducted to determine the appropriate model specification. Table 2 reports the corresponding test results. The results strongly reject both the pooled ordinary least squares (OLS) and random-effects models, supporting the use of a fixed-effects model.

Table 2
Results of the Hausman and F Tests

Dependent variable	F test		Hausman test	
	F	P	Chi ²	P
RIP	9.399	Prob>F=0.0000	47.521	Prob>Chi ² =0.0000
SIP	3.371	Prob>F=0.0000	37.776	Prob>Chi ² =0.0000
TIP	6.508	Prob>F=0.0000	51.104	Prob>Chi ² =0.0000

(1) Benchmark Model

The baseline specification is:

$$EIP_{i,t} = \beta_0 + \beta_1 CERS_{i,t} + \beta_2 Controls_{i,t} + \delta_{id} + \lambda_{year} + \varepsilon_{i,t} \quad (1)$$

In this model, $EIP_{i,t}$ denotes innovation performance, alternatively measured as substantive innovation performance ($RIP_{i,t}$), strategic innovation performance ($SIP_{i,t}$), or total innovation performance ($TIP_{i,t}$). $CERS_{i,t}$ represents the intensity of restricted stock incentives for core employees. The control variables include firm size, leverage, growth, ownership concentration, profitability, and governance characteristics. δ_{id} and λ_{year} denote individual and year fixed effects, respectively. Although the model includes firm and year fixed effects to account for time-invariant heterogeneity and common macroeconomic shocks, the limited within-firm variation in the core explanatory variable (CERS) means that the estimates should be interpreted primarily as conditional associations rather than definitive causal effects. Therefore, holding the observed variables constant, the regression coefficients indicate whether restricted stock incentives for core employees are associated with variations in innovation performance within firms over time. A positive and significant β_1 indicates a statistically significant positive association between core-employee equity incentives and innovation performance.

(2) Mediation Framework

To examine whether R&D investment mediates this association, the following mediation models are estimated:

$$RD_{i,t} = \beta_0 + \beta_1 CERS_{i,t} + \beta_2 Controls_{i,t} + \delta_{id} + \lambda_{year} + \varepsilon_{i,t} \quad (2)$$

$$EIP_{i,t} = \beta_0 + \beta_1 RD_{i,t} + \beta_2 Controls_{i,t} + \delta_{id} + \lambda_{year} + \varepsilon_{i,t} \quad (3)$$

$$EIP_{i,t} = \beta_0 + \beta_1 CERS_{i,t} + \beta_2 RD_{i,t} + \beta_3 Controls_{i,t} + \delta_{id} + \lambda_{year} + \varepsilon_{i,t} \quad (4)$$

In this specification, $RD_{i,t}$ denotes R&D investment, measured as either R&D capital intensity or R&D personnel intensity. The stepwise regressions (three-step method) provide only descriptive evidence regarding the mediation mechanism. Formal inference on mediation is based on bootstrap estimation of the indirect effects, with bias-corrected confidence intervals reported.

4. Results

4.1 Descriptive Statistics

Table 3 presents the descriptive statistics for the variables used in this study. The sample consists of A-share listed companies in China and contains 2,469 observations. The substantial dispersion in

firm size indicates considerable heterogeneity across enterprises. The maximum and minimum values of CERS are 1 and 0.252, respectively, indicating substantial variation in RSI schemes across firms. Observations with zero patent counts are excluded from the measures of substantive and strategic innovation. The dispersion of substantive and strategic innovation is broadly similar, although the higher mean for strategic innovation suggests that firms generally exhibit stronger strategic than substantive innovation performance.

Table 3

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
CERS	2469	.831	.166	.252	1
RDI	2469	.078	.071	.002	.389
RDP	2469	.205	.159	.008	.771
RIP	2469	2.966	1.33	.693	7.09
SIP	2469	3.079	1.329	.693	6.872
TIP	2469	3.829	1.234	1.386	7.62
SIZE	2469	22.155	1.176	20.182	26.104
LEV	2469	.379	.176	.063	.779
GROWTH	2469	.253	.333	-.404	1.796
OWNER	2469	.313	.136	.08	.681
ROA	2469	.057	.055	-.136	.229
DIR	2469	2.207	.27	1.386	2.773
INDIR	2469	.388	.098	0	.625
DUALE	2469	.427	.495	0	1

4.2 Correlation Analysis

The correlations among the variables are also examined, with Table 4 reporting the corresponding Pearson correlation coefficients.

Table 4

Pairwise Correlations

Variables	CERS	SIZE	LEV	GROWTH	OWNER	ROA	DIR
CERS	1.000						
SIZE	0.198***	1.000					
LEV	0.011	0.502***	1.000				
GROWTH	0.017	0.021	0.078***	1.000			
OWNER	0.032	0.037*	0.011	-0.021	1.000		
ROA	0.079***	-0.015	-0.345***	0.249***	0.130***	1.000	
DIR	-0.029	0.192***	0.120***	-0.006	-0.093***	-0.078***	1.000
INDIR	0.008	0.009	0.037*	-0.015	-0.005	-0.054***	0.263***
DUALE	0.054***	-0.096***	-0.079***	-0.015	-0.020	0.005	-0.004
RDI	0.130***	-0.182***	-0.343***	-0.056***	-0.171***	-0.131***	-0.033*
RDP	0.145***	-0.123***	-0.288***	0.043**	-0.196***	0.007	-0.054***
RIP	0.206***	0.544***	0.231***	0.031*	-0.014	0.017	0.110***
SIP	0.122***	0.478***	0.331***	0.024	0.085***	0.050***	0.106***
TIP	0.184***	0.560***	0.303***	0.027	0.034*	0.035*	0.118***

Table 4

Continued

Variables	INDIR	DUALE	RDI	RDP	RIP	SIP	TIP
INDIR	1.000						
DUALE	-0.029	1.000					
RDI	0.011	0.127***	1.000				
RDP	-0.017	0.114***	0.671***	1.000			
RIP	-0.023	-0.024	0.200***	0.213***	1.000		
SIP	0.003	-0.048**	-0.143***	-0.117***	0.608***	1.000	
TIP	-0.010	-0.037*	0.056***	0.076***	0.888***	0.877***	1.000

*** p < 0.01, ** p < 0.05, * p < 0.10

4.3 Multicollinearity Test

In linear regression models, multicollinearity among explanatory variables can increase the variance of coefficient estimates and reduce estimation precision. Therefore, to assess whether the selected explanatory and control variables are suitable for the empirical analysis, the variance inflation factor (VIF) is used to test for multicollinearity, as reported in Table 5.

Table 5

Variance Inflation Factors

	VIF	1/VIF
LEV	1.893	.528
RDI	1.632	.613
SIZE	1.535	.651
RDP	1.534	.652
ROA	1.445	.692
GROWTH	1.132	.884
CERS	1.1	.909
OWNER	1.083	.923
DIR	1.07	.935
DUALE	1.03	.971
INDIR	1.008	.992
Mean VIF	1.315	.

Existing research generally considers VIF values below 5 to indicate that multicollinearity is unlikely to pose a serious concern. Table 5 reports the VIF test results for the core explanatory variable, mediating variables, and control variables. The VIF values range from 1.008 to 1.893, with a mean of 1.315. All values are well below the conventional threshold of 5, indicating no evidence of serious multicollinearity among the variables included in the analysis.

4.4 Benchmark Regression Analysis

The benchmark regression examines the relationship between core employees' RSIs and corporate innovation performance after controlling for relevant firm characteristics. The results are reported in Table 6.

Table 6 reports the relationship between RSIs for core employees and innovation performance. Columns (1) to (3) present the results for substantive innovation performance (RIP), strategic innovation performance (SIP), and total innovation performance (TIP), respectively. The estimated CERS coefficients for RIP, SIP, and TIP are 0.782, 0.286, and 0.574, respectively. The coefficients are positive and statistically significant at the 1% level for RIP and TIP and at the 5% level for SIP, indicating that a larger proportion of restricted stock incentives allocated to core employees is

associated with higher innovation performance across all three dimensions. The findings suggest that RSIs are positively associated with both substantive innovation, reflected in invention patent activity, and strategic innovation, reflected in utility model and design patent activity. From an economic perspective, firms that allocate a greater share of incentives to core technical employees tend to exhibit stronger innovation performance. This finding is consistent with the argument that equity-based incentives align employee interests with firms' long-term innovation objectives. Overall, the results support Hypotheses 1a, 1b, and 1c and are consistent with prior research suggesting that employee equity incentives may strengthen firms' innovation capacity and encourage innovation-oriented behavior.

Table 6
Benchmark Regression Results

	(1)	(2)	(3)
	RIP	SIP	TIP
CERS	0.782*** (5.707)	0.286** (1.988)	0.574*** (4.524)
SIZE	0.627*** (26.929)	0.426*** (17.460)	0.536*** (24.884)
LEV	-0.355** (-2.198)	1.298*** (7.666)	0.424*** (2.843)
GROWTH	0.072 (1.025)	-0.139* (-1.881)	-0.046 (-0.709)
OWNER	-0.504*** (-3.045)	0.393** (2.266)	-0.103 (-0.672)
ROA	0.044 (0.093)	3.032*** (6.203)	1.535*** (3.561)
DIR	0.162* (1.916)	0.101 (1.131)	0.141* (1.798)
INDIR	-0.196 (-0.867)	-0.174 (-0.732)	-0.143 (-0.681)
DUALE	0.065 (1.452)	-0.016 (-0.334)	0.030 (0.711)
_cons	-11.605*** (-23.849)	-7.503*** (-14.695)	-8.991*** (-19.966)
N	2469	2469	2469
R ²	0.322	0.252	0.325
F	129.471	91.830	131.262
ID	Yes	Yes	Yes
YEAR	Yes	Yes	Yes

*Notes: All regressions include firm fixed effects and year fixed effects. The figures in parentheses are t-values. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. This note also applies to the following tables.

4.5 Robustness Tests

This section applies three approaches to assess the robustness of the benchmark regression results: replacing the independent variable, replacing the dependent variable, and using a lagged dependent variable. First, the proportion of restricted shares allocated to core employees relative to total share capital (RS) is used as an alternative independent variable, and the regression is re-estimated accordingly. This ratio reflects the intensity of the restricted stock incentive program for core employees. The results are reported in Table 7. Second, the dependent variables are replaced with RIP1, SIP1, and TIP1, measured as the natural logarithm of the number of patents independently filed by the firm in the current year plus one, excluding patents jointly filed with other firms. The

results are presented in Table 8. Third, lagged innovation performance variables (L.RIP, L.SIP, and L.TIP) are used as the dependent variables. Table 9 reports these results. Since this study uses unbalanced panel data and the sample period spans 11 years, there are many instances of missing data when the dependent variable is lagged by one period, resulting in a sharp decline in the sample size. The findings in Tables 7, 8, and 9 are consistent with the benchmark regression, supporting the robustness of the main results.

Table 7

Robustness Test I

	(1)	(2)	(3)
	RIP	SIP	TIP
RS	5.021*** (2.636)	3.844* (1.934)	5.033*** (2.864)
_cons	-11.147*** (-21.806)	-7.179*** (-13.452)	-8.549*** (-18.122)
N	2469	2469	2469
R ²	0.314	0.251	0.321
F	125.330	91.798	129.262

*Notes: The model controls for firm and year fixed effects. The results for the control variables are not reported in the table.

Table 8

Robustness Test II

	(1)	(2)	(3)
	RIP1	SIP1	TIP1
CERS	0.832*** (5.966)	0.342** (2.345)	0.616*** (4.727)
_cons	-10.481*** (-21.164)	-6.758*** (-13.048)	-8.135*** (-17.578)
N	2469	2469	2469
R ²	0.277	0.219	0.281
F	104.828	76.609	106.997

*Notes: The model controls for firm and year fixed effects. The results for the control variables are not reported in the table.

Table 9

Robustness Test III

	(1)	(2)	(3)
	L.RIP	L.SIP	L.TIP
CERS	1.213** (2.523)	0.894* (1.716)	1.233*** (2.795)
_cons	-11.678*** (-6.944)	-10.557*** (-5.788)	-10.080*** (-6.530)
N	237	237	237
R ²	0.441	0.393	0.456
F	19.912	16.309	21.108

*Notes: The model controls for firm and year fixed effects. The results for the control variables are not reported in the table.

4.6 Analysis of Mediating Effects

This study further examines the mechanisms through which RSIs for core employees are associated with corporate innovation performance. To assess the mediating role of R&D investment, it follows the approach described in [26] and applies a stepwise mediation procedure (three-step

method). Specifically, the analysis first examines whether RSIs for core employees are significantly associated with corporate innovation performance. It then evaluates whether RSIs affect firms' R&D investment and whether R&D investment is associated with innovation performance. After R&D investment is introduced as a mediating variable into the benchmark regression model, changes in the coefficients of core employees' RSIs and R&D investment are assessed simultaneously. In this study, R&D investment comprises both human and financial resources devoted to research and development.

4.6.1 Mediating Effects of R&D Capital Investment

The mediating effects of R&D capital and personnel investment are examined separately. Table 10 presents the results for the mediating role of R&D capital investment in the relationship between core employees' RSIs and corporate innovation performance.

Table 10
Mediating Effect of R&D Capital Investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	RDI	RIP	SIP	TIP	RIP	SIP	TIP
CERS	0.061*** (7.775)				0.476*** (3.580)	0.366** (2.520)	0.433*** (3.410)
RDI		5.209*** (15.589)	1.169*** (3.205)	2.471*** (7.734)	5.022*** (14.883)	1.313*** (3.560)	2.301*** (7.129)
_cons	0.072*** (2.598)	-11.943*** (-25.527)	-7.389*** (-14.471)	-9.134*** (-20.419)	-11.969*** (-25.640)	-7.408*** (-14.523)	-9.158*** (-20.513)
N	2469	2469	2469	2469	2469	2469	2469
R ²	0.210	0.374	0.253	0.335	0.378	0.255	0.338
F	72.461	163.483	92.767	137.682	149.124	84.307	125.612
Sobel Z		6.891***	3.237***	5.254***			
Bootstrap (500 replications) confidence interval		[0.2201851, 0.3923203]	[0.0308886, 0.1292135]	[0.0873241, 0.1932644]			

*Notes: The model includes firm and year fixed effects. The results for the control variables are not reported in the table.

Table 10 presents the mediation analysis for R&D capital investment. Column (1) shows that RSIs are positively associated with R&D capital investment ($\beta = 0.061$, $p < 0.01$), indicating that firms allocating a larger proportion of restricted stock incentives to core employees tend to invest more in R&D activities. This result supports Hypothesis 2a. Columns (2) to (4) show that R&D capital investment is positively associated with substantive innovation performance (RIP), strategic innovation performance (SIP), and total innovation performance (TIP), satisfying an important condition for mediation. Columns (5) to (7) further show that when RSIs and R&D capital investment are included in the same model, both remain positively and significantly associated with innovation performance. The reduction in the RSI coefficients relative to the benchmark regressions suggests partial mediation.

These findings indicate that RSIs are associated with stronger innovation performance partly through increased capital investment in R&D. Thus, R&D capital investment acts as an important transmission channel linking RSIs to corporate innovation performance, supporting Hypotheses 3a, 3b, and 3c. Sobel and bootstrap tests further support the mediation results. The Sobel statistics exceed 2.58 and are significant at the 1% level, while the 95% bias-corrected bootstrap confidence intervals exclude zero. These results provide further evidence that R&D capital investment partially

mediates the relationship between RSIs and innovation performance and are consistent with the stepwise mediation analysis.

4.6.2 Mediating Effects of R&D Personnel Investment

The mediating role of R&D personnel investment in the relationship between core employees' RSIs and corporate innovation performance is also examined, as reported in Table 11.

Table 11
Mediating Effect of R&D Personnel Investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	RDP	RIP	SIP	TIP	RIP	SIP	TIP
CERS	0.140*** (7.729)				0.404*** (3.121)	0.243* (1.669)	0.332*** (2.670)
RDP		2.756*** (19.596)	0.348** (2.208)	1.775*** (13.154)	2.687*** (18.916)	0.307* (1.925)	1.719*** (12.602)
_cons	0.217*** (3.355)	-12.169*** (-26.653)	-7.559*** (-14.774)	-9.348*** (-21.341)	-12.187*** (-26.739)	-7.570*** (-14.799)	-9.363*** (-21.400)
N	2469	2469	2469	2469	2469	2469	2469
R ²	0.159	0.405	0.252	0.364	0.408	0.253	0.366
F	51.809	186.269	91.967	156.152	169.212	83.108	141.600
Sobel Z		7.155***	1.868*	6.589***			
Bootstrap (500 replications) confidence interval		[0.2784272, 0.4764954]	[0.0053186, 0.0915454]	[0.1719446, 0.3108596]			

*Notes: The model controls for firm and year fixed effects. The results for the control variables are not reported in the table.

Table 11 presents the mediation analysis for R&D personnel investment. Column (1) shows that RSIs are positively associated with R&D personnel investment ($\beta = 0.140$, $p < 0.01$). This indicates that firms allocating a larger proportion of restricted stock incentives to core employees tend to invest more heavily in R&D human capital, supporting Hypothesis 2b.

Columns (2) to (4) show that R&D personnel investment is positively associated with substantive innovation performance (RIP), strategic innovation performance (SIP), and total innovation performance (TIP), indicating the importance of innovation-related human capital in generating innovation outputs. When RSIs and R&D personnel investment are included simultaneously in Columns (5) to (7), the RSI coefficients decline relative to the benchmark models, while both RSIs and R&D personnel investment remain positive and statistically significant. This pattern indicates partial mediation and supports Hypotheses 3a, 3b, and 3c.

The Sobel and bootstrap tests provide further support for the mediation effect. The Sobel statistics for RIP and TIP exceed 2.58 and are significant at the 1% level, while the indirect effect for SIP is significant at the 10% level. Moreover, the 95% bias-corrected bootstrap confidence intervals for all three indirect effects exclude zero. Overall, the results indicate that R&D personnel investment serves as a significant transmission channel through which RSIs are associated with improved corporate innovation performance.

4.7 Heterogeneity Analysis

4.7.1 Regional Heterogeneity

Regional heterogeneity in the effects of core employees' RSIs on corporate innovation performance is also examined, as reported in Table 12.

Table 12
Regional Heterogeneity Analysis

	Eastern region			Central and Western region		
	RIP	SIP	TIP	RIP	SIP	TIP
CERS	0.822*** (5.432)	0.266* (1.650)	0.597*** (4.219)	0.606 (1.501)	0.403 (1.314)	0.467 (1.640)
_cons	-11.904*** (-22.216)	-7.091*** (-12.357)	-8.964*** (-17.882)	-10.535*** (-8.905)	-10.244*** (-8.997)	-9.612*** (-9.213)
N	1954	1954	1954	515	515	515
R ²	0.343	0.247	0.331	0.263	0.312	0.330
F	112.919	70.876	107.040	19.800	25.115	27.274

*Notes: The model controls for firm and year fixed effects. The results for the control variables are not reported in the table. Additional seemingly unrelated estimation (SUEST) tests confirm statistically significant coefficient differences between regional groups ($p < 0.05$).

To examine regional heterogeneity, this study classifies firms according to their locations and compares the eastern region with the central and western regions. Group-specific regressions were estimated, and SUEST tests were conducted to assess differences in coefficients between the regional groups. For firms in the eastern region, RSIs for core employees are positively associated with substantive innovation performance, strategic innovation performance, and total innovation performance. The coefficients are significant at the 1% level for RIP and TIP and at the 10% level for SIP. In contrast, the RSI coefficients for firms in the central and western regions are not statistically significant, suggesting no discernible association with innovation performance in these regions. Further tests of between-group differences yield p-values below 0.05, confirming statistically significant regional differences in the relationship between RSIs and innovation performance. These results confirm regional heterogeneity.

4.7.2 Heterogeneity by Business Ownership

The heterogeneous effects of core employees' RSIs on corporate innovation performance across firms with different ownership structures are also examined. Specifically, firms are divided into state-owned and non-state-owned enterprises, with the results reported in Table 13.

Table 13
Heterogeneity Analysis by Business Ownership

	State-owned enterprises			Non-state-owned enterprises		
	RIP	SIP	TIP	RIP	SIP	TIP
CERS	2.252*** (2.818)	1.324** (2.848)	1.735*** (2.584)	0.672*** (4.884)	0.225* (1.722)	0.495*** (3.833)
_cons	-11.866*** (-6.817)	-9.721*** (-6.232)	-10.068*** (-6.701)	-10.913*** (-20.207)	-6.938*** (-11.941)	-8.439*** (-16.664)
N	273	273	273	2196	2196	2196
R ²	0.330	0.349	0.376	0.290	0.210	0.282
F	14.406	15.677	17.608	99.071	64.450	95.268

*Notes: The model controls for firm and year fixed effects. The results for the control variables are not reported in the table. Additional SUEST tests confirm statistically significant coefficient differences between ownership groups ($p < 0.05$).

To further examine ownership heterogeneity, a formal between-group coefficient comparison was conducted using the SUEST approach. The results reject the null hypothesis of coefficient equality between state-owned enterprises (SOEs) and non-state-owned enterprises (non-SOEs) at the 5% significance level for substantive innovation performance (RIP), strategic innovation performance

(SIP), and total innovation performance (TIP). These findings indicate that the positive association between RSIs and innovation performance differs systematically across ownership types. As reported in Table 13, RSIs are positively associated with innovation performance in both SOEs and non-SOEs; however, the estimated coefficients are consistently larger for SOEs. Beyond statistical significance, this finding suggests that equity-based incentives may generate greater innovation-related benefits in state-owned firms. One possible explanation is that SOEs generally operate under more rigid compensation systems, making restricted stock incentives a more effective mechanism for aligning employee interests with long-term innovation objectives. In contrast, non-SOEs often rely on more market-oriented compensation arrangements, which may reduce the incremental motivational effect of RSIs. The economic implication is that the effectiveness of RSIs depends on organizational context. While RSIs are positively associated with innovation across both ownership types, their effect appears particularly pronounced in SOEs, where equity incentives may provide a stronger stimulus for innovation-related effort and engagement. The SUEST results therefore confirm that ownership structure moderates the relationship between RSIs and innovation performance. These results confirm ownership heterogeneity.

5. Discussion

The empirical analysis demonstrates that corporate innovation performance is significantly and positively associated with the allocation of RSIs to core employees. Firms that grant a larger proportion of restricted shares to their core technical and business personnel exhibit higher patent output in both substantive and strategic innovation. The findings also indicate that R&D investment is an important transmission channel underlying this relationship. These findings should be considered in relation to [29], who establish that restricted stock incentives for core employees can enhance corporate innovation through firm-specific knowledge investment. The present study extends this evidence in three ways. First, the results show that the association is not uniform across innovation outcomes: RSIs are positively related to substantive, strategic, and total innovation, suggesting that incentive allocation can support both exploratory and incremental forms of innovation. Second, the mediation results identify R&D capital and R&D personnel investment as distinct transmission channels, thereby extending the knowledge-based explanation to firm-level resource allocation. Third, the differences observed across regions and ownership structures indicate that the effectiveness of core-employee RSIs is contingent on organizational and institutional contexts. Accordingly, the study moves beyond the general RSI-innovation relationship by examining differentiated innovation outcomes, resource-allocation mechanisms, and contextual conditions through which this relationship operates. Based on these results, equity-based reward programs designed to focus on core employees may influence organizational and behavioral processes that support sustainable innovation.

RSIs are positively associated with both substantive and strategic innovation, but the underlying behavioral mechanisms differ. Substantive innovation is characterized by technological uncertainty, long development cycles, and irreversible R&D expenditure. By reducing employees' risk aversion and increasing their willingness to engage in exploratory research, RSIs may encourage substantial innovation with long-term benefits. In contrast, strategic innovation involves incremental technological advances, process optimization, and design refinement. As these activities generally involve less uncertainty and shorter innovation cycles, RSIs may strengthen organizational commitment, facilitate information exchange, and sustain employee involvement in incremental innovation. Equity incentives may therefore motivate both exploratory and incremental innovation, although through different mechanisms.

The findings can be interpreted through human capital theory and agency theory. Because employees become residual claimants to the firm's innovation returns, restricted stock creates long-term incentive alignment that reduces conventional agency problems [6, 32]. Substantive innovation involves long development cycles, high uncertainty, and delayed payoffs, which correspond closely to the long-term horizon embedded in restricted stock incentives. Substantive innovation relies on long-term technological accumulation and sustained investment, whereas strategic innovation depends on process optimization and continuous improvement; both require the stable participation of core employees. Restricted stock plans, with their extended lock-up periods and vesting conditions, may reduce the likelihood of core-employee turnover and prevent disruptions to R&D activities. They may therefore help maintain the continuity and stability of innovation activities, thereby supporting both substantive and strategic innovation. Core employees are typically risk-averse, whereas substantive innovation carries a high probability of failure and involves lengthy development cycles. Restricted stock schemes allow these employees to share in the long-term benefits of successful innovation, potentially reducing their aversion to failure and encouraging investment of effort in high-risk, high-value original R&D. At the same time, strategic innovation involves moderate risk and produces results over shorter periods. Given stable expectations, employees may be more willing to devote effort to technical improvements and optimization, thereby supporting both higher-risk and lower-risk innovation activities.

The findings of this study are broadly consistent with empirical research showing that equity incentives can stimulate innovative behavior by increasing technical employees' willingness to take risks, exercise creativity, and collaborate [36]. The first set of hypotheses examines whether RSIs for core employees are positively associated with firms' substantive, strategic, and total innovation performance. The results are consistent with earlier research [21, 23], which suggests that corporate innovation can be encouraged by equity-based incentive systems. The second set of hypotheses examines the relationship between RSIs for core employees and R&D investment. The results are consistent with previous studies [7, 17], indicating that equity incentives can encourage firms to increase investment in innovation. The third set of hypotheses examines whether R&D investment mediates the association between RSIs for core employees and corporate innovation performance. The results are consistent with previous research [13, 18, 20], which identifies R&D investment as an important channel through which incentive mechanisms are associated with improved innovation performance. However, most earlier studies have focused on executives rather than core mid-level or technical personnel. By shifting attention to core employees, whose roles differ substantially from those of senior executives, this study extends the literature by showing that incentive alignment at different organizational levels is also relevant to innovation performance. The study further distinguishes between substantive and strategic innovation performance and categorizes R&D investment into financial and human resource inputs, providing a more comprehensive analytical perspective.

Finally, existing research indicates that innovation performance depends not only on incentives but also on the allocation of resources within an organization. The present findings support and extend prior evidence concerning the mediating role of R&D investment [27]. The empirical models used in this study provide a more detailed account of how incentive structures are associated with innovation performance in practice.

5.1 Institutional Heterogeneity and Economic Context

The stronger effect observed in the eastern region may reflect deeper financial markets, stronger intellectual property protection, denser industrial clusters, better university-industry collaboration, more developed supply chains, and greater availability of skilled labor. These factors may improve

the efficiency with which firms transform R&D investment into innovation performance, thereby strengthening the effectiveness of restricted stock incentives. Deeper capital markets, denser innovation networks, and stronger property-rights protection may also increase the expected returns to innovation, making equity-based incentives more credible and effective. In contrast, weaker innovation ecosystems and greater uncertainty regarding the appropriation of innovation returns in the central and western regions may limit the incentive effect of restricted stock.

Similarly, the more pronounced effect observed in SOEs may stem from their lower baseline incentive intensity. Administrative constraints and rigid compensation systems can weaken innovation incentives in SOEs, so the introduction of restricted stock may represent a larger marginal improvement in incentive alignment. SOEs generally face greater compensation constraints and a higher risk of talent attrition. At the same time, their stronger long-term orientation, more standardized governance structures, and greater availability of innovation resources may facilitate the motivational, retention, and long-term incentive effects of restricted stock incentive schemes. Non-state-owned enterprises, by contrast, already rely more heavily on market-based compensation, which may reduce the incremental effectiveness of restricted stock incentives.

5.2 Theoretical Implications

This study offers several theoretical contributions. First, it extends agency theory by showing that RSIs can alleviate agency problems among core non-executive employees, a group often overlooked in incentive-innovation research. The results indicate that ownership-based incentives can influence the behavior of employees whose contributions are central to innovation but who have traditionally been subject to weaker incentive alignment than senior executives.

Second, the findings are consistent with human capital theory, which suggests that RSIs can encourage long-term investment in firm-specific knowledge. Compensation linked to long-term value creation may encourage core employees to engage in continuous learning, experimentation, and the accumulation of tacit knowledge.

Third, this study provides a broader theoretical account of the relationship among incentives, resource allocation, and innovation performance by considering R&D investment as a mediating variable. This addresses a gap in the literature concerning how incentives influence innovation beyond corporate-level decision-making. The theoretical framework therefore connects employees' micro-level motivation with firm-level resource allocation and innovation performance.

5.3 Practical Implications

The study's findings have several important managerial implications. First, because core technical employees are directly involved in knowledge production, technology development, and innovation implementation, firms seeking to improve innovation performance should consider allocating a larger proportion of RSIs to these employees. The findings suggest that equity-based incentives can strengthen commitment to innovation activities by aligning employee interests with long-term organizational objectives. Second, managers should view RSIs not merely as a reward mechanism but as a strategic human resource management tool that can support both R&D investment and innovation performance. Specifically, the mediation results indicate that firms can strengthen the effectiveness of RSIs by concurrently increasing investment in R&D capital and personnel. Thus, innovation-oriented compensation plans should be coordinated with broader R&D investment strategies to improve innovation performance.

The findings also have important policy implications. Policymakers seeking to strengthen national innovation capacity should encourage the adoption of long-term incentive structures that support employee participation in innovation activities. Regulatory authorities could consider improving

corporate governance standards and equity incentive policies to facilitate the use of RSIs for core technical employees, particularly in innovation-intensive industries. Policymakers may also encourage state-owned enterprises to adopt innovation-oriented equity incentive schemes as part of broader innovation and industrial upgrading initiatives, given that the positive association between RSIs and innovation performance is stronger in state-owned enterprises. Such measures may support increased R&D investment, stronger innovation performance, and long-term economic development.

5.4 Limitations of the Study

Several limitations should be acknowledged. Because the identifying variation is partly cross-sectional and the key explanatory variable changes slowly within firms over time, the findings should be interpreted cautiously as evidence of robust associations rather than definitive causal relationships. The restricted stock incentive measure also captures the proportion of incentives allocated to core employees rather than the absolute intensity or monetary value of equity compensation. Consequently, firms with similar values may differ in the total amount of restricted stock granted.

First, patent-based measures are used to assess innovation performance. These measures do not necessarily capture the full economic value or commercial success of innovation. Many productivity-enhancing innovations remain unpatented, potentially resulting in the omission of economically meaningful innovation activities.

Second, although the dataset is structured as firm-year observations, the identification strategy relies substantially on differences between firms because restricted stock incentive plans are generally implemented as discrete events rather than continuous policy changes. Although a fixed-effects model is employed to reduce potential bias, unobserved firm-level characteristics may still influence both the design of incentive mechanisms and innovation performance.

Third, the sample is limited to A-share listed companies in China. China's distinctive institutional characteristics, including its regulatory framework and capital market structure, may limit the generalizability of the findings to other economic and institutional contexts.

Finally, while the study examines R&D capital and personnel investment as the primary mediating channels, other potentially important behavioral mechanisms, such as changes in risk-taking and collaboration, cannot be observed because of data limitations.

5.5 Recommendations for Future Research

Future research can extend this study in several ways. First, researchers could employ more comprehensive measures of innovation performance, such as innovation revenue, new product launches, or innovation efficiency. Second, comparative studies of other types of organizations, such as private small and medium-sized enterprises or firms with different levels of technological intensity, could provide a better understanding of the conditions under which RSIs are effective. Third, qualitative or mixed-methods research could examine how organizational culture, leadership practices, team characteristics, and RSIs jointly influence innovation.

Future research could also examine how longitudinal changes in multi-stage equity incentive plans, such as repeated grants, plan revisions, or failure to meet vesting conditions, influence innovative behavior. Finally, cross-country research could investigate the moderating role of institutional environments, including investor protection, labor regulations, and capital market maturity, in the relationship between employee equity incentives and corporate innovation performance.

6. Conclusions

This study examined whether RSIs for core employees are associated with improved corporate innovation performance and investigated the mediating role of R&D investment. Drawing on agency theory and human capital theory, the study used panel data from publicly listed companies to empirically test the proposed relationships. The findings indicate that restricted stock incentives for core employees are positively associated with corporate innovation performance, including both substantive and strategic innovation. The results further suggest that the positive association between restricted stock incentives and corporate innovation performance is stronger when market institutions function effectively and incentive commitments are credible. These findings indicate that incentive mechanisms should be designed according to the organizational and institutional context rather than through the uniform application of standardized compensation schemes.

This study makes several contributions to the existing literature. First, it extends theoretical and empirical research on equity incentives within organizational hierarchies by shifting the focus of analysis to core employees. These employees are directly engaged in innovation activities and possess firm-specific tacit knowledge that supports firms' innovation processes.

Second, the study measures incentive allocation as the proportion of restricted stock incentives granted to core technical personnel relative to the total number of restricted stock incentives granted during the same period. This approach provides a transparent measure of the allocation of equity incentives within firms and addresses measurement limitations in previous studies.

Finally, by integrating incentive design with resource allocation, the study provides a broader analytical framework for explaining how organizations develop innovation capabilities under complex and uncertain conditions.

From a practical perspective, the results suggest that innovation performance cannot be sustained by strategic aspirations or rhetoric alone. Firms also require well-designed incentive systems that promote long-term alignment and a sustained willingness to invest in innovation. For firms seeking to improve innovation performance, restricted stock incentives can serve as an effective strategic tool for motivating core employees, retaining talent, and signaling a long-term commitment to value creation. To realize their full effectiveness, however, such incentive schemes need to be integrated with existing organizational practices and aligned with appropriate R&D investment strategies.

Although this study extends the existing literature, its limitations also suggest several directions for further research. Future studies could examine the dynamic effects of multi-stage or revised equity incentive plans, broaden the range of innovation measures, and conduct cross-industry or cross-country analyses. A deeper understanding of how team composition, leadership, and organizational culture relate to RSIs could further clarify the behavioral mechanisms underlying innovation. The findings of this study indicate that aligning core employees' financial interests with those of the firm through RSIs can strengthen innovation performance. They also suggest that RSIs are associated with different forms of innovation through distinct mechanisms. Substantive innovation is primarily associated with incentives for long-term, high-risk technological research, whereas strategic innovation is more closely related to incremental improvement and organizational commitment. These distinct channels help explain how equity incentives are associated with corporate innovation.

Against the background of intensifying global competition, innovation is becoming increasingly important for corporate survival. Well-designed incentive systems that prioritize long-term value creation can help firms build and sustain competitive advantage.

Author Contributions

Conceptualization, Min Wan and S.M. Ferdous Azam; Methodology, Min Wan; Software, Min Wan; Validation, Min Wan, S.M. Ferdous Azam; Formal Analysis, Min Wan; Investigation, Min Wan; Resources, Min Wan; Data Curation, Min Wan; Writing – Original Draft Preparation, Min Wan; Writing – Review & Editing, S.M. Ferdous Azam; Visualization, Min Wan; Supervision, Min Wan; Project Administration, Min Wan; Funding Acquisition, S.M. Ferdous Azam.

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Data Availability Statement

Data sets generated during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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Declaration of Generative AI and AI-Assisted Technologies in the Manuscript Preparation Process

During the preparation of this work, the authors used AI-assisted tools, ChatGPT-5.6, to enhance readability and improve language structure. These tools were not used to generate scientific content, analyses, or conclusions. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the final manuscript. No generative AI tools were used to create or modify the study figures or artwork.

References

- [1] Al Hayek, M. A., E'leimat, D., Alshdaifat, S. M., & Mansour, I. J. (2025). The impact of job satisfaction on financial performance in Jordanian industrial companies: The mediating role of innovation. *International Review of Management and Marketing*, 15(5), 156–166. <https://doi.org/10.32479/irmm.19069>
- [2] Almeida, H., Ersahin, N., Fos, V., Irani, R. M., & Kronlund, M. (2024). How do short-term incentives affect long-term productivity? *Review of Financial Studies*, 39(1), 114–157. <https://doi.org/10.1093/rfs/hhae064>
- [3] Barardehi, Y., Bird, A., Karolyi, S., & Ruchti, T. (2024). Are short selling restrictions effective? *Management Science*, 71(5), 3829–3851. <https://doi.org/10.1287/mnsc.2024.4987>
- [4] Blum-Kusterer, M., & Hussain, S. S. (2001). Innovation and corporate sustainability: An investigation into the process of change in the pharmaceuticals industry. *Business Strategy and the Environment*, 10(5), 300–316. <https://doi.org/10.1002/bse.300>
- [5] Chen, H., Qiao, S., & Zhang, K. (2024). Equity structure and corporate innovation performance: Evidence from Chinese high-tech companies. *Heliyon*, 10(24), e39470. <https://doi.org/10.1016/j.heliyon.2024.e39470>

- [6] Chen, K. L., Tsai, S. H. J., Hu, K. K., & Roeschmann, J. (2023). Pay more, earn more: The shared value approach and contingency of high-tech industry. *R&D Management*, 54(3), 542–557. <https://doi.org/10.1111/radm.12654>
- [7] Chen, S., Xu, K., Nguyen, L. T., & Yu, G. (2018). TMT's attention towards financial goals and innovation investment: Evidence from China. *Sustainability*, 10(11), 4236. <https://doi.org/10.3390/su10114236>
- [8] Danni, W., & Qi, Z. (2024). Analyzing the influence of dividend policy on corporate value: A financial perspective with Haier as a case study. *Journal of Accounting, Business and Management*, 32(1), 84–90. <https://doi.org/10.31966/jabminternational.v32i1.1464>
- [9] Del Sordo, E., & Zattoni, A. (2024). The role of employee ownership, financial participation, and decision-making in corporate governance: A multilevel review and research agenda. *Corporate Governance: An International Review*, 33(3), 529–549. <https://doi.org/10.1111/corg.12614>
- [10] Ogunmola, G. A., Madrahimov, U., Maraimova, U., & Talgatovna, S. (2026). Technological innovation and green paradigms as drivers of sustainability: A structural equation modeling study with institutional moderators. *Management & Sustainability: An Arab Review*. Advance online publication. <https://doi.org/10.1108/MSAR-12-2025-0513>
- [11] Gornall, W., Gredil, O. R., Howell, S. T., Liu, X., & Sockin, J. (2024). Do employees cheer for private equity? The heterogeneous effects of buyouts on job quality. *Management Science*, 71(5), 4287–4317. <https://doi.org/10.1287/mnsc.2022.00951>
- [12] Guerri, M., Radaelli, G., Siletti, E., Cirella, S., & Shani, A. B. R. (2015). The impact of human resource management practices and corporate sustainability on organizational ethical climates: An employee perspective. *Journal of Business Ethics*, 126(2), 325–342. <https://doi.org/10.1007/s10551-013-1946-1>
- [13] Lerner, J., & Wulf, J. (2007). Innovation and incentives: Evidence from corporate R&D. *Review of Economics and Statistics*, 89(4), 634–644. <https://doi.org/10.1162/rest.89.4.634>
- [14] Radović Marković, M. (2025). The organizational resilience models under digital transformation and creative destruction: Lessons from Estonia, Lithuania, and Latvia. *Journal of Entrepreneurship and Business Resilience*, 8(2), 21–39. <https://doi.org/10.65537/jebr.202582.151>
- [15] Qian, C., Ge, L., Geng, X., Li, J., & Hasenhuttl, M. (2025). Large owner expropriation threat and stock option pay's effect on firm risk-taking behaviors in weak institutions. *Corporate Governance: An International Review*, 34(1), 233–251. <https://doi.org/10.1111/corg.70012>
- [16] Gal-Or, R., Goldman, W., Gooley, M., & Gujarathi, M. R. (2026). Lumber Liquidators: A case in financial statement analysis and valuation. *Issues in Accounting Education*, 41(2), 91–112. <https://doi.org/10.2308/ISSUES-2024-017>
- [17] Radović Marković, M., Srebro, B., Dedjanski, S., & Vrbanc, M. (2025). Gender perspectives on SME international trade and revenue in the digital era: Evidence from Serbia. *Journal of Women's Entrepreneurship and Education*, (1-2), 198–216. <https://doi.org/10.28934/jwee25.12.pp198-216>
- [18] Mec, M., Zeman, M., & Cermakova, K. (2024). Stock market prediction using generative adversarial network (GAN): Study case Germany stock market. *International Journal of Economic Sciences*, 13(2), 87–103. <https://doi.org/10.52950/ES.2024.13.2.005>
- [19] Adak, A. K., Jovcic, S., Bozanic, D., & Marinkovic, D. (2026). Selection of optimal stock for business investment using Pythagorean fuzzy Aczel-Alsina CoCoSo method. *Journal of Contemporary Decision Science*, 2(1), 287–304. <https://doi.org/10.67334/cds21202621>
- [20] Zhong, J., Tang, S., & Albitar, K. (2026). Earnings pressure and environmental, social and governance performance: How executive compensation incentives mitigate short-termism. *Corporate Social Responsibility and Environmental Management*, 33(3), 4329–4347. <https://doi.org/10.1002/csr.70387>
- [21] Jin, X., Yu, J., Yuan, G., & Zang, R. (2025). Impact of state-owned equity participation on the risk-taking capacity of private enterprises in China: Insights from a quasi-natural experiment. *Corporate Governance: An International Review*, 33(4), 629–662. <https://doi.org/10.1111/corg.12619>
- [22] Ogunmola, G. A., & Kumar, V. (2025). Policy regulations and global standards: A perspective on sustainable computing. *EDPACS*, 71(4), 61–76. <https://doi.org/10.1080/07366981.2025.2552564>
- [23] Li, H., & Liu, Q. (2022). Empirical study on equity incentive of core employees, enterprise innovation and financial performance: Evidence from GEM listed companies. In *Proceedings of the 5th International Conference on Computing and Big Data (ICCBD)* (pp. 73–77). IEEE. <https://doi.org/10.1109/ICCBD56965.2022.10080175>
- [24] Li, N., Feng, J., & Zhang, C. (2023). Macro tax incentives and corporate sustainable innovation: Evidence from Chinese enterprises. *Environmental Science and Pollution Research*, 30(45), 101546–101564. <https://doi.org/10.1007/s11356-023-29268-0>
- [25] Shi, Y., & Ge, J. (2025). The role of government fiscal and tax incentives in green technology innovation and enterprise development: Implications for human health and hygiene. *Frontiers in Public Health*, 12, 1502856. <https://doi.org/10.3389/fpubh.2024.1502856>

- [26] Villani, E., Linder, C., De Massis, A., & Eddleston, K. A. (2024). Employee incentives and family firm innovation: A configurational approach. *Journal of Management*, 50(5), 1797–1835. <https://doi.org/10.1177/01492063231157323>
- [27] Li, C., Sun, H., & Zhang, Q. (2024). Exploring the mesomeric effect of executive equity incentives on enterprise innovation: A study in the context of digital transformation. *Kybernetes*, 53(2), 734–751. <https://doi.org/10.1108/K-06-2023-1056>
- [28] Franco, F., & Urcan, O. (2026). Multi-metric vesting schemes in executive performance equity grants. *The Accounting Review*, 101(2), 215–248. <https://doi.org/10.2308/TAR-2024-0108>
- [29] Li, Y., You, J., & Chen, R. (2026). Can restricted stock incentives foster corporate innovation? Insights from core employees' firm-specific knowledge investments. *Asia Pacific Journal of Management*, 43(2), 989–1016. <https://doi.org/10.1007/s10490-025-10042-4>
- [30] Makri, M., Lane, P. J., & Gomez-Mejia, L. R. (2006). CEO incentives, innovation, and performance in technology-intensive firms: A reconciliation of outcome- and behavior-based incentive schemes. *Strategic Management Journal*, 27(11), 1057–1080. <https://doi.org/10.1002/smj.560>
- [31] Ma, J., & Wang, H. (2024). Research on the impact of equity incentive model on enterprise performance: A mediating effect analysis based on executive entrepreneurship. *PLOS ONE*, 19(4), e0300873. <https://doi.org/10.1371/journal.pone.0300873>
- [32] Makeeva, E., Murashkina, I., & Mikhaleva, I. (2019). The impact of R&D tax incentive programs on the performance of innovative companies. *Foresight*, 21(5), 545–562. <https://doi.org/10.1108/FS-06-2018-0063>
- [33] Wen, Y., John Mariadoss, B., & Bi, S. (2026). Conversion privileges? The effect of convertible debt on strategic emphasis and firm performance. *Journal of Marketing Theory and Practice*, 34(1), 250–264. <https://doi.org/10.1080/10696679.2024.2446149>
- [34] Podsakoff, P. M., Podsakoff, N. P., & Shao, Y. (2026). Experimental approaches for testing mediation effects models: A review, assessment, and recommended practices. *Journal of Business and Psychology*, 41(1), 1–26. <https://doi.org/10.1007/s10869-025-10089-6>
- [35] Ren, J., & Yu, Y. (2025). Relationship between intellectual capital, executive motivation, and corporate innovation level: Evidence from Chinese listed manufacturing companies. *Journal of Advanced Computational Intelligence and Intelligent Informatics*, 29(1), 118–130. <https://doi.org/10.20965/jaciii.2025.p0118>
- [36] Li, H., Yu, Z., Chen, G., & Nie, Y. (2025). Research on the impact of green finance on regional carbon emission reduction and its role mechanisms. *Scientific Reports*, 15(1), 17293. <https://doi.org/10.1038/s41598-025-02481-2>