Empirical Study on the Relationship between R&D Investment and Performance of Specialized, Refined, Unique and New Enterprises: Based on Data Analysis of A-share Specialized, Refined, Unique and New Listed Companies

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Abstract. Innovation is the soul of specialized and innovative enterprises. As an important force in promoting new industrialization and developing new quality productivity, continuously improving its innovation capability is an inevitable requirement to polish this "golden signboard". This article selects panel data from 577 specialized, refined, and new enterprises between 2018 and 2023 as the research sample to empirically analyze the relationship between company R&D investment and performance. Research has found that R&D investment can enhance the innovation performance of specialized, refined, and innovative small and medium-sized enterprises. After considering endogeneity and a series of robustness tests, the conclusion still holds true; Heterogeneity results indicate that compared to large-scale enterprises, R&D investment in small-scale enterprises has a significant positive promoting effect. The research conclusion of this article provides policy implications for enhancing the competitiveness of specialized, refined, and innovative enterprises in the industrial chain and helping the economy achieve high-quality development.

Keywords: New Quality Productivity achievements, Specialized and innovative listed company.

1. Introduction

Technological innovation is not only a development issue, but also a survival issue. In the context of global innovation driven development, specialized, refined, and innovative enterprises have become a key force in "filling gaps and forging strengths", and have become an important carrier for China's industrial chain modernization and core technology breakthroughs. These types of enterprises focus on niche fields and, with the advantages of specialization, refinement, specialization, and novelty, not only promote the substitution of key technologies, but also play a strategic leading role in industrial upgrading (Dong Zhiyong, Li Chengming, 2021) [1]. However, research and development activities often have high costs (Feng Yanhong and Lu Zhenying, 2024) [2] and significant uncertainties and risks. If innovation fails, it will not only exacerbate business risks, but also have a negative impact on business performance. Therefore, this article focuses on examining the mechanism by which R&D of specialized and innovative "little giants" enterprises affects company performance, and explores how to promote the development of technological innovation in enterprises, which has practical significance.

Based on this, this article takes the data of specialized, refined, unique and new listed companies from 2018 to 2023 as a sample to study how R&D investment affects specialized, refined, unique and new "little giant" enterprises, and explores the role of enterprise R&D investment in this process. This study will help reveal the relationship between R&D investment and company performance, promote high-quality development of the manufacturing industry, and drive the formation of a stronger innovation, higher added value, and safer and more controllable industrial and supply chain.

2. Literature Review and Hypothesis Proposal

The academic community has long focused on the synergistic effect between corporate R&D investment and business performance. As of now, there is a considerable amount of research on the relationship between corporate R&D investment and its performance. However, there is no consensus in the academic community. The research conclusions are mainly divided into three perspectives.

Firstly, a company's R&D investment has a positive or lagged effect on its performance. (Liu Yun and Ma Zhiyun et al., 2020; Liu Ying and Wang Hongxin, 2023; Feng Qiliang and Angel et al., 2024;) [3] [4] [5] pointed out that when an enterprise increases its R&D investment, its current performance will also increase, and the impact will strengthen over time, but this effect has a certain time lag. It should be noted that although many scholars at home and abroad have the same conclusions, the standards for measuring corporate performance are not the same. There are both overall evaluation indicators for enterprises (Qiu Yunjie and Wei Wei, 2016) [6], as well as profitability indicators such as return on total assets (Zhai Fengqi, 2025) [7], gross profit margin (Jiang Zhiwen, Zheng Huiqiang, 2024) [8], and operating profit margin (Feng Yanhong and Lu Zhenying, 2024) [2].

Secondly, there is a negative correlation between a company's R&D investment and its performance (Xie Qun and Zhang Yuwen, 2025; Wang Hua and Zhang Ying, 2024) [9] [10], or there is no direct correlation at all. Suttipun and Krittiga Insee (2024) [11] pointed out that R&D intensity has a negative impact on company performance, while company size has a positive impact on company performance. (Khan A M, Bin M, 2023) [12] As R&D expenses increase, company performance decreases, while the impact on state-owned enterprises is not as significant.

Thirdly, some scholars point out that the performance effect of R&D investment exhibits nonlinear characteristics. (Pathak S, Sen K P, 2019) [13] pointed out that the ability of R&D intensity to affect a company's performance depends on the consistency between the R&D intensity of the company's supply base and its own R&D intensity. (Chen Jianli and Meng Lingjie et al., 2014) [14] pointed out that there is a moderate range of R&D intensity, and excessively high R&D intensity is negatively correlated with lag stage corporate performance. Enterprises with high R&D intensity have higher marginal returns, while low-intensity investment may not be effective due to resource dispersion or inefficient management (Drini Morina, Henning Lucas et al., 2025) [15] pointed out that R&D investment has a promoting effect on company performance, but there is a significant intensity threshold. In terms of threshold effect research, (Dai Xiaoyong and Cheng Li, 2014) proved the dual threshold effect between the two for [16], and (Zheng Qiusheng and Zhou Ye et al., 2024) [17] pointed out that the impact of R&D investment on firm performance has nonlinear characteristics, and its effect depends on factors such as R&D intensity, revenue scale, and executive education level, with multiple threshold effects.

At present, there is still relatively little empirical analysis on specialized and innovative "little giant" enterprises. On the one hand, most literature focuses on traditional enterprises or generalized high-tech enterprises, lacking targeted exploration of the policy-oriented group of "specialization, refinement, novelty". On the other hand, research is often limited to direct relationship analysis, ignoring the impact of moderating variables such as firm size and lifecycle, leading to doubts about the generalizability of the conclusions.

In summary, R&D investment, as the core driving force of enterprise technological innovation, can significantly enhance the innovation capability and market competitiveness of enterprises. As a high-quality enterprise that focuses on segmented fields and has specialized, refined, distinctive, and novel characteristics, the effect of R&D investment may be more significant for specialized, innovative, and new "little giant" enterprises. At the same time, combining resource-based theory and technological innovation theory, R&D investment can help enterprises accumulate core technologies, optimize product structure, and improve production efficiency, thereby directly or indirectly enhancing business performance. In addition, specialized and innovative "little giant" enterprises usually have strong technological transformation capabilities and market adaptability, which can more efficiently transform research and development achievements into actual productivity, thereby promoting business performance growth. Therefore, this article proposes the first hypothesis:

Assumption 1: The R&D investment of specialized and innovative "little giant" enterprises is positively correlated with the company's performance.

In addition, a significant feature of R&D investment is the existence of time lag effects, that is, the entire process from the development of R&D activities to the acquisition of new technologies, and then to their application in actual production, requires a certain period of time. Especially in the field of basic research, this time lag effect is particularly prominent. Based on this, this article proposes the second hypothesis:

Assumption 2: The R&D investment of specialized and innovative "little giant" enterprises have a positive impact on business performance with a lag period.

The role of enterprise scale in R&D investment cannot be ignored, especially in specialized, refined, and innovative enterprises, where the scale effect may exhibit unique dynamic characteristics. Under the same R&D investment, the expansion of enterprise scale may lead to problems such as resource dispersion, increased management complexity, and decreased innovation efficiency, which may have potential negative impacts on business performance. Therefore, this article proposes a third hypothesis:

Assumption 3: Under the same R&D investment conditions, the scale of specialized, refined, and innovative enterprises will have a negative relationship with their business performance.

3. Research design

3.1. Sample selection and data sources

This article selects a total of 577 "specialized, refined, unique, and new" small and medium-sized enterprises listed on the A-share market from 2018 to 2023 as research objects, and analyzes the impact of R&D investment on their own development. The data is mainly sourced from the CSMAR database and analyzed using EXCEL and Stata.17 software.

3.2. Variable selection and definition

(1) The dependent variable. The return on assets (ROA) is chosen as a financial performance indicator to reflect the sustained growth and competitiveness of a company, as it measures its ability to create net profits using all its assets; Gross profit margin is a key indicator for measuring a company's core profitability, and gross profit margin (GPR) is selected as a replacement variable; The return on total assets starts from the perspective of asset utilization efficiency, while the gross profit margin starts from the perspective of core profitability. The combination of the two can reveal more deeply the mechanism of R&D investment on corporate performance.

(2) Explain the variables. Select the R&D investment to revenue (R&D) ratio as the independent variable in the model, which can reflect the level of R&D innovation investment by enterprises. In addition, the size of the enterprise, financial leverage, asset turnover rate, and revenue growth rate are all factors that can affect the total asset return rate of the enterprise.

(3) Control variables. In addition, referring to the literature (Li Xiangmei and Li Lin et al., 2024; Qi Xiuhui and Wang Wei et al., 2016; Feng Yanhong, Lu Zhenying, 2024) [2] [18] [19], this article also controls for the following key variables: enterprise size, financial leverage, asset turnover rate, and revenue growth rate, which are also positively correlated with total asset return rate. In summary, we chose the return on total assets (ROA) of the enterprise as the dependent variable, R&D investment intensity (RD) as the explanatory variable, and also selected enterprise size (SIZE), financial leverage (LEV), asset turnover rate (TU), and revenue growth rate (GR) as control variables. The specific indicator definitions are shown in Table 1.

Table 1. Summary of Variables

Variable type	Variable	Variable Symbol	Variable Declaration
Explained Variable	Return on Total Assets	ROA	Net profit/average total assets
	Gross margin	GPR	Net profit/operating income
Explanatory variable	R&D intensity	RD	R&D expenses/operating income
Control variable	Enterprise size	SIZE	Ln (year-end total assets)
	Financial Leverage	LEV	Total liabilities/total book assets
	Asset turnover	TU	Operating revenue/total assets
	Revenue growth rate	GR	(Current Revenue - Previous Revenue)/Previous Revenue

3.3. Model building

Build a regression model based on sample data: measurement model of the impact of R&D intensity on corporate performance

(1) R&D intensity (RD) versus return on assets (ROA)

Regression model of impact (1):

$$\mathrm{ROA}_{i,t} = \alpha_0 + \alpha_1 RD_{i,t} + \alpha_2 SIZE_{i,t} + \alpha_3 LEV_{i,t} + \alpha_4 TU_{i,t} + \alpha_5 GR_{i,t} + \varepsilon_{i,t} \tag{1}$$

(2) R&D intensity (RD) versus gross profit margin (GPR)

Regression model of impact (2):

$$\mathrm{GPR}_{i,t} = \beta_0 + \beta_1 RD_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \beta_4 TU_{i,t} + \beta_5 \mathrm{GR}_{i,t} + \varepsilon_{i,t} \tag{2}$$

Among them, ROAi, tis the return on total assets of the enterprise, GPR is the gross profit margin of a company, $\varepsilon_{\mathrm{i,t}}$ is the missing error term in the model, β_1 is the parameter estimation of the explanatory variable, $\beta_{2、3、4、5}$ is the parameter estimation of the control variable, $\mathrm{RD}_{\mathrm{i},t}$ represents the explanatory variable of the R&D intensity of the enterprise, $\mathrm{SIZE}_{i,t}$、$LEV_{i,t}$、$TU_{i,t}$、$\mathrm{GR}_{\mathrm{i},t}$ represent the control variable.

4. Empirical analysis

4.1. Descriptive analysis and correlation analysis

Firstly, a descriptive analysis was conducted on 10824 samples of 2706 listed companies surveyed, and the descriptive statistical results are shown in Table 2. Firstly, a descriptive analysis was conducted on 3248 samples of 577 specialized and innovative "little giant" enterprises surveyed. The descriptive statistical results are shown in Table 2. It can be seen that under other control variables and a relatively small degree of R&D dispersion, the standard error of the control variable enterprise size is relatively large, resulting in a significant degree of dispersion in enterprise performance. Except for the large variance of enterprise size, the standard errors of other variables are relatively small, indicating that the data is relatively concentrated and the fluctuations are not significant.

Table 2. Results of Statistical Analysis and Correlation Analysis

Variable	Average value	Standard error	ROA	RD	LEV	TU	GR	lnsize	VIF
ROA	5.878	7.773	1						
RD	0.114	0.154	0.086***	1					1.01
LEV	0.064	0.208	0.008	-0.004	1				4.97
TU	0.361	1.024	0.045***	-0.034*	0.888***	1			5.10
GR	0.622	0.896	0.201***	-0.029	0.011	0.020	1		1.00
lnsize	15.522	48.080	-0.077***	0.038**	-0.051***	-0.166***	0.038**	1	1.08

Note: *, * *, * * * respectively indicate significance at the 10%, 5%, and 1% significance levels

From the correlation test, it can be seen that R&D, TU, and GR are significantly positively correlated at the 1% level, indicating that the higher the R&D intensity asset turnover rate and revenue growth rate, the higher the innovation performance of small and medium-sized enterprises. In addition, to avoid bias in regression results, it is necessary to test for multicollinearity among variables before conducting regression analysis. This article measures the variance inflation factor of all explanatory variables. If the coefficient of variance inflation factor (VIF) of a variable is less than 10, it is generally considered that there is no multicollinearity between variables; On the contrary, it is considered that there is severe multicollinearity between variables. The test results are shown in Table 2. The mean VIF of each variable is 2.63, and the VIF values are all less than 6, far less than 10. Therefore, there is no multicollinearity among the variables in this article.

4.2. Multiple linear regression

As shown in Table 3, after testing, the F-statistic is 1.42, corresponding to a P-value of 0.000, which is less than 0.05. The chi square statistic is 44.78, with a corresponding P-value of 0.000 and less than 0.05, indicating that a fixed effects model should be used.

Table 3. Main Regression Results

Variable	(1) re	(2) fe	(3) ols
R&D	3.590*** (5.545)	3.409*** (4.433)	3.714*** (5.825)
LEV	-1.016*** (-3.341)	-1.104** (-2.432)	-0.974*** (-3.383)
TU	1.316*** (3.692)	1.288** (2.305)	1.273*** (3.818)
GR	0.034*** (12.145)	0.035*** (10.953)	0.033*** (12.046)
lnsize	-0.359*** (-4.217)	-1.498*** (-7.271)	-0.308*** (-4.015)
_cons	11.908*** (6.760)	34.985*** (8.269)	10.903*** (6.858)
N	3248	3248	3248
R2	0.064	0.075	0.061
F-test	F (576, 2666) = 1.42		Prob > F = 0.0000
hausman test	chi2(5) = 44.78 Prob > chi2 = 0.0000		

Based on the regression coefficient table, it can be seen that the regression coefficient of R&D to ROA is 3.409. This indicates that, keeping other factors constant, for every 1-unit change in R&D value, the ROA value will correspondingly change by 3.409 units in the same direction. Assuming this holds true, however, in the control variables, the regression coefficients of LEV and lnsize to ROA are significantly negative, with magnitudes of -1.104 and -1.498, respectively.

Table 4. Benchmark Analysis Results

Variable	(1) ROA	(2) ROA
R&D	3.2044*** (1.0274)	3.4876*** (1.1582)
LEV	-	-0.9662** (0.3963)
TU	-	1.2313** (0.5028)
GR	-	0.0331*** (0.0054)
lnsize	-	-0.4717* (0.2751)
Fixed year effect	YES	YES
Individual fixed effects	YES	YES
_cons	5.6724*** (0.1501)	14.2543** (5.6030)
N	3248.0000	3248.0000
R2	0.0977	0.1358

Note: The data in parentheses represent clustering standard errors, with * * *, * *, and * representing significance levels of 1%, 5%, and 10%, respectively

Then, after introducing year fixed effects and individual fixed effects, regardless of whether control variables were added, the R&D regression results were significantly positive, as shown in Figure 4, indicating that R&D has a significant positive promoting effect on ROA. Prove the hypothesis that R&D has a significant positive impact on GPR.

4.3. Robust Test

(1) Lag effect

Table 5. Shows a lag of one period in R&D investment

Variable	(1) RD	(2) ROA
L.RD	0.4181*** (0.1128)	
RD		11.2250** (5.5232)
LEV	-0.0062 (0.0245)	4.1356** (2.0897)
TU	-0.0329*** (0.0102)	1.1080 (0.9020)
GR	-0.0000 (0.0001)	0.0435*** (0.0048)
lnsize	-0.0162** (0.0066)	-0.0091 (0.3421)
Fixed year effect	YES	YES
Individual fixed effects	YES	YES
_cons	0.3949*** (0.1279)	3.4508 (6.9916)
N	2623.0000	2623.0000
R2	0.4836	0.1082

Note: The numbers in parentheses represent clustering standard errors, with * * *, * *, and * representing significance levels of 1%, 5%, and 10%, respectively

As shown in Figure 5, this article uses the lagged one period of the core explanatory variable R&D as an instrumental variable for endogeneity testing, which satisfies the hypotheses of exogeneity and correlation of instrumental variables. The regression results of the first stage indicate that R&D lag has a significant positive impact on current R&D. The regression results of the second stage indicate that after treating endogeneity, R&D still has a significant promoting effect on ROA. This indicates that the selection of instrumental variables in this article is reasonable, and the results of the benchmark regression are robust and reliable, confirming hypothesis two.

(2) Replace explanatory variables

Table 6. Replace the dependent variable with ROA and replace it with GPR

Variable	(1) GPR	(2) GPR
R&D	0.0574*** (0.0163)	0.0583*** (0.0161)
LEV		-0.0570*** (0.0130)
TU		0.0690*** (0.0168)
GR		0.0000 (0.0000)
lnsize		0.0205*** (0.0049)
Fixed year effect	YES	YES
Individual fixed effects	YES	YES
_cons	0.1099*** (0.0022)	-0.3276*** (0.1012)
N	3248.0000	3248.0000
R2	0.4563	0.4712

Note: The numbers in parentheses represent clustering standard errors, with * * *, * *, and * representing significance levels of 1%, 5%, and 10%, respectively

As shown in Figure 6, after replacing the dependent variable ROA with GPR and conducting regression analysis again, it can be seen from the regression results that the R&D regression coefficient is still significantly positive, indicating that the benchmark regression results are robust.

(3) Excluding the impact of the epidemic

Table 7. Excluding Epidemic Years

Variable	(1) ROA	(2) ROA
R&D	3.4565*** (1.2189)	3.4565*** (1.2189)
LEV	-0.7701* (0.4291)	-0.7701* (0.4291)
TU	0.9746* (0.5436)	0.9746* (0.5436)
GR	0.0254*** (0.0057)	0.0254*** (0.0057)
lnsize	-0.4917* (0.2892)	-0.4917* (0.2892)
Fixed year effect	YES	YES
Individual fixed effects	YES	YES
_cons	14.6689** (5.9114)	14.6689** (5.9114)
N	2697.0000	2697.0000
R2	0.1113	0.1113

Note: The numbers in parentheses represent clustering standard errors, with * * *, * *, and * representing significance levels of 1%, 5%, and 10%, respectively

Considering the impact of the global COVID-19 epidemic in 2020, this paper chooses to eliminate the data of 2020 and re analyze the benchmark regression results. As shown in Table 7, it can be seen from the regression results that the R&D regression coefficient is still significantly positive, indicating that the benchmark regression results are robust.

(4) Tail truncation test

Table 8. Tailing and truncation processing

Variable	(1) ROA 1% before and after tail reduction	(2) ROA truncation before and after 1%
R&D	2.9449*** (0.7602)	2.4296*** (0.5939)
LEV	-0.8338** (0.3479)	-0.5493* (0.3084)
TU	1.0829** (0.4415)	0.7486* (0.3891)
GR	0.0276*** (0.0037)	0.0209*** (0.0038)
lnsize	-0.3980 (0.2497)	-0.2830 (0.2355)
Fixed year effect	YES	YES
Individual fixed effects	YES	YES
_cons	12.9759** (5.0981)	10.9247** (4.8074)
N	3248.0000	3183.0000
R2	0.1333	0.1151

Note: The numbers in parentheses represent clustering standard errors, with * * *, * *, and * representing significance levels of 1%, 5%, and 10%, respectively

To reduce the impact of outliers on the conclusions of this study, we chose to perform 1% truncation and truncation on the samples, as shown in Table 8. Specifically, tail reduction refers to replacing the sample values greater than the 99% percentile and less than the 1% percentile with the sample values of the 99% percentile and the 1% percentile, respectively; The truncation process replaces missing values with sample values greater than the 99% percentile or less than the 1% percentile, and re estimates the baseline regression using truncated and truncated samples to test the robustness of the research findings. The regression results are shown in columns (1) and (2) of the table. From the results, it can be seen that the regression results of columns (1) and (2) have not changed significantly from the baseline regression results after truncation and truncation. Therefore, it is considered that the baseline regression results are valid and the empirical conclusions are robust.

4.4. Heterogeneity test

Table 9. Different levels of dependent variables

Variable	(1) Small scale enterprises ROA	(2) Large scale enterprises ROE
R&D	4.0107*** (1.3378)	0.6554 (0.7855)
LEV	-1.4016 (0.9675)	0.9443 (3.2731)
TU	1.0071* (0.5595)	0.8126 (1.2164)
GR	0.0276** (0.0113)	0.0429*** (0.0056)
lnsize	-0.0697 (0.3825)	-1.8622** (0.7852)
Fixed year effect	YES	YES
Individual fixed effects	YES	YES
_cons	7.0447 (7.3198)	43.9145*** (16.8804)
N	1616.0000	1632.0000
R^2	0.1280	0.1529

Note: The numbers in parentheses represent clustering standard errors, with * * *, * *, and * representing significance levels of 1%, 5%, and 10%, respectively

This article divides the sample into two parts based on enterprise size for regression analysis: small-scale enterprises and large-scale enterprises. From the regression results in Table 9, it can be seen that R&D has a significant positive effect on the ROA of small-scale enterprises, while the promotion effect on the ROA of large-scale enterprises is not significant. Hypothesis three holds true. Possible reasons may be the flattened organizational structure and short decision-making chain of small businesses, which can quickly respond to market changes and transform research and development achievements into products or services. However, large enterprises have complex hierarchical structures, intricate internal processes, cross departmental coordination of research and development results, and long conversion cycles. Even with technological breakthroughs, the improvement effect of ROA may be diluted due to market positioning and delayed supply chain adjustments. The significant promotion of ROA for small and medium-sized enterprises by R&D investment is essentially the resonance effect between the "focus on innovation - rapid transformation - high-risk return" mechanism and the light asset structure; However, large enterprises are constrained by organizational inertia, resource dispersion, and diseconomies of scale, resulting in lower ROA elasticity for R&D investment. This law provides important decision-making basis for policy makers (such as targeted subsidies for small and medium-sized enterprise R&D) and investors (evaluating the innovation value of enterprises of different sizes).

5. Conclusions and recommendations

There is a positive correlation between R&D investment and corporate performance in specialized, refined, and innovative enterprises, but there is a lagged positive relationship, and the lag period is relatively short. R&D has a significant positive effect on the performance of small-scale enterprises, but the promotion effect on the performance of smaller, more refined, unique, and new enterprises is not significant.

Based on the above research conclusions, the following suggestions are proposed: formulate a "precision drip irrigation" policy and strengthen research and development support for specialized, refined, unique, and new small and medium-sized enterprises. In response to the efficient R&D investment but limited resources of specialized, refined, and innovative small and medium-sized enterprises, it is recommended that the government optimize existing policy tools and implement "precise support". One is to improve the pertinence and intensity of R&D subsidies. For small and medium-sized enterprises that break through key areas of technology (such as semiconductors and new materials), the subsidy ratio can be increased from 20% to 40% -50%, and the application and approval process can be simplified to reduce administrative costs for enterprises. The second is to build a "technology transformation through train" platform, led by the government to integrate the technical resources of universities and research institutes, targeted to match the needs of small and medium-sized enterprises, and accelerate the transformation of laboratory achievements into market-oriented products. The third is to establish a "R&D Risk Sharing Fund" to provide 30% -50% cost compensation for failed innovation projects of small and medium-sized enterprises, alleviate their concerns about "not daring to invest and unable to afford to invest", and truly play the role of policy support.

Establish a collaborative innovation mechanism for large, medium, and small enterprises to enhance the overall efficiency of R&D resource allocation. Based on the characteristics of low marginal benefits of R&D investment in large enterprises and strong flexibility in small enterprises, it is recommended to promote a collaborative model of "chain leader leading+specialized, refined, unique and new supporting". On the one hand, leading enterprises (such as automobile and equipment manufacturers) are required to drive at least three specialized and innovative enterprises to participate in key technology research and development projects when applying for government R&D projects, and pay them a share of 5% -10% of the commercialization benefits of R&D results. On the other hand, encourage large enterprises to open up experimental equipment, testing platforms and other resources to small and medium-sized enterprises, and use "R&D resource sharing vouchers" to offset taxes and fees, forming an innovative ecosystem of "big leading small, small supplementing big".

Establish a dynamic evaluation system for the innovation sustainability of specialized, refined, and innovative enterprises. To prevent enterprises from falling into development bottlenecks due to excessive reliance on a single technological path, it is recommended to set an "innovation health" indicator at the policy level: firstly, to include "diversity of technological reserves" in the specialized and innovative certification standards, and suspend subsidies for those who fail to meet the standards; Secondly, it is mandatory for companies to disclose their "R&D investment structure" (such as the proportion of basic research and applied research) and issue warnings to companies with obvious short-term utilitarian tendencies; The third is to develop a government level "innovation risk assessment model" that automatically generates customized transformation suggestions based on data such as enterprise patent distribution and cooperation networks, guiding enterprises to build sustainable innovation capabilities.

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