Review of Economic Assessment

Homepage: https://www.anserpress.org/journal/rea

New Quality Productivity, Institutional Environment and Sustained Firm Innovation

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ABSTRACT

This paper investigates the impact of new quality productivity on corporate innovation, and empirically analyzes it using A-share data from 2012-2022. New quality productivity, which includes emerging industries, future industries and digital transformation of traditional industries, has a significant positive effect on corporate innovation. The study shows that new quality productivity promotes innovation by enhancing innovation incentives and improving ESG performance. Improvements in the institutional environment can enhance its role in promoting innovation. It is recommended to enhance new quality productivity, stimulate innovation in SMEs, focus on ESG performance and develop differentiated strategies to support sustained innovation in corporate technology.

KEYWORDS

New Quality Productivity; Institutional Environment; Continuous Innovation; Innovation Incentives

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ISSN
doi: 10.58567/rea03040002

Received 4 December 2024; Accepted 7 January 2025; Available online 16 January 2025; Version of Record 15 December 2024

1. Introduction

In September 2023, General Secretary Xi Jinping first put forward the important concept of "new quality productivity" during his visit and research in Heilongjiang, and in March 2024, during the deliberation of the Jiangsu delegation, the General Secretary pointed out that the development of new quality productivity should be led by scientific and technological innovation, and should be coordinated to promote the upgrading of traditional industries, the growth of new industries, and the cultivation of future industries, and to strengthen the deep fusion of scientific and technological innovation and industrial innovation. innovation and industrial innovation, and actively promote the development of new productivity. The definition of new quality productivity in the government report not only covers emerging industries and future industries, but also emphasises the upgrading and transformation of traditional industries, especially the promotion of the innovative development of digital economy. This policy orientation aims to achieve revolutionary technological breakthroughs, innovative allocation of production factors, and in-depth transformation and upgrading of industries through the key driving force of "innovation", which in turn will give rise to "high-quality" workers, labour materials, labour objects and their optimal combinations, ultimately leading to total factor productivity (TFP) improvement. Ultimately, the "advanced productivity" of total factor productivity will be formed. In this context, enterprises, as the micro-main body of economic development, have become a key indicator of their competitiveness in terms of their ability to sustain innovation. The proposal of new quality productivity provides enterprises with unprecedented development opportunities, and at the same time, it also puts forward higher requirements for their continuous innovation ability.

At present, our economy is facing an important period of transformation and upgrading. Over the past few decades, China's economy has grown at a high rate and made remarkable achievements. However, as economic development has entered a new normal, the traditional crude growth mode has become difficult to adapt to the development needs of the new era. At the same time, the global economic situation is complex and volatile, and international competition is becoming increasingly fierce, which requires China's economy to accelerate transformation and upgrading to achieve high-quality development. The national "14th Five-Year Plan" and the 2035 Vision Outline clearly point out that innovation is the core of modernisation, and emphasise the need to accelerate the construction of an innovation-led industrial system and promote high-quality development. The emergence of new quality productivity provides an important path for enterprises to achieve transformation and upgrading. Through the development of emerging industries, cultivation of future industries, and promotion of the digital transformation of traditional industries, enterprises can continuously improve their innovation ability and core competitiveness. Therefore, it is of great significance to study the impact of the development of new quality productivity on the continuous innovation of enterprises, in order to upgrade the industrial structure and enhance the competitiveness of enterprises. At present, relevant research mainly focuses on the theoretical level, and empirical research is relatively scarce. Based on this, this paper uses the financial statement data of A-share listed enterprises from 2012 to 2022 to empirically test the impact and transmission mechanism of developing new quality productivity on enterprises' continuous innovation, and puts forward policy recommendations based on the research findings to help enterprises adapt to the market development trend faster and achieve sustainable development.

2. Literature Review and Research Hypotheses

2.1. Literature review

2.1.1. Relevant studies on new quality productivity

Compared with traditional productivity, new quality productivity adapts to the requirements of the new era,

gathers new knowledge, masters new processes, develops new products, contains new kinetic energy, expands new markets, and meets the new needs of the people, reflecting a qualitative leap in productivity development and enrichment of connotation (Luo, 2024). Understanding new quality productivity must be based on the new phenomena, new problems and new reforms of China's economic development, and effectively deal with the dynamic balance between the supply side and the demand side (Zhang, 2024), productivity and production relations (Gao, 2023), capital and workers' income, and the real economy and finance. Regarding the research on indicator measurement of new quality productivity, at the macro level, some scholars have constructed a comprehensive evaluation indicator system, which is used to assess the level of new quality productivity from four key dimensions, namely, the industrial innovation system, the economic support system, the talent supply system, and the future industrial development system (Wu et al., 2024). Based on the micro level, some scholars have constructed a micro enterprise level indicator system based on the theory of the two factors of productivity, from the four sub-factors of live labour, materialised labour, hard technology and soft technology, and used the entropy value method to measure the new quality productivity (Song et al., 2024). Some scholars have also constructed a comprehensive system of indicators in the three dimensions of green productivity, technological productivity and digital productivity, and used the improved entropy weight-TOPSIS method to measure the new quality productivity (Lu et al., 2024).

Most academic research on new quality productivity focuses on the driving mechanism, characteristics of the elements and the role of empowerment. In today's globalisation, culture has become one of the key factors to measure the comprehensive national power of a country, and is as important as economy and politics. The strength of cultural soft power directly affects the development direction of the country and becomes a key factor to promote the leap of productivity (Guo, 2024). Based on the factor characteristics of new quality productivity, Zhang et al. (2024) explored the spatial and temporal characteristics of the development of China's new quality productivity by using the Dagum Gini coefficient method, the kernel density estimation method, and the global and local Moran indices, and found that the overall difference in China's new quality productivity and its internal differences in the eastern, central, and northeastern regions are on the rise, while the internal differences in the western region are on the decline. In addition, NPP empowers different aspects, for example, Zhang (2024) argues that digital NPP can help common prosperity by promoting the extension of the agricultural industry chain, in which the extension of the agricultural industry chain plays a partly intermediary role between digital NPP and common prosperity. Ren (2024) points out that the enabling role of new quality productivity is reflected in the construction of a modern economic system, the cultivation of new kinetic energy and the enhancement of the quality of the supply system, which is a strategic task to achieve the new development of Chinese-style modernisation. In order to further promote the development of new productive forces, China should follow the dynamic evolutionary logic of "nurturing-generating-developing-diffusing-sustaining", and realise a dual balance between disruptive and progressive innovation. This requires optimising the organisational management model and fostering new production relations that are adapted to the development of new productive forces (Zeng et al., 2024).

2.1.2. A related study on continuous innovation in business

Scholars have been studying continuous innovation in enterprises from different perspectives. Within firms, some scholars have found that through employee stock ownership plans, firms are able to motivate their employees to improve their skills and knowledge, thus enhancing the firm's innovation capability and efficiency (Yushan, 2024). Continuous innovation mediates the relationship between technological diversification and firm resilience. Technological diversification enhances firms' adaptive capacity and strategic flexibility by promoting continuous innovation, which in turn affects firms' resilience and long-term stability in the face of adversity (Wang et al., 2024). Some scholars have also focused on national speciality and new small-giant listed companies and found that the

presence of academic executives has a positive effect on the promotion of continuous innovation (Cai et al., 2023). In addition, digital transformation stimulates innovation vitality and motivation within the enterprise by building an innovation incentive mechanism. Regionally, the relationship between regional dispersion and innovation persistence shows an inverted U-shaped feature, i.e., increasing regional dispersion to a certain extent can promote innovation, but beyond a certain point, its positive effect diminishes (Jia et al., 2021); for the ways to promote enterprises' persistent innovation, some scholars have mentioned that resource patchwork is a key mediator of enterprises' persistent innovation. SMEs promote innovative activities through exploratory and exploitative resource patchwork, i.e., reconfiguring and utilising existing resources as well as exploring new resources (Zheng et al., 2024). Zhang et al. (2022) argue that integrating key technologies and innovation resources in the industry through continuous restructuring and mergers and acquisitions, as well as converging and integrating global innovation resources and integrating into the global innovation chain and industrial chain, are important ways to enhance the innovation capability of enterprises. At the same time, attracting and cultivating high-end talents through digital platforms and tools can provide intellectual support for enterprise innovation (Ling et al., 2024). In order to cultivate the sustained innovation capability of enterprises, both the immediate response strategy through strengthening the current innovation investment and the historical reserve strategy through utilising the historical innovation accumulation can significantly enhance the value reengineering level of distressed enterprises (He et al., 2024).

2.1.3. Literature Review

Although there has been a lot of literature exploring the issue of new quality productivity or sustained innovation of enterprises, there is still a relative lack of literature examining the relationship between new quality productivity and sustained innovation of enterprises from the perspective of microdata. As the pig's trotters of a country's innovation capability, empirical studies with enterprises as the object of study can provide more reliable empirical evidence for the relationship between new quality productivity and sustained innovation of enterprises. Based on this, and without filling the gap in the existing literature, this paper explores the impact of developing new quality productivity on firms' sustained innovation based on the existing literature. Possible marginal contributions include: (1) Most of the current research on NQP focuses on the theoretical level, but this paper uses "high-tech", "high-performance", "high-quality" and "advanced productivity" as seed terms. Advanced Productivity" as the seed vocabulary, combined with the connotation of enterprise science and technology innovation, with the help of Word2Vec neural network model, to complete the construction of the dictionary of new quality productivity, which provides ideas and methods for future research. (2) The article analyses the unique impact of NQP on the sustainable innovation of enterprises from both direct and indirect perspectives. Compared with the traditional concept of productivity, the new quality productivity focuses more on innovation, change and breakthrough, which not only focuses on the innovation of technology, but also emphasises the innovation of organisation, management and market. (3) Through the heterogeneity analysis, the impact of NQP on the sustainable innovation of different enterprises is examined from both macro and micro perspectives, which provides empirical evidence for enterprises to break through the traditional model and achieve sustainable development.

2.2. Research hypotheses

The core of new quality productivity lies in the innovation and progress of technology. With the rapid development of science and technology, new technologies, processes, materials and modes are emerging, and new quality productivity provides enterprises with more efficient, intelligent and environmentally friendly production methods (Yang, 2024). The application of these innovative technologies not only improves productivity and product quality, but also inspires enterprises to explore new business models and market opportunities. In addition, the

development of new quality productivity promotes organisational optimisation and talent cultivation within enterprises (Xu et al., 2024). Driven by new quality productivity, firms need to adjust and optimise their organisational structure to adapt to the rapidly changing market and technological environment. This includes promoting cross-functional collaboration, improving decision-making flexibility and responsiveness, and building a more open and innovative corporate culture. As NQP continues to mature and be applied, firms are able to develop more competitive products and services and enter new market segments. At the same time, NQP also promotes the integration and optimisation of global supply chains (Zhang, 2024), enabling enterprises to make more effective use of global resources and improve the international competitiveness of their products and services. In addition, enterprises can introduce foreign advanced technology and management experience through international co-operation to accelerate the pace of their own technological innovation, and at the same time, they can also promote their innovations to the international market to achieve wider application and impact. Based on the above analysis, this paper puts forward the first research hypothesis:

HI: Developing new qualitative productivity can help promote sustained innovation in enterprises

The development of NPPs can have an innovation incentive effect on firms. Firstly, through the development of NQP, firms can adopt and master cutting-edge technologies (Xu et al., 2024), thus gaining a leading position in the market. This technological advantage not only brings higher profit margins for enterprises, but also meets consumer demand for high-quality and high-efficiency products and services, which in turn stimulates enterprises' willingness to innovate. Secondly, the cultivation of new quality productivity promotes a change in corporate culture (Luo, 2024), encouraging employees to actively innovate and experiment. An environment that supports innovation and tolerates failure can stimulate the creativity of employees, promote new ideas and solutions within the enterprise, and bring continuous innovation vitality to the enterprise. Furthermore, government support for new quality productivity, including policies such as tax incentives and capital subsidies, reduces the economic risks and costs of innovation for enterprises (Feng, 2024). These incentives provide enterprises with the necessary resources, optimise the innovation environment and encourage long-term R&D investment and innovation activities. Based on the above analysis, this paper proposes the second research hypothesis:

H2: Developing new qualitative productivity will promote continuous innovation in firms through innovation incentive effects.

The development of NQP can lead to improvements in three aspects of firms' environmental, social and governance performance. Firstly, NQP usually involves clean energy, environmentally friendly materials and sustainable production processes, and these practices reduce the negative impact on the environment (Ren, 2024), which helps to reduce firms' innovation costs and innovation risks. Secondly, the development of NQP helps to enhance the contribution of firms to the well-being of society, and firms build a good public image through the fulfilment of their social responsibilities, which not only enhances employee satisfaction and loyalty, but also attracts more customers and partners, and creates a positive social environment for the firms' innovation activities (Zhang, 2024). Furthermore, the advancement of new quality productivity is often accompanied by the optimisation of corporate governance structures, such as enhanced transparency, decision-making efficiency and risk management capabilities. Excellent governance practices enhance the trust of investors and other stakeholders and provide broader resources and support for corporate innovation (Xuexin, 2024). Based on the above analyses, this paper proposes the third research hypothesis.

H3: Developing new qualitative productivity will promote sustained innovation in firms by improving their ESG performance

The institutional environment creates an ecosystem conducive to innovation for firms by providing support in a variety of areas, such as intellectual property protection, policy support, financial market development, education and training systems, fair competition policies, technological infrastructure, social and cultural incentives, clear

regulatory frameworks, and international co-operation and exchanges (Wu, 2023). In such an environment, firms are able to obtain the necessary resources and confidence to reduce innovation costs, cultivate innovative talent, reduce uncertainty in the innovation process, and, guided by market demand and consumer preferences, more actively adopt new quality productivity and engage in sustained innovation activities to adapt to changing market and technological conditions. This reinforcing effect of the institutional environment makes it more likely for enterprises to achieve continuous innovation in the face of new-quality productivity and promotes the common development of enterprises and society (Guan, 2024).

H4: Other things being equal, the institutional environment reinforces the impact of new quality productivity on firms' continued innovation.

Based on the above analysis, the framework diagram of this paper is shown in Figure 1.

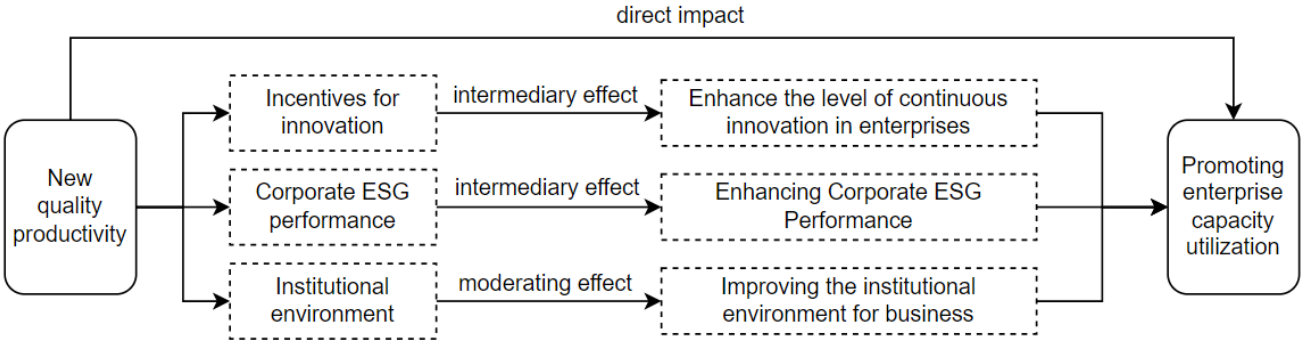

Figure 1. Developing new qualitative productivity.

3. Research design

3.1. Modelling

Based on the above analyses, the following basic econometric model is constructed in order to test the effect of new quality productivity on the innovation activities of enterprises:

$$lnopt_{i,t} = \alpha_0 + \alpha_1 Npro_{i,t} + \sum_{k=1}^{n} \eta_k Control_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

where i denotes an individual firm and t denotes a year;$lnopt_{i,t}$ denotes the innovation performance of firm i in year t; $Npro_{i,t}$

denotes the level of development of firm i's new qualitative productivity in year t; $Control_{i,t}$ denotes a set of control variables;μ_i denotes individual firm fixed effects;γ_t for time fixed effects;$\varepsilon_{i,t}$ is a random perturbation term.

3.2. Description of variables

3.2.1. Explained variables

In this paper, enterprise sustained innovation (lnopt) is selected as an explanatory variable. Drawing on the study of Ling Shixian et al. and referring to the study of Ling Shixian (2024) and others, it reflects the sustained innovation capability of enterprises by comparing the patent output data of the current period and the previous

period.

$$lnopt_t = \ln\left[\frac{Patentapply_t + Patenrplay_{t-1}}{Patentapply_{t-1} + Patenrplay_{t-2}} \times (Patentapply_t + Patenrplay_{t-1}) + 1\right] \quad (2)$$

$lnopt_t$ is the sustained innovation of the firm in year t of the listed company, and $Patentapply$ is the sum of the number of applications for invention patents and utility model patents. t-1 and t-2 are the previous year and the previous two years of the sample year, respectively.

3.2.2. Explanatory variables

The core explanatory variable in this paper is new quality productivity (Npro). In order to avoid endogeneity problems, this paper adopts text mining metrics to measure firms' new quality productivity in the following steps:

Firstly, "new quality productivity" is used as the seed word; secondly, "advanced productivity" is also used as the seed word based on the CCTV news' viewpoint on new quality productivity; the text of the annual report is screened, and it is found that "new quality productivity" has not appeared in the annual report disclosed up to 2022; "advanced productivity" has been partially used. The word frequency of "new quality productivity", "advanced productivity" has been part, so continue to expand the word frequency category, the three characteristics of the new quality productivity: "high-tech", "high-efficiency", "high-quality" and "advanced productivity" as the seed words. Thirdly, based on the four seed words, we use the Word2Vec neural network model to obtain the seed words using the python technique. Third, based on the four seed words, we obtain the similar words of the seed words by using the Word2Vec neural network model and python technology, and in order to improve the accuracy of the measurement, we only keep the words with higher similarity, for example, we exclude some high-tech company names to complete the lexicon construction; fourth, we mine the word frequency of the seed words and the similar words that appeared in the annual financial report +1 to take the natural logarithm to indicate the new quality productivity of the enterprise.

3.2.3. Control variables

The main control variables in this paper are management shareholding, equity concentration, firm size, two positions, percentage of independent directors, nature of ownership, salary incentives, type of audit opinion, and market intensity. Specific variables are defined as shown in Table 1:

Table 1. List of variable definitions.

categorisation	variable name	Variable Definition
independent variable	Npro	new quality productivity
implicit variable	lnopt	Continuous corporate innovation
	pms	Management shareholding
	con	shareholding concentration
	size	Enterprise size
	dual	two jobs in one
control variable	pid	Percentage of independent directors
	soe	Nature of property rights
	ci	Salary incentives
	audit	Type of audit opinion
	ms	market intensity

3.3. Data sources and descriptive statistics

In this paper, the financial statement data of A-share listed companies from 2010 to 2022 are selected as the research sample, and balanced panel data are constructed. In order to ensure the validity and stability of the sample, the samples of ST, *ST and PT listed companies with missing values and poor operation are excluded, and at the same time, the data of all the samples are shrunk by 1% up and down to get a total of 7,091 companies' observations. The data used in this study are obtained from Wind database and Cathay Pacific database.

The results of the descriptive statistical analysis of the variables show that the maximum value of sustained innovation of enterprises is 13.0559, the minimum value is 0, and the mean value is 3.8291, which indicates that there are significant differences in sustained innovativeness among different enterprises. The maximum value of new quality productivity is 5.9026, the minimum value is 0, the mean value is 3.3673, and the standard deviation is 0.7745, which also indicates that there is a difference in the degree of development of new quality productivity among different enterprises.

The Pearson correlation coefficients between the variables show that new quality productivity is positively correlated with sustained innovation in enterprises at the 1 per cent level, indicating that the development of new quality productivity is conducive to the promotion of sustained innovation in enterprises. The correlation coefficients between the variables are less than 0.536, indicating that there is no problem of multicollinearity between the variables.

Table 2. Basic statistical characteristics of the main variables.

VarName	Obs	Mean	SD	Min	Median	Max
lnopt	7090	3.5323	2.3338	0.0000	3.8291	13.0559
Npro	7090	3.3387	0.7745	0.0000	3.3673	5.9026
pms	7090	0.1505	0.1960	0.0000	0.0303	0.8918
con	7090	33.4426	14.3067	2.1969	31.0967	87.4563
size	7090	22.3656	1.3197	18.3696	22.1620	28.5483
dual	7090	0.3130	0.4637	0.0000	0.0000	1.0000
pid	7090	0.3855	0.0759	0.2000	0.3750	0.8000
soe	7090	0.2992	0.4579	0.0000	0.0000	1.0000
ci	7090	15.5223	0.7028	13.0448	15.5025	18.9415
audit	7090	0.9766	0.1512	0.0000	1.0000	1.0000
ms	7090	0.1685	0.2075	0.0064	0.1321	13.5580

Table 3. Correlation analysis.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) lnopt	1.000										
(2) Npro	0.129***	1.000									
(3) pms	-0.077***	0.053***	1.000								
(4) con	0.093***	-0.122***	-0.107***	1.000							
(5) size	0.269***	0.131***	-0.380***	0.219***	1.000						
(6) dual	-0.056***	0.060***	0.220***	-0.020*	-0.194***	1.000					
(7) pid	0.018	0.011	0.121***	0.062***	-0.037***	0.103***	1.000				
(8) soe	0.141***	-0.089***	-0.471***	0.210***	0.434***	-0.310***	-0.123***	1.000			
(9) ci	0.198***	0.219***	-0.178***	0.006	0.536***	-0.115***	-0.041***	0.150***	1.000		
(10) audit	0.070***	0.001	0.029**	0.077***	0.074***	0.000	0.016	0.034***	0.068***	1.000	
(11) ms	-0.067***	-0.057***	0.109***	-0.076***	-0.243***	0.081***	0.025**	-0.137***	-0.059***	-0.141***	1.000

*** p<0.01, ** p<0.05, * p<0.1*

4. Empirical testing and analysis of results

4.1. Baseline regression results

Table 4 reports the results of the benchmark regression on the impact of new quality productivity on firms' continuous innovation. Column (1) shows that the coefficient on new quality productivity is 0.389, which is significantly positive at the 1 per cent level when no control variables are included. Column (2) reports the effect of all control variables on firms' continuous innovation. Column (3) shows that the regression coefficient of new quality productivity is 0.313, which is still significantly positive at the 1 per cent level when all control variables and industry and year fixed effects are added, indicating that new quality productivity has a significant positive facilitating effect on firms' continuous innovation. The results in Table 3 indicate that the development of new quality productivity significantly promotes sustained innovation of enterprises, which supports the research hypothesis 1. The possible reason for this is that the development of new quality productivity requires enterprises to continuously pursue new technologies, processes and methods in order to optimise the production process. Improve production efficiency, thus promoting the technological progress and industrial upgrading of enterprises. At the same time, the new quality productivity emphasises the cross-fertilisation of multiple fields and technologies, which allows enterprises to break the boundaries of traditional industries and realise cross-field co-operation and innovation between enterprises.

The results of control variables show that management shareholding, equity concentration, firm size, percentage of independent directors, nature of ownership, salary incentives, and type of audit opinion are significantly and positively related to firms' continuous innovation.

Table 4. Baseline regression results.

	(1) lnopt	(2) lnopt	(3) lnopt
Npro	0.389***		0.313***
	(0.039)		(0.038)
pms		0.432***	0.348**
		(0.155)	(0.154)
con		0.004**	0.005***
		(0.002)	(0.002)
size		0.407***	0.382***
		(0.028)	(0.029)
dual		-0.042	-0.062
		(0.059)	(0.059)
pid		0.734**	0.687**
		(0.346)	(0.345)
soe		0.297***	0.336***
		(0.071)	(0.070)
ci		0.324***	0.303***
		(0.047)	(0.047)
audit		0.574***	0.563***
		(0.174)	(0.173)
ms		0.118	0.159
		(0.131)	(0.130)
Year fixed effects	YES	YES	YES
industry fixed effect	YES	YES	YES
N	7090	7090	7090
R^2	0.078	0.148	0.156

*Note: *, **, *** indicate significant at the 1 percent, 5 percent and 10 percent levels, respectively, with standard errors in parentheses. The following table is the same*

4.2. Robustness tests

4.2.1. Substitution of explanatory variables

In order to prove the robustness of the above conclusions, this paper refers to the study of Song Jia (2024) et al. and adopts the total factor productivity of enterprises accounted for by the LP method as a measure of new quality productivity. From the regression results in column (1) of Table 5, the total factor productivity coefficient is significantly positive at the 5 per cent level, indicating that after replacing the explanatory variables, the development of new-quality productivity has a significant contributing effect on firms' sustained innovation, and Hypothesis 1 of this paper is initially verified.

Table 5. Robustness Tests.

	(1) Interpretation of substitutions variant	(2) Replacement is explained variant	(3) Exclusion of anomalous years	(4) Remove anomalies municipalities
Npro	0.126***		0.345***	0.269***
	(0.014)		(0.042)	(0.042)
TFP_LP		0.103**		
		(0.051)		
pms	0.159***	0.430***	0.269	0.317*
	(0.057)	(0.155)	(0.173)	(0.169)
con	0.003***	0.004**	0.005**	0.004*
	(0.001)	(0.002)	(0.002)	(0.002)
size	0.749***	0.350***	0.394***	0.282***
	(0.011)	(0.040)	(0.033)	(0.034)
dual	0.017	-0.040	-0.007	-0.040
	(0.022)	(0.059)	(0.067)	(0.064)
pid	0.376***	0.765**	0.513	0.527
	(0.128)	(0.347)	(0.395)	(0.386)
soe	0.041	0.289***	0.399***	0.442***
	(0.026)	(0.071)	(0.081)	(0.077)
ci	0.366***	0.306***	0.311***	0.390***
	(0.017)	(0.048)	(0.053)	(0.052)
audit	0.444***	0.548***	0.700***	0.628***
	(0.066)	(0.176)	(0.192)	(0.184)
ms	0.812***	0.157	0.376	0.126
	(0.083)	(0.134)	(0.243)	(0.136)
Year fixed effects	YES	YES	YES	YES
industry fixed effect	YES	YES	YES	YES
N	6811	7075	5377	5664
R^2	0.677	0.148	0.167	0.137

4.2.2. Substitution of explanatory variables

To further capture the quality of sustained innovation, the natural logarithm of the amount of firms' R&D investment is used to measure firms' sustained innovation, drawing on Mei (2024) and others. The results are shown in column (2) of Table 5, and the coefficient of Npro is 0.126 and significant at the 1 per cent level, indicating the robustness of the benchmark regression.

4.2.3. Exclusion of anomalous years

Due to the impact of the new crown epidemic in 2020-2022, there is a certain degree of instability in the development of enterprises. Therefore, this paper excludes 2020, 2021, 2022 and other years affected by the new crown epidemic for regression again, the regression results are shown in column (3) of Table 5. It can be found that the coefficients of the core explanatory variables are significantly positive at the 1 per cent level, which indicates the robustness of the core argument that "new quality productivity can significantly promote sustained innovation in enterprises".

4.2.4. Excluding anomalous cities

Considering that the specificity of the administrative level may have some impact on the regression results, this paper draws on Zhang (2024) and others to exclude the samples from the four municipalities of Shanghai, Beijing, Tianjin and Chongqing, and the regression results are shown in Column (4) of Table 5, where it is found that the

regression results are still significant, proving once again that the benchmark regression is robust.

4.3. Endogeneity test

4.3.1. GMM estimation

Although the benchmark regression controls for industry and year fixed effects, the empirical results of this paper may still be affected by some unobservable factors as well as the reverse causality between new-quality productivity and firms' sustained innovation, for example, firms with a high level of sustained innovation can often continuously improve their productivity and quality by introducing new technologies and developing new products, which are technologically innovative, and can be directly transformed into productivity This technological innovation can be directly transformed into productivity, which in turn affects the new quality productivity level of the firm. In addition, omitted variables can also lead to endogeneity problems, in order to alleviate these problems, this paper refers to Han (2024) et al. and adopts differential GMM to test the causality between the two, and the results are shown in Table 6. Firstly, the Hansen test of the GMM model fails the original hypothesis at the 10 per cent significance level, that is, the instrumental variables do not suffer from over-identification problems. It can be found that the level of new quality productivity still significantly contributes to the level of continuous innovation of firms after considering the endogeneity problem.

Table 6. Endogeneity test.

variant	(1) differential GMM	(2) Heckmman two-stage regression
lnopt	--	0.252** (0.123)
IMR	--	-1.421* (2.717)
L.lnopt	0.441*** (0.113)	--
control variable	be	be
Year fixed effects	be	be
industry fixed effect	be	be
sample size	7090	7090
AR(2) P-value	0.192	--
Hansen test P-value	0.765	--
Wald chi2	--	202.73 (0.000)

4.3.2. Heckman two-stage regression

In this paper, we refer to the research idea of Yuhao (2024) et al. and use the Heckman two-stage model to deal with the endogeneity problem due to self-selection bias. The first stage uses the probit model to predict the probability of selective value taking and get the inverse Mills ratio (IMR) to test whether the control variable in the previous period has an effect on the firm's new qualitative productivity (Npro), and in the second stage the IMR as a control variable is added to the model to correct the selectivity bias to get more accurate estimation, and the results are shown in column (2) of Table 6. The results show that the regression result of new quality productivity on firms' continuous innovation is significantly positive, indicating that the model setting can effectively overcome the endogeneity problem.

4.4. Analysis of intermediation effects

Based on the previous analyses, this paper argues that the development of new quality productivity will

promote firms' continuous innovation through innovation incentives and ESG performance. In order to test the above mechanism of action, this paper constructs a stepwise method mediation effect model based on model (1):

$$M_{i,t} = \alpha_0 + \alpha_1 Npro_{i,t} + \sum_{k=1}^{n} \eta_k Control_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t} \quad (3)$$

$$lnopt_{i,t} = \alpha_0 + \alpha_1 Npro_{i,t} + \alpha_2 M_{i,t} + \sum_{k=1}^{n} \eta_k Control_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t} \quad (4)$$

where M is the mediating variable and the other variables are the same as before.

4.4.1. Incentives for innovation

New quality productivity is often accompanied by the application of new technologies, which can inspire enterprises to develop new products and services to meet new market and consumer needs. Through continuous innovation, enterprises are able to develop new market areas and increase market share, which in turn improves the level of continuous innovation. Therefore, this paper refers to the study of Ling Shixian (2024) and takes the ratio of research and development investment to operating income (R&D) as the corporate innovation incentive variable, and the regression results are shown in columns (1) and (2) of Table 7. The results in column (1) show that the estimated coefficient of new quality productivity on firms' innovation incentives (R&D) is 0.709, which is significant at the 1% level, indicating that the development of new quality productivity can significantly increase the level of firms' innovation incentives. The results in column (2) show that the estimated coefficient of corporate innovation incentives (R&D) on firms' sustained innovation is 0.029, which is significant at the 1 per cent level, indicating that corporate innovation incentives (R&D) play a mediating effect between new-quality productivity and firms' sustained innovation, which verifies hypothesis 2.

4.4.2. Corporate ESG performance

The development of new quality productivity can not only directly promote the technological progress and product innovation of enterprises, but also create a more stable and favourable external environment for enterprises by enhancing their ESG performance, thus providing a solid foundation for their continuous innovation. In this paper, the annual average of firms' ESG scores is used as the mediating variable of ESG performance, and the regression results are shown in columns 3 and 4 of Table 7. The results in column (3) show that the estimated coefficient of new quality productivity on firms' ESG performance (ESG_score) is 0.030, which is significant at the 10 per cent level, indicating that the development of new quality productivity can significantly improve the level of firms' ESG performance. The results of column (2) show that the estimated coefficient of enterprise ESG performance (ESG_score) on enterprise sustained innovation is 0.135, which is significant at the 1% level, indicating that enterprise ESG performance (ESG_score) plays a mediating effect between new quality productivity and enterprise sustained innovation, which verifies hypothesis 3.

Table 7. Mediation effect test.

	(1) R&D	(2) lnopt	(3) ESG_score	(4) lnopt
Npro	0.709***	0.274***	0.030*	0.328***
	(0.089)	(0.039)	(0.017)	(0.038)
pms	1.276***	0.278*	0.538***	0.241
	(0.362)	(0.157)	(0.069)	(0.157)

con	-0.016***	0.005**	0.004***	0.005**
	(0.005)	(0.002)	(0.001)	(0.002)
size	-0.386***	0.386***	0.111***	0.388***
	(0.069)	(0.030)	(0.013)	(0.029)
dual	0.539***	-0.049	-0.085***	-0.047
	(0.139)	(0.060)	(0.026)	(0.059)
pid	0.947	0.604*	1.238***	0.483
	(0.812)	(0.352)	(0.155)	(0.350)
soe	0.664***	0.335***	0.128***	0.320***
	(0.167)	(0.072)	(0.031)	(0.071)
ci	0.781***	0.294***	0.229***	0.241***
	(0.111)	(0.048)	(0.021)	(0.048)
audit	1.676***	0.444**	0.778***	0.596***
	(0.421)	(0.183)	(0.086)	(0.194)
ms	21.046***	-0.041	-0.635***	0.787***
	(0.522)	(0.252)	(0.099)	(0.225)
R&D		0.029***		
		(0.005)		
ESG_score				0.135***
				(0.027)
Year fixed effects	YES	YES	YES	YES
industry fixed effect	YES	YES	YES	YES
N	6736	6736	6946	6946
R^2	0.341	0.151	0.144	0.159

4.5. Moderating effects test

This paper uses the following model to test the moderating effect of the institutional environment based on the benchmark regression:

$$lnopt_{i,t} = \alpha_0 + \alpha_1 Npro_{i,t} + \alpha_1 Npro_{i,t} \times IE_{pt} + \sum_{k=1}^{n} \eta_k Control_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t} \quad (5)$$

where IE_{pt} represents the institutional environment of the province p where the firm is located in period t. See equation (1) for the explanation of the other variables.

Next, this paper tests the moderating effect of institutional environment between new quality productivity and firm sustained innovation, and the results are shown in Table 8. The results show that the coefficients of the interaction terms of new-quality productivity, new-quality productivity and firm sustained innovation are all significantly positive, indicating that the effect of new-quality productivity on firm sustained innovation is positively moderated by the institutional environment. This paper further analyses the impact of five dimensions of institutional environment - the relationship between government and market (IE_1), the development of non-state economy (IE_2), the degree of development of product market (IE_3), the degree of development of factor market (IE_4), and the development of market intermediary organisations and the legal institutional environment (IE_5) on the impacts of new-quality productivity and firms' sustained innovation. Therefore, where the institutional environment is better, the promotion effect of new quality productivity on firms' continuous innovation is strengthened, verifying Hypothesis 4.

Table 8. Moderating effect test results of institutional environment.

	(1) lnopt	(2) lnopt	(3) lnopt	(4) lnopt	(5) lnopt	(6) lnopt
Npro	0.314***	0.239**	0.488*	0.514***	0.180**	0.329**
	(0.128)	(0.106)	(0.264)	(0.142)	(0.042)	(0.128)
IE	0.042***					
	(0.007)					
Npro×IE	0.023***					
	(0.002)					
IE_1		0.078**				
		(0.058)				
Npro×IE_1		0.030**				
		(0.015)				
IE_2			0.076***			
			(0.009)			
Npro×IE_2			0.015***			
			(0.003)			
IE_3				0.098**		
				(0.053)		
Npro×IE_3				0.025**		
				(0.011)		
IE_4					0.013**	
					(0.003)	
Npro×IE_4					0.011***	
					(0.001)	
IE_5						0.037***
						(0.008)
Npro×IE_5						0.011***
						(0.002)
control variable	containment	containment	containment	containment	containment	containment
Year fixed effects	YES	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES	YES
N	7079	7079	7079	7079	7079	7079
R^2	0.157	0.156	0.157	0.157	0.157	0.157

5. Summary and Implications

The report of the twentieth CPC National Congress points out that innovation is the first driving force leading development, and that it is necessary to open up new fields and new tracks of development and to continuously shape new dynamics and new advantages in development. Continuous innovation occupies a central position in the overall situation of China's modernisation. A large number of studies have examined the impact of enterprise management structure and development background on continuous innovation, but few scholars have explored the impact of new quality productivity level on enterprise continuous innovation. By mining the seed vocabulary of new quality productivity through Python technology and manually arranging the database of new quality productivity of A-share listed companies with the help of Word2vec neural network model, this paper empirically analyses the specific impact of the level of new quality productivity on the continuous innovation of the enterprise and the mechanism of its action. The main findings of this paper: ① The development of new quality productivity has a significant role in promoting enterprise sustained innovation; ② The development of new quality productivity can promote the continuous innovation of enterprises through the innovation incentive effect and the enhancement of enterprise ESG performance; ③ With the improvement of institutional environment, the promotion effect of new quality productivity on enterprise continuous innovation becomes more obvious.

Based on the above research, it can provide important lessons for developing countries such as India, China and Pakistan. The study provides policymakers, business managers and academic researchers in these countries with a new perspective that the development of new quality productivity (including emerging industries, future

industries and digital transformation of traditional industries) is an important way to promote sustainable innovation and economic growth. The significant positive effect of new quality productivity on firm innovation revealed by the study encourages firms in these countries to invest more in emerging technologies and digital transformation to enhance their core competitiveness. Improvements in the institutional environment were highlighted as being able to strengthen the role of new and qualitative productivity in promoting firm innovation, implying that countries such as India, China and Pakistan need to continue to optimize the institutional environment in terms of intellectual property rights protection, policy support and financial market development in order to provide good external conditions for firm innovation.

Based on the above findings, this paper puts forward the following policy recommendations:

Firstly, we should correctly grasp the new qualitative state of the new quality productivity and improve the development of the new quality productivity. Research findings indicate that the development of new qualitative productivity has a significant contribution to sustained innovation by enterprises. Specifically, the government can encourage enterprises to adopt and master cutting-edge technologies, improve productivity and product quality through technological innovation, and develop new business models and market opportunities. Internally, enterprises can be encouraged to restructure their organisations, establish cross-sectoral collaboration mechanisms, and improve their flexibility in decision-making and speed of response to market changes. In addition, it can guide enterprises to explore new market demands, continuously adjust and optimise their products and services through market research and user feedback, and inject new kinetic energy into their continuous innovation.

Second, it stimulates innovation in SMEs and improves market competitiveness. Based on the findings of the study, the development of new quality productivity can promote continuous innovation by enterprises through the innovation incentive effect. Accordingly, government departments can establish and improve innovation ecosystems, including technology innovation platforms, business incubators, science and technology parks, etc., to provide enterprises with all-round innovation support. Measures such as education reforms and talent introduction programmes can also be adopted to cultivate and attract highly skilled personnel to provide human resources for enterprise innovation. In addition, enterprises' innovation activities can be monitored and evaluated on a regular basis, so as to keep abreast of the effects of innovation policies, provide a basis for policy adjustments, and help enterprises to sustain innovation in technology.

Third, focusing on corporate ESG performance and developing ESG practices. The study concludes that the development of new quality productivity can promote continuous innovation by enhancing corporate ESG performance. For the environment, enterprises should adopt clean energy and environmentally friendly materials and implement green production processes to reduce negative impacts on the environment. Meanwhile, by fulfilling their social responsibilities, such as providing fair labour conditions and participating in community services, companies can build a good public image and enhance their social performance. In addition, corporate governance can be strengthened to enhance transparency and decision-making efficiency, and risk management capabilities, in order to enhance the governance performance of enterprises and jointly promote the sustainable development of corporate innovation.

Fourthly, the institutional environment should be strengthened to stimulate market dynamism. Research findings indicate that as the institutional environment improves, the role of new quality productivity in promoting sustained innovation by enterprises becomes more obvious. Accordingly, the government should formulate clear industrial and innovation policies, specifying which fields and industries to support, and providing enterprises with a clear development direction and expectations. At the same time, the predictability of policies can be improved through an open and transparent policy formulation and implementation process, reducing uncertainty and compliance costs for enterprises. In addition, the effects of policies are regularly assessed, feedback from enterprises and the community is collected, and policies are adjusted and optimised in a timely manner to improve

the level of sustained innovation by enterprises.

Funding Statement

This research received no external funding.

Acknowledgments

Acknowledgments to anonymous referees' comments and editor's effort.

Conflict of interest

All the authors claim that the manuscript is completely original. The authors also declare no conflict of interest.

References

Cai, Shuangli, and Guo, Qiang. (2023). Academic executives and sustained innovation in specialized and new enterprises - The dual moderating effect of corporate incentives and risk-taking level. *Journal of Zhejiang Gongshang University*, 1, 120-134. https://doi.org/10.14134/j.cnki.cn33-1337/c.2023.01.011

Cao, Yushan, and Chen, Zhe. (2024). Employee Stock Ownership Plan and Corporate Sustained Innovation - Based on the Perspective of Human Capital Structure Upgrading. *Statistics and Decision Making*, 40(3), 179-183. https://doi.org/10.13546/j.cnki.tjyjc.2024.03.032

Feng, Yuan. (2024). New quality productivity and cost management: formation motives, paradigm characteristics and innovative development. Monthly *Journal of Finance and Accounting*, 8, 50-56. https://doi.org/10.19641/j.cnki.42-1290/f.2024.08.008

Gao, Fan. (2023). The logic, multidimensional connotation and significance of "new quality productivity". *Review of Political Economy*, (06), 127-145.

Guan, J. L., Huang, H., Wang, X., and Zhao, S. T. (2024). Study on the Driving Path of Small and Medium-sized Sports Enterprises' Innovative Development--An Analysis of the Grouping of Specialized, Specialized and New Sports Enterprises Based on the Institutional Environment. *Research in Sports*, 2, 106-118. https://doi.org/10.15877/j.cnki.nsic.20240428.004

Guo, Wanchao. (2024). On the Cultural Motivation of the Generation of New Quality Productivity--Constructing the Basic Framework of the Cultural Theory of New Quality Productivity. *Journal of Shandong University (Philosophy and Social Science Edition)*, 4, 25-34. https://doi.org/10.19836/j.cnki.37-1100/c.2024.04.003

Han, L., Zhang, R. S., and Zhao, F. (2024). New Quality Productivity Level Measurement and New Dynamics of China's Economic Growth. *Research on Quantitative and Technical Economics*, 6, 5-25. https://doi.org/10.13653/j.cnki.jqte.20240418.001

He, S. G., Chen, Y., Yang, C., and Yan, J. P. (2023). A study on the mechanism of continuous innovation's impact on recovery of distressed firms. *Research Management*, 12, 146-157. https://doi.org/10.19571/j.cnki.1000-2995.2023.12.015

Jia, Jianlin, and Fan, Xia. (2021). Research on the realization mechanism of corporate innovation sustainability based on external R&D innovation process. *China Science and Technology Forum*, 11, 78-87. https://doi.org/10.13580/j.cnki.fstc.2021.11.010

Li, Chun-Tao, Yan, Seo-Wen, Song, Min and Yang, Wei. (2020). Financial technology and corporate innovation - Evidence from New Third Board listed companies. *China Industrial Economics*, 1, 81-98. https://doi.org/10.19581/j.cnki.ciejournal.2020.01.006

Ling, Shixian, and Zhang, Xiaoyu. (2024). Impact of digital transformation on continuous innovation of enterprises - An analysis based on digital empowerment function and synergistic function mechanism. *Soft Science*, 8, 78-84+93. https://doi.org/10.13956/j.ss.1001-8409.2024.08.11

Liu, X. X., Cao, C. Z., and Kong, X. X. (2024). Theoretical Logic and Realization Path of New Quality Productivity Formation in the Context of Great Power Competition. *Journal of Chongqing University (Social Science Edition)*, 1, 145-155.

Lu, J., Guo, Z., and Wang, Y. P. (2024). The Development Level of New Productivity, Regional Differences and the Path to Improvement. *Journal of Chongqing University (Social Science Edition)*, 3, 1-17.

Luo, Jianwen. (2024). New quality productivity is a new development of Marxist productivity theory. *Academic Exchange*, 4,5-20.

Mei, J., Wu, X. Y., and Yang, D. H. (2024). A study on the innovation incentive effect of national industrial investment funds: Evidence from integrated circuit enterprises. *Research Management*, 2, 50-60. https://doi.org/10.19571/j.cnki.1000-2995.2024.02.006

Ren, P. P. (2024). Focus and tasks of empowering Chinese-style modernization with new quality productivity. *Economic Issues*, 5, 1-6. https://doi.org/10.16011/j.cnki.jjwt.2024.05.010

Song, J., Zhang, J. C., and Pan, Y. (2024). A study on the impact of ESG development on firms' new quality productivity-empirical evidence from Chinese A-share listed firms. *Contemporary Economic Management*, 6, 1-11. https://doi.org/10.13253/j.cnki.ddjjgl.2024.06.001

Tseng, X. J., and Tseng, K. (2024). New quality productivity: composite concept, developmental basis and systematic innovation path. *Journal of Shenzhen University (Humanities and Social Sciences Edition)*, 2, 5-15.

Wang, H. H., Li, Y. J., and Gong, Y. Y. (2024). Technological Diversification, Continuous Innovation and Firm Resilience - The Moderating Role of Dual Networks. *Science and Technology Progress and Countermeasures*, 1-12.

Wang, Yuhao and Ma, Yeqing. (2024). New quality productivity, firm innovation and supply chain resilience: micro evidence from Chinese listed companies. *Xinjiang Social Science*, 3, 68-82+177. https://doi.org/10.20003/j.cnki.xjshkx.2024.03.007

Wu, W.-S., Rong, Y., and Wu, H.-Q. (2024). Digital economy empowers the development of new quality productivity - A study based on the Yangtze River Delta city cluster. *Finance and Economics*, 4, 15-27.

Wu, Xiaojie, and Yang, Dandan. (2023). Corporate management capability, institutional environment and firms' global value chain position. *International Trade Issues*, 11, 158-174. https://doi.org/10.13510/j.cnki.jit.2023.11.008

Xu, Zheng, and Zhang, Jiao Yu. (2024). New quality productivity for the transformation and upgrading of manufacturing industry: value orientation, logical mechanism and important initiatives. *Journal of Social Sciences of Hunan Normal University*, 2, 104-113. https://doi.org/10.19503/j.cnki.1000-2529.2024.02.011

Yang, Guangyue. (2024). Research Status and Prospects of New Quality Productivity. *Economic Issues*, 5, 7-17. https://doi.org/10.16011/j.cnki.jjwt.2024.05.017

Yu, Yihua, Zhao, Qifeng, and Ju, Xiaosheng. (2018). Inventor executives and corporate innovation. *China Industrial Economics*, 3, 136-154. https://doi.org/10.19581/j.cnki.ciejournal.2018.03.008

Zhang, Chang. (2024). Digital New Quality Productivity, Agricultural Chain Extension and Common Wealth. *Statistics and Decision Making*, 9, 37-42. https://doi.org/10.13546/j.cnki.tjyjc.2024.09.006

Zhang, J. (2024). New Quality Productivity Theory Innovation and China's Practical Path. *Hebei Journal*, 3,127-134.

Zhang, Jiao-yu, and Luo, Li. (2024). New Productivity Enabling the Integration of Domestic and Foreign Trade: Logical Rationale and Relief Strategies. *International Trade*, 3, 22-29+41. https://doi.org/10.14114/j.cnki.itrade.2024.03.008

Zhang, J. M. (2024). Review of the ability of colleges and universities to serve the development of new quality productivity and reform of evaluation mechanism. *Journal of Hebei Normal University (Education Science Edition)*, 3, 15-23. https://doi.org/10.13763/j.cnki.jhebnu.ese.2024.03.003

Zhang, Shuman and Hara, Nagahiro. (2022). How to cultivate key core technology sustained innovation ability of manufacturing leading enterprises? *Research Management*, 4, 103-110. https://doi.org/10.19571/j.cnki.1000-2995.2022.04.012

Zhang, Shushan, and Dong, Xuda. (2024). Intelligent Transformation, Organizational Resilience and High Quality Development of Manufacturing Firms. *China Circulation Economy*, 1, 104-114. https://doi.org/10.14089/j.cnki.cn11-3664/f.2024.01.010

Zhang, Zhe, Li, Ji-Gang and Tang, Nuer-Halik. (2024). Measurement and spatial and temporal evolution of China's new quality productivity development level. *Statistics and Decision Making*, 9, 18-23. https://doi.org/10.13546/j.cnki.tjyjc.2024.09.003

Zheng, Ye, and Wu, Hao. (2024). How information-based policy tools promote sustained innovation in small and medium-sized enterprises (SMEs)-the mediating effect of resource patchwork and the moderating effect of innovation dynamics. *Science and Technology Progress and Countermeasures*, 17, 106-116.