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Research on the Impact Mechanism of Enterprise Innovation on the Sustainable Development of Time-honoured Enterprises: Evidence from China

Weifeng Xia[1,a,*], Zhaomei Wang[1,b], Jingkai Xu[1,c], Xinmei Zhang[1,d]

[1]*School of Management, Changchun Guanghua University, Changchun City, China*
[a]*xiaweifeng@ghu.edu.cn*, [b]*wangzhaomei@ghu.edu.cn*, [c]*xujingkai@ghu.edu.cn*,
[d]*zhangxinmei@ghu.edu.cn*
[*]*Corresponding author*

Abstract: *This study examines how enterprise innovation influences the sustainable development of China time-honoured enterprises. Time-honoured enterprises, significant carriers of Chinese traditional culture, face challenges adapting to market changes. By constructing an evaluation index system, this research analyses the impact of innovation on these enterprises' sustainable development. Using panel data from 2012 to 2022, the study employs a fixed-effect multiple linear regression model to explore the relationship between enterprise innovation and sustainable development. The findings indicate that innovation significantly enhances the sustainable development of these enterprises by improving investment efficiency.*

Keywords: *Time-honoured Enterprises, Enterprise Innovation, Sustainable Development*

1. Introduction

Enterprises, as the main actors in microeconomic activities, are fundamental to the sustainable development of the entire economy [1]. Time-honoured enterprises are crucial to China's commercial culture, combining commercial and cultural values, and have significantly contributed to the nation and society. However, they have struggled due to failing to adapt to environmental changes and competition from emerging brands. In March 2020, the Ministry of Commerce and eight other departments issued the "Opinions on Promoting the Innovative Development of Time-honoured Enterprises," outlining 13 measures to stimulate innovation and foster development. These measures aim to enhance the innovative development of these enterprises, promote independent brands, boost consumption, and strengthen cultural confidence, thereby better meeting people's needs for a better life. While innovation drives high-quality development, sustainable enterprise development is multidimensional, requiring a comprehensive approach. This paper focuses on China time-honoured enterprises, constructing an index system for their sustainable development. It posits that improving innovation capability significantly boosts enterprise investment, facilitating sustainable development, and provides a theoretical basis for enhancing the sustainable development capabilities of China time-honoured enterprises.

2. Theoretical Analysis and Research Hypotheses

2.1 Enterprise Innovation and Sustainable Development

Time-honoured enterprises are vital carriers of Chinese traditional culture and business practices, embodying deep historical, cultural, and social significance while playing a unique role in today's market economy. These enterprises sustain their core competitiveness and market position by preserving traditional craftsmanship and business philosophy, thus safeguarding brand value and cultural heritage [2]. They demonstrate a strong commitment to innovation, continually meeting evolving consumer needs through product innovation and service enhancements, which sustains their brand vitality and competitiveness in the dynamic market environment. In the field of modern economics, the ability to innovate is widely regarded as one of the core driving forces for enterprise growth. It is not only related to the operational efficiency and market competitiveness of enterprises, but also at the regional economic level, through the gathering and inheritance of the spirit of innovation, it shapes a unique business culture and innovation atmosphere, which has a far-reaching impact on the high-quality development of the

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regional economy [3].

Enterprise innovation plays a crucial role in the sustainable development of time-honoured enterprises. It promotes the sustainable development of time-honoured enterprises by enhancing innovation ability and improving enterprise operation efficiency and market competitiveness. Accordingly, the following hypotheses are proposed:

Hypothesis 1: Enterprise innovation could promote the sustainable development of time-honoured enterprises.

2.2 Enterprise Innovation, Investment Efficiency, and Sustainable Development

Enterprise innovation is the rational allocation of long-term resources to improve efficiency in technology, products, processes, and procedures, thereby increasing cash flow and enhancing market position [4]. By investing in science and technology innovation, enterprises can enhance their value and investment efficiency, laying a solid foundation for future growth through the development of new technologies and products. Technological upgrades provide cost advantages, allowing enterprises to achieve higher outputs with limited investments and improve investment efficiency [5]. Investment is crucial for enterprise survival, development, and profit generation, and serves as a key risk control measure. Innovative enterprises demand high-quality accounting information to boost investment efficiency. Through R&D and the introduction of new products, enterprises can better capture the market, increase turnover, and enhance performance [6]. The size of the firm and the degree of marketisation further amplify the impact of innovation on performance. Time-honoured enterprises can gain more resources through market innovation, improving their competitive edge and profit-making ability. Successful innovation can lead to excess profits through innovative products and patents, providing strong support for development and reducing business risk.

The sustainable development ability and investment efficiency of time-honoured enterprises are positively affected by corporate innovation. Accordingly, the following hypothesis is proposed:

Hypothesis 2: Corporate innovation could invest in efficiency.

Hypothesis 3: Enterprise innovation could promote investment efficiency, which in turn promotes the sustainable development of time-honoured enterprises.

3. Construction of Evaluation System

3.1 Basis for the Construction of Sustainable Development Evaluation System for Time-honoured Enterprises

At present, academics do not have a clear connotation about the sustainable development of time-honoured enterprises. S.J., Huang et al. (2018) defined the connotation of enterprise sustainable development as the goal state or development paradigm of the enterprise's pursuit of shaping the superior quality ability of sustained enterprise growth and sustained value creation [1]. Cultural inheritance is the biggest characteristic of time-honoured enterprises, therefore, the connotation of sustainable development of time-honoured enterprises should incorporate the characteristics of ‘time’ on the basis of the connotation of enterprise sustainable development. Based on this, this paper argues that the connotation of sustainable development of time-honoured enterprises should include four major elements, namely, effectiveness, efficiency, solvency and inheritance.

3.2 Construction of Sustainable Development Evaluation System for Time-honoured Enterprises

There are two main ways for existing studies to measure enterprise sustainable development: single indicators and multidimensional indicators. Single indicators mainly include enterprise total factor productivity, research and development innovation, and enterprise economic value added; multidimensional indicators are mainly centred on the connotation, characteristics and development concept of enterprise sustainable development. This paper focuses on the connotation and characteristics of time-honoured enterprises' sustainable development and proposes an indicator system of sustainable development of time-honoured enterprises, as shown in Table 1, which mainly focuses on the benefits, efficiency, solvency, and inheritance, including eight secondary indicators.

Benefit is represented by the growth rate of revenue and net profit. Efficiency is the proportion of

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fixed assets ratio and total assets growth rate. Solvency, as measured by current ratio and quick ratio. Inheritance, measured by ESG rating and the natural logarithm of the brand lifespan of existence.

Table 1: Evaluation System for Sustainable Development of Time-honoured Enterprises

Primary Indicators	Weight	Secondary Indicators	Weight
Benefit	0.290	Revenue Growth Rate	0.151
		Net Profit Growth Rate	0.139
Efficiency	0.218	Proportion of Fixed Assets	0.107
		Total Asset Growth Rate	0.111
Solvency	0.247	Current Ratio	0.124
		Quick Ratio	0.124
Inheritance	0.244	ESG Rating	0.134
		Brand Lifespan	0.110

3.2.1 Research Method

The entropy method is used to measure the indicators, firstly, the data of each indicator is standardised, and then the weight of each indicator is calculated.

3.2.2 Data Sources and Processing

This paper selects time-honoured enterprises' data from 2012 to 2022 as the research object. The listed enterprises of time-honoured enterprises come from the hand-collected list of time-honoured enterprises published by the Ministry of Commerce, the raw data mainly comes from the CSMAR database, the enterprise patent data comes from the CNRDS database, the brand establishment time comes from the digital museum of time-honoured enterprises, and the official website of the enterprises collected and collated manually, and the ESG rating are adopted from the Wells Fargo ESG index. Excluding delisted and missing data samples, 56 time-honoured enterprises with 562 observations are selected. For individual missing data, interpolation is used to fill in the blanks.

3.3 Evaluation of Sustainable Development of China Time-honoured Enterprises

Due to the large number of sample enterprises, this paper does not list their comprehensive scores one by one. To facilitate the analysis of the overall development, the annual comprehensive score of each sample enterprise is taken. Its overall development level is in poor condition, although it fluctuates little and shows a slight upward trend.

4. Empirical Analysis

4.1 Variable Selection and Data Sources

This paper mainly discusses the impact of corporate innovation on the sustainable development of time-honoured enterprises. The previous article has theoretically discussed the role of corporate innovation in promoting the sustainable development of time-honoured enterprises. The empirical analysis part uses panel data of time-honoured enterprises listed on the A-share market in China from 2012 to 2022 to construct a fixed-effect multiple linear regression model for empirical analysis. The dependent variable is the sustainable development ability of time-honoured enterprises, the explanatory variable is the innovation performance of enterprises, and the control variables are selected with reference to the relevant research of Y, Chen and D.K, Si (2023) [7].

Explained Variable: sustainable development of time-honoured enterprises (OLD): the sustainable development of time-honoured enterprises is selected as the explanatory variable, and the variable is measured according to the sustainable development index of time-honoured enterprises constructed in the previous section.

Explanatory Variable: enterprise innovation performance (Innovation): enterprise innovation is selected as the explanatory variable, and the natural logarithm of the number of patent applications + 1 is used to measure this variable, with reference to the research of X.M, Fang (2023) and other scholars [8]. If a company actively applies for patents, it indicates that it has actively explored and created new technologies, products or processes.

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Table 2: Variable Description

Variable Type	Variable Name	Symbolic Representation	Data Indicators
Explained Variable	Sustainable Development of Time-honoured Enterprises	OLD	Sustainable Development Index of Time honoured Enterprises
Explanatory Variable	Corporate Innovation	Innovation	Natural Logarithm of the Number of Patent Applications + 1
Control Variable	Enterprise value	PB	Net Profit Ratio
	Firm Age	FirmAge	Natural Logarithm of the Number of Years the Enterprise has been listed
	Profitability	ROA	Net Profit Margin on Total Assets
	Enterprise Growth	Growth	Annual Growth Rate of Revenue
	Cash Flow	CashFlow	Cash Flow Ratio
	Size of the Board of Directors	Board	Natural Logarithm of the Number of Board Members
	Profit Growth Rate	NetProfitGrowth	Net Profit Growth Rate

4.2 Descriptive Statistics

The observation data of the variables of China time-honoured enterprises listed on the A-share market from 2012 to 2022 were sorted and analysed. The mean, standard deviation, minimum and maximum values of the variables are shown in the following Table 3:

Table 3: Descriptive Statistics

Variable	Obs	Mean	Std.dev.	Min	Max
OLD	562	38.32	4.950	10.81	52.87
Innovation	562	2.109	1.529	0	6.082
Cashflow	562	0.0652	0.0706	-0.173	0.267
Growth	562	0.0828	0.273	-0.658	3.324
FirmAge	562	3.093	0.266	1.792	3.611
PB	562	4.197	3.406	0	21.69
ROA	562	0.0630	0.0662	-0.180	0.245
Board	562	2.177	0.202	0	2.708
NetProfitG~h	562	-0.244	3.056	-28.42	15.50

4.3 Model Building

This study uses Stata 17 to perform a panel data multiple linear regression analysis based on panel data from 2012-2022 for a total of 562 observations of A-share listed China time-honoured enterprises. The fixed effect model of panel data regression is finally selected to complete this study.

In summary, the following two-way fixed-effects multiple linear regression model based on panel data is constructed:

$$\mathrm{OLD}_{it} = \beta_0 + \beta_1 Innovation_{it} + \beta_2 Controls + \mu_i + \mathrm{v}_t + \varepsilon_{it} \quad (1)$$

β_i is the regression coefficient of each variable, *i* represents A-share listed time-honoured enterprises, and *t* represents the time period from 2012 to 2022. μ_i represents individual fixed effects, v_i represents time fixed effects, and ε_{it} is a random perturbation term.

The presence of multicollinearity can be tested by calculating the Pearson correlation coefficient between variables.

The maximum value of the correlation coefficient is less than 0.8, indicating that there is no high correlation between the explanatory and control variables. The maximum value of the VIF between variables is less than 10, indicating that the correlation between the explanatory and control variables is not strong and there is no serious issue of multicollinearity. According to the results of the correlation test, the correlation coefficient between the sustainable development and innovation of China time-

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honoured enterprises is positive and reaches a significance level of 1%, which preliminarily proves the significant positive correlation between enterprise innovation and the sustainable development of China time-honoured enterprises.

4.4 Model Regression Results

The regression results of constructing a multiple linear regression model based on the above panel data are as follows: (1) the results without considering control variables and double fixed effects, (2) the results with double fixed effects added when control variables are not considered, (3) the results with control variables without double fixed effects considered, and (4) the results with both controls variables and double fixed effects considered:

Table 4: Model Regression Results

	(1)	(2)	(3)	(4)
	OLD	OLD	OLD	OLD
Innovation	0.205	0.249	0.313**	0.289**
	(1.382)	(1.379)	(2.447)	(2.018)
Cashflow			0.953	2.474
			(0.450)	(1.171)
Growth			3.516***	3.527***
			(8.433)	(8.501)
FirmAge			-0.335	-13.718***
			(-0.471)	(-5.250)
PB			-0.032	-0.017
			(-0.745)	(-0.370)
ROA			8.982***	4.476
			(3.058)	(1.498)
Board			-1.698**	-1.443*
			(-2.186)	(-1.804)
NetProfitGrowth			0.427***	0.437***
			(10.906)	(11.396)
_cons	37.957***	37.737***	41.774***	78.693***
	(61.391)	(73.924)	(14.987)	(10.252)
Time fixed effects	No	Yes	No	Yes
Individual fixed effects	No	Yes	No	Yes
N	562.000	562.000	562.000	562.000
r2	0.001	0.026	0.3623	0.405

According to the regression results of models (1) - (3), the regression coefficients of sustainable development of time-honoured enterprises on enterprise innovation are all positive, once again confirming that enterprise innovation has a promoting effect on the sustainable development of time-honoured enterprises.

According to model (4), after adding control variables and double fixed effects, the regression coefficient of sustainable development of time-honoured enterprises on enterprise innovation is positive and significant. Therefore, we can conclude that the improvement of enterprise innovation level can significantly promote the sustainable development of time-honoured enterprises.

4.5 Robust Test

Based on the regression results of the above model, we can conclude that improving enterprise innovation can significantly promote the sustainable development of time-honoured brand enterprises. To test the robustness of the model, this article first considers the possible heteroscedasticity between variables and conducts regression analysis again using a robust standard error. Referring to Q.Y., Chen ‘s (2020) method, robustness tests were conducted again by excluding samples from the 2019-2021 epidemic period. The explanatory variables were subjected to robustness tests using a bilateral 5% quantile truncation method to remove extreme values [9]. According to the robustness test results, the regression coefficient of sustainable development of time-honoured enterprises on enterprise innovation is still positive and significant, which can verify the robustness of the conclusion.

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4.6 Testing the Intermediary Effect Mechanism

To explore the mechanism of the role of corporate innovation in promoting the sustainable development of time-honoured enterprises, this paper refers to the 'operational suggestions for the analysis of the mediating effect' proposed by T, Jiang (2022) and adopts the mechanism test research method [10]. The following model is used to discuss the relationship between corporate innovation and investment scale (Invest), and the impact of investment scale on the sustainable competitiveness of time-honoured enterprises is explained using relevant research conclusions. Invest is the amount of new capital investment made by the enterprise in the *t* year (the sum of the amount spent on the construction of fixed assets, the purchase of intangible assets and other long-term assets, the cash spent on acquiring subsidiaries, the amount of debt investment and the amount of equity investment, minus the amount earned from the disposal of intangible assets, fixed assets and other long-term assets, and finally dividing the difference by the total assets of the enterprise at the beginning of the year.

According to the regression results, the regression coefficient of innovation capability of time-honoured brand enterprises on investment scale is positive and significant, indicating that the improvement of enterprise innovation capability can significantly promote enterprise investment. Time-honoured enterprises can enhance their sustainable competitiveness on multiple levels by increasing their investment scale.

5. Conclusion and Recommendations

5.1 Research Conclusion

Based on the regression results above, we can conclude that improving the innovation capability of time-honoured enterprises can significantly enhance competitiveness and promote sustainable development. This promotion effect is mainly achieved by increasing the investment scale. Time-honoured enterprises, with their profound historical heritage and unique brand value, hold an irreplaceable position in the market. However, with the rapid development of the market economy and the increasing diversification of consumer demands, time-honoured enterprises must continuously improve their innovation capabilities to maintain their advantages in fierce market competition. The improvement of innovation capability is of great significance for time-honoured enterprises to enhance their market competitiveness and promote sustainable development.

5.2 Research Suggestions

Firstly, enhancing innovation capabilities helps China time-honoured enterprises develop unique and differentiated products or services, which is crucial for gaining a competitive edge in a crowded market. Continuous technological and product innovation allows these enterprises to offer personalized and diverse choices, meeting evolving consumer needs and creating a unique market advantage. Innovation also boosts the brand image, showcasing the enterprise's vitality and forward-thinking nature, thereby increasing consumer trust and loyalty.

Secondly, improved innovation capabilities enable time-honoured enterprises to stay at the forefront of technology. Technological advancements drive enterprise development, enhancing product quality and performance to meet consumers' desire for a high-quality life. Continuous innovation allows these enterprises to quickly adapt to market changes and consumer demands, improving market responsiveness.

Finally, innovation helps time-honoured enterprises preserve and enhance their unique cultural heritage and craftsmanship. By integrating traditional culture with modern elements, these enterprises create new cultural values, boosting their cultural competitiveness and promoting sustainable development. Moreover, innovation supports environmental protection and social welfare by enabling more sustainable practices in product design, production, and supply chain management, contributing to overall societal sustainability.

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