

Exploring the Influence of Confucian Culture on Green Innovation in China: The Mediating Role of Corporate Social Responsibility

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Declarations of interest: none

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Data availability statement : The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author contributions:

Kuang-Cheng Chai: Conceptualization, Investigation, Methodology. **Yu-Jiao Lu:** Formal analysis, Investigation, Methodology, Writing-original draft. **Xin-Rui Ma:** Formal analysis, Investigation, Methodology. **Wen-Tao Xi:** Investigation, Software, Validation. **Ke-Chiun Chang:** Conceptualization, Data curation, Project administration, Supervision.

Abstract: Confucianism has a profound impact on Chinese culture. In such an atmosphere with thousands of years of cultural heritage, Chinese enterprises are also deeply influenced by

Confucianism in the course of their development. This paper takes China's industrial listed enterprises from 2011 to 2020 as the research object, and explores the influence of Confucian culture on enterprise green innovation. The study found that Confucian culture promotes the fulfillment of corporate social responsibility, and good fulfillment of corporate social responsibility will positively affect the level of green innovation, and corporate social responsibility plays a partial intermediary role in the effect of Confucian culture on the level of green innovation. The research results enrich the relevant content of the influence of Confucian culture on enterprise development, and provide a theoretical basis for enterprise decision-making and management, and further provide reference for whether enterprises should integrate Confucianism into fulfilling social responsibilities.

Keywords: Confucian Culture; Green Innovation; Corporate Social Responsibility; Informal Institution

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1. Introduction

China has a long history and profound cultural heritage, and the historical flavor is precipitated in the inheritance and development of national culture. The proposal of the strategy of cultural power not only implements the new development concept of innovation, coordination, green, openness and sharing in the field of cultural development, but also integrates cultural development into the construction of the new industrial development pattern. The inheritance and development of culture affects national development. China has had business experience since ancient times, and the embryonic form of enterprises has gradually begun to be established. The development of enterprises has been influenced by different cultures with the change of social system. Enterprises' development is not only influenced by the formal system, but also influenced by informal institutions, such as the constraints of legal provisions; Confucian culture. Confucian culture has a subtle influence on enterprises, and "A man

without distant care must have near sorrow” affects the development of enterprises. If enterprises want to be able to stay in the market for a long time without recession, it is important to focus on the impact of short-term and the medium- and long-term results on enterprises, and be prepared for a rainy day.

The development of China’s excellent traditional culture also needs to adapt to the requirements of the new era with the changes of the times. While conforming to the trend of the times, it integrates excellent traditional culture into national education, cultural creation and production and life. Traditional Chinese culture inherently contains the reform spirit of “Do Away with the Old and Set Up the New”, the tolerance spirit of “Have Ample Virtue and Carry All Things”, the inaction spirit of “Rule Through Non-action”, and the scientific spirit of “Dao Operates Naturally” (Xu et al., 2019). As the mainstream thought of Chinese traditional culture, Confucian culture contains rich spiritual connotation and has a wide range of influence, so that many Confucius Institutes have been established one after another. The core ideas of Confucianism, ‘benevolence’, ‘righteousness’, ‘rites’, ‘wisdom’ and ‘faith’ are reflected in all aspects of life, but the idea of ‘reform’ is easy to ignore. The idea of “Do Away with the Old and Set Up the New” of Confucianism is in line with the current spirit of innovation, and it has a lot in common with the theory of CSR. “A benevolent person loves others” in Confucian culture represents the benevolent person has a loving heart for others, which coincides with the point of view in social responsibility theory that profits are not the only goal. Enterprises must take the initiative to undertake social responsibilities, so as to obtain more support and make the enterprise sustainable development for a longer time.

These informal systems such as culture subtly affect the development of enterprises. In modern society, industrial enterprises play the leading role in the national economy, and the smooth development of them has a very significant role in promoting national economic development. However, industrial output often causes environmental pollution at the expense of social value (Padilla-Lozano and Collazzo, 2021). In particular, China is still a developing country. Although the government have gradually strengthened their awareness of environmental protection, the effective implementation of various environmental protection measures and the development of environmental protection enterprises cannot be achieved overnight.

Compared with foreign developed countries, China’s environmental protection level still needs to be improved. Therefore, each enterprise needs to start from its own industrial chain, improve environmental protection awareness, and reduce the discharge of related harmful substances. From the

perspective of industrial enterprises, green innovation is crucial to both the development of the enterprise itself and the protection of the environment. Further increasing the output of green innovation is undoubtedly an effective way to enhance the social value and reputation of enterprises and protect the environment.

As an informal system, Confucian culture, like the legal system, can replace each other and affect the development of enterprises. The innovation behavior of enterprises is deeply influenced by Confucianism, and some scholars have studied the influence of Confucianism on enterprise innovation, and discussed from the perspective of incentive hypothesis and inhibition hypothesis. This paper analyzes how Confucian culture affects the green innovation of industrial enterprises, further explores its mechanism, and finds that CSR has an intermediary role.

The contributions of this paper are: (1) Enriching the literature on the influence of Confucian culture on enterprises in informal institutions, through the analysis of the potential influencing factors of green innovation in Chinese industrial enterprises, it is found that CSR plays an intermediary role. (2) Confucianism is a part of Chinese traditional culture, which will have a certain impact on the management concept of enterprises. Exploring the mechanism of traditional culture affecting enterprise management plays a certain warning role for enterprise development. (3) Inherit and carry forward the excellent traditional Chinese culture, improve international competitiveness, and have certain inspiration for China's innovation and development policy.

2. Literature Review

2.1 Confucian Culture and Green Innovation

Among the political, economic and social factors, culture is an important factor. Therefore, in addition to the influencing factors at the formal system and the enterprise level, culture, as an important part of the informal system, influences the innovation behavior of enterprises (Li et al., 2013). Chinese scholars' research on corporate innovation mostly focuses on government subsidies (Jia et al., 2021), corporate R&D investment (Xu et al., 2020; Jiang et al., 2022), and policy uncertainty (Xu, 2020; Guan et al., 2021), digital economy development (Rao et al., 2022), etc. Most of the existing research abroad explores the factors that affects enterprise innovation, such as supplier change (Zu and Zhang, 2022) and tax (Atanassov and Liu, 2019). Combined with the current research status, it is found that there are many factors affecting enterprise innovation.

Industrial enterprises need to take the road of green transformation for long-term development. Confucianism advocates the spirit of “Do Away with the Old and Set Up the New”, such as “Even an established nation like Zhou still regards self-renewal as its mission.”, “If you can in one day renovate yourself, do so from day to day. Yea, let there be daily renovation.” (“The She King, Grater Odes of the Kingdom, Odes of the Temple and the Alter”; “Book of Rites, Great Learning”), etc., which coincides with the idea of green innovation of enterprises. Confucian culture inherently contains the innovative spirit of “Do Away with the Old and Set Up the New” and the enterprising spirit of “Strive Continuously to Strengthen Oneself”, which has always inspired the Chinese nation to continue to innovate and move forward. As an informal system, Confucian culture cannot be ignored its role in enterprise development. In China, more scholars explore from the perspective of corporate culture, however, the formation of enterprise organizational culture is based on the influence of Chinese traditional culture. Some scholars study culture and innovation, and have come to the conclusion that Confucian culture impacts enterprise innovation, which has positive promoting and negative inhibitory. The positive promotion of enterprise innovation is the innovation spirit contained in the Confucian culture, while the negative inhibition of enterprise innovation is the conservative thought contained in the Confucian culture, which will prevent enterprises from innovating. For industrial enterprises, corporate innovation development should focus on green innovation. The influence of culture has a subtle effect, and Confucian culture will affect the decision-making and behavior of enterprises unconsciously. For industrial enterprises, green transformation is the mainstream development trend of enterprises under the current environmental policy. Confucian culture affects the green innovation by influencing the decision-making judgment of managers.

2.2 Confucian Culture and CSR

Modern enterprises can better understand the importance of corporate social responsibility. The implementation of CSR will be reflected through such as charitable donations, environmental protection, employee rights protection, and emphasis on product quality (Wan et al., 2020). As a part of promoting economic development, enterprises play an important role in economic growth and social development. The Western definition of social responsibility is not well suited to the Chinese market, because it does not take into account the impact of China’s environment and culture (Wang and Juslin, 2009). Corporate culture is a factor affecting social norms, which affects the attitudes and behaviors of organizational members, and then affects the decision-making and development of enterprises, such as the implementation of corporate social responsibility (Kucharska and Kowalczyk, 2019). CSR is a sense of responsibility that reflects an enterprise. Of course, CSR will have a positive impact, resulting in net profits and improved reputation, but it may also have a negative impact, which is the net cost to the business of undertaking social responsibility (Quazi and O'Brien, 2000). CSR requires a certain cost, but it brings a good side to the reputation and development of enterprises, which is positive for long-term development. The fulfillment of CSR is the embodiment of the relationship between internal and external. Most scholars study the results of CSR through performance, satisfaction, etc., and this seems to be direct and reasonable (Liu and Lin, 2020), but it is equally important to explore the influencing

factors and influencing processes of CSR. Research has shown that, there is a strong link between the political relationship of stakeholders and CSR (Di Giuli and Kostovetsky, 2014), not only the political relationship of stakeholders will affect, but also many factors will have an impact on CSR, and CSR is bound to be influenced by corporate culture (Guiso et al., 2015).

2.3 CSR and Green Innovation

For investigation and research of corporate social responsibility, it is generally believed that CSR has a positive effect on performance. Some scholars start from the work behavior of employees and find that the performance of CSR can enhance employees' self-esteem (Gao et al., 2017). When the CSR is well fulfilled, the self-esteem of employees is improved, and they are more motivated to participate in the daily affairs of the company, which improves corporate performance. According to the stakeholder theory, the fulfillment of CSR includes consumers, suppliers, shareholders, society and so on. Most industrial enterprises are sources of pollution that threaten the environment and people's healthy lives (Padilla-Lozano and Collazzo, 2021), and have not yet realized the serious consequences of environmental problems, and have not taken environmental protection and energy conservation measures. This will not only lose public confidence, but also be punished by relevant policies. In addition, with the increasing environmental pollution problem, enterprise managers will realize the importance of the natural environment for enterprise development, and thus pay more attention to the fulfillment of social responsibilities such as environmental protection and sustainable development. Modern society has higher requirements for the fulfillment of CSR. More and more people pursue a higher and better living environment, so enterprises need to earnestly fulfill their responsibility for improving the social environment. The development of industrial enterprises is inseparable from technical support, and environmental improvement requires innovation, especially green innovation. Research based on foreign data also confirms that cultural values directly affect the innovation willingness and behavior of innovation subjects (Hoffman and Hegarty, 2016). The influence of Confucian culture is the most profound, and the philosophy contained in culture corresponds to all aspects of reality.

3. 3. Theoretical Analysis and Hypothesis Development

3.1 Confucian Culture and Corporate Green Innovation

In addition to the influence of social system and economic development, cultural factors also have important explanatory power for corporate behavior (Williamson, 2000). Confucian culture is one of the most far-reaching cultures affecting China, which is reflected in corporate decision-making (Ip, 2009; Du, 2014; Chen et al., 2018). Confucianism advocates the concept of "justice and interests", which is "guided by righteousness, and controlled by reason", and it is conducive to regulating the utilitarian behavior of enterprises, guiding enterprises to actively undertake social responsibilities, and reducing damage to public interests. Previous studies have shown that the concept of "interest first" affects green transformation of enterprises, and the transformation measures taken under this influence will affect

green development and reduce the actual transformation efficiency of green investment. On the other hand, Confucianism advocates the establishment of “justice and interests”, which points out that one cannot blindly pursue interests. This will help to shape a good business environment, guide enterprises to establish a healthy competition concept, and establish a sustainable development concept, thereby stimulating the enthusiasm of enterprises for green innovation. As an important part of Chinese culture, Confucian values unconsciously influence Chinese people’s behavioral decisions (Liao et al., 2018). Cultural values refer to the beliefs that most members of society embrace and advocate; they importantly affect individual decision-making behavior (Cieciuch, 2017). The fear of nature and the thought of environmental protection in Confucian culture will affect people’s behavior. As an industrial enterprise, it needs to take certain responsibility for the improvement of the social ecological environment. The behavior decision of enterprise managers is influenced by Confucian culture, which further affects the innovation of enterprises.

Upper Echelons Theory and Imprint Analysis believe that under the influence of long-term growth environment and cultural influence, personal cognition and values will be affected by it, which is reflected in company managers (Marquis and Tilcsik, 2013). As part of the long-term influence of Confucian culture on Chinese traditional culture, entrepreneurs or managers will form ideas of innovation and change. This “cultural imprint” will affect their risk attitude and innovation preference when making decisions (Yan et al., 2021), which will also affect the green innovation. When the formal system develops more mature, the influence of the informal system will decrease (Du, 2014; Xia et al., 2017; Chen et al., 2019; Jebran et al., 2019). In turn, this shift is still the case. When the formal system is not mature, the another will significantly impact the enterprises’ decision-making and development. Based on the above analysis, this paper makes the following assumptions:

Hypothesis 1: Confucian culture is positive related to the green innovation of enterprises.

3.2 Confucian Culture and CSR

Different scholars have different definitions of CSR, since stakeholders will constrain the economy and law of enterprises, CSR is a measure taken to meet their constraints. It is currently believed that CSR can be considered as a means of managing various business activities, including environmental and social services. Corporate social responsibility reflects a part of an enterprise’s capabilities, and fulfilling CSR can effectively improve the reputation of an enterprise. Kalyar mentioned that the factors affecting CSR are formal strategic planning and cultural characteristics (Kalyar et al., 2013), and there is a theory that cultural characteristics can also affect the ability of CSR.

Most of the research on CSR has been empirically tested from the perspective of corporate performance (Kang and Liu, 2013), and the links between the two have been explored from the perspective of formal institutions, such as corporate governance (Fifka and Pobizhan, 2014). Few studies have been done on the characteristics of informal institutions such as religious beliefs, culture, etc. Social norms generally accepted by people, such as national culture, such a formal system will affect the perception of organizations and individuals, and respond through corporate social responsibility reports (Gray et al., 1995; van der Laan Smith et al., 2005; Orij and Burritt, 2010), and this has been confirmed

in Mohamed Adnan (Mohamed Adnan et al., 2018), and Cultural factors will affect the quality of CSR information disclosure. Different countries have their own cultural backgrounds, and culture will affect the development of organizations. As an important part of Chinese national culture, the development of Confucian culture has a positive impact on CSR. Some scholars have studied that corruption culture has an inhibitory effect on CSR, and corporate integrity culture is promoting enterprises to fulfill their social responsibilities. Based on the above analysis, this paper proposes the following assumptions:

Hypothesis 2: Confucian culture has a positive relationship with corporate social responsibility (CSR).

3.3 CSR and Green Innovation

With the continuous development of industry, the consumption and utilization of natural resources have gradually increased, resulting in a serious reduction in the holdings of natural resources and frequent occurrence of various environmental problems. Industrial wastewater wastes cause damage to the environment, leading to global warming and climate change (Ji and Zhang, 2019). Under the premise that the current global energy pattern development trend is still dominated by traditional energy and the instability is increasing, sustainable energy alone cannot effectively reduce environmental pressure. Therefore, it is necessary to innovate production methods and enhance the innovation ability of enterprises (Chai et al., 2022). Nowadays, many companies integrate green development into their business operations, which not only increases the efficiency of resource utilization, but also has a favorable impact on business performance. Green innovation is an effective measure to reduce the negative impact of enterprise management on the environment (Shahzad et al., 2020; Hao and He, 2022). Green innovation can improve corporate performance. if the company can better fulfill its social responsibility for environmental protection, it will have a positive effect on the improvement of its reputation and future development. Based on the stakeholder theory, the company must take into account the role of stakeholders. The pressure of external and internal stakeholders is the main factor affecting green innovation (Weng et al., 2015), and in this way to improve corporate reputation, promote the further development of enterprises and improve performance.

Some scholars have found that CSR can promote green innovation. However, some scholars believe that in promoting green innovation, CSR does not bring positive results, which may be because of the focus on other aspects, resulting in greater costs (Mbanyele et al., 2022). Under the influence of factors such as external conditions, their own enterprise development, and culture, enterprises may make different decisions and have different impacts on innovation. Based on the above analysis, this paper makes the following assumptions:

Hypothesis 3: Corporate social responsibility (CSR) mediates the relationship between confucian culture and green innovation of enterprises.

4. Method and Measurement

4.1 Sample Selection and Data Collection

This paper selects the data of China's industrial listed companies from 2011 to 2020, discusses the influence of the informal system of Confucian culture on the green innovation of industrial enterprises, and conducts an empirical study on it. (1) Select the sample of industrial listed companies; (2) Exclude the samples that cannot be filled with missing data manually; (3) Exclude ST, *ST type samples (an abnormal financial or other condition occurs); (4) Winsorize the values at 1% and 99% levels., and finally get 5780 valid observations. The data of Confucian culture are manually collected, CSR data from Hexun.com, as well as the Cathay Pacific Patent Search and Analysis (CNIPA) and CNRDS, and other data are obtained from the CSMAR database, and the data analysis was done using Stata16 software.

4.2 Measurement

Green Innovation (GI): Referring to the research of existing scholars, the natural logarithm of the number of green patent applications plus 1 in the national patent search database is used as a measure of green innovation.

Confucian culture (Confucian): The measurement index of Confucian culture selects the geographical location of representative Confucian temples for measurement. Obtain the latitude and longitude of the Confucius Temple on Google Maps and Baidu Maps, and calculate the distance between the Confucius Temple and the registered place of the listed company (Du, 2014). The establishment of Confucius Temple is closely related to the spread of Confucianism. The closer to the company's registration, the more vulnerable to the influence of Confucian culture, which will have an impact on the ideological culture and personality of the region (Yan et al., 2021). The natural logarithm of the number of Confucian Temples within a radius of 200km and 300km was used as an explanatory variable.

Corporate Social Responsibility (CSR): At present, the measurement method of CSR generally uses the social responsibility report of listed companies published on Hexun.com in China. The evaluation index of Hexun's CSR report is based on the CSR report and annual report officially released by the listed companies of Shanghai Stock Exchange and Shenzhen Stock Exchange. The CSR reporting index is measured from five dimensions: shareholder responsibility, employee responsibility, supplier, customer and consumer rights and interests responsibility, environmental responsibility and social responsibility. Compared with other social responsibility index reports in China, Hexun's CSR report index covers a large number of listed companies, with comprehensive evaluation and timely data update, which has been recognized by a large number of Chinese scholars. This paper uses the comprehensive score of the CSR report in Hexun. The higher the total score, the better the CSR.

The control variables are selected as enterprise size (natural logarithm of total assets), return on assets (net profit/total assets), board size (number of board members), proportion of fixed assets (fixed assets/total assets), proportion of independent directors (proportion of independent directors on the board = number of independent directors/number of directors), age of listed companies (natural logarithm of

age), nature of property rights (1 for state-owned enterprises, 0 for non-state-owned enterprises), financial leverage (total liabilities/total assets) and year, control variables are represented by Controls.

[Insert Table 1 here]

5. Empirical Analysis

5.1 Descriptive Analysis

Table 2 is a descriptive statistical analysis of the main variables, taking industrial enterprises as the research object, involving 578 enterprises, and the sample size is 5780. According to Table 2, It can be seen from Table 2 that the minimum value of green innovation is 0, the maximum value is 4.522, and the average value is 0.615, indicating that the overall level of green innovation of industrial enterprises is low, and the ability needs to be improved, but there are some enterprises with high innovation ability. The number of Confucius temples can be drawn from the table that its distribution is generally uniform. However, there are some cases where companies are registered within a radius of 200km without strong Confucian culture, and there is a big difference between the two poles. It can be seen from the variance that the number of such companies is small.

[Insert Table 2 here]

5.2 Analysis of Regression Results

Table 3 is the basic regression result. Model 1 shows that the influence of Confucian culture on enterprise green innovation is significantly positively correlated at the level of 1%, which verifies hypothesis 1. Model 2 verifies hypothesis 2 and positively affects corporate social responsibility at the 1% level. According to the method of stepwise regression of mediating effect (Baron and Kenny, 1986), combined with Model 1 and Model2, if the mediating variable and independent variable in Model 3 have a significant impact on the dependent variable and the coefficients of the independent variable is smaller than it in Model 1, which is partial mediate effect. If the mediating variable has a significant impact on the dependent variable and the independent variable has no significant impact on the dependent variable, it is a full mediation. Combined with model 3, the regression results of partial mediation are satisfied, and it shows that the influence of Confucian culture on green innovation is carried out through corporate social responsibility, which verifies hypothesis 3.

The results show that Confucian culture impacts green innovation positively. The more the number of Confucian temples within 200 km of the company's registration radius, the higher the degree of CSR and green innovation. As Confucian culture's influence increases, enterprises will be more active in green innovation and fulfilling social responsibilities. The influence of Confucian culture is subtle, not only affecting individuals but also groups. As a group organization, the development process of enterprises is deeply influenced by traditional Chinese culture. For industrial enterprises, the level of green innovation will be further improved under the influence of the Confucian culture's idea of "Do Away with the Old and Set Up the New". At the same time, because Confucian culture has a positive

impact on the fulfillment of CSR, enterprises need to take more responsibility for social services and the environment, such as environmental protection and improving resource utilization. By fulfilling social responsibilities, enterprises can create a positive and innovative atmosphere, so that enterprises can obtain a good social reputation, and the further innovation and development of enterprises can obtain more input from external resources, thereby increasing innovation output and promoting the overall development of enterprises.

[Insert Table 3 here]

In addition, we refer the methods of Gao and Shahzad, using PROCESS for SPSS (27.0 version) to test mediating effect. Further, this study selected 95% confidence for bias-corrected confidence intervals and the significance of the hypotheses was tested through 5000 bootstrapping samples estimate (Gao et al.,2017; Shahzad et al., 2020). Table 4 shows the result of the mediating effect through model 4 of PROCESS to test. From it, we see that CSR plays a mediating role, and this effect is significant because 95% CI does not include 0.

[Insert Table 4 here]

5.3 Robustness Test

5.3.1 Replace the Explanatory Variable Confucian Culture

In order to test whether the regression results are robust, this paper replaces the explanatory variable within the enterprise's registered radius of 200 km with the enterprise's registered radius of 300 km. As can be seen from Table 5, after replacing the explanatory variables, the conclusion remains the same as before, indicating that the conclusion is robust. Table 6 is the result of the mediating effect after replacing the independent variable. From Table 6, we see that the mediating effect of CSR still exists and this effect is significant because 95 % CI does not include 0.

[Insert Table 5 here]

[Insert Table 6 here]

5.3.2 Endogeneity Test

In order to prevent the influence of time trend, this paper controls the year, but the omission of some influencing factors is inevitable. Therefore, based on Du's method, the regional general budget income (LnRev), regional per capita GDP (LnGDP) and the number of universities (University) are selected as instrumental variables, and logarithmic processing is performed. Two-stage least squares regression (2SLS) is used to solve potential endogenous problems (Du, 2015, 2016; Liu and Chiang, 2021). Through the over-identification test, the p values corresponding to χ^2 are all greater than 10%, and the selected instrumental variables meet the exogenous conditions. The F statistic of the first stage is 33.46, which is significantly greater than 10. Furthermore, the minimum eigenvalue statistic is 186.61, which is greater than the corresponding critical value of 12.83, indicating that there is no weak instrumental variable

problem. The regression results of the second stage show that the regression coefficient of Confucian2 is significantly positive at the level of 1%. The results are presented in Table 7.

[Insert Table 7 here]

6. Conclusions

The development of green innovation has always been a common concern. This paper selects Chinese industrial listed companies from 2011 to 2020 as the research object, discusses the impact of the informal system of Confucian culture on corporate green innovation, and studies the role of CSR in the process of their impact.

The research results show that under the influence of Confucian culture, the future development of enterprises has been greatly affected. Confucian culture can positively affect the level of green innovation of enterprises. The more Confucian temples there are in a certain radius, the higher the enthusiasm of enterprises for green innovation. And the study found that Confucian culture also has a positive impact on the performance of corporate social responsibility, and CSR plays a part of the mediating role. Confucian culture has a positive effect on CSR and green innovation. The higher the degree of CSR, the higher the degree of green innovation.

The possible reason is that the enterprise is influenced by the informal system of Confucian culture, which subtly affects the enterprises' decision-making and actions, and the idea of "Do Away with the Old and Set Up the New" affects the production of green innovation behaviors. Under the influence of Confucianism, enterprises are more able to undertake social responsibilities, and show a positive side in social charity and environmental governance, and the ideas of "Ren" and "Yi" in Confucianism also reflect responsibility. In addition, Confucianism also reflects the relationship between man and nature. "Has Nature ever said anything? The four seasons run their cyclical course and all things grow vigorously. Has Nature ever said anything?" ("The Analects·Yang Huo"), which reveals Confucius' reverence for the laws of nature and the importance of environmental protection. From this perspective, it also reflects a kind of responsibility of enterprises, and it can further promote enterprises to carry out green innovation.

As an informal system, Confucian culture and the formal system complement each other. For example, the formal system of law is the external constraint to the enterprise, while the informal system is to influence the development of the enterprise from the inside. Culture can affect people's thinking and behavior. The country should pay attention to the output of cultural education, and take the essence of Confucianism and remove the dross. For enterprises, we should pay attention to the influence of culture, an informal system. Confucian culture can have an impact on the formation of corporate culture, thus further exerting a subtle influence on business decisions. There are many uncertainties in the current market environment, and the fulfillment of CSR has become a new round of problems. Attention should be paid to the influence of informal institutions like Confucian culture to motivate enterprises to consciously fulfill their social responsibilities.

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Table1 Variable Definitions

Category	Variable name	Variable symbol	Variable destruction
Independent Variable	Confucian culture	Confucian	The natural logarithm of the number of Confucian Temples, the number “2” represents a radius of 200km, and “3” represents a radius of 300km
Dependent Variable	Green innovation	GI	The natural logarithm of the number of green patent applications plus 1
Mediating Variable	Corporate Social Responsibility	CSR	Build corporate social responsibility measurement system
	Enterprise size	Size	Natural logarithm of total assets
	Year of listed Enterprise	Age	Natural logarithm of the year
	Return on assets	ROA	Net profit/Total assets
	Proportion of fixed assets	Assets	Fixed Assets/Total Assets
Control Variable	Financial leverage	Lev	Total Liabilities/Total Assets
	Property rights	SOE	1 for state-owned enterprises and 0 for non-state-owned enterprises
	Board size	Board	Board of Directors
	Proportion of independent directors	Indratio	Number of Independent Directors/Number of Board of Directors

Table 2 Descriptive Statistics

Variable	Mean	SD	Min	Max
GI	0.615	1.012	0	4.522
Confucian2	2.655	0.789	0	4.007
CSR	26.20	16.46	-2.320	77.71
ROA	0.0440	0.0470	-0.132	0.198
Assets	0.247	0.145	0.0230	0.667
Lev	0.429	0.185	0.0580	0.828
Size	22.57	1.251	20.32	26.41
Age	2.820	0.372	1.558	3.445
Board	2.157	0.190	1.609	2.708
Indratio	0.372	0.0520	0.333	0.571
SOE	0.418	0.493	0	1

Table 3 Regression Results

VARIABLES	(1) GI	(2) CSR	(3) GI
Confucian2	0.045*** (0.016)	0.695*** (0.226)	0.044*** (0.016)
CSR			0.002** (0.001)
ROA	0.029 (0.302)	106.806*** (4.267)	-0.169 (0.318)
Assets	-0.592*** (0.091)	-1.404 (1.289)	-0.589*** (0.091)
Lev	0.124 (0.090)	-6.790*** (1.274)	0.136 (0.090)
Size	0.248*** (0.014)	3.805*** (0.192)	0.241*** (0.014)
Age	-0.206*** (0.041)	2.266*** (0.572)	-0.211*** (0.041)
Board	0.379*** (0.081)	3.201*** (1.150)	0.373*** (0.081)
Indratio	0.390 (0.278)	7.826** (3.926)	0.375 (0.278)
SOE	0.047* (0.029)	2.355*** (0.403)	0.043 (0.029)
Constant	-5.523*** (0.346)	-72.351*** (4.890)	-5.388*** (0.353)
Number of groups	578	578	578
Observations	5,780	5,780	5,780
R-squared	0.121	0.338	0.122
Year	Yes	Yes	Yes

Note: * p < 0.1, ** p < 0.05, *** p < 0.01, standard errors in parentheses

Table 4 Results for Mediation Effect

Path	Effect	SE	LLCI	ULCI
Confucian2→CSR→GI	0.0013	0.0008	0.0001	0.0031

Number of bootstrap samples for bias corrected bootstrap confidence intervals:5000

Table 5 Robustness Test Results

VARIABLES	(1) GI	(2) CSR	(3) GI
Confucian3	0.066*** (0.016)	0.514** (0.229)	0.065*** (0.016)
CSR			0.002** (0.001)
ROA	0.039 (0.302)	106.791*** (4.269)	-0.159 (0.318)
Assets	-0.601*** (0.091)	-1.487 (1.290)	-0.598*** (0.091)
Lev	0.124 (0.090)	-6.829*** (1.274)	0.137 (0.090)
Size	0.248*** (0.014)	3.798*** (0.192)	0.241*** (0.014)
Age	-0.204*** (0.040)	2.226*** (0.572)	-0.208*** (0.041)
Board	0.381*** (0.081)	3.083*** (1.149)	0.375*** (0.081)
Indratio	0.394 (0.278)	7.545* (3.925)	0.380 (0.278)
SOE	0.047* (0.029)	2.363*** (0.403)	0.043 (0.029)
Constant	-5.619*** (0.346)	-71.509*** (4.895)	-5.487*** (0.353)
Number of groups	578	578	578
Observations	5,780	5,780	5,780
R-squared	0.123	0.337	0.123
Year	Yes	Yes	Yes

Note: * p < 0.1, ** p < 0.05, *** p < 0.01, standard errors in parentheses

Table 6 Results for Mediation Effect (Replace Independent Variable)

Path	Effect	SE	LLCI	ULCI
Confucian3→CSR→GI	0.0010	0.0007	0.0000	0.0030

Number of bootstrap samples for bias corrected bootstrap confidence intervals:5000

Table 7 Endogeneity Test Results (2SLS-IV)

VARIABLES	(1) Confucian2	(2) GI
LnRev	0.194*** (5.55)	
LnPGDP	0.209*** (4.99)	
University	0.002*** (4.34)	
Confucian2		0.525*** (9.10)
SOE	0.060*** (2.65)	0.034 (1.11)
ROA	-0.288 (-1.21)	0.150 (0.46)
Assets	0.110 (1.52)	-0.572*** (-5.83)
Lev	-0.074 (-1.04)	0.185* (1.91)
Size	-0.012 (-1.14)	0.255*** (17.43)
Indratio	-0.467** (-2.12)	0.827*** (2.73)
Board	-0.256*** (-3.99)	0.563*** (6.26)
Age	-0.121*** (-3.78)	-0.121*** (-2.72)
Constant	-0.044 (-0.11)	-7.750*** (-17.17)
Number of groups	578	578
Observations	5,780	5,780
F statistic	33.46	42.42
Wald F statistic		186.61
Year	Yes	Yes

Note: *** p<0.01, ** p<0.05, * p < 0.1, t-statistics in parentheses.