

The Innovation Performance of Socially Responsible Investment from Stakeholders' Perspective: Evidence from STAR MARKET

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Abstract: From the perspective of stakeholders, this paper empirically examines the impact of corporate socially responsible investment (SRI) and various dimensions of SRI on their innovation performance, taking Chinese science and technology innovation board (STAR) listed companies as samples. The results show that the social responsible investment of STAR MARKET enterprises has a significant positive impact on innovation performance, while the impact of various dimension's social responsible investment on innovation performance is heterogeneous, the specific performance is as follows: social responsible investment in investors, employees, customers and government helps to improve the innovation performance of the enterprises, however, social responsible investment in the community will have a negative impact on innovation performance.

Keywords: STAR MARKET, SRI, Innovation performance, Stakeholders.

1. Introduction

Since its opening more than four years ago, Science and Technology Innovation Board has continued to give full play to the 'experimental field' function of capital market reform, steadily promoted institutional innovation, and contributed to the high-quality development of listed companies. As a supplement to China's multi-level market, enterprises from STAR MARKET are more focused on high-tech and strategic emerging industries, and the enterprises in these industries have the characteristics of large scale of R & D investment, fast technology iteration, high risk and so on, the ability of innovation is stronger than that of enterprises in other boards, however, as they enter the new journey of building a modern socialist country in an all-round way. The development of sustainable socially responsible investment for environment, society and corporate governance is the social responsibility of enterprises, financial institutions and government ministries. Enterprises should not only take technological innovation as the sole goal, but also pay attention to the needs of various stakeholders (investors, employees, communities, governments and customers) and take them into technological innovation and investment decisions, so as to carry out effective social responsible investment (Social Responsible Investment, referred to as SRI), realize the organic combination of economic, social and ecological benefits, and enhance the ability and level of sustainable development.

Based on China's institutional policy background, this paper takes Science and Technology Innovation Board listed enterprises in China during 2019 and 2022 as a sample to empirically test the effects of STAR MARKET corporates' SRI and various dimensions of SRI on innovation performance from the perspective of stakeholders. The results show that the SRI of enterprises from STAR MARKET has a significant positive effect on its innovation performance. Further study found that various dimensions of SRI on innovation performance is heterogeneous, specifically: corporates' socially responsible investment in the community is negatively related to innovation performance, but not significant, while corporates' socially responsible investment

in other stakeholders helps to improve corporate innovation performance.

The main contribution of this paper lies in: the existing literature studies the economic consequences of general corporate social responsibility, and seldom examines the impact of corporate social responsibility investment on corporate social responsibility investment. Taking Science and Technology Innovation Board listed companies as a sample, this paper examines the impact of corporate SRI on innovation performance from the perspective of stakeholders, enriching the relevant literature on corporate social responsibility investment and innovation performance.

2. Literature Review

2.1. A Summary of Enterprise Innovation Performance

Through the review of the literature, it is found that the research on enterprise innovation performance indicators in the existing literature mainly focuses on two aspects: one is to take the enterprise's patent achievements as the measure standard of innovation performance, and the other is to establish a comprehensive evaluation method to carry out performance evaluation of innovation subjects that pay attention to efficiency. In terms of the definition of patent achievements, Wang Lanfan and Hu Yue (2017) believe that innovative patents have the strongest innovation and the highest value. Sun et al. (2018) pointed out that the patent system can protect the independent innovation of enterprises, and the number of patent applications effectively reflects the performance and quality of enterprise innovation, while Fu Qiao et al. (2018) believe that exclusive interest can directly reflect enterprise innovation achievements and innovation output. In the construction of comprehensive evaluation indicators, Ni Jie et al. (2020) use analytic hierarchy process and mean cluster analysis to construct the evaluation index system of innovation ability of listed enterprises based on four first-level indicators: innovation input, innovation output, business performance and innovation environment. Wang Tao (2023) correlates the different resources acquired and

invested by each innovation subject with their innovation achievements, considers them together, establishes a comprehensive evaluation method of AHP combined with DEA, and carries out efficiency-focused performance evaluation of innovation subjects.

2.2. A Summary of socially Responsible Investment

In terms of measurement indicators of socially responsible investment, Huan Lianqin et al. (2019) based on the perspective of resource investment, believe that the actual cost borne by enterprises can better reflect the reliability of corporate social responsibility investment. Guillermo B (2020) pays attention to the performance of individual socially responsible investment portfolios from the perspective of individual investors, and finds that the performance of socially responsible investment portfolios is higher than that of conventional investments. Zhang (2021) takes the total CSR score of stocks held by funds as the overall measure of socially responsible investment. In terms of the measurement of social responsibility, most domestic researchers take CSR score and ESG score as the measure of corporate social responsibility. Zhao Shengming et al. (2023) used the total score in the CSR report to measure the level of corporate social responsibility. Huang Shizhong (2021) believed that there was an overlap between the contents of CSR and ESG, and that the ESG report was deeply influenced by the theory of corporate social responsibility. Fang Xianming et al. (2023) also believed that corporates' ESG performance was an important reference for the performance of social responsibility.

2.3. A Summary of the Relationship Between SRI and Corporate Innovation Performance

There is not much research on the relationship between corporate socially responsible investment and corporate innovation performance in domestic literature. Huan Lianqin et al. (2019) found that high-tech corporates' socially responsible investment can significantly innovate performance. Most scholars focus on the relationship between the implementation of corporate social responsibility and innovation performance. Chen (2016) found that the implementation of social responsibility to the stakeholders within the enterprise and the stakeholders in the supply chain will have a positive impact on the innovation performance of the enterprise. on the other hand, the implementation of social responsibility by external stakeholders has no positive impact on corporate innovation performance. Duan Junshan et al. (2020) discussed the influence mechanism of corporate social responsibility implementation on innovation investment and found that corporate social responsibility stratification affects corporate innovation investment. Han Qinxiao (2023) discussed the impact of corporate social responsibility on innovation performance from short-term and long-term respectively, and concluded that there is no contradiction between strategic emerging enterprises' goal of social return and innovation performance. Zhao Shengming et al. (2023) believe that corporate social responsibility reduces financial risks and suppresses the principal-agent problem by easing financing constraints.

3. Theoretical Basis and Research Hypothesis

Stakeholder theory holds that the development of enterprise management activities needs to comprehensively balance the interests of all stakeholders. The term "stakeholder" was first put forward by the Stanford Institute in the 1960s, which holds that enterprises have stakeholders such as communities, consumers, capital providers (investors), competitors, employees and special interest groups. According to whether there is a transactional contract between stakeholders and the enterprise industry, stakeholders are divided into two types: internal stakeholders and external stakeholders. Based on this classification, this paper selects five stakeholders who are closely related to corporate performance, including three internal stakeholders (investors, employees, customers) and two external stakeholders (government and community) to study the mechanism between SRI and innovation performance.

The purpose of traditional investment is to obtain the return on investment, so as to maximize the appreciation of capital. Socially responsible investment (SRI) not only obtains the return on investment, but also includes the investment of various stakeholders, actively promoting the company to make good performance in the aspects of employee protection, consumer protection and so on. Social responsibility investment regards corporate shareholders as one of the corporate stakeholders and fully considers the rights and interests of other stakeholders. In recent years, all parties pay more and more attention to corporate socially responsible investment, social equity and long-term healthy economic development and other issues show the importance of socially responsible investment.

Based on the above theories, this paper puts forward the following hypotheses:

a. SRI to investors has a positive impact on innovation performance.

The innovation of enterprises is inseparable from a large amount of financial support, for Science and Technology Innovation Board enterprises, the importance of capital is particularly prominent. The enterprise industry can get the attention and support of investors when fulfilling its social responsibility, and then obtain the capital to promote innovation.

b. SRI to employees has a positive impact on innovation performance.

Technological innovation requires the joint efforts of R & D personnel and internal staff. Corporate social responsibility investment can enhance the enthusiasm and loyalty of employees and provide human capital for technological innovation.

c. SRI to customers has a positive impact on innovation performance.

Corporates' socially responsible investment in consumers can obtain consumer feedback and advice, which has a positive impact on corporate innovation.

d. SRI to government has a positive impact on innovation performance.

The government is one of the important external stakeholders of the enterprise. after establishing a good relationship with the government, the enterprise can get the policy information of the government in time, which plays an important role in improving the performance of technological innovation.

e. SRI to community has a positive impact on innovation performance

The development of enterprises is inseparable from the influence of the external environment. Corporate social responsibility investment helps to establish a good corporate image and obtain more social resources needed for innovation.

4. Conclusion

4.1. Model

Based on the above analysis and hypothesis of Science and Technology Innovation Board's corporate socially responsible investment and innovation performance, this paper establishes a multiple linear regression model for empirical analysis, the specific model is as follows:

$$LNP_{i,t} = \alpha_0 + \beta_1 SRI_{i,t} + \beta_2 R_D_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 CASH_{i,t} + \beta_5 ROA_{i,t} + \beta_6 CEO_pay_{i,t} + \beta_7 D^{ind} + \beta_8 D^{year} + \varepsilon_{i,t}$$

Among them, the explained variable $LNP_{i,t}$ represents the innovation performance of company, and the explanatory variable $SRI_{i,t}$ indicates the SRI of company. There are many factors that affect the performance of corporate innovation. This paper selects two kinds of control variables: corporate characteristics and corporate governance, in which the corporate characteristic variables include R&D expenditure ($R_D_{i,t}$), enterprise size ($SIZE_{i,t}$), cash flow ($CASH_{i,t}$) and ROA ($ROA_{i,t}$), and the corporate governance variable is high-

management compensation ($CEO_pay_{i,t}$).

4.2. Variable Definition

4.2.1. Enterprise Innovation performance (LNP)

This paper takes the number of patents that Science and Technology Innovation Board applied to the relevant departments and finally approved as an index to measure innovation performance. Due to the large differences in the number of patents among companies, and considering that the number of granted patents in some samples may be zero in a particular year, this paper defines innovation performance as LN (1 + the number of patents applied for in the current year).

4.2.2. Socially responsible Investment (SRI)

Based on the perspective of stakeholders and taking into account the availability of data, this paper calculates SRI by summarizing the actual costs paid by five stakeholders, including: (1) socially responsible investment to investors (SRI_g), measured by dividend payment rate; (2) socially responsible investment to employees (SRI_y), which is measured by employee interest rate. (3) socially responsible investment to clients (SRI_z) is measured by the cost rate of main business; (4) socially responsible investment in government (SRI_s) is measured by tax expenditure rate; and (5) socially responsible investment in the community (SRI_j) is measured by donation expenditure rate.

The definition and calculation of the above variables are shown in Table 1.

Table 1. variable name and definition

Variable type	Variable name	Variable code	Variable calculation method
Interpreted variable	Innovation performance	LNP	LN (1+ the number of patents applied for in the current year)
explanatory variable controlvariable	socially responsible investment	SRI	dividend payment rate + employee interest rate + cost rate of main business + tax expenditure rate + donation expenditure rate
	dividend payment rate	SRI_g	$\frac{\text{Cash flow for the distribution of dividends, profits, or interest payments}}{\text{Operating income}}$
	employee interest rate	SRI_y	$\frac{\text{Cash flow paid to and for employees}}{\text{Operating income}}$
	cost rate of main business	SRI_z	$\frac{\text{Main business cost}}{\text{Operating income}}$
	tax expenditure rate	SRI_s	$\frac{\text{Taxes and fees paid}}{\text{Operating income}}$
	donation expenditure rate.	SRI_z	$\frac{\text{Expenditures on external donations}}{\text{Operating income}}$
	R&D expenditure	R_D	$\frac{\text{R\&D expenditure}}{\text{Total assets at the end of the period}}$
Controlvariable Variable type	cash flow	CASH	$\frac{\text{Net cash flow from operating activities}}{\text{Total assets at the end of the period}}$
	enterprise size	SIZE	LN (Total assets of the enterprise)
	ROA	ROA	$\frac{\text{Net profits}}{\text{Total assets at the end of the period}}$
	executive compensation	CEO_pay	$\frac{\text{Total executive compensation}}{\text{Operating income}}$

4.3. Sample and Data Sources

Science and Technology Innovation Board announced its establishment on November 5, 2018, and officially opened the board in June 2019, which is a new board independent of the existing motherboard. This paper selects the listed companies of STAR MARKET from 2019 to 2022 as the research sample,

excluding the companies with incomplete ST, * ST and related financial data, and finally obtains 1148 valid samples, including 68 in 2019, 210 in 2020, 377 in 2021 and 493 in 2022. In addition, this paper reduces the tail of the main variables by 1% to ensure the reliability of the data research. The data sources of the sample companies are Wind, CSMAR and CNRDS (patent part).

5. Empirical Result Analysis

5.1. Descriptive Statistical Analysis

Table 2. Descriptive statistics

Variable	N	Mean	p50	SD	Min	Max
LNP	1146.00	3.143	3.258	1.407	0.000	6.952
SRI	1146.00	0.884	0.886	0.216	0.227	2.115
R_D	1146.00	0.045	0.035	0.036	0.001	0.324
SIZE	1146.00	21.627	21.427	0.895	20.000	26.444
CASH	1146.00	0.034	0.036	0.089	-0.450	0.726
ROA	1146.00	0.069	0.066	0.094	-0.438	0.969
CEO_pay	1146.00	0.015	0.012	0.017	0.000	0.402
SRIg	1146.00	0.047	0.029	0.056	0.000	0.559
SRIy	1146.00	0.233	0.189	0.185	0.012	1.839
SRIi	1146.00	0.064	0.058	0.040	0.000	0.260
SRIj	1146.00	0.002	0.000	0.032	0.000	1.051
SRIz	1146.00	0.538	0.571	0.214	0.011	1.159

Table 2 shows the descriptive statistical results of each study variable. It can be seen from the table that the minimum value of Science and Technology Innovation Board's enterprise innovation performance (LNP) is 0, the maximum value is 6.952, and the average value is 3.143, that is, the number of patents varies greatly among enterprises. The average value of socially responsible investment intensity (SRI) is 0.884, which is close to the median (0.886), and the maximum value is 2.115, indicating that all enterprises have made different degrees of socially responsible investment, and there are some differences in SRI among enterprises. From the average value of each dimension of SRI, the SRI of Science and Technology Innovation Board enterprises to customers is the largest, the average is 0.538, while the minimum is only 0.011, indicating that there are great differences in the cost rate of different Science and Technology Innovation Board enterprises. The second is the socially responsible investment in employees, with an average of 0.233. The smallest is the corporate socially responsible investment to the community, the average is only 0.002, which shows that the contribution of STAR MARKET enterprises to social benefits is not high.

5.2. Analysis of Benchmark Regression Results

Table 3 shows the estimated results of the relationship between SRI and innovation performance of Science and Technology Innovation Board's enterprise. It can be seen from the figure that the R² value is adjusted to 0.353, indicating that the model fits well. The F test results show that the regression results of the model are significantly effective. The regression coefficient of SRI is about 1.011, and it is significant at 1% level, indicating that corporate social responsibility investment has a significant positive impact on innovation performance. The results verify the above hypothesis, that is, the improvement of SRI can promote corporate innovation performance.

Table 3. benchmark regression results

VARIABLES	(1) LNP	(2) LNP
SRI	0.476** (2.28)	1.011*** (4.16)
R_D		3.182** (2.52)
SIZE		0.556*** (13.17)
CASH		1.408*** (2.74)
ROA		-0.022 (-0.04)
CEO_pay		-11.278*** (-4.34)
Constant	2.722*** (14.45)	-9.802*** (-10.13)
Observations	1,146	1,146
R-squared	0.175	0.353
YEAR FE	YES	YES
IND FE	YES	YES
t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1		

This paper chooses the average socially responsible investment intensity (SRI_ind) of the industry and the one lag period SRI (SRI1) as the instrument variables. In terms of correlation, the SRI intensity of other enterprises in the same industry is related to the SRI of the enterprise. In terms of exclusion, the SRI of other enterprises in the same industry will not directly affect the income distribution of the enterprise. The calculation method of industry SRI is that industry SRI is equal to the sum of industry average dividend payment rate, industry average employee income interest rate, industry average tax expenditure rate, industry average donation expenditure rate and industry average main business cost rate. The two-stage least square estimation is carried out to reduce the endogenous problems in econometric recognition. The regression results are shown in table4. In the first stage, the industry SRI estimation coefficient is

significantly positive at 10% level and the one lag period SRI estimation coefficient is significantly positive at 1% level, which indicates that the tool variables have a good interpretive power for the endogenous variable; at the same time. In the second stage, the estimation coefficient of tool variables is significantly positive at the level of 1%, which is consistent with the results described above.

Table 4. 2SLS regression

	(1)	(2)
	first	two
VARIABLES	SRI	LNP
SRI1	0.699*** (24.03)	
SRI_ind	0.005* (0.86)	
SRI		1.469*** (4.13)
ROA	-0.475*** (-5.12)	2.031** (2.33)
CEO_pay	2.681*** (5.40)	-12.916*** (-2.99)
Constant	0.279* (1.90)	-10.185*** (-7.78)
Observations	652	652
R-squared	0.640	0.212
Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1		

5.3. Robustness Test

5.3.1. Replace innovation performance metrics

Table 5. Robustness test

	(1)	(2)
VARIABLES	LNP_W	LNP
SRI	0.636***	
SRI_NEW		1.011*** (6.34)
R_D	2.979** (2.52)	1.714 (1.33)
SIZE	0.575*** (14.63)	0.552*** (13.85)
CASH	0.798* (1.70)	1.521*** (2.99)
ROA	-0.510 (-1.02)	-1.363*** (-2.72)
CEO_pay	-11.260*** (-3.29)	-5.542*** (-2.86)
Constant	-9.749*** (-10.75)	-9.112*** (-10.45)
Observations	1,074	1,145
R-squared	0.357	0.359
YEAR FE	YES	YES
IND FE	YES	YES
Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1		

In the above, the number of patents applied for by enterprises is used to measure innovation performance, and the patents of enterprises can be divided into three parts: invention-specific interests, practical patents and design patents, and the technical requirements of the first two are higher. Therefore, this paper will use the sum of invention patents and practical patents as a substitute index to test the above hypothesis, and the regression results are shown in column (1) of table5. The regression coefficient of socially responsible person investment (SRI) to invention and practical patent (LN_W) is 0.636, which is significant at 1% level, which is consistent with the above regression results, and confirms the reliability of the above hypothesis again.

5.3.2. Replace the measure of SRI

The socially responsible investment indicators used above are standardized on the basis of operating income. in the robustness test, this paper will use the total assets as the benchmark to calculate the intensity of socially responsible investment and replace the original indicators for regression testing. the regression results are shown in column (2) of table5. The regression coefficient of corporate social responsibility investment replacement index (SRI_NEW) to innovation performance is 1.011, and it is significant at the level of 1%, which further shows the reliability of the above results.

5.4. Erogenicity Analysis

Table 6 shows the regression results of corporate socially responsible investment and innovation performance. The explanatory variables of model (1) to (5) are SRI of enterprise to investor, employee, government, community and customer respectively. As can be seen from the chart, although the overall impact of corporate SRI on innovation performance is significantly positive, for each sub-dimensional index, corporate social responsibility investment to the community shows a significant negative impact. This may be due to the fact that there is no direct relationship between community and enterprise, corporate donation may help to establish a good corporate image, but can not directly have an effect on innovation performance. In addition, there is a significant positive relationship between corporate customer responsible investment and innovation performance, which is consistent with the above hypothesis. Although the socially responsible investment for employees, investors and governments is positively related to innovation performance, it is not significant. This may be due to the fact that only four years of data are used in this paper, and the investor structure and government policies do not change much in the short term, so they can not have a significant impact on innovation performance.

Table 6. Heterogeneity analysis results

	(1)	(2)	(3)	(4)	(5)
VARIABLES	LNP	LNP	LNP	LNP	LNP
SRIg	0.849				
	(1.14)				
SRIy		0.324			
		(1.02)			
SRI _s			1.298		
			(1.27)		
SRI _j				-0.750***	
				(-2.99)	
SRI _z					0.831***
					(3.69)
R_D	3.442**	2.742*	3.466**	3.297**	4.303***
	(2.56)	(1.90)	(2.54)	(2.47)	(3.24)
SIZE	0.562***	0.558***	0.561***	0.557***	0.544***
	(12.85)	(12.73)	(12.60)	(12.79)	(13.21)
CASH	1.466***	1.536***	1.538***	1.545***	1.575***
	(2.81)	(2.96)	(2.97)	(2.98)	(3.04)
ROA	-1.088**	-0.951*	-1.223**	-1.129**	-0.641
	(-2.17)	(-1.85)	(-2.38)	(-2.25)	(-1.21)
CEO_pay	-9.770***	-10.935***	-9.979***	-9.497***	-6.782***
	(-3.08)	(-3.09)	(-2.93)	(-3.11)	(-2.85)
Constant	-9.029***	-8.946***	-9.044***	-8.885***	-9.178***
	(-9.27)	(-9.18)	(-9.05)	(-9.18)	(-10.05)
Observations	1,146	1,146	1,146	1,146	1,146
R-squared	0.340	0.340	0.340	0.340	0.347
YEAR FE	YES	YES	YES	YES	YES
IND FE	YES	YES	YES	YES	YES

Robust t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

6. Conclusion

From the perspective of stakeholders, this paper examines the impact of corporate social responsibility investment (SRI) and various dimensions of SRI on their innovation performance, taking Chinese science and technology innovation listed companies as samples. The study found that corporate social responsibility investment has a significant positive impact on innovation performance, and further analysis shows that corporate social responsibility investment in investors, employees, customers and government helps to improve corporate innovation performance. Corporate social responsibility investment in the community will have a negative impact on innovation performance, which shows that corporate social responsibility investment has a heterogeneous impact on innovation performance.

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