

# ESG, R&D and Brand Value: Taking the Chinese Listed Companies of 3C Equipment Manufacturing Industry

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**Abstract.** Taking the listed 3C industries as research samples, this paper discusses the impact of corporate R&D investment on brand value and further explores the moderating role of corporate social responsibility in the relationship between the two. The results show that 1) Except for the companies with low brand value, R&D investment, and ESG performance have positive and significant effects on overall brand value, while the intersection of innovation performance and ESG has no significant effect on brand value. 2) CSR performance and active disclosure of CSR reports are beneficial to brand value at the early stage of brand value building. In terms of overall brand value, the input and output of corporate innovation activities and ESG performance have a significant positive correlation with brand value, but ESG performance has no moderating effect between corporate innovation and brand value. For sample companies with low brand value, R&D investment has no significant impact on brand value. Based on the above research results, this paper also puts forward corresponding suggestions.

**Keywords:** R&D; ESG; Brand value.

## 1. Introduction

Branding is based on changes in the business environment that affect consumers, competitors, the company's own business conditions, partners, and the market economy. Brands need to be ready to respond to changes in these factors in order to continuously improve and enhance themselves, and thus promote rebranding. In the "CRED" model proposed by Prof. Elie Ofek, D stands for differentiation, and the main reason for the formation of brand differences is that the differentiation of a particular brand from other brands forms a distinct impression and feeling in consumers' minds. Innovation is the inexhaustible driving force for the development of corporate brands. In recent years, people's awareness of environmental protection has been gradually strengthened, and the green innovation performance of enterprises has been paid more and more attention by society. Since the outbreak of the epidemic and the global economic downturn, many enterprises have actively assumed social responsibility to help the governments in the epidemic areas to solve their urgent needs and bring new light to the development of their own brand values, and corporate social responsibility has had a subtle influence on the development of certain brands today. The study of the relationship between corporate social responsibility, corporate innovation performance, and brand value can bring different perspectives and possibilities for corporate brand building and brand value improvement.

Most studies have shown that innovation contributes to brand value. Studies in technological innovation have found that innovative technology is a key factor in establishing a firm's brand (Xie et al. 2006; Li et al. 2019); innovative technology can indirectly increase brand value by maintaining brand status and protection and enhancing brand security (Edelstein et al. 2004). Wang and Chen (2017) argue that overall, regardless of the level of competition in the market, there is a significant positive correlation between technological innovation and the brand value of a company. Therefore, technological innovation plays an important role in brand value enhancement. In terms of product innovation, Truong et al. (2014) argued that innovative products can comprehensively enhance the attractiveness of products to consumers, and therefore the application of technological innovation in products is one of the assets for companies to break through the market; Li (2015) asserted that innovative products can further deepen consumers' understanding of the original brand, thus enhancing the brand influence and thus the brand value; Canh (2019) showed that process and product innovation has a significant positive impact on for the performance of the company and can

help companies gain more market share, and Ma (2017) argued that studying whether technological innovation has a positive effect on the enhancement of brand value should be accompanied by considering risk factors, that is, considering the positive correlation between indicators under risk factors. Qi et al. (2020) concluded that there is a significant N-shaped relationship between technological innovation and brand value. Some scholars have also shown that excessive strategic tilting of firms on innovation can lead to a disproportionate share of technology investment in the total investment to the extent that it may take away other resources for enhancing brand value, which in turn is detrimental to the enhancement of brand value (Li et al., 2019). It has also been shown that for the innovation value transformation stage, the return on innovation investment is usually not realized in the short term (Hart, 1996).

Most of the above literature believes that corporate innovation performance has a positive and significant effect on corporate brand value, even though a few pieces of literature holds a different view, but also believe that the positive effect can be seen under specific conditions or value transformation process that requires a certain amount of time. Therefore, summarizing the findings of the above-related literature, this paper deduces research hypothesis one as follows.

H1: Corporate innovation performance has a positive and significant effect on corporate brand value.

There are many studies on the impact of CSR on corporate innovation performance, and although most advocate a positive effect (Huang and Sun, 2019), there is also a lot of literature that advocates a negative effect or a different effect under certain conditions. Scholars who argue for the impact of CSR and corporate innovation performance argue that, as firms implement CSR, they also generate other benefits, such as the identification of new business opportunities due to greater social concern and a better understanding of consumer preferences (Li and Wang, 2020), as well as influence firms' technology strategies (Barney, 1986); and the improvement of human quality due to employee care and thus enhance the quality of human resources (Jin et al., 2021); Some scholars with the opposite opinion believe that more CSR will hinder the development of corporate innovation (Hull and Rothenberg, 2008), and that the resources obtained from more CSR will not meet the needs of corporate technological development in the long run, and therefore the two are inversely related (Wang and Wang, 2011), while the study by Liu and Chen (2021) found that CSR and R&D investment are positively correlated when firms undertake less CSR; however, when the degree of CSR fulfillment is higher, the dominant strategy of firms will evolve from R&D competition to yield competition caused by CSR, so when CSR is performed at a higher level, the degree of complementary relationship with R&D investment will change from a substitution. There are also studies in the literature that find an inverted U-shaped relationship between CSR and corporate innovation (Wang and Shao, 2018; Li et al., 2018), i.e., both are positively correlated at intermediate levels, otherwise, they are complementary. Some other scholars believe that the relationship between CSR and innovation is based on certain preconditions, for example, the benefits of CSR on innovation are stronger when CSR is demonstrated through voluntary disclosure of CSR reports (Bai and Wang, 2020), and the effect is more significant for high-tech industries and economic policy instability (Xie et al., 2022). Moreover, Zeng et al. (2020) study the impact of CSR on innovation capacity enhancement with a lag. Based on the above findings, the research hypotheses can be summarized as follows:

H2: CSR performance has an impact on corporate innovation.

019) argue that CSR performance can increase consumers' willingness to purchase and thus enhance brand value, so companies should actively fulfill their CSR and thus gain consumers' recognition. Li (2022) also believes that companies that are active in CSR can greatly expand the influence of their brands. However, Wright and Friedman (1970) argue the opposite, because when a company discloses that it is going to make a CSR investment, the company's stock price will react by falling, indicating that investors are distrustful of the company's future development, and therefore the company's brand value will be adversely affected. In summary of the above findings, this paper summarizes the following research hypotheses.

H3: CSR performance influences brand value.

Combining research hypotheses H2 and H3, it can be summarized that social responsibility performance plays a moderating role in the relationship between corporate innovation and brand value.

## 2. Methodology

Based on the literature review, three research hypotheses are summarized: 1) Corporate R&D input has a positive and significant effect on corporate brand value, 2) CSR performance has an impact on corporate R&D input, and 3) CSR performance has an influence on brand value. Therefore, the relationship between corporate innovation performance, CSR, and brand value shows in Figure 1. We use the Ordinary Least Square (OLS) and Quantile regression method for the research design and empirical probe.

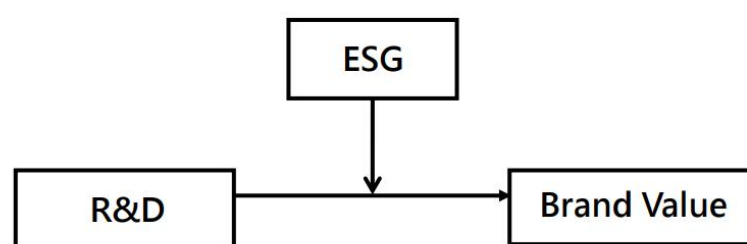


Figure 1 Correlation between R&D, ESG, and brand value

The 3C industry is the largest industry in the digital industry. Therefore, this paper selects the 3C industry of Chinese listed companies from 2018 to 2021 as the research sample, to explore the association between corporate R&D, ESG, and brand value

The sample data in this paper are obtained from CSMAR and WIND databases. After downloading the original sample data, the samples of delisted, special treatment (ST) companies were excluded first, then the samples with missing data were excluded, and finally, the extreme values were processed by winsorize; finally, a total of 653 samples were obtained.

### 2.1 Research method and regression formula

The research method used in this paper is the Ordinary Least Square Method (OLS) and the Quantile Regression which is executed by setting the explanatory variables at 25%, 50%, and 75% strata from low, medium, and high, respectively. The regression models are as follows.

$$BV_{it} = \beta_0 + \beta_1 RD_{it} + \beta_2 PATENT_{it} + \beta_3 ESG_{it} + \beta_4 RD * ESG_{it} + \beta_5 PATENT * ESG_{it} + \beta_6 NOREG_{it} + \beta_7 GRI_{it} + \beta_8 SCALE_{it} + \beta_9 AGE_{it} + \beta_{10} SOE_{it} + \beta_{11} CYEAR_{it} + \varepsilon_{it} \quad \dots\dots\dots(1)$$

### 2.2 Variable Description

#### 2.2.1 Explanatory variables

The explanatory variables are brand value (BV), the brand evaluation model used in this paper adopts the HIROSE model, published in 2012 by a research team led by Dr. Yoshikuni Hirose of Waseda University in Japan. The model is characterized by the transparency and objectivity of the data sources, as the data are obtained from the financial statements approved by CPA, and the model is as follows.

$$BV = (PD, LD, ED)/r$$

Note: BV means brand value; PD is prestige driver; LD represents loyalty driver; ED is expansion driver; r is the risk-free rate.

## 2.2.2 Explanatory variables

### 2.2.2.1 R&D

The proxy variable for innovation input is research and development (RD), which is calculated by dividing the total amount of capitalized and expensed R&D investment by the net sales revenue of the firm.

### 2.2.2.2 CSR

Considering the adequacy and timeliness of the sample size, this paper adopts the ESG rating results of Sino-Securities Index Information Service (Shanghai) Co. Ltd and converts them into corresponding scores as the proxy variable; Based on some research findings advocated that the implementation of CSR will make investors lose confidence (Friedman, 1970), so we set a dummy variable of no to retrogress of CSR compared with last year (NOREG), to analyze the effect of continuously strengthening CSR investment. if there is no retrogression compared with last year, the dummy variable is set to "1", otherwise it is set to "0"; Finally, considering the effect of CSR report disclosure on the effectiveness of CSR implementation, this paper also establishes a dummy variable (GRI) for whether enterprises disclose social responsibility reports in accordance with the "GRI reporting guidelines", and sets it to "1" if they disclose social responsibility reports in accordance with the "GRI reporting guidelines", otherwise it is set to "0".

### 2.2.2.3 Moderating effect test

According to the relationship diagram in Figure 1, ESG is the moderating variable, so the two explanatory variables of ESG and innovation performance, i.e., R&D set as an interaction (ESG\*RD) in this paper.

### 2.2.3 Control variables

Considering other factors that may have an impact on brand value, this paper selects company size (SCALE), company age (AGE), nature of property rights (SOE), and epidemic year (CYEAR) as control variables.

## 3. Results

Table 1 Descriptive statistics (N = 653)

Variable	Min.	Max.	Ave.	Std.r
BV	19.114	27.647	22.812	1.529
PD	20.566	26.253	22.761	1.130
LD	0.037	0.944	0.676	0.205
ED	1.000	47.575	2.976	6.771
RD	0.009	0.401	0.081	0.061
ESG	1.000	8.000	5.300	1.681
RDESG	-0.425	0.202	-0.007	0.085
PTESG	-325.319	757.589	20.840	151.646
NOREG	0.000	1.000	0.542	0.499
GRI	0.000	1.000	0.066	0.248
SCALE	19.986	25.828	22.351	1.221
AGE	11.022	38.033	20.242	5.774
SOE	0.000	1.000	0.306	0.461
CYEAR	0.000	1.000	0.389	0.488

Note: For the definition of variable code please refer to the variable descriptions in 2 Methodology.

Table 2 the empirical results of model (1) (N=653)

Variable	25%	50%	75%	OLS
Con_	5.226***	3.753***	2.161**	4.291***
RD	1.337	1.992***	2.37***	1.532**
ESG	0.172***	0.096**	0.111***	0.142***
RDESG	0.261	0.253	0.456	(0.000)
NOREG	(0.227)	(0.176)	(0.012)	(0.196)
GRI	0.505**	0.477***	0.230	0.530***
SCALE	0.717***	0.820***	0.916***	0.802***
AGE	(0.003)	0.002	(0.004)	(0.013)*
SOE	(0.048)	(0.036)	(0.145)	(0.096)
CYEAR	0.412**	0.233*	0.194**	0.240*

Note 1: For the definition of variable code please refer to the variable descriptions in 2 Methodology.

Note 2:  $p \leq 0.01$ , significance is \*\*\*,  $0.01 < p \leq 0.05$ , significance is \*\*,  $0.05 < p \leq 0.1$ , significance is \*.

Note 3: The numbers in the columns are coefficients.

Table 2 shows that, except for the companies with low brand value, R&D investment, and CSR performance have positive and significant effects on overall brand value, while the intersection of innovation performance and CSR has no significant effect on brand value, confirming the findings of Liu and Chen (2021) that innovation performance and CSR performance have a mutually exclusive effect.

A deeper analysis of the quantile regression results reveals that CSR performance and active disclosure of CSR reports are beneficial to brand value at the early stage of brand value building, nevertheless, excessive investment in CSR is not helpful to brand value building, and the acquisition of patent rights is also necessary. This result is in line with Vernon's (1966) product life cycle theory, where the first stage is the introduction period when the brand needs to be introduced to the market so that potential consumers can be exposed to the product information and then purchase it.

When the brand value has significantly increased to the middle and high levels, the company needs to stabilize the existing market and at the same time importance to pursuit of innovation. However, for high-end brands, since the good brand image has been rooted deeply in customers, it is enough as long as CSR performance is good and does not negatively affect the brand image. The impact on brand value is slightly weaker than the previous stage whether input huge cost in CSR or not, and whether disclosure CSR report.

The overall empirical results of this paper corroborate most of the previous scholars' findings that innovation performance contributes to brand value building (Saber, 2018; Canh, 2019); and that innovation activities and social responsibility are complementary (Liu and Chen, 2021).

#### 4. Conclusions and Recommendations

This paper takes the 3C industry of listed companies in China as the research sample to investigate the impact of corporate innovation performance on corporate brand value and further explores the moderating role of CSR in the relationship between the two. The main findings are as follows.

Except for the companies with low brand value, R&D investment, and ESG performance have positive and significant effects on overall brand value, while the intersection of innovation performance and ESG has no significant effect on brand value.

CSR performance and active disclosure of CSR reports are beneficial to brand value at the early stage of brand value building.

Based on the above findings, this paper makes the following recommendations.

1. Building brand value is the goal that companies pursue. Although both innovation and CSR are vital factors that contribute to brand value building, however, the investment costs for both are huge, so companies need to develop implementation strategies according to the actual business environment to make the most efficient allocation of funds.

2. Unlike most research findings, we find that there are significant differences in the effects of innovation and CSR on brand value at different stages of the brand building effectively enhancing brand value, which can provide an alternative viewpoint thinking in academia.

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