

## Research Article

# Financing Constraints and Environmental Performance: Management in Resource Constraint Settings

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The majority of research examines the relationship between finance and the environment empirically, but they lack a comprehensive theoretical framework. To shorten this gap, we develop an analytical framework dubbed “management in resource constraint settings” and elucidate the theoretical process of finance constraints influencing environmental performance. We explore the influence of finance constraints on environmental performance of China’s enterprises, as well as their possible mechanism, using financial data from A-share listed companies on the Shanghai Stock Exchange from 2010 to 2019. Our findings suggest that financial constraints can drastically reduce China’s firms’ environmental performance, and that green management is a viable channel. These discoveries are crucial for China’s ecological civilization and considerable economy to develop in a coordinated manner.

## 1. Introduction

Over the past decades, Chinese enterprises have made significant contributions to China’s rapid economic development. However, it’s not “green.” High-speed expansion necessitates more energy and resource usage, which has resulted in serious ecological environmental issues [1, 2]. Improving environmental performance has been a consensus as “the Belt and Road” building progresses [3]. From the micro-level, the environmental performance of enterprises is the object that needs attention.

According to a World Bank analysis, China has the greatest percentage of non-financial listed companies reporting financing constraints as the key impediment to their growth among 80 nations [4]. Chinese financial market is thought to be “underdeveloped” [5]. Financial institutions only provide limited credit to Chinese enterprises. Firms’ financial decisions are influenced by financing constraints [6, 7]. Due to financial constraints, firms are unable to fund

their projected investments, particularly in the environmental investment, a vital component of green management [6, 8]. The topic is whether financial constraints have an impact on environmental performance through green management in China. If this mechanism works, it is critical to comprehend the function of firm management in enhancing enterprises performance by resolving the problem of financial constraints.

Therefore, we investigate the relationship between financing constraints, management, and performance. The impact of financing constraints on environmental performance and the influence of green management on environmental performance have been studied before. But we are interested in the impact of financing constraints on environment performance through the indirect channel of green management. To close this gap, this research develops a comprehensive framework dubbed “management in resource constraint settings” and elucidates the theoretical process of finance constraints influencing environmental

performance. We explore the influence of finance constraints on environmental performance of China's enterprises, as well as their possible mechanism, using financial data from A-share listed companies on the Shanghai Stock Exchange from 2010 to 2019. Our findings suggest that financial constraints can drastically reduce China's firms' environmental performance, and that green management is a viable channel. The findings demonstrate that financial constraints will considerably reduce Chinese firms' environmental performance, with green management as the transmission variable.

The rest of the paper is organized as follows. Section 2 introduces the theory development and presents the research hypotheses. Section 3 explains the research methods and empirical results. Section 4 presents the results, Section 5 is the discussion, and Section 6 presents the conclusion of the study. Figure 1 shows the organizational structure of the article.

## 2. Literature Review

*2.1. Green Management and Performance.* With the growing recognition of environmental sustainability and protection as the emerging trends, green management has been widely concerned by enterprises and governments and has become one of the crucial strategies of companies in developed and emerging markets since global sustainability and the awareness of environmental protection became trends. [9, 10]. Green management, which is defined as "through continuous learning and development, and by accepting environmental goals and strategies that are fully integrated with organizational goals and strategies, apply innovation to achieve sustainability, waste reduction, social responsibility and competitive advantage [11]," is becoming more closely linked to a company's financial [12] and environmental performance [13]. Green management's major purpose is to protect natural resources and the environment as well as to boost resource and operational efficiency [14].

Enterprises are motivated to improve their environmental performance. The Porter hypothesis (PH) is based on the idea of achieving good corporate environmental performance through long-term incentives [15]. Researchers have looked at the "green" motive of businesses from a variety of perspectives in recent years, whereas they focused more on consumer preferences and the spillover effect [16]. Previous research, such as Wesseh and Lin's, has suggested that high environmental performance helps businesses gain a competitive edge and improve their economic performance [17, 18].

However, the resource-based view (RBV) rationale holds that a senior management team's dedication to tackle ecological challenges is "worthy," but "rare," "high imitation cost," and "irreplaceable" [19]. It is also widely accepted that senior management support for environmental issues leads to improved environmental performance over time [20]. The factors used to evaluate a company's environmental performance include pollution reduction, recycling programs, and waste minimization [21]. Almost every industry has recently implemented green management methods, which

were efficient waste treatment and timely disposal of hazardous chemicals, to demonstrate enhanced productivity [20]. This phenomenon is due to the worldwide awakening that motivated ASEAN (Association of Southeast Asian Nations) countries and forced businesses to become more ecologically conscious during the 1970s [22].

The RBV believes that the peak of enterprises' comprehensive performance and a firm's resources (physical, human, and organizational capital) is decided by the degree to which an organized system holds and controls such resources [23], and a firm's resources comprise physical, human, and organizational capital. Organizational capital reflects the firm's reporting structure and procedures and relationships between units within the enterprises and throughout their surroundings. When a company's resources enable it to "conceive of and implement plans that raise the productivity and validity of the organization," it is said to be "valuable" [23]. Thus, organizational capital is supposed to be one of the most essential intangible resources, despite the fact that there are various resources in an enterprise. Therefore, in this essay, green management, a beneficial organizational resource that contributes to improved environmental performance, shows its validity through its performance.

*2.2. Management in Resource Constraint Settings.* Traditional industries' ecological evolution and the establishment of late-model green ecological industries require financial support [24, 25]. Credit limitations, illiquidity, and the inability to borrow or issue shares are all examples of financial constraints that inhabit enterprises from funding their projected investments [26, 27]. By altering the optimal allocation of production inputs, financial constraints are likely to influence enterprises' real activities and investment decisions [28, 29]. Therefore, financing feature in enterprises' environmental investment, which is a fundamental research topic of finance, ecological civilization, and substantial economy. Organizations can invest strategically in the production components required to improve environmental performance when they have access to financial resources. Enterprises, on the other hand, frequently encounter financial barriers to accessing the capital market, which inhibits their growth. This is because they must prioritize productive investment, firms with greater budgetary constraints tend to invest more in tangible assets rather than intangible assets [30–32].

On the other hand, most studies show that enterprises generally have external financing constraints [4, 33]. Environmental investment, one of the important strategies of green management, will increase the operating cost of enterprises, and its short-term income is not high [34]. Therefore, it is much more difficult for companies to take environmental performance into account [35]. They often reduce voluntary environmental investment to ensure financial performance, which probably hinders the effective treatment of environmental pollution [36, 37]. Furthermore, several research works on the impact of development finance on carbon footprint has been shown so far [38, 39].

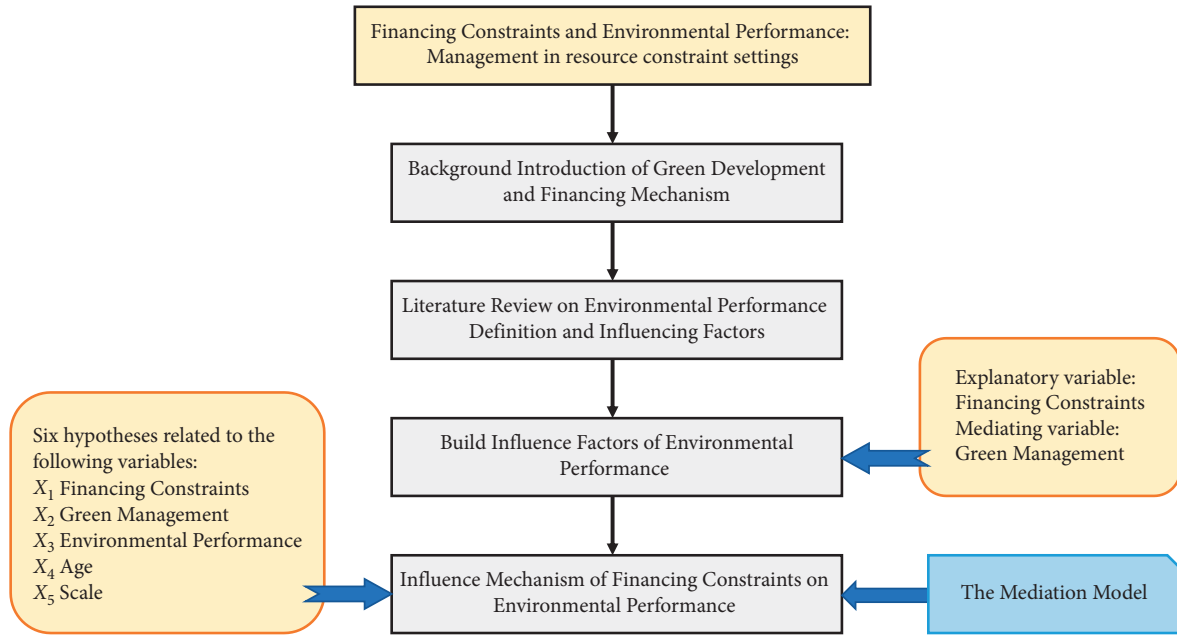


FIGURE 1: Article structure map.

Lahiani [40] discovered that China benefited from the development of finance, which could be seen in less emission of CO<sub>2</sub> and the enhanced ecological quality. According to Zhao and Yang [41], the development of finance has distinct impacts on CO<sub>2</sub> footprint. It has also been found that financial development is capable of lowering footprint of different ecological indexes such as the effluent economy and nitrogen oxides [40, 42]. However, few studies pay attention to the problem that companies' investment in green management would be limited if they have financial constraints. This study attempts to investigate the influence of financing constraints on environmental performance of Chinese enterprises and its potential channel. Therefore, it is vital to find out whether financing constraints will affect the effectiveness of green management, that is, environmental performance, and whether environmental investment in green management is an intermediary.

Above all, this paper makes the following assumptions.

*Hypothesis 1.* Financing constraints significantly affect environmental performance.

*Hypothesis 2.* Financing constraints significantly affect green management.

*Hypothesis 3.* Green management significantly affects environmental performance.

*Hypothesis 4.* Financing constraints significantly affect environmental performance through green management.

Figure 2 shows the conceptual model of these hypotheses.

*2.3. Environmental Performance.* The measurement indicators of environmental performance are largely divided into two categories in extant research. Laosirihongthong [43], who is one of the representatives, used a questionnaire to separate environmental performance into many indicators. Liu [44], another representative, divided environmental performance into two main categories: behavior level (activity-oriented action) and capability competency (management-oriented performance). The result of environmental activity level and environmental management competence equals total environmental performance. Due to the information disclosure and data availability of listed companies and the current environment governance in China, this paper in general uses the second method to analyze the environmental behavior level and capability competency of listed companies.

As a result, the environmental performance in this research is divided into two categories: environmental activity level and environmental institutional organization. The former is pollutant treatment and cleaner production. The latter is the content of the company's environmental management, which is separated into two dimensions: monetary indicators, which include a series of environmental protection spending, tax, and income, and non-monetary indicators, including environmental disclosure information, and so on. To measure the success of the company's green management, the score of environmental activities is multiplied by the average score of environmental institutional arrangements to get environmental performance. Figure 3 shows the environmental performance evaluation process.

### 3. Models and Variables

*3.1. Research Methods.* Bootstrap was first proposed by Efron [45]. Using the repeated sampling statistics generated

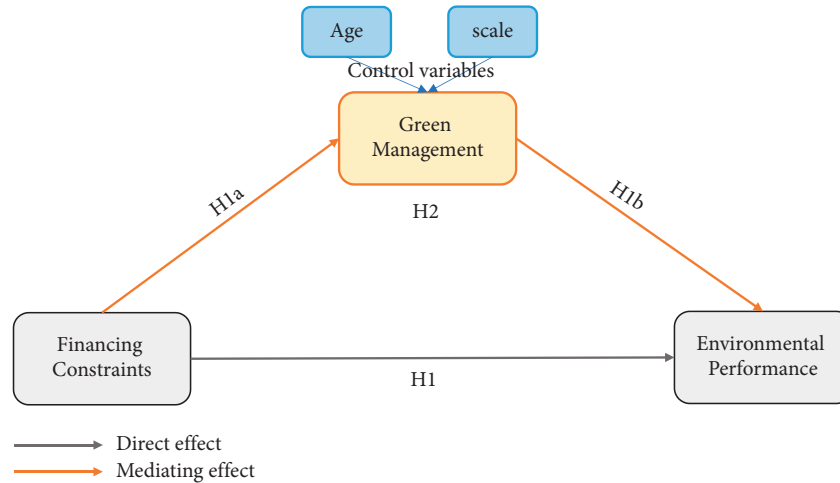


FIGURE 2: Conceptual model.

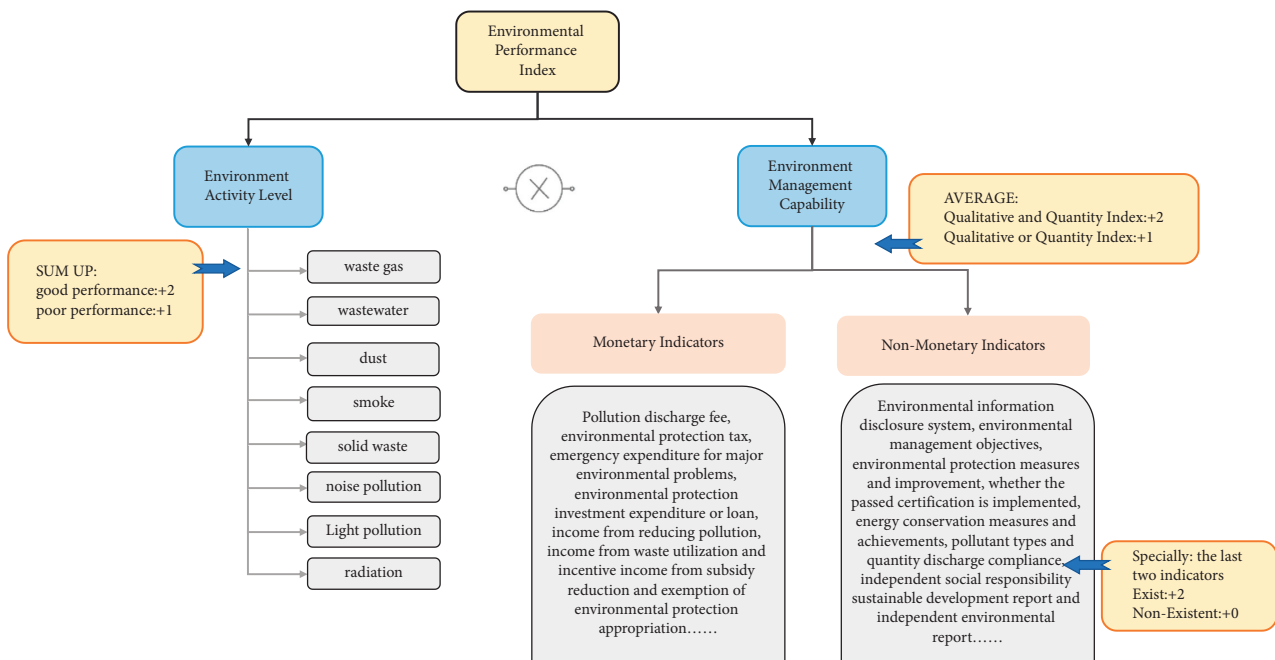


FIGURE 3: Environmental performance evaluation.

by the original sample, it can deduce statistical information about the population. When examining restricted sample data, Davidson and MacKinnon believe that the bootstrap method outperforms the large sample asymptotic theory (Davidson and MacKinnon, 1999). Chang and Park used mathematical derivation and simulated studies to demonstrate the bootstrap method's efficiency in statistical tests [46]. To some extent, bootstrap overcomes the reasoning error samples in finite element statistical tests. The bootstrap approach is used to estimate the sample data in the confidence interval of 95% parameters due to the inherent limitations of the data collecting method in this work, namely, the abnormal distribution of some variables.

3.2. *Data Source and Sample Selection.* We chose A-share listed firms that published green management and environmental performance before December 31, 2019, as the research sample, with variables ranging from 2015 to 2019 (the deadline for sample sampling is May 1, 2021). This work uses a five-year timeframe, which is in line with current environmental research practice and the bootstrap method's requirement for continuous variables. Because publicly available reports and data from publicly traded companies (such as financial reports, social responsibility reports, and the company's official website) are dispersed, data of environmental investment and environmental performance are primarily derived from the corporate social

responsibility report. Financial constraints force the search and supplementation of some deficient data using the China Stock Market and Accounting Research (CSMAR) database of listed firms. Control variables are primarily derived from the yearly report published on the company's official website. Finally, we successfully access 1850 cases of effective samples. The following is a list of sample selections. (1) Companies listed on the ST and PT exchanges, as well as those with audit views other than unqualified opinions, are excluded. (2) Remove publicly traded enterprises in the categories of environmental protection, banking, insurance, and real estate from consideration. (3) Remove companies from the list if their variable data are missing.

### 3.3. Variable Design

**3.3.1. Explained Variable.** Investment Cash Flow Sensitivity Coefficient Model [47], KZ index [48], and the WW index [49] are some of the most widely used financial constraint measurement methodologies in the United States and overseas. The FHP approach was first proposed earlier, and numerous literature studies in China have used it. However, there are several inconsistencies in the implementation of the FHP approach [47]. The WW index eliminates the need for pregrouping of companies and the use of the Tobin Q value, which requires variables from company reports and market data, and the data are readily available [49]. As a result, the WW index will be used as the agent of financing constraints in this work. According to WW index [49], the formula is as follows:

$$WW = -0.091C_{it} - 0.062D_{it} + 0.021LTD_{it} - 0.044L_{it} + 0.102I_{it} - 0.035S_{it}. \quad (1)$$

$C$  is the rate of cash flow to assets. When dividends are distributed,  $D$  assigned a value of 1 is a dummy variable. The rate of long-term liabilities to assets is  $LTD$ .  $L$  is logarithmic treatment of total assets, and  $I$  is the trade where the enterprise is located.  $S$  stands for the enterprises' sales growth ratio. The higher the WW index, the more severe the financial limitations faced by businesses.

**3.3.2. Mediating Variable.** The company's publicly available environmental investment data consist primarily of environmental spending. This study uses the logarithmic form of the current amount of environmental protection spending as the agency volume for better regression analysis.

**3.3.3. Control Variable.** Many researchers believe the level of firms' financing constraints has remarkable difference in China considering listed firms' varying scale and age [50, 51], because it is supposed that these corporates are riskier with respect to default probability and information hazard when being in the capital market [52–55]. As a result, the control variable sequence in this research includes the years of establishment and the size of the businesses. The establishment years are calculated using the company's reported

establishment period, and the logarithm of the enterprise asset scale is used as the control variable (see Table 1).

**3.3.4. Descriptive Analysis.** The maximum and minimum values, mean values, and standard deviations of variables are listed in Table 2. There are some variances in financing constraints among businesses in the sample, but they are not substantial. The environment investment that businesses encounter is largely comparable due to the immature development of China's financial market. Furthermore, there are some variances in environmental protection spending among businesses, but they are minor. Meanwhile, the sample data have an atypical distribution, the difference in environmental performance sample data between businesses is not statistically significant, and the mean value is low. It demonstrates that Chinese firms' investments in ecological protection are limited due to policy restraints, a lack of passion to improve the company's environmental performance, and a low and concentrated environmental performance score. Before regression analysis, the values of the sample data of each variable in Table 2 were treated by subtracting the mean value to solve data centralization. In addition, there is a violent reverse side relationship between financial constraints and environmental investment and performance. Environment investment has a negative correlation with financial restrictions and a positive correlation with environmental performance. It makes environmental investment statistically significant as an intermediary variable indicator of the influence of funding restrictions on environmental performance.

## 4. Results

Under the 95% confidence interval, the results of main effect test and the intermediary effect test are expressed in Table 3 and Figure 4. The test result of the main effect result is valid, indicating that financing constraints indeed significantly influence the environmental performance. Thus, Hypothesis 1 is valid. The test intervals of financing constraints on green management and green management on environmental performance are effective. Therefore, Hypothesis 2 and Hypothesis 3 are valid. According to the test results of intermediary effect, the indirect effect suggests the intermediary effect of green management is valid, and the effect value is  $-0.3756$ . In addition, after controlling the intermediary variable green management, the direct impact of independent variable financing constraints on dependent variable environment performance is also significant. Thus, Hypothesis 4 is valid. Overall, the test results show that green management plays an intermediary role and is the only intermediary variable, that is, the complete intermediary variable.

## 5. Discussion

Using a large-panel information set of Chinese listed enterprises, we discover that financial constraints are crucial factors influencing firm green management and its performance. When financial constraints become

TABLE 1: Variable design.

Variables	Name	Explanation	Resources
X <sub>1</sub>	Financing constraints	WW index proposed by White and Wu [49]	Annual report
X <sub>2</sub>	Green management	= logarithm of current amount of environmental protection investment expenditure	CSMAR, corporate social responsibility report
X <sub>3</sub>	Environmental performance	= environmental activities × environmental management capability	CSMAR, corporate social responsibility report
X <sub>4</sub>	Age	Years from establishment to 2019	Annual report of listed companies
X <sub>5</sub>	Scale	= logarithm of enterprise asset scale	Annual report of listed companies

TABLE 2: Maximum and minimum values, mean and standard deviation, and Pearson correlation.

Variables	Obs	Mean	SD	Min	Max	X <sub>1</sub>	X <sub>2</sub>
X <sub>1</sub>	370	-1.0544	0.0787	-1.789	-0.8374		
X <sub>2</sub>	370	15.6987	2.0961	6.0000	21.2139	-0.422**	
X <sub>3</sub>	370	3.9834	1.8845	0.4615	10.1538	-0.309**	0.332**

\*\*At 0.01 level (two tailed), the correlation was significant.

TABLE 3: Mediation effect test.

Test	Path	$\beta$	s.e.	t
<b>Direct effects</b>				
H <sub>1</sub>	Financing constraints→environmental performance	2.5881	1.5126	1.7110**
H <sub>1a</sub>	Financing constraints→green management	-3.9459	1.6760	-2.3543**
H <sub>1b</sub>	Environmental performance→green management	0.0952	0.0468	2.0327**
<b>Indirect effects</b>				
H <sub>2</sub>	Financing constraints→green management→environmental performance	2.2126	1.5077	1.4675**
<b>Significant control variables</b>				
	Age→green management	0.0414	0.0177	2.3350**
	Scale→green management	0.8898	0.0988	9.0023**

\*\*At 95% level, the test was significant.

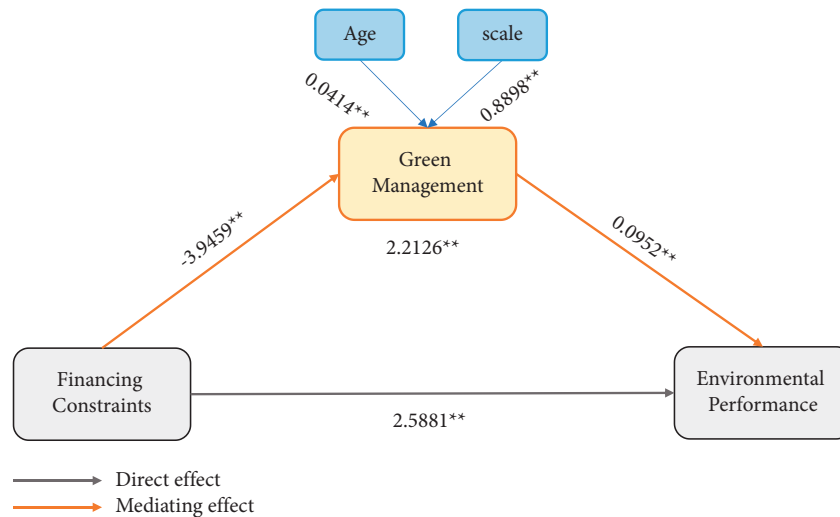


FIGURE 4: Test results.

more severe, the likelihood of company environmental investment decreases. Moving towards a lower level of financial constraints is likely to improve environmental performance. Financial constraints are considered a market selection mechanism that will stifle the company’s growth prospects. This paper investigates the

relationship between financial constraints and ecological protection. The findings show that, similar to previous study, financial constraints have a significant direct effect on environmental performance, but there is an intermediary variable in the form of green management. Previous study has not explicitly considered the

relationship between financial constraints and environmental performance, but we have. When listed companies face financial constraints, the more the financial constraints are, the less interest there is in investing in environmental protection, and as a result, listed companies' environmental performance suffers, through the channel of green management.

**5.1. Policy Significance.** Financing constraints reflect the dilemma of insufficient internal financing and high external financing costs faced by enterprises. Much high debt will often hit enterprises' enthusiasm to increase investment in green management. Therefore, due to financing constraints, listed companies often have poor performance of environment. The existing institutional environment is to promote the construction of a multi-level capital market, vigorously develop direct financing channels, optimize the financial system structure, form a multi-level financing development pattern such as credit, bonds, equity, venture capital, and funds, and reduce the financing cost of listed companies. However, it seems to be insufficient. The traditional financial model's development challenge may be addressed by a new form of highly efficient and sustainable financial model. For example, the financial sector has improved its integration with information technology in recent years. Digital finance, which employs a number of modern technologies such as artificial intelligence, big data, and cloud computing, is a complement to traditional finance and is critical to the advancement of firms' green management. Much of the risk associated with environmental investment can be spread out over a larger area. As a result, digital finance helps top management overcome their funding challenges, thereby promoting the environmental performance as a whole.

**5.2. Theoretical Significance.** Previous research mainly looked at the direct impact of financial constraints on environmental performance but did not go into details of the impact channel. We examine an influence mechanism between financing constraints and environmental performance, offer a new perspective on "management in a resource constrained environment," and recognize that poor environmental performance of companies may be due to a lack of environment investment in green management, which is primarily influenced by financing constraints. As a result, it is decided that if the company wants to improve its environmental performance, it would require not only internal green management improvements but also financial market support. This is to fill in the gaps in existing literature study on increasing listed firms' environmental performance.

**5.3. Practical Significance.** The results of this paper provide vital enlightenment for listed companies and decision makers. Firstly, the research framework of this paper aims to guide listed companies on the influence of investment on environmental performance. Listed companies can use the

new research framework of environmental performance to enhance their environmental performance by increasing the proportion of environmental protection investment, doing an excellent job in waste gas and wastewater emission reduction, solid waste utilization and disposal, noise, light pollution, radiation, and other treatment and cleaner production, and improving the quality of environmental information disclosure.

## 6. Conclusion

Researchers have discussed the relationship between finance and environment empirically; however, there is no comprehensive framework. In this paper, we develop an analytical framework and elucidate the theoretical process of financial constraints influencing environmental performance. We used financial data from a group of companies in Shanghai Stock Exchange that published green management and environmental performance and explored the influence of finance constraints on environmental performance of the enterprises. When financial constraints become more severe, the likelihood of company environmental investment decreases. Moving towards a lower level of financial constraints is likely to improve environmental performance. This research work suggests that finance constraints can reduce the environmental performance of these enterprises, and the green management is a viable channel.

## Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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