

Chen, Suijun; Lakkanawanit, Pankaewta; Suttipun, Muttanachai; Xue, He

Article

Environmental regulation and corporate performance: The effects of green financial management and top management's environmental awareness

Cogent Business & Management

Provided in Cooperation with:

Taylor & Francis Group

Suggested Citation: Chen, Suijun; Lakkanawanit, Pankaewta; Suttipun, Muttanachai; Xue, He (2023) : Environmental regulation and corporate performance: The effects of green financial management and top management's environmental awareness, Cogent Business & Management, ISSN 2331-1975, Taylor & Francis, Abingdon, Vol. 10, Iss. 1, pp. 1-17, <https://doi.org/10.1080/23311975.2023.2209973>

This Version is available at:

<https://hdl.handle.net/10419/294420>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

Environmental regulation and corporate performance: The effects of green financial management and top management's environmental awareness

Suijun Chen, Pankaewta Lakkanawanit, Muttanachai Suttipun & He Xue

To cite this article: Suijun Chen, Pankaewta Lakkanawanit, Muttanachai Suttipun & He Xue (2023) Environmental regulation and corporate performance: The effects of green financial management and top management's environmental awareness, Cogent Business & Management, 10:1, 2209973, DOI: [10.1080/23311975.2023.2209973](https://doi.org/10.1080/23311975.2023.2209973)

To link to this article: <https://doi.org/10.1080/23311975.2023.2209973>



© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



Published online: 08 May 2023.



Submit your article to this journal [↗](#)



Article views: 1972



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 3 View citing articles [↗](#)



Received: 12 March 2023
Accepted: 24 April 2023

*Corresponding author: Pankaewta Lakkanawanit, Logistics and Business Analytics Center of Excellence (LOGBIZ), Walailak University, Nakhon Si Thammarat 80160, Thailand
E-mail: lpankaew@mail.wu.ac.th

Reviewing editor:
Collins G. Ntim, Accounting,
University of Southampton, United
Kingdom

Additional information is available at
the end of the article

ACCOUNTING, CORPORATE GOVERNANCE & BUSINESS ETHICS | RESEARCH ARTICLE

Environmental regulation and corporate performance: The effects of green financial management and top management's environmental awareness

Suijun Chen¹, Pankaewta Lakkanawanit^{2*}, Muttanachai Suttipun³ and He Xue⁴

Abstract: Drawing from the circular economy, which prioritizes resource optimization, waste reduction, and operational efficiency, the objective of this study is to investigate the influence of environmental regulations on Green Financial Management (GFM), the role of GFM as a mediator between environmental regulations and corporate performance, and the moderating effect of Top Management's Environmental Awareness (TMEA). Using the questionnaires from 684 Chinese green enterprises, the structural equation analysis is used to verify the results. The empirical findings indicate that environmental regulation has a positive effect on GFM and that GFM acts as a mediator between environmental regulation and corporate performance. However, it is found that TMEA does not have a significant moderating effect between environmental regulation and GFM. This study contributes to the broader discussion around resource efficiency and sustainability in the circular economy by emphasizing the importance of companies complying with environmental regulations and adopting GFM strategies to improve performance. Policymakers can consider the role of GFM in promoting sustainable business development, and prioritize the development and implementation of strong environmental regulations.

Subjects: Entrepreneurship and Small Business Management; Finance

Keywords: Environmental regulation; green financial management; top management's environmental awareness; corporate performance

1. Introduction

China's economy has boomed since its reform and opening up. However, its economic development has influenced on environmental pollution, global warming, ecological degradation, and excessive energy consumption (Y. Yang et al., 2020). The increased risk of environmental degradation has drawn particular attention of researchers and policymakers to the link between economic growth and environmental protection (Sumayya et al., 2022). As the result, the Chinese government has recognized the need to transition towards a more sustainable and efficient use of resources in order to mitigate these challenges and promote a circular economy (X. Song et al., 2019). To support this transition, the Chinese government has implemented green financing

policies, such as using public finance to increase green investment, improving environmental governance, and offering price subsidies for energy restructuring (X. Yu & Gu, 2015). Companies play a critical role in this process, as their decisions directly impact the environment. They must adopt a green mindset, balancing economic gains with environmental concerns. This can be achieved through effective green financial management (GFM) (Z. Wang, 2022) and the wise use of enterprise funds (L. Zhang & Yi, 2021).

Previous studies of GMF have mainly focused on its definition, components, and system design (Du & Zheng, 2020; Nagarjuna, 2015). Some studies have explored how GMF can enhance efficiency and improve performance (Panova et al., 2018; G. Zhou et al., 2021; Qiu et al., 2020). Y. Zhang and Wan (2020) proposed that GFM consists of four dimensions: green financing, green investment, green operation and green distribution. Each of these four factors offer unique benefits and have been shown to significantly boost an organization's efficiency and contribute to better corporate performance (Ngniatedema et al., 2014). Green financing reduces financing costs and increases income (Nagarjuna, 2015), while green investment enhances resource utilization efficiency, reduces environmental risks, and strengthens competitive advantage (Xiao & Li, 2020). Green investments positively impact financial and sustainable performance (Indriastuti et al., 2021). Green operations minimize environmental harm and increase productivity (Chawla et al., 2020), and green distribution ensures internal green financing by distributing profits between the company and green investors (L. Yang, 2017). However, the existing literature only examines the impact of GFM on firm performance from a single dimension. This paper aims to conduct further research and investigations to gain a deeper understanding of the impact of the four dimensions of GFM on corporate performance and to provide empirical evidence of the significant role GFM plays in influencing corporate performance.

While GFM might be advantageous for enterprises, some companies may neglect environmental concerns if they are not aware of the problem (Zuo, 2016). Hence, the government's role extends beyond policy-making and includes setting regulations to enforce environmental standards. The Chinese government has made many positive efforts to address environmental challenges in the form of sound environmental regulation and management (Elmagrhi et al., 2019). Environmental regulation refers to the government-created policies and regulations aimed at addressing pollution and regulating corporate activities (M. Wang & Li, 2020). Environmental regulations can drive organizations to prioritize environmentally-friendly operations and investments (Bi & Yu, 2016). A higher level of environmental regulation is associated with improved environmental performance (Liu & He, 2020). Companies are incentivized to adopt greener practices and avoiding penalties for non-compliance. Thus, environmental regulation is deemed crucial in foster GFM as a green behavior of companies.

GFM is impacted by environmental regulations. Moreover, the GFM also has an impact on corporate performance. The continuous improvement of environmental regulation presents that the companies with the opportunity will receive more policy support through the adoption of green financial management, leading to reduced environmental pollution and improved economic efficiency (D. Zhang, 2017). The study on the consecutive link between environmental regulation, GFM, and corporate performance with a focus on GFM as a mediator can provide a more accurate depiction of the situation. By examining the relationships between these factors, it can give insights into how environmental legislation affects business performance through the adoption of GFM practices.

In addition to government regulation, the participation of managers is crucial for the success of environmental protection activities (X. Hu et al., 2023). Top Management's Environmental Awareness (TMEA) can raise companies' awareness of environmental issues and encourage them to take action to address the problems (Gholami et al., 2013). In other words, the level of environmental awareness of top managers could affect the strength of the relationship between environmental regulations and the adoption of GFM practices. A higher level of environmental

awareness among top managers may lead to stronger efforts to comply with environmental regulations and a more proactive approach to implementing GFM, compared to companies with lower levels of environmental awareness among top managers (Teng & He, 2019). Studying the moderation effect of TMEA on the relationship between environmental regulation and GFM can deepen the understanding of how environmental regulations and GFM practices are related, and how the level of environmental awareness of top managers influences this relationship.

To sum up, this study mainly aims to shed light on the effects of environmental regulation and GFM on corporate performance, as well as the mediating role of GFM in the impact of environmental regulation. It also focuses on the moderating impact of TMEA on the relationship between environmental regulation and GFM. This study provides the following contributions to the field of environmental management and sustainable business practices. First, the results can provide a deeper understanding of the mechanisms through which environmental regulation affects corporate performance, and how GFM and TMEA can influence this relationship. Second, the study could inform the top manager and policy decisions and recommendations on how to promote the adoption of GFM and improve environmental outcomes in organizations. Third, this study can also contribute to the advancement of circular economy theory by explaining the role of GFM and TMEA in promoting environmental sustainability and mitigating the impact of environmental regulation on business performance.

2. Background

The Chinese government has pledged its commitment to the growth of a circular economy (X. Song et al., 2019) and has implemented environmental regulations to curb pollution caused by businesses. In an effort to reconcile economic growth with environmental preservation, President Hu Jintao introduced the “Harmonious Society” policy framework, which is built on the principles of the “Scientific Outlook on Development.” The strategy aims to balance economic growth with conservation of natural resources. Green finance management, on the other hand, seeks to promote a mutually beneficial relationship between nature and the economy from a business standpoint. At the 19th National Congress of the Communist Party of China in 2017, the goal of integrating “ecological civilization” into modernization with Chinese characteristics was set forth as a major priority. The concept of “green development” has gained great significance in China.

Achieving “green development” requires substantial financial support, and banks play a critical role in filling the gap in green financing. To encourage banks to increase their investment in green initiatives, government policies play a crucial role. The government advances the growth of green finance through various fiscal measures, policy formulation, and promotion. China’s green bond market has seen significant growth due to the support of the government’s green financial policies. In 2019, China’s domestic market saw the issuance of nearly 288.5 billion yuan in labeled green bonds, representing a 31.10% increase over 2018. The reduced interest rate for green bond issuance has brought down corporate financing costs and relieved financing pressure (Shang, 2020). In 2020, China’s “substantially green” bond market is expected to continue its steady growth, and the market participants will become more diverse (Liao et al., 2021).

China’s tax policies have also positively impacted the implementation of green finance management. For instance, the “Regulations on the Implementation of the Enterprise Income Tax Law of the People’s Republic of China” provides tax benefits such as “three exemptions and three reductions” to companies engaged in environmental protection projects. The “Environmental Protection Tax Law” advocates “more emissions, more payment; less emissions, less payment; no emissions, no payment,” and supports investment in equipment for environmental protection, energy and water conservation, and safe production, which can be used to offset corporate income tax. The continued implementation of China’s green policies has driven the growth of corporate GFM.

As China is a leading player in the global drive towards sustainability and environmental protection, making it a valuable study for the relationship between environmental regulation,

GFM, and corporate performance. The findings can provide insight into the effectiveness of government policies in promoting sustainable development. Moreover, understanding the impact of environmental regulation and GFM on corporate performance is crucial for businesses and policymakers to make informed decisions about future investments and initiatives in the green finance sector. The findings of this study have implications for the wider global community, as they can provide valuable information and lessons learned for other countries looking to implement similar green finance policies. The promotion of green development in China is supported by corresponding laws and regulations, and the concept of green management has gradually become integrated into the operation and management of enterprises. The implementation of GFM, combined with green concepts, can help enterprises balance the development of the ecological environment while pursuing profits. This study on GFM is relevant to the current situation of China's sustainable development, as it seeks to maximize the benefits for enterprises from a long-term perspective (Xia, 2012).

3. Theoretical literature review

The circular economy is an economic growth mode that takes the efficient utilization and recycling of resources as the core, takes the principle of “reduction, reuse and recycling”, takes low consumption, low emissions and high efficiency as the basic characteristics, and conforms to the concept of sustainable development (National Development and Reform Commission's Economic System and Management Research Institute “my country's Circular Economy Development Strategy Research” research group, 2005). Companies are the basic constituent units of social economy, and the development of circular economy cannot be separated from the support of companies. Similarly, if modern enterprises want to achieve sustainable development, they must also apply the concept of circular economy to their enterprise management (Xia, 2012). The principles of circular economy theory can help explain the role of GFM and TMEA in promoting environmental sustainability and reducing the impact of environmental regulation on business performance.

Circular economy theory emphasizes the importance of reducing waste and promoting sustainability in economic systems, which aligns with the goals of both GFM and TMEA. Circular economy requires enterprises to fully consider the ecological environment factors in their economic activities. The more energy consuming and polluting industries, the higher their capital demand (Y. Zhang, 2016). While GFM can help companies achieve “win-win” in economy and environment (Y. Li, 2013). Circular economy theory provide a useful framework for understanding the role of GFM in mediating the impact of environmental regulation. By promoting sustainable business practices and reducing the negative impact of environmental regulation on corporate performance, GFM can support the transition to a more sustainable economy (Qian, 2021), as envisioned by circular economy theory.

Additionally, circular economy theory can explain the moderating impact of TMEA on the relationship between environmental regulation and GFM by suggesting that the level of environmental awareness of top management can influence the adoption of GFM practices and the ability of companies to respond to environmental regulation. According to circular economy theory, companies that adopt a more circular approach to business are likely to be more environmentally sustainable and better equipped to respond to environmental regulation (Huang et al., 2020). TMEA, or top management environmental awareness, is a key factor in promoting circular economy principles and practices (Wen et al., 2017). Companies with higher TMEA are more likely to adopt GFM practices, such as sustainable finance and resource efficiency, which can help them to better respond to environmental regulation.

Germany has incorporated the concept of circular economy into its environmental policy to address issues related to the utilization of raw materials and natural resources for sustained economic growth (Geng & Doberstein, 2008). In North America and Europe, circular economy applications focus on strengthening the “3Rs” and building sustainable eco-industrial parks

(Hunt et al., 1996). Similarly, in China, circular economy is considered as a viable model for economic reform, and it is utilized for new technology development, equipment upgrades, and improved industry management (Yuan et al., 2006). The Chinese government has implemented corresponding laws, regulations, and industrial production standards to support the implementation of circular economy. Enterprises that aim for long-term development must apply the circular economy concept in their management practices to achieve coordinated development of the economy and the environment (Xia, 2012). Therefore, this study requires a framework that incorporates the principles of circular economy to provide a comprehensive understanding of the role of GFM and TMEA in promoting environmental sustainability and reducing the impact of environmental regulation on corporate performance.

4. Empirical literature review and hypotheses development

4.1. Environmental regulation and GFM

The government uses regulatory means to curb environmental pollution problems in accordance with the theory of circular economy, while companies employ GFM to achieve economic benefits while also paying attention to environmental protection. This approach aligns with the principles of sustainable development (Y. Li, 2013). Environmental regulation is the sum of policies and regulations formulated by the government to solve environmental pollution problems (Fu, 2006). Scholars have been exploring the impact of environmental regulation in their research. Costa (2021) argued that both incentive-based policies and regulatory-based policies and regulations can be effective in green behaviors. L. Wang (2021) believes that the impact of environmental regulation on corporate behavior can be achieved through direct or indirect channels. Through the policy analysis of state-owned enterprises, it is found that governments at all levels incorporate emission reduction targets into the performance appraisal system of state-owned enterprises (B. Wang & Sh, 2016). This impact mechanism has enhanced the implementation effect of China's environmental policies. Tang et al. (2013)'s study found that there is a threshold effect in the impact of environmental regulation on corporate environmental protection investment behavior among China's A-share listed companies. Enterprises that fail to break through the environmental policy threshold will lose their qualifications to participate in market competition (Jin & Shen, 2010). Therefore, shareholders are paying more and more attention to corporate environmental governance and green transformation (Lv & Xu, 2020). Zhong and Zheng (2014) believe that institutional pressure is the most important driving force for companies to implement environmental strategies and carry out green innovation. Zhu et al. (2017) studied the reasons for motivating Chinese manufacturing companies to practice green. The results showed that institutional pressures pushed manufacturers to adopt green practices.

Environmental regulation is a key driver for companies to carry out green investment (Ma, 2021). Liu and He (2020) studied the relationship between environmental regulation and financing efficiency of listed companies in China. They found that environmental regulation can significantly enhance financing efficiency. W. Li et al. (2018) studied heavily polluting and non-heavy polluting companies among listed companies in China and found the positive correlation between environmental regulation and corporate financing efficiency. Moreover, it was found that environmental regulation has a greater impact on the financing efficiency of heavily polluting companies than non-heavy polluting companies. Bi and Yu (2016) analyzed China's heavily polluting listed companies from the perspective of the environmental tax system, and found the positive impact of the environmental tax system on the amount of green investment.

Enterprises are the main target group of environmental regulations, and the continuous strengthening of environmental regulations by the government plays an important role in promoting enterprises to actively implement GFM. In order to reduce environmental pollution, the government regulates and restricts the behavior of companies through the formulation of environmental regulations. Under the influence of regulations, companies implement green

management and promote GFM. This study is grounded in the theory of circular economy and assumes that as environmental regulations become more stringent, companies will need to implement GFM. Based on this assumption, the following hypotheses are proposed:

H1: Environmental Regulation has the impact on GFM.

4.2. Mediating role of GFM

The circular economy theory emphasizes the importance of promoting sustainability and reducing waste in economic systems, which aligns with the goals of both GFM and environmental regulation. To address the challenge of balancing business goals with environmental concerns, the Chinese government has included circular economy as a key policy (Yuan et al., 2006). Companies can respond to regulatory policies by applying the concept of circular economy to GFM.

GFM involves enterprises fully considering resource utilization and environmental protection in their financial activities to achieve both economic and environmental benefits (Y. Zhang & Wan, 2020). This approach encompasses various components, including green financing, investment, operations, and distribution (Nagarjuna, 2015; Y. Zhang & Wan, 2020). This includes strengthening GFM which can promote corporate performance while also paying attention to environmental protection. Through the mediation role of GFM, companies can achieve a balance between economic growth and environmental preservation, as envisioned by the circular economy theory.

Most of the existing studies suggest a positive relationship between GFM and corporate performance. In a study of corporate financing and performance in African countries, Fowowe (2017) found that financing constraints have a negative impact on corporate development. Specifically, companies that raise funds from a variety of financing channels tend to have a more positive relationship with enterprise development. In their analysis of green securities in China's high energy-consuming industries, Xiao and Li (2020) discovered that such securities play a significant role in promoting the efficiency of green investment in listed companies. Zhou and L. Wang (2021) believe that improving financing efficiency and fully exploring financing capabilities are effective ways to improve corporate performance. Meanwhile, the relatively loose conditions for raising and repaying green funds, coupled with the reduced costs of green financing, have led to increased income (Nagarjuna, 2015). Auer (2016) argues that green investment can lead to increased profits for companies. In a study on heavily polluting companies listed in China, H. Yu and Li (2021) found a positive correlation between environmental protection investment and financial performance. Similarly, M. Zhang (2020) used a spatial Durbin model to demonstrate that green investment has a significant impact on high-quality economic development in the process of marketization.

At the same time, government environmental regulation can have a significant impact on corporate performance through GFM. On one hand, environmental protection policies can incentivize companies to invest in green fields, as green management can reduce costs (W. Song & Yu, 2018). On the other hand, pollution penalty regulations can increase the cost of environmental violations for companies, which in turn forces them to follow regulations to avoid policy risks and legal sanctions. Strict government environmental supervision can also encourage companies to prioritize environmental issues and allocate equity funds towards green operations for a more sustainable business approach (Liu & He, 2020). Through the continued optimization of environmental regulation, companies are receiving more policy support to implement GFM, ultimately leading to a "win-win" situation for environmental protection and economic growth (D. Zhang, 2017). Meanwhile, P. Chen et al. (2022) analyzed the data of listed companies in Zhejiang Province of China and found that green finance plays a mediating role between green financial policies and high-quality economic development. Specifically, green finance is able to alleviate the unfavorable repercussions of environmental regulation on the actual economy by extending financial support to environmentally conscious ventures and encouraging sustainable growth. Based on these

findings, this study proposes the hypothesis that GFM acts as a mediator between environmental regulation and corporate performance. The second assumption is as follows:

H2: GFM has mediating effect toward the impact of environmental regulation on corporate performance.

4.3. Moderating role of TMEA

GFM is a modern management concept that aligns with the principles of circular economy. The adoption and implementation of GFM practices are largely influenced by TMEA. The level of TMEA can affect the actual impact of corporate green management on corporate performance (Pei, 2020). Environmental awareness refers to a concern and understanding of environmental issues (X. Chen et al., 2019). It is also a strategic tool for managers to promote sustainability across their organization and society (Benevene & Buonomo, 2020). TMEA can assist companies in prioritizing environmental issues and influence a series of follow-up actions (Gholami et al., 2013). When company managers are environmentally conscious, they can better promote innovation within the company to meet the market's green demands (Markowitz et al., 2012). Therefore, hiring managers with a strong environmental consciousness can increase environmental awareness in various aspects of the company's operations. The environmental regulations that require companies to use more environmentally-friendly resources can lead to an increase in the availability of green resources for businesses. Corporate executives who prioritize environmental awareness are more likely to take note of this shift in market demand and recognize the potential for broad market development in the application of green-friendly materials (Peng & Wei, 2015). As a result, they may be more willing to adopt GFM than those who are less environmentally conscious.

B. Zhang et al. (2015) surveyed industrial companies in China's Bohai Rim Economic Zone and found that TMEA plays an important role in the strategic practice of companies implementing green energy conservation. Peng and Wei (2015) found that TMEA has a positive moderating effect on the relationship between government environmental protection policies and product eco-innovation. Teng and He (2019) investigated the impact of environmental awareness on investor trading behavior and stock prices. The results show that environmental awareness regulates trading behavior by affecting the severity of perceived pollution, but the impact of environmental awareness directly causing psychological effects is limited. In addition, Pei (2020) found that TMEA positively influences companies' willingness to adopt green technologies. As a cognitive awareness, TMEA is believed to have a moderating effect. It is assumed that top managers with high environmental awareness are more aware of the value and benefits of implementing green-friendly materials (GFM) and are more willing to adopt them. Therefore, the third hypothesis of this study is as follows:

H3: TMEA has moderating effect toward the impact of environmental regulation on GFM.

5. Research design

The sample frame for this study is taken from companies in the green industry in China. According to the "2021 China Environmental Protection Industry Development Status Report" released by the Ministry of Ecology and Environment of China, as of 2020, there are 15,556 green industries companies distributed in seven regions of China. Stratified random sampling was used in this study to ensure the representativeness of all regions in China. This study obtained the list of green industry companies in each region from the Bureau of Statistics and the Bureau of Industry and Commerce, and randomly selected companies in each region as the survey sample.

The questionnaires are primarily in the form of electronic version, sent to the participants via email and social software after obtaining their agreement to participate. The respondents will be informed of the research's purpose and confidentiality policy before participating in the survey. The respondents are chosen from the senior management or financial personnel who are directly

Table 1. Distribution of the sampled firms by region (N = 684)

	N	Percentage
North China	127	18.57
Northeast China	48	7.02
East China	249	36.40
Central China	45	6.58
South China	100	14.62
Southwest China	85	12.43
Northwest China	30	4.39

involved in the company's green financial management activities and have knowledge of the company's green financial management.

A sample of 1000 questionnaires was distributed, and 684 were returned, resulting in a response rate of 68.4%. The sample breakdown by region is shown in Table 1, with North China accounting for 18.57%, Northeast China 7.02%, East China 36.4%, Central China 6.58%, South China 14.62%, Southwest China 12.43%, and Northwest China 4.39%. The results show a relatively balanced distribution of the sample in different regions of China, which can accurately reflect the situation of green financial management and corporate performance in China.

This study used a questionnaire that was divided into three parts. The first part provided a brief introduction to the survey, while the second part collected basic information about the research subjects. The third part consisted of formal items that measured the four main constructs of the study using a 5-point Likert scale ranging from 1 to 5. The scale included the response options "strongly disagree," "disagree," "neutral," "agree," and "strongly agree," with higher scores indicating greater agreement with the description.

This study contains independent variables (Environmental Regulation) and dependent variables (Corporate Performance), as well as moderator variables (TMEA) and mediator variables (GFM). The questionnaire items representing each variable were primarily based on previous literature and are described below.

5.1. Environmental Regulation (ER)

Environmental regulation is treated as an independent variable in this study, and is measured using a scale developed by Zhu et al. (2017) and Pei (2020). The scale includes four items that assess the degree of environmental regulation faced by the company, including "the degree of perfection of environmental regulation faced by the company", "the independence and authority of the environmental regulation and supervision department faced by the company", "the strictness of the environmental protection production technology standard faced by the company", and "the punishment for violating environmental regulations."

5.2. Top Management Environmental Awareness (TMEA)

Top Management Environmental Awareness (TMEA) is treated as a moderator variable in this study, and is measured using a scale based on the research of Peng and Wei (2015). The scale includes four items that assess the level of environmental awareness and importance placed on environmental issues by top management, including "top management attaches importance to the adverse impact of corporate activities on the environment", "top management attaches importance to the impact of environmental laws and regulations on enterprises", "top management attaches great importance to the understanding of environmental protection measures", and "top management agrees with environmental protection initiatives".

5.3. Green Financial Management (GFM)

Green Financial Management (GFM) is treated as an intermediary variable in this study, and is measured using a scale based on the research results of Y. Zhang and Wan (2020). The scale divides GFM into four dimensions: green financing, green investment, green operation, and green delivery. These dimensions are used to assess the extent to which companies are implementing sustainable financial practices and investing in environmentally-friendly activities.

5.4. Corporate Performance (CP)

Company performance (CP) is often influenced by industry factors and may not be disclosed publicly by companies. Given that subjective evaluations of performance have been found to be strongly correlated with objective evaluations (Schindehutte et al., 2000), this study follows the approach of Luo (2019) and Yam et al. (2004) by asking respondents to evaluate whether their company has advantages in five indicators compared to their main competitors. The indicators are net profit margin, total asset turnover, return on investment, market share, and sales growth rate.

5.5. Control variables

Based on the research of Peng and Wei (2015), this study includes “number of employees”, “industry”, and “type of ownership” as control variables, as they have been found to impact performance. The “number of employees” variable is measured by the natural logarithm of the current year’s number of employees. “industry” is categorized into six groups based on the “Green Industry Guidance Catalog (2019 Edition)” (NDRC of China, 2019), which includes energy-saving and environmental protection industry, clean production industry, clean energy industry, ecological environment industry, green upgrading industry of infrastructure, and green service industry. Lastly, “type of ownership” is categorized into three types: state-owned/state-holding, private/private-holding enterprises, and others.

6. Empirical results and discussion

6.1. Reliability and validity

Mplus7.0 was used in this study for statistical analysis, including a measurement model evaluation. The measurement model tests the reliability, convergent validity, discriminant validity, and overall fit of the scale through confirmatory factor analysis (CFA), as described by Anderson and Gerbing (1988a). This helps assess the adequacy of each item in reflecting its construct.

The green financial management scale consists of 12 questions in four sub-dimensions, and this study uses both first-order and second-order CFA for analysis. The Marsh and Hocevar (1985) method is used to compare the fit of the first- and second-order models and determine the optimal model. A t value close to 1 indicates that the second-order CFA is a better fit. In this study, the t value of green financial management was 0.98, indicating good fitness of the second-order CFA. As a result, the results of the second-order CFA were used in the structural model analysis.

In terms of reliability, Nunnally and Bernstein (1994) considered a Cronbach’s α and combined reliability of over 0.7 to be acceptable. The results in Table 2 show that the Cronbach’s α of each variable in this study ranges from 0.71 to 0.96, with combined reliability (CR) from 0.71 to 0.92, indicating good reliability of the research variables. Additionally, the validity of this study was assessed using convergent and discriminant validity. The standardized factor loadings of all items in the CFA should be greater than 0.5 and significant, according to Anderson and Gerbing (1988b), indicating good convergent validity. Table 2 shows that the standardized factor loadings for all items in this study range from 0.61 to 0.98, and are significant, indicating acceptable convergent validity.

For the criterion of discriminant validity, Fornell and Larcker (1981) suggested that the AVE of a specific construct should be higher than the square of its correlation coefficient with other

Table 2. The reliability and convergent validity analysis of measurable variable

Dim.	Item	Mean	Factor loading	S.E.	Est./S.E.	P-Value	CR	AVE	Caonbach α
ER	ER1	3.81	0.86	0.01	71.36	***	0.91	0.73	0.91
	ER2	3.84	0.89	0.01	87.38	***			
	ER3	3.80	0.85	0.01	68.47	***			
	ER4	3.94	0.80	0.02	51.26	***			
TMEA	TMEA1	4.27	0.59	0.03	19.69	***	0.71	0.40	0.72
	TMEA2	4.22	0.62	0.03	21.12	***			
	TMEA3	4.18	0.61	0.03	20.34	***			
	TMEA4	4.21	0.67	0.03	24.44	***			
GFM	GF	4.13	0.68	0.04	16.43	***	0.92	0.75	0.71
	GI	4.13	0.96	0.05	18.83	***			
	GO	4.10	0.99	0.05	21.96	***			
	GD	3.97	0.79	0.06	14.15	***			
CP	CP1	4.08	0.70	0.02	28.97	***	0.81	0.46	0.81
	CP2	4.05	0.63	0.03	23.11	***			
	CP3	4.06	0.68	0.03	26.64	***			
	CP4	4.05	0.71	0.02	29.72	***			
	CP5	4.10	0.67	0.03	26.07	***			

Note: ***p<0.001

constructs. According to the results in Table 3, the square root of AVE for each variable in this study ranges from 0.63 to 0.87, which are all larger than the correlation coefficients between the various dimensions. Anderson and Gerbing (1988b) suggested using the confidence interval identification method to determine discriminant validity, which involves observing whether the confidence interval of the relevant parameters excludes 1. If the confidence interval does not contain 1, the scale is considered to have discriminant validity. The observed variables in this study do not contain 1 in the 95% confidence interval, indicating that each measurement variable has good discriminant validity. Additionally, the Pearson correlation coefficients shown in the lower triangles of Table 3 are all less than 0.7, indicating that there is no multicollinearity problem in the data.

6.2. Structural equation model

After analyzing the reliability and validity by measuring the model, this study began to analyze the fitness of the structural model. Structural equation modeling (SEM) analysis usually uses Chi-Square (χ^2) to verify the fitness of the model. The model fit index of this study is $\chi^2 = 759.47$, $Df = 267$, $\chi^2/Df = 2.84 < 3$, $p = 0.000$, $CFI = 0.92 > 0.9$, $TLI = 0.91 > 0.9$, $SRMR = 0.06 < 0.08$, and $RMSEA = 0.05 < 0.08$. Thus, all indicators meet the standards (L. Hu & Bentler, 1999), indicating that the research model in this paper has a good degree of adaptation. The results of SEM analysis are shown in Figure 1.

6.3. Hypothesis testing

In this study, the path relationship between variables was explored through path analysis, thereby verifying the research hypothesis. From the standardized path coefficient values, t values and results shown in Figure 1, it can be seen that environmental regulation positively affects GFM ($\beta = 0.24$, $t = 10.4$, $p < 0.001$). Therefore, H1 is supported. The finding that government regulations and laws positively influence green business practices aligns with previous research findings (Bi & Yu, 2016; Liu & He, 2020; W. Li et al., 2018). These results suggest that companies may need to adopt green management and implement green financial management (GFM) practices to avoid environmental penalties as environmental regulations become more stringent. This finding supports the concept of circular economy, which provides a theoretical framework for understanding how environmental regulations can promote the adoption of sustainable business practices, such as GFM.

Bootstrapping is considered a more useful method in testing the effect of mediator variable (Williams & MacKinnon, 2008). This study tested the mediation effect by bootstrap are 5000 times. The results are shown in Table 4. The indirect effect of GFM on environmental regulation and corporate performance is ($\beta = 0.43$, $p < 0.001$), and 0 is not included in the 95% confidence interval. Therefore, H2 is supported. The finding that GFM has a mediating role on the impact of environmental regulation on corporate performance aligns with P. Chen et al. (2022). The results showed that GFM has a positive impact on corporate performance, indicating that companies can enhance their performance through the implementation of GFM practices. Furthermore, these findings support previous studies (Auer, 2016; Nagarjuna, 2015) and suggest that environmental regulations serve as an external factor that affects corporate performance through the implementation of GFM. The findings also confirm the role of GFM in promoting sustainable business practices, which is in line with the circular economy theory. GFM can help support the transition to a more sustainable economy (Qian, 2021) by reducing the negative impact of environmental regulation on corporate performance and promoting sustainable business practices.

Moreover, it can be seen from Figure 1 that GFM has a positive effect on corporate performance ($\beta = 1.33$, $t = 11.58$, $p < 0.001$). The coefficient of determination (R^2) for GFM ability in this study is 0.57, while the R^2 for enterprise performance is 0.53. These results suggest that the model has a good explanatory ability, with GFM accounting for a substantial portion of the variance in corporate performance.

To examine the moderating effect of TMEA, this study used the coefficient product method proposed by Hayes (2013) to analyze the moderated mediation effect. Specifically, we tested the significance of the product of the path coefficients between the interaction term and the mediating variable to judge whether the moderated mediation effect was significant. Moderated mediation exists when the independent variable affects the mediating effect between dependent variables through the mediating variable and is influenced by the moderator variable (Edwards & Lambert, 2007). However, the results from Figure 1 showed that the interaction between environmental regulation and TMEA was not significant ($\beta = -0.03$, $p = 0.63$), indicating that H3 was not supported. This suggests that strong environmental regulation by itself may be sufficient to drive the implementation of GFM in companies. The findings are consistent with previous research by Zhong and Zheng (2014) who found that well-designed regulations can promote environmentally responsible behavior. This results also align with those of Teng and He (2019), who found that the influence of TMEA can be limited, especially in industries that are highly regulated or face significant environmental challenges. The companies may be more likely to adopt GFM as a response to environmental regulations rather than as a proactive strategy to improve sustainability. This highlights the need for strong environmental regulations to promote sustainable business practices, such as GFM, and supports the concept of circular economy by promoting resource efficiency and reducing waste.

6.4. Common method variance test

Using questionnaires to collect data may introduce common method variation, leading to internal effects (Podsakoff et al., 2003). Therefore, after the questionnaires are collected, the Harman single factor model (single factor model) test method can be used to test the problem of common method variation. The analysis results show that the fit of the single factor model is not good ($\chi^2 = 2131.25$, $Df = 275$, $\chi^2/Df = 7.75$; $CFI = 0.71$; $TLI = 0.69$; $SRMR = 0.09$; $RMSEA = 0.10$), and it is significantly lower than the original measurement. Therefore, the fitness of the measurement model in this study is better than that of the single factor model ($\Delta\chi^2 = 1371.78$, $\Delta Df = 8$, $p < 0.001$), which means that the problem of common method variation can be ignored.

7. Summary and conclusion

This study investigated the influence of environmental regulations on GFM and the mediating effect of GFM on the relationship between environmental regulations and corporate performance. Additionally, it explored the moderating effect of TMEA on the relationship between environmental regulations and GFM. The study utilized data collected from companies in green industry in China through questionnaires, and SEM analysis was applied to test hypotheses. At the outset, the results of this study showed a significant positive effect of environmental regulations on GFM implementation, which is in line with prior empirical studies demonstrating the positive influence of government regulations and laws on green business practices. Furthermore, our findings revealed that GFM plays a mediating role in the relationship between environmental regulations and corporate performance, supporting the theory that sustainable business practices, including GFM, are critical to improving performance and achieving resource efficiency. However, there is the lack of a significant moderating effect of TMEA on the relationship between environmental regulation

Table 3. Convergent and discriminant validity analysis

Dim.	Convergent validity	Discriminant validity			
	AVE	ER	TMEA	GFM	CP
ER	0.73	0.85			
TMEA	0.4	0.43	0.63		
GFM	0.75	0.57	0.61	0.87	
CP	0.5	0.4	0.53	0.57	0.71

and GFM. This suggests that strong environmental regulations alone can drive the implementation of GFM in companies.

This study provides several both practical and theoretical contributions and implications. The results have important implications for academia, policy, and the economy, highlighting the critical role of environmental regulations and the adoption of GFM in achieving resource efficiency and sustainable development. From a practical perspective, firstly, the findings of this study offer insights for policymakers and companies in terms of the importance of environmental regulation and the role of GFM in promoting corporate performance. The results also show that environmental regulation can positively impact the implementation of GFM, which in turn can enhance corporate performance. This highlights the need for companies to comply with environmental regulations and adopt green financial management strategies in order to improve their performance.

Additionally, the finding of mediation effect of green financial management (GFM) has practical implications for policymakers. The results indicate that implementing GFM can be an effective way to improve corporate performance by reducing environmental risks and promoting environmental sustainability. This means that policymakers can encourage companies to adopt GFM by providing incentives, setting environmental regulations and promoting green financial products and services. The results also suggest that policymakers should consider the role of GFM in their strategies for promoting corporate sustainability, and design regulations and incentives that take into account the importance of GFM in improving firm performance and reducing environmental risks.

Furthermore, this study found evidence of a positive relationship between environmental regulation and GFM, with no moderating effect observed from TMEA. This result provided the suggestions to policy makers and companies to prioritize the development and implementation of strong environmental regulations. While top management awareness may be important in promoting environmental sustainability, the findings suggest that it is not sufficient on its own to drive green practices. The regulations set by the government can provide a framework for companies to follow and ensure that they are taking appropriate action to protect the environment. Policy makers should focus on creating and enforcing regulations that are effective in promoting environmentally responsible behavior, while companies should work to ensure that they are fully complying with the regulations in place.

From a theoretical standpoint, the findings of this study contribute to the body of knowledge on circular economy theory by highlighting the mediating effect of GFM in the relationship between environmental regulation and corporate performance. It suggests that the implementation of GFM can act as a catalyst in promoting circular economic activities and achieving sustainable outcomes. The results support the idea that environmental regulations

Figure 1. The structural equation model of ER, TMEA, GMF, and CP.

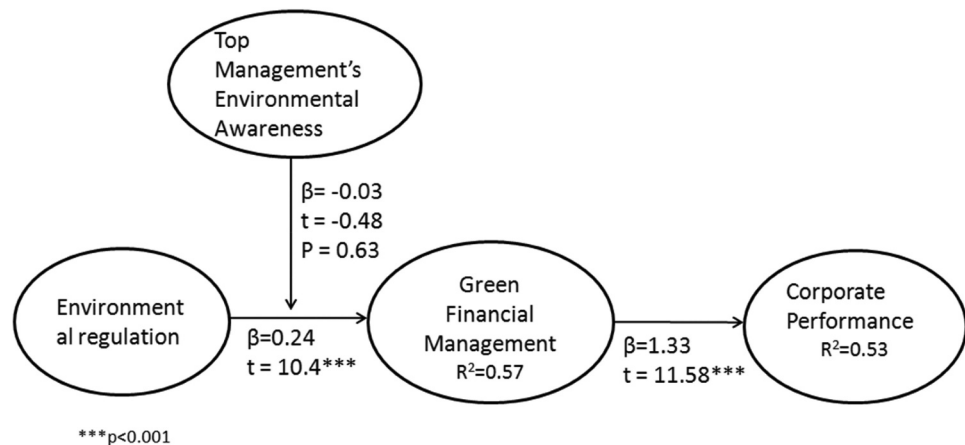


Table 4. Indirect effect analysis of green financial management capabilities

	Point Est.	Product of Coefficients			BOOTSTRAP 5000 TIMES 95%CI			
					Percentile		Bias corrected	
		S.E.	Est./S.E.	P-Value	Lower	Upper	Lower	Upper
ER→CP	0.43	0.06	6.85	***	0.30	0.55	0.31	0.57

Note: ***p<0.001

play an important role in encouraging firms to adopt circular economic practices, but the impact of these regulations can be strengthened through the implementation of GFM. This indicates that GFM can play a crucial role in mediating the relationship between environmental regulation and circular economic activities, leading to improved firm performance. The results contribute to the understanding of the role of GFM in promoting circular economic practices and can inform policy decisions and business strategies aimed at promoting sustainable development.

Despite the efforts to maintain rigor in the research design, this study has some limitations that can be addressed in future studies. Firstly, the study is limited to a cross-sectional design and lacks a longitudinal perspective. Future research could address this limitation by collecting multiple cross-sectional data over time for analysis. Secondly, this study was conducted solely in the green industry in China, which may not be representative of other industries. To address this limitation, future researchers could extend the analysis to other industries and compare their results with ours. Finally, this study focused on the relationship between GFM and environmental regulation in the Chinese context, which may limit the generalizability of our findings. Therefore, future research could consider expanding the scope of the study and including more diverse samples in different countries or regions to validate and generalize our findings in different institutional contexts.

Author details

Suijun Chen¹
 Pankaewta Lakkanawanit²
 E-mail: lpankaew@mail.wu.ac.th
 ORCID ID: <http://orcid.org/0000-0002-8609-6132>
 Muttanachai Suttipun³
 He Xue⁴
¹ College of Graduate Studies, Walailak University, Nakhon Si Thammarat 80160, Thailand.
² Logistics and Business Analytics Center of Excellence (LOGBIZ), Walailak University, Nakhon Si Thammarat 80160, Thailand.
³ Faculty of Management Sciences, Prince of Songkla University, Songkhla 90112, Thailand.
⁴ College of Management, Wuzhou University, Guangxi 543002, China.

Disclosure statement

No potential conflict of interest was reported by the authors.

Citation information

Cite this article as: Environmental regulation and corporate performance: The effects of green financial management and top management’s environmental awareness, Suijun Chen, Pankaewta Lakkanawanit, Muttanachai Suttipun & He Xue, *Cogent Business & Management* (2023), 10: 2209973.

References

aBenevene, I., & Buonomo, I. (2020). Green human resource management: An evidence- based systematic literature review. *Sustainability*, 12(15), 5974.

Anderson, J. C., & Gerbing, D. W. (1988a). Structural Equation Modeling in Practice: A Review and Preferences. *The Journal of Consumer Research*, 27 (2), 233–248.

Anderson, J. C., & Gerbing, D. W. (1988b). Structural Equation Modeling in Practice: A Review and Recommended Two-step Approach. *Psychological Bulletin*, 103(3), 411–423. <https://doi.org/10.1037/0033-2909.103.3.411>

Auer, B. R. (2016). Do socially responsible investment policies add or destroy European stock portfolio value ? *Journal of Business Ethics*, 135(2), 381–397. <https://doi.org/10.1007/s10551-014-2454-7>

Bi, Q., & Yu, L. (2016). Research on the Green Investment Effect of Environmental Taxes: An Empirical Study Based on Panel Quantile Regression. *China Population? Resources and Environment*, 03, 76–82. CNKI:SUN:ZGRZ.0.2016-03-010

Chawla, V. K., Chhabra, D., Gupta, P., & Shrikant Karande, V. (2020). Evaluation of green operations management by fuzzy analytical hierarchy process. *Materials Today: Proceedings* (4), <https://doi.org/10.1016/j.matpr.2020.07.200>.

Chen, P., Ding, Z., & Wang, J. (2022). The role of green finance in promoting the high-quality development of Zhejiang’s real economy—An analysis of the mediation effect based on the Bootstrap method. *Business Economics*, 12, 164–168+196. <https://doi.org/10.19905/j.cnki.syjj1982.2022.12.059>

Chen, X., Huang, B., & Lin, C. T. (2019). Environmental awareness and environmental Kuznets curve. *Economic Modelling*, 77, 2–11. <https://doi.org/10.1016/j.econmod.2019.02.003>

- Costa, J. Carrots or Sticks: Which Policies Matter the Most in Sustainable Resource Management?. (2021). *Resources*, 10(2), 12. MDPI AG Retrieved from. <https://doi.org/10.3390/resources10020012>
- Du, L., & Zheng, L. (2020). Research on the Quality Evaluation of China's Green Finance Policy. *Journal of Wuhan University (Philosophy and Social Sciences Edition)*, 03, 115–129. <https://doi.org/10.14086/j.cnki.wujss.2020.03.012>
- Edwards, J. R., & Lambert, L. S. L. (2007). Methods for Integrating Moderation and Mediation: A General Analytical Framework using Moderated Path Analysis. *Psychological Methods*, 12(1), 1–22. <https://doi.org/10.1037/1082-989X.12.1.1>
- Elmagrhi, Elmagrhi, M. H., Ntim, C. G., Elamer, A. A., & Zhang, Q. (2019). A study of environmental policies and regulations, governance structures and environmental performance: The role of female directors. *Business Strategy and the Environment*, 28(1), 206–220. <https://doi.org/10.1002/bse.2250>
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 24(2), 337–346. <https://doi.org/10.1177/002224378702400401>
- Fowowe, B. (2017). Access to finance and firm performance: Evidence from African countries. *Review of Development Finance*, 1(1), 6–17. <https://doi.org/10.1016/j.rdf.2017.01.006>
- Fu, J. (2006). *The impact of environmental regulation on trade patterns and its policy coordination* (PhD dissertation, Jinan University). <https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CDFD9908&filename=2007045601.nh>
- Geng, Y., & Doberstein, B. (2008). Developing the circular economy in China: Challenges and opportunities for achieving leapfrog development. *International Journal of Sustainable Development & World Ecology*, 15(3), 231–239. <https://doi.org/10.3843/SusDev.15.3:6>
- Gholami, R., Sulaiman, A. B., Ramayah, T., & Molla, A. (2013). Senior managers' perception on green information systems (is) adoption and environmental performance: Results from a field survey. *Information & Management*, 50(7), 431–438. <https://doi.org/10.1016/j.im.2013.01.004>
- Hayes, A. F. (2013). *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. The Guilford Press.
- Huang, S. Z., Lu, J. Y., Chau, K. Y., & Zeng, H. L. (2020). Influence of ambidextrous learning on eco-innovation performance of startups: Moderating effect of top management's environmental awareness. *Frontiers in Psychology*, 11.
- Hu, L., & Bentler, P. M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria versus New Alternatives. *Structural Equation Modeling*, 6(1), 1–55. <https://doi.org/10.1080/10705519909540118>
- Hu, X., Li, R. Y. M., Kumari, K., Ben Belgacem, S., Fu, Q., Khan, M. A., & Alkhouraydili, A. A. (2023). Relationship between Green Leaders' Emotional Intelligence and Employees' Green Behavior: A PLS-SEM Approach. *Behavioral Sciences*, 13(1), 25. <https://doi.org/10.3390/bs13010025>
- Hunt, R. G., Franklin, W. E., & Hunt, R. G. (1996). LCA—How it came about. *The International Journal of Life Cycle Assessment*, 1(1), 4–7. <https://doi.org/10.1007/BF02978624>
- Indriastuti, M., Chariri, A., & McMillan, D. (2021). The role of green investment and corporate social responsibility investment on sustainable performance. *Cogent Business & Management*, 8(1). <https://doi.org/10.1080/23311975.2021.1960120>
- Jin, X., & Shen, Z. (2010). The “quota-trading” model of newly added construction land management—a comparative study with the emission trading system. *China Population. Resources and Environment*, 07, 86–91.
- Li, Y. (2013). Green financial management in enterprises. *Modernization of Shopping Malls*, 24, 176. <https://doi.org/CNKI:SUN:SCXH.10.2013-24-108>
- Liao, Y., An, G., Shang, J., & Masai. (2021). Report on the Operation of China's “Substantially Green” Bond Market in 2020. *Bonds*, 02, 49–55. <https://CNKI:SUN:ZHQU.0.2021-02-014>
- Li, W., Li, Y., & Lu, M. (2018). The Impact of Environmental Regulation on Financing Efficiency: Based on the Comparison of Heavy Polluting and Non-heavy Polluting Industries. *Journal of Hubei University of Technology*, 03, 9–14. [CNKI:SUN:HGX.0.2018-03-003](https://doi.org/CNKI:SUN:HGX.0.2018-03-003)
- Liu, Y., & He, J. (2020). Environmental Regulation, Financing Efficiency and R&D Investment. *Accounting Communications*, 10, 49–52. <https://doi.org/10.16144/j.cnki.issn1002-8072.2020.10.009>
- Luo, J. (2019). Application of Balanced Scorecard in Performance Management of Small and Medium-sized Enterprises. *Hunan Social Sciences*, 01, 120–125. <https://doi.org/CNKI:SUN:FLSH.0.2019-01-017>
- Lv, M., & Xu, G. (2020). Equity Refinancing, Environmental Regulation and Corporate Environmental Protection Investment. *Business Accounting*, 19, 12–15. <https://CNKI:SUN:SYKI.0.2020-19-005>
- Ma, Y. (2021). Research on the driving factors of corporate green investment behavior. *Environmental Economic Research*, 02, 57–79. <https://doi.org/10.19511/j.cnki.jee.2021.02.005>
- Markowitz, E. M., Goldberg, L. R., Ashton, M. C., & Lee, K. (2012). Profiling the pro-environmental individual: A personality perspective. *Journal of Personality*, 80(1), 81–111. <https://doi.org/10.1111/j.1467-6494.2011.00721.x>
- Marsh, H. W., & Hocevar, D. (1985). Application of Confirmatory Factor Analysis to the Study of Self Concept: First and Higher-Order Factor Models and Their Invariance Across Groups. *Psychological Bulletin*, 97(3), 562–582. <https://doi.org/10.1037/0033-2909.97.3.562>
- Nagarjuna, L. (2015). Green Financial Management Practices in the Public and Private sector Banks - a Case study of SBI & ICICI. *International Multidisciplinary E-Journal*, 295–306.
- National Development and Reform Commission's Economic System and Management Research Institute “my country's Circular Economy Development Strategy Research” research group. (2005). The development of circular economy is an important way to implement the scientific concept of development. *Macroeconomic Research* (04), 3–8. <https://doi.org/10.16304/j.cnki.11-3952/f.2005.04.001>
- NDRC of China. (2019, march 8). The Development and Reform Commission answers questions about the “Green Industry Guidance Catalogue”. Website of the Central People's Government of the People's Republic of China. Retrieved from http://www.gov.cn/fuwu/2019-03/08/content_5371892.htm
- Ngniatedema, T., Li, S., Li, S., & Illia, A. (2014). Understanding the Impact of Green Operations on Organizational Financial Performance: An Industry Perspective. *Environmental Quality Management*, 1(1), 45–59. <https://doi.org/10.1002/tqem.21379>

- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory* (3rd ed.). McGraw-Hill.
- Panova, S., Shaydurova, A., Fedosova, R., & Zlotnikova, G. (2018). Investment attractiveness of “green” financial instruments. *Journal of Reviews on Global Economics*, 7, 711.
- Pei, Q. (2020). *The Influence of Environmental Regulation on Enterprises' Willingness to Adopt Green Technology* (Master's Thesis, Wuhan University of Technology). <https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202102&filename=1021652843.nh>.
- Peng, X., & Wei, J. (2015). Stakeholders' environmental protection orientation and corporate ecological innovation - the moderating role of executives' environmental protection awareness. *Scientific Research*, 07, 1109–1120. <https://doi.org/10.16192/j.cnki.1003-2053.2015.07.018>
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *The Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>
- Qian, D. (2021). On the origin of green financial management. *Accountants*, 02, 5–6. <https://CNKI:SUN:KJSZ.0.2021-02-003>
- Qiu, Y., Zhang, M., Zhu, L., & Peng, G. (2020). Research on the Impact of Green Finance Development on Innovation Performance—Based on the Perspective of Invested Subjects. *Northern Finance*, 06, 9–16. <https://doi.org/10.1645/9j>
- Schindehutte, M., Morris, M. H., & Kuratko, D. F. (2000). Triggering events, corporate entrepreneurship and the marketing function. *Journal of Marketing Theory and Practice*, 8(2), 18–30.
- Shang, J. (2020). 2019 China Green Bond Operation Report. *Bond*, 01, 37–41. <https://CNKI:SUN:ZHQU.0.2020-01-012>
- Song, W., & Yu, H. (2018). Green innovation strategy and green innovation: The roles of green creativity and green organizational identity. *Corporate Social Responsibility and Environmental Management*, 25(2), 135–150. <https://doi.org/10.1002/csr.1445>
- Song, X., Zhou, Y., & Jia, W. (2019). How do economic openness and R&D investment affect green economic growth? - evidence from China. *Resources Conservation and Recycling*, 146, 405–415. <https://doi.org/10.1016/j.resconrec.2019.03.050>
- Sumayya, R. I., Amna S, C., & Shoaib, A. (2022). Does green finance matter for environmental safety? empirical evidence from the atomic power states. *Cogent Business & Management*. <https://doi.org/10.1080/23311975.2022.2098638>
- Tang, G., Li, L., & Wu, D. (2013). Environmental regulation, industry attributes and corporate environmental protection investment. *Accounting Research*, 06, 83–89+96. <https://CNKI:SUN:KJYJ.0.2013-06-014>
- Teng, M., & He, X. (2019). Air quality levels, environmental awareness and investor trading behavior: Evidence from stock market in China. *Journal of Cleaner Production*, 244, 118663. <https://doi.org/10.1016/j.jclepro.2019.118663>
- Wang, L. (2021). *Research on the Impact of Environmental Regulation on Enterprises' Strategic Green Innovation* (Master's Thesis, Shandong University of Finance and Economics). <https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202102&filename=1021585587.nh>
- Wang, Z. (2022). Research on Enterprise Financial Management under Environmental Protection. *Environmental Engineering*, 01, 293. <https://doi.org/CNKI:SUN:HJGC.0.2022-01-079>
- Wang, M., & Li, Y. (2020). Government Market Regulation Drives Enterprise Green Technology Innovation Mechanism. *China Science and Technology Forum*, 06, 85–93. <https://doi.org/10.13580/j.cnki.ftsc.2020.06.016>
- Wang, B., & Sh, Q. (2016). The technological innovation effect of market-based and command-based policy tools on energy conservation and emission reduction—Empirical evidence based on Chinese industrial patent data. *China Industrial Economy*, 06, 91–108. <https://doi.org/10.19581/j.cnki.ciejournal.2016.06.008>
- Wen, S., Xue, B., & Shi, L. (2017). Project investment decision-making method and application based on circular economy. *Friends of Accounting*, 16, 132–136. <https://doi.org/CNKI:SUN:KJZY.0.2017-16-026>
- Williams, J., & MacKinnon, D. P. (2008). Resampling and distribution of the product methods for testing indirect effects in complex models. *Structural Equation Modeling*, 15(1), 23–51. <https://doi.org/10.1080/10705510701758166>
- Xia, J. (2012). Research on the application of circular economy in financial management. *The China Business Review*, 35, 82–83. <https://doi.org/CNKI:SUN:ZGSM.0.2012-35-042>
- Xiao, L., & Li, X. (2020). The impact of green securities on corporate green investment efficiency: Based on the test of listed companies in six high-energy-consuming industries. *Financial Supervision Research*, 12, 78–97. <https://doi.org/10.13490/j.cnki.frr.2020.12.006>
- Yam, C. M., Guan, J. C., Pun, K. F., & Tang, P. Y. (2004). An Audit of Technological Innovation Capabilities in Chinese firms: Some Empirical findings in Beijing, China. *Research Policy*, 33(8), 1123–1250. <https://doi.org/10.1016/j.respol.2004.05.004>
- Yang, L. (2017). Construction of Green Financial Management Mechanism of Listed Companies. *Enterprise Reform and Management*, 02, 122–123. <https://doi.org/10.13768/j.cnki.cn11-3793/f.2017.0691>
- Yang, Y., Chen, Y., Zheng, X., Zhang, Y., & Hou, T. (2020). Research on the Classification of China's Economic Development Status. *Cooperative Economy and Technology*, 632(09), 6–8.
- Yuan, Z., Bi, J., & Moriguichi, Y. (2006). The circular economy: A new development strategy in China. *Journal of Industrial Ecology*, 10(1-2), 4–8. <https://doi.org/10.1162/108819806775545321>
- Yu, X., & Gu, S. (2015). Research on the technical and economic paths of emission reduction in different types of regions. *Science and Technology Management Research*, 35(16), 5.
- Yu, H., & Li, Y. (2021). The Impact of Environmental Protection Investment on Corporate Performance under Financing Constraints—Based on Empirical Data of Listed Companies with Heavy Pollution. *Business Accounting*, 02, 70–75. <https://CNKI:SUN:SYKI.0.2021->
- Zhang, D. (2017). *Environmental Regulation, Industry Characteristics and Corporate Financing Efficiency* (Master's Thesis, Hubei University of Technology). <https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201702&filename=1017815604.nh>
- Zhang, M. (2020). Research on the Spatial Effect of Green Investment on High-quality Economic Development in the Process of Marketization—Empirical Analysis Based on Spatial Durbin Model. *Journal of Guizhou University of Finance and Economics*, 04, 89–100. <https://doi.org/CNKI:SUN:GZCB.0.2020-04-011>

- Zhang, Y. (2016). *Research on Green Financing in Environmental Protection Industry* (Master's Thesis, Shaanxi Normal University) <https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201701&filename=1017040729.nh>
- Zhang, Y., & Wan, X. (2020). Research on the Design of Green Financial Management System of Chinese Enterprises. *Chinese Collective Economy*, 650(30), 132–133.
- Zhang, B., Wang, Z. H., & Lai, K. H. (2015). Mediating effect of managers' environmental concern: Bridge between external pressures and firms' practices of energy conservation in China. *Journal of Environmental Psychology*, 43(01), 203–215. <https://doi.org/10.1016/j.jenvp.2015.07.002>
- Zhang, L., & Yi, Y. (2021). Development Status and Countermeasures of Enterprise Green Accounting. *Brand Research*, 000(010), 129–133,136.
- Zhong, L., & Zheng, J. (2014). Green management driving force model and innovation path research under institutional isomorphism. *Science and Technology Progress and Countermeasures*, 12, 12–17.
- Zhou, G., Sun, Y., Luo, S., & Liao, J. (2021). Corporate social responsibility and bank financial performance in China: The moderating role of green credit. *Energy Economics*, 97(4), 105+190. <https://doi.org/10.1016/j.eneco.2021.105190>
- Zhu, Q., Sarkis, J., & Lai, K. H. (2017). Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices. *Journal of Purchasing & Supply Management*, 19(2), 106–117. <https://doi.org/10.1016/j.pursup.2012.12.001>
- Zuo, L. (2016). Problems and Countermeasures of Enterprises Implementing Green Financial Management Model. *Chinese Market*, 50, 155+170. <https://doi.org/10.13939/j.cnki.zgsc.2016.50.155>