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Research Article

Specific Digitalization's Effect on Corporate ESG Performance: China's National Pilot Zone as Evidence

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Abstract

Companies now have to deal with increasingly complicated and wide-ranging social duties in light of the real economy's deep integration and the fast expansion of digitalization. This research builds a double-difference model and applies it to China's National Prototype Area for the Progressive Growth of the Digital Economy to empirically examine how regional digitalization affects companies' ESG performance. The data used in the analysis is from 1178 A-share listed companies in the Shanghai and Shenzhen markets from 2013 to 2022. This study discovered that by increasing risk resilience, increasing the number of social contributions, and boosting corporate environmental information disclosure, regional digital construction may enhance corporate ESG performance. Furthermore, the improvement of digital construction on business ESG performance is more evident in regions where public environmental concerns are stronger. In addition, companies with higher executive environmental awareness than lower executive environmental awareness saw a greater contribution from regional digital construction to corporate ESG. In addition, this paper addresses the criticisms leveled at corporate environmental and social responsibility (ESG) by confirming that the disclosure of corporate ESG reports is driven more by corporate sustainability than by self-serving management, as measured by the company's real environmental behavior and information manipulation. Promoting businesses' active engagement in ESG practices via the potential of digital growth is crucial for developing nations.

Keywords: ESG performance, digitalization's, social contributions, digital economy, self-serving management

Introduction

A worldwide challenge to humanity's development and sustainable social and economic growth has emerged in light of current climate change, income disparity, and resource scarcity [1][1] -relevant publications. The strategic obligation of promoting sustainable development falls on enterprises as the market's most active micro-entities. People from all walks of life have been talking about ESG (environmental, social, and governance) performance a lot since it is a reflection of sustainable growth at the firm level.

Previous studies have examined how digital transformation affects ESG performance in situations when organizations voluntarily use it in response to stakeholder demands or other external market forces. Many people need to recognize the government's substantial involvement in promoting the digital environment. According to Yin et al. [2], China is known for being a policy-centric society where government actions may often influence company decision-making. It is easy to overlook the government's crucial role in driving the digital landscape. The Chinese government has been an outspoken supporter of digitization since the turn of the century, enacting a number of initiatives meant to strengthen the country's digital economy. China has launched programs like the "Broadband China" plan and the creation of the "fusion of the two" pilot zones to meet the basic environmental requirements for the development of digitalization and informatization. In response to the maturation of China's digital economy, the government has introduced new policies to foster growth in areas like big data and the Internet of Things; these policies have been tailored to specific industries like industrial manufacturing and regions like "smart cities" and digital villages. The effects of government-led regional digitalization programs are still being studied, even though they have been in place for more than ten years. Is the ESG performance of corporations

improved as a result of this? Sustainable development raises important but as-yet-unanswered challenges about how to achieve win-win results for the economy, society, and the environment while also improving corporate governance.

N. Environment Programmed (UNEP) paper "Who Cares Wins?" from 2004 was the first work to propose ESG (environmental, social, and corporate governance). Unlike CSR, ESG considers economic, social, and environmental development to be of equal importance. Consideration of the interplay between businesses, communities, and the natural world is key, as is a focus on fostering long-term sustainability in all three areas via the generation of value and the distribution of profits to stockholders. Antonio Guterres, UN Secretary-General, presented the 2030 Agenda for Sustainable Development to the world in September 2015 and listed 15 worldwide Sustainable Development Goals (SDGs). Promoting the concept that ecologically responsible development and digitization are complementary is one of these goals.

A stronger digital ecosystem is still needed for China's regional digitization, according to this report, which also identifies several issues with digital application, technical innovation, data ownership, and institutional protections. In it, the authors trace the evolution of Chinese policies that have enabled the country's exterior environment to become digital [3]. In October 2019, Hebei (Xiong 'an New Area), Zhejiang, Fujian, Guangdong, Chongqing, and Sichuan will be the first locations to host experimental zones as part of the National Experiment Zone for the Innovative Growth of the Digital Economy. Four additional pillars have been added to the effort: digital infrastructure development, the digital governance system, digital change, and data circulation. By funding research and development in digital infrastructure and providing incentives for companies to become digital, the initiative hopes to hasten the growth of the digital economy.

Establishing a digital economy innovation pilot zone at the national level has had encouraging results. By the end of 2022, the IT businesses in Chongqing will have made over one hundred billion yuan. While the digital economy's main firms in Shenzhen produced over 900 billion yuan in value, the core industries in Sichuan province only managed to produce 401.2 billion yuan. Guangdong Province became China's leading digital economy in 2022, surpassing the national average inside the pilot zones by 6.41 trillion yuan. More than half of Fuzhou's GDP—700 billion yuan—was generated by the city's digital economy in 2023, thanks to its more than two thousand high-tech firms. More than half of Fuzhou's GDP—700 billion yuan—was generated by the city's digital economy in 2023, thanks to its more than 2,900 high-tech firms.

This study constructs a difference-in-differences model by examining China's "National Pilot Zone for Creative Growth of Digital Economy," which serves as a quasi-natural experiment to foster the growth of the country's digital economy via investment in digital technologies. The objective of this study is to investigate the impact of regional digitization on the environmental, social, and governance (ESG) performance of firms and to draw conclusions from the obtained results. Employing a distinction in different methodologies, this study examines the performance of firms in the pilot zone and non-pilot zones both before and after the implementation of the program. Its objective is to evaluate the impact of regional digitization on corporate ESG. Additional research into the effect mechanisms reveals that regional digital building encourages companies to step up their CSR initiatives, fortify their corporate risk resilience, and disclose environmental data. Through these three channels, it pushes for improved ESG performance from companies. However, according to Habib et al. [4], business success in ESG areas was more driven by management's attempts to boost their self-image than by genuine efforts to promote sustainable development. This research verifies that ESG performance helps promote company sustainability on two levels: management's disclosure behavior manipulation and actual environmental activities.

The following novel insights may be yielded by this study when compared to prior research: To begin, digital transformation's impact on ESG performance has been the subject of several research in the literature [5]. Additionally, the effect of digitization on ESG performance from the outside world is ignored. Second, to find out how regional digitalization affects ESG in businesses, this research uses a difference-in-differences method to create a natural-looking trial. Here in the "National Pilot Zone for Innovation Development of Digital Economy", we put our theories to the test. We may now say that the

pilot policy was effective. Resolving the endogeneity issue offers a higher advantage than what is now supplied by research. Third, the question of whether knowledge sharing or impression management is the source of corporate ESG is explained. This proves that ESG is a legitimate and practical way for companies to map out sustainability goals, and it strongly disagrees with the skeptical and contemptuous stance that some academics have taken towards ESG ratings.

The following is the subsequent organization of the research: Section 2 includes a literature review; Section 3 covers research hypotheses and the organizational setting; Section 4 covers the econometric model and information samples; Section 5 presents empirical results; Section 6 discusses supplementary analyses; and Section 7 concludes with policy implications and conclusions.

Review of the literature and academic foundations

Review of the literature

Data is seen as a growing component in regional digitization, as opposed to traditional industrial aspects. This paradigm also aids in dismantling barriers related to information asymmetry, as it compels organizations to actively fulfill their social commitments and enhance the standard of information disclosure. Source: [6] only bolsters favorable market expectations but also improves businesses' decision-making skills via data storage, processing, and analysis. The study conducted by Ji et al. [7]. Nevertheless, current research has yet to reach a unanimous conclusion about how digitization impacts corporate ESG. There are three main groups into which the results of the available research fall: Digitization on a regional level may help boost ESG performance in the business world [8].

argued that regional digitization may improve infrastructure, facilitate talent aggregation, and reduce transaction costs, which in turn can boost corporate environmental and social responsibility and internal governance procedures. The impact of digital technology is particularly notable in the areas of internal corporate management and environmental pollution control. Second, there is little evidence that digitization has improved corporate ESG performance. To illustrate the point, Zhao et al. [9] found that digital construction is great at improving internal governance and corporate social responsibility, but it doesn't do much to improve energy efficiency or decrease pollution from corporations. Thirdly, digitization's effect on ESG performance in corporations is nonlinear.

United Nations Environment Programmed (UNEP) research "Who Cares Wins" from 2004 was the first to suggest the term "ESG" (environmental, social, and corporate governance). ESG, in contrast to CSR, gives equal weight to economic, social, and environmental development. Consideration of the interplay between businesses, communities, and the natural world is key, as is a focus on fostering long-term sustainability in all three areas via the generation of value and the distribution of profits to stockholders. In his summary of the 2030 Agenda for Sustainable Development, presented in September 2015, Antonio Guterres, the Secretary General of the United Nations, enumerated fifteen worldwide Sustainable Development Goals (SDGs). Among these aims is the promotion of the idea that digitalization and environmentally friendly growth go hand in hand.

According to this report, a stronger digital ecosystem is still needed for China's regional digitization, which also identifies several issues with digital application, technical innovation, data ownership, and institutional protections. In it, the authors trace the evolution of Chinese policies that have enabled the country's exterior environment to become digital [10]. According to the plan for the National Experiment Zone for the Progressive Growth of the Digital Economy, Hebei (Xiong 'a New Area), Zhejiang, Fujian, Guangdong, Chongqing, and Sichuan will be the first places to construct experimental zones in October 2019. Four additional pillars have been added to the effort: digital infrastructure development, digital governance framework, digital change, and data circulation. The program's stated goal is to hasten the growth of the digital economy by fostering digital development and creating a conducive atmosphere for companies to become digital.

The Digital Economy Innovation National Pilot Zone has been successful. By year's end 2022, Chongqing's tech companies will have earned over 100 billion yuan. While the digital economy's main firms in Shenzhen produced over 900 billion yuan in value, the core industries in Sichuan province only managed to produce 401.2 billion yuan. Guangdong Province became China's leading digital economy in

2022, surpassing the national average inside the pilot zones by 6.41 trillion yuan. More than half of Fuzhou's GDP—700 billion yuan—was generated by the city's digital economy in 2023, thanks to its more than 2,900 high-tech firms. More than half of Fuzhou's GDP—700 billion yuan—was generated by the city's digital economy in 2023, thanks to its more than 2,900 high-tech firms.

In order to bolster the digital economy, this study constructs a difference-in-differences model based on the quasi-natural experimentation of China's "National Pilot Zone for Innovative Growth of Digital Economy," which Investment in Digital Technologies' China's development environment assistance. The purpose of this study is to find out how regional digitization impacts company ESG performance and draw implications from it. Employing a difference-in-differences approach, this study compares firms in the pilot and non-pilot zones both before and after the policy's implementation to determine the effect of regional digitization on corporate ESG performance. Regional digital construction encourages companies to step up their CSR initiatives, fortify their business risk resilience, and disclose environmental data, according to research on the effect mechanisms. Through these three channels, it pushes for improved ESG performance from companies. However, according to Zhang et al. [11], business success in ESG areas was more driven by management's attempts to boost their self-image than by genuine efforts to promote sustainable development. This research verifies that ESG performance helps promote company sustainability on two levels: management's disclosure behavior manipulation and actual environmental activities.

The following novel insights may be yielded by this study when compared to prior research: To begin, digital transformation's impact on ESG performance has been the subject of several research in the literature [12]. It also doesn't take into account how digitalization impacts ESG performance from the outside. The second contribution of this study is the quasi-natural experiment it employs, the difference-in-differences approach, to determine the effects of regional digitization on ESG in companies. Testing our hypotheses in this "National Pilot Zone for Sustainable Development of Digital Economy," The pilot policy seems to have been successful. Addressing the endogeneity issue offers more value than what is currently available in research. Third, we elucidate the root of corporate ESG, which is whether it is information sharing or impression management.

In contrast to the suspicious and dismissive attitude that several scholars have adopted towards ESG ratings, this demonstrates that ESG is a valid and useful tool for businesses to plot out their sustainability objectives. Discover that companies' ESG performance may be improved via digital transformation and validate those environmental restrictions, both official and informal, have a moderating role for the better. While many studies have examined topics like inclusive economic development, eco-friendly growth [13], and related subjects, more is needed about the effects of digitization on the external environment. Few studies have examined how digitalization affects companies' ESG performance.

Foundations in theory
The immediate results of digitalization at the regional level
When it comes to market transactions, those who have access to more comprehensive information usually come out on top. However, regional digital development could break down information silos and help people overcome this information asymmetry. One positive aspect is that big data platforms can help corporate management and investors get more accurate and timely information disclosure. The 2016 study by Zhou et al. Because of this, company executives may enhance accounting robustness and conduct precise risk assessments. However, investors, creditors, and other stakeholders might be more trusted and acknowledged via open and honest corporate disclosure. Research conducted by Habib,[14] had brought attention to the ways in which businesses demonstrated strong operational procedures and impressive environmental, social, and governance (ESG) performance, leading to the development of intangible corporate reputations and creditworthiness. Consequently, these businesses were able to get more favorable financing conditions in the face of intense market competition.

Furthermore, a robust regional digital infrastructure may lessen the costs of information-seeking and increase people's access to it. The year 2019 was hypothesized that encouraging a free and open exchange

of goods and services would inspire locals to seek out work and start their businesses. The expansion of various digital industries brought about by improvements to physical infrastructure would further increase the number of available jobs. By performing product data analysis, bolstering continuous digital supervision, and building strong internal monitoring mechanisms, businesses may use big data technology to quickly identify and resolve agency concerns.

[15] thought that regional digitization could improve internal and external oversight and incentive systems, leading to more harmony in goals and interests among creditors, shareholders, and management and paving the way for joint endeavors to promote enterprises' societal and environmental adaptive growth.

Companies should prioritize their financial success, according to traditional organizations that adhere to the idea of shareholder primacy. This is contradicted by stakeholder theory, which argues that businesses should prioritize societal good alongside profit maximization [16]. it was discovered that, as digitalization increases in the external environment, companies are more likely to take a proactive stance. Increasing spending is a common problem for businesses right now. Therefore, it's more important than ever to connect with outside groups and take the initiative to meet CSR obligations. In the near run, businesses may gain an advantage over their competitors by actively seeking out and maintaining favorable partnerships with other groups in order to get access to development resources. In 2006, due to the instability of these ties, it is essential to understand that substantial financial expenditures are necessary to sustain cooperative partnerships with customers both upstream and downstream[17]. Regional digitization is expected to bring about long-term cost savings and operational efficiency improvements for enterprises via the use of abundant market data. Businesses will be better able to fulfil their social obligations at a reduced cost when they reduce their reliance on particular suppliers. This alleviates their disadvantage in the industrial chain and gives them more Investment in Digital Technologies when negotiating with suppliers upstream and consumers downstream. In 2022, Yin et al. [2] found that employees in the current digital age had more options for when and how they work, such as telecommuting and flexible scheduling. This led to higher job satisfaction, loyalty, and organizational success. Adapting to the different demands of consumers is an essential part of regional digitalization, which entails more than just improved company performance. Businesses now have a better notion of what their consumers could want because of connected technologies such as big data and cloud computing, which have substantially enhanced data mining and processing.

Meng et al. [18] reported in 2020, which indicates that enhancing the ad distribution service's pinpoint precision enhances the likelihood that customers would acquire the offered things, thus helping to revive customer value. In their focus on the year 2022, emphasized the potential benefits of regional digitalization in facilitating the full-flow monitoring of a product's lifespan, from design to production, usage, and disposal. This facet has the potential to lessen issues with agencies. Management, shareholders, and creditors may all benefit from a better relationship as a result of regional digitization's enhanced internal and external monitoring and incentive systems. Businesses may increase their social and environmental growth via unity and flexibility through this proximity. Additionally, it enables faster regulation and adaptation of business outputs and customer behaviors by management. The goal of Zhang et al. [19] in their 2020 article was to make it easier for individuals at all levels to comply with environmental legislation. Businesses can utilize big data technologies to extract raw material consumption data early in the planning process, supported by comprehensive regional digitization, which facilitates the development of effective strategies for controlling environmental performance. Subsequently, the distribution network established by the regional digital platform is employed throughout production to achieve local distribution, thereby reducing transportation and storage costs for the business. By 2020, the by-products had been enhanced and recycled to maximize resource utilization [20].

Enterprises may follow and offer feedback on processes from pre-preparation to manufacturing by monitoring and analyzing product use data. Products are subject to routine maintenance and upkeep activities throughout their use phase in order to extend their service life. Research conducted by Sun, [21].

Regional digitization is essential to encourage companies to reduce their environmental impact and act responsibly. It lays the groundwork for companies to realize their digital potential.

In light of the above, this research proposes the following hypotheses.

The primary theory. Regional digitization may lead to better cooperative ESG performance.

Regional digitization's indirect consequences
1) Transparency about environmental data
The social benefits of environmental governance often outweigh the private gains, and this is one of the many externalities associated with environmental governance. Companies may not be sufficiently motivated to meet their environmental responsibilities due to this mismatch. The region's digital growth has the potential to significantly lower the expenses for businesses to meet their environmental duties and provide stakeholders and other businesses with feedback bearing the logo of an eco-friendly business [22]. Businesses can attract more eco-conscious investors by being transparent about their environmental practices and policies, according to signal theory. This includes things like the number of people working in environmental management, the amount of money allocated to environmental governance, and the company's plans for green development in line with societal norms and ethics. Businesses may gain an advantage in the finance market by shifting their production and operations towards greener, lower-carbon practices, which can be encouraged by this "incentive-type" signal. On the other hand, according to Zhang, [23], when industry experts or social media users openly criticize a firm for ignoring its environmental responsibilities, From the other side, when people in the know openly criticize a firm of ignoring its environmental responsibility, it may be very damaging. Companies often provide ESG reports, which stand for "independent environmental responsibility reports," to reveal more accurate and thorough environmental data. Businesses may promote more sustainable practices by disclosing more environmental information, both in quantity and quality.

2) The magnitude of charitable contributions
Agoraki et al. [24] found that corporate social giving operations become more open and trustworthy when information flows efficiently in the area, leading to improved openness and traceability. Companies' strategy discussions now heavily include strategic charitable donations, thanks to the growing recognition of social responsibility. Giving to charity is only sometimes a selfless act, according to strategic philanthropy theory. According to Song et al. [25], businesses may get a competitive advantage by gaining recognition from stakeholders. Businesses will encourage the increase of their surplus and value while providing social contributions. Concurrently, the "advertising effect" will be activated when the business receives some renown as a result of its outstanding corporate philanthropy activities [26]. Groups may expand their product marketplaces and lower their finance constraints by influencing investment decisions and customer behavior. This socially responsible conduct may reach more investors and customers via an effective digital platform. Government subsidies and necessary resources may be available to them as well, giving them an even greater edge over their competitors.

As an act of social contribution, it helps close the wealth gap across regions and brings about equitable economic development. Companies may improve their corporate social performance via charitable activities by encouraging positive interaction between businesses and stakeholders from all walks of life.

The third point is the resilience of the enterprise to risk.
Digital technologies such as big data and the Internet of Things have made it possible for enterprises to store and show vast amounts of internal, private, public, and stakeholder data, which is a boon for risk assessment. Organizational learning theory may help companies see potential threats and opportunities in both internal and external developments. According to Li et al. [27], businesses' risk perception abilities have been enhanced as a result of the shift from a "passive response" attitude to an "active identification" in risk management . From a customer's point of view, the new digital infrastructure provides a powerful digital disclosure platform to meet their unique needs. As a result of this change, the demand environment for consumer goods has become more complex, diverse, and dispersed rather than a single, homogeneous model. According to Sun et al. [28], businesses may diversify their risk exposure and business models by

taking advantage of the diversification of demand, which in turn increases the digital development needs of companies in the digital era.

Enterprise internal control experts worry that management's desire for riskier, more aggressive actions may be frustrated by internal and external monitoring systems as information asymmetry increases. Regional digitization is continuing strong, which means that information can be disseminated across several markets much more effectively. Enterprises' risk-taking and coping abilities are enhanced, and benign external environmental limitations are formed [29]. This improves decision-making and decreases excessive speculation and risk aversion. In addition, businesses may benefit from regional digital transformation by making management decisions more efficiently. For example, businesses may quickly take advantage of technological innovation and implementation by analyzing data thoroughly to determine the best way for corporate innovation, given the present state of technology and institutional constraints. According to [30], this preventative measure helps lessen the impact of market rivalry on businesses. Certain studies have indicated that, in the near run, enterprises' ability to improve their ESG performance and receive resources from stakeholders falls under the category of social exchange based on the principle of exchange. The capacity of businesses to withstand systemic risks is time-sensitive, and these occurrences are characterized by declining marginal impacts. According to [31], an enterprise's early investments unleash a large quantity of cash flow over the long term. By reducing management's motivation to engage in excess management and financial manipulation, businesses will be better able to withstand idiosyncratic risks, minimize noisy trading, and screen out illogical investors. The improvement of corporate governance performance is facilitated by regional digitalization, which helps enterprises boost their risk resistance. This work proposes the following theory based on the theoretical processes that have been previously discussed.

Better there are three ways in which regional digitization might improve ESG performance: greater transparency about environmental information, bigger societal contributions, and more resistance to risk.

Data and Methodology

indicator variables.

1) Variable Elements.

This investigate employs a metric for business ESG performance (ESG) derived from Bloomberg's publicly available data on ESG scores. The score may generate a customized indicator rating system for each industrial category via the analysis of publicly available information Examples include business websites, yearly filings, ESG reports, and CSR reports. Results from studies by Zhang et al. [32] demonstrate the extensive usage of the score, which may vary from 0.1 to 1. On the other hand, certain companies may have a strategic motive for producing ESG reports. In order to satisfy regulators or investors or to increase information disclosure for the benefit of stakeholders, an ESG report may be produced. In light of the increasing demand for eco-friendly and low-carbon products and services, "greenwashing" has become commonplace among companies. The term "corporate perception management" might describe this kind of transparency. This pattern shows the quality of various countries' ESG reports. So, it would be wise for countries to collaborate to improve the quality of their ESG disclosures. The bottom line can take a hit if companies disclose ESG factors.

The financial performance of corporations is adversely affected by the management's entrenched strategy and fulfilling social obligations, according to Huang et al, [33]. Companies' financial performance is inversely related to their disclosure of ESG aspects, according to a study by Zeng et al. [34]. Companies' value drops when they disclose environmental, social, and governance (ESG) factors (2018). Management takes the correlation between the company's success and the disclosure risk into account when making decisions on ESG disclosure. Mandatory disclosure rules have been applied to a handful of polluting Chinese companies thus far. The absence of this will discourage companies from falsifying or altering data. Consequently, the likelihood of inaccurate or misleading information being included in ESG reports or other publicly accessible material from Chinese corporations is low.

Table 1. The function and measurement of control variables.

Variable	Symbol	Dimension methods
Corporate, ESG Performance	*ESG_P*	Environmental, Social, and Governance (ESG) index or score (usually from 0 to 100 or like).
Extent of years mentioned	*Listing Time*	*Ln (The years mentioned)*
Market volatility	σM	Unitless or represented as a percentage (%) or decimal
Financial limitations	*Limitation on Funding*	*Refer to* [35] *in* order to build (FC) index.
Corporate donations or social investment	SI Dorp_{corp}Dorp	Monetary units (e.g., USD, CNY, EUR)
invest in fixed-asset vehicles	*Long-Term Assets*	Net fixed assets/Total assets
significant portion of revenues going to shareholders	*Occupy*	(Additional receivables - Other payables)/Total assets
Ownership of shares by executives	*Investment in digital technologies*	Executives' ownership stake
Regional digitalization policies	RDP	Binary (0 or 1) or Index (Unitless)
Board dimensions	*Overall ESG rating*	Ln (Number of Board of Directors)
Concentration of Shareholdings	*Top10*	The percentage of shares held by the top 10 shareholders
Economic development level	*GRP*	*Ln (Gross Regional Product)*
Sustainability Initiatives	Financial Organization	Secondary GRP/GRP
Funding efforts to protect the environment	*Money Outlay*	Allocation of Funds for Environmental Defense /GRP

2) Partially Reliant on Another

This study employs a quasi-natural experiment that is derived from the 2019 China National Pilot Area for Innovative Development of the Digital Economy plan. For the purpose of tracking the implementation date of the policy in the pilot region, a time dummy variable may be created (Time). In this variable, we shall record 1 for the year the policy was first put into effect and 0 for each year after that. The next thing to do is create a fake variable called Treat. This will represent the area where the company's registration is. For business registrations, a location is denoted by a zero, and as a pilot area, by a one. The way the time dummy variable interacts with the pilot area of the business registration location (Time × Treat) represents the net impact of the National Pilot Zone for Innovation Development of Digital Economy.

At last, evidence has been discovered. Provinces and communities with administrative power at the provincial level will test the approach first. This study looks at how the pilot area's regional digitization initiatives affected the ESG performance of local businesses. The article delves further into the consequences of these limitations. Next, Variables That Can Be Controlled

This study's authors attempted to reduce the impact of potential confounding factors by including control variables at both the company and regional levels. ESG_P, listing timing, gearing ratio, financing limitation, return on total assets, CEO compensation, employee welfare initiatives, and total assets are all factors at the business level that are taken into account in this research. Based on previous research by [36], the top ten factors to consider include investment in digital technologies, salary, overall ESG rating ESG_P, and shareholder concentration. Fiscal spending for environmental protection (GRP), degree of economic development (GRP), and Sustainability Initiatives (ES) are the three regional metrics used in this study. All of the elements above that may affect ESG performance in corporations are included in the model in this study. Our analysis includes regional environmental fiscal expenditures as a control variable, which is a critical point to make. Incorporating this metric is a response to the growing emphasis on environmental protection at the national and corporate levels in China, driven by a widespread preference for measuring ESG performance in relation to environmental impacts. Conversely, found that companies may be incentivized to be more environmentally conscious if Governance score on environmental protection is increased. It is possible to eliminate the possibility that government-introduced environmental subsidies and tax incentives affect business ESG performance by managing environmental protection budgetary expenditures. Table 1 displays detailed descriptions**.**

Description of the model
The present study used a difference-in-differences (DID) model to assess the effects of the policies implemented by the National Pilot Zone for Innovative Development of the Digital Economy on collaborative ESG performance, with reference to Li et al. [27].

$$ESG_{i,t} = \alpha + \beta Time_t \times Treat_i + \gamma X_{i,t} + \delta_i + \mu_t + \varepsilon_{i,t} \qquad (1)$$

In equation (1), a subscript denotes the year, while another subscript states the companies. "Time" is divided by "Treat." It represents the average change in ESG performance across regions that were involved in the policy's deployment and those that weren't over time. In this section, the control variables mentioned are represented by a vector.

The random error term denotes the continuous influence of changing firms, which accounts for a common temporal component for all enterprises. Parameters are the primary emphasis of our research. If the regulation is both substantial and beneficial, it assists firms in improving their performance on environmental, social, and governance measures.

Data sources and sample selection
Company A-shares listed on the Shanghai Stock Exchange and the Shenzhen Stock Exchange in China from 2013 to 2022 are a part of this study. Additionally, businesses in the banking and financial industries are not included in this study as; while engaging in daily operations involving a substantial volume of capital movement, these companies need to generate actual wealth. Additionally, companies with gearing ratios higher than 1 were not included in this study due to the fact that these businesses had negative owner's equity and might potentially go bankrupt. Businesses that have been listed for less than a year or that have Special Treatment (ST or *ST) do not qualify for our research. Lastly, our research sample consists of 1,178 listed businesses with a total of 7,204 observations. Researchers manually culled environmental investment data from company financial statements. The financial data of companies comes from the Cathay Pacific database (CSMAR), while data at the provincial level is derived from the China Statistical Yearbook. Table 2 shows the descriptive statistics of the key variables.

Findings and conversation
Findings from the regression at the starting point
The results of the regression analysis are shown in Table 3. Following year-fixed effects and firm-fixed effects, we use columns (1) and (2) to account for the average effect of pilot projects on businesses' ESG performance. Even after controlling for other variables, Column (1) shows that the pilot method had a

statistically significant effect on ESG performance (r=0.514) at the 1% significance level. That the pilot program significantly improves the ESG performance of the participating companies is evident from these results. With all the control variables included in Column (2), the regression coefficient is 0.460, which is statistically significant at the 5% level. Listed companies that were unaffected by the policy shock have much superior ESG performance as compared to those who are involved in the pilot area of digitalization initiatives [37].

Table 2. An analytical synopsis.

Variable	Obs	Mean	Std.Dev.	Minimum	Maximum
ESG	7206	32.919	7.95	12.344	68.917
$Time_t \times Treat_i$	7206	0.176	0.378	0	1
Treat	7206	0.358	0.479	0	1
ESG_P	7206	8.579	1.291	2.308	13.166
Listing Time	7206	2.67	0.609	0.695	3.469
Investment in Digital Technologies	7206	0.477	0.195	0.009	1.699
Financing Constraint	7206	0.268	0.224	0	0.972
ROA	7206	0.09	0.072	−0.647	0.968
Employee welfare initiatives	7206	0.224	0.178	0	0.956
Occupy	7206	−0.019	0.043	−0.795	0.35
Investment in digital technologies	7206	0.069	0.139	0	0.812
Wage	7206	0.848	0.955	0	11.409
Overall ESG rating	7206	2.279	0.184	1.387	2.87
Top10	7206	0.9	0.159	0.134	1.014
GRP	7206	10.408	1.348	0.488	11.738
Digital economy index	7206	0.378	0.096	0.066	0.507
Governance score	7206	0.236	3.359	0.005	77.789

Test of dynamic effects
The average effect of this results policy shows this pilot policy's average effect on companies' ESG performance. The benchmark regression does not take into consideration the fact that the policy practice in question will have consequences that change over time. This research builds on the following model by using the Event Study Approach proposed by Jiang and Ma, [38] to examine the dynamic impacts. In order to account for the years 2013–2022, one for each year of the "National Pilot Zone for Big Data Innovation and Development" policy's implementation and one for the years after that, this study used dummy variables.

Table 3. Regressions in DID and policy shocks related to digitalization.

	(1)	(2)
$Time_t \times Treat_i$	0.514***	0.460**
	(0.191)	(0.190)
ESG_P		1.367***
		(0.208)
Listing Time		1.043**
		(0.479)
Investment in Digital Technologies		−2.734***
		(0.713)
Financing Constraint		−0.474
		(0.528)
ROA		1.412
		(0.958)
Employee welfare initiatives		−1.746*
		(1.005)
Occupy		−2.502**
		(1.219)
Investment in digital technologies		0.536
		(1.179)
Wage		−0.165
		(0.108)
Overall ESG rating		−0.348
		(0.539)
Top10		−2.157*
		(1.268)
GRP		0.067
		(0.085)
Sustainability Initiatives		−3.008
		(2.609)
Fiscal Expenditure		−0.018
		(0.025)
cons	31.835***	21.258***

Table 3. continued.		(1)	(2)
		(0.054)	(2.457)
Year FE		✓	✓
Firm FE		✓	✓
Obs		7207	7207
R²		0.834	0.837

They were then multiplied by the combination variable "Treat" to produce an interaction term. Subsequently, regression analysis was performed after including this component in the baseline model [39]

$$ESG_{i,t} = \alpha + \sum_{t=2013}^{2022} \beta T_t \times Treat_i + \gamma X_{i,t} + \delta_i + \mu_t + \varepsilon_{i,t} \tag{2}$$

Equation (2) denotes each year's dummy variable by Tt. The base year, also known as period 0, is the year before the commencement of the pilot policy. Equation (1) defines all of the variables, and the coefficient shows the effect on company ESG performance both before and after the pilot region was set up [40]

Figure 2 shows the estimated regression coefficients with 5% confidence intervals, according to the work by Nunn and Qian (2011). From 2015 to 2018, prior to the pilot zone's construction, the interaction term's coefficient estimates were minor, and the sample passed the parallel trend test. Furthermore, the coefficient estimates show little significance during the policy introduction period but do show a noticeable increase in the second and third periods, suggesting that the policy may have a delayed impact. Regional digitalization's promotion impact on company ESG performance is on the increase, according to the policy implementation effect viewpoint. The digital economy may have a lasting and increasing influence, which might explain this finding. As stated by [41], the area may greatly benefit from the digital economy's amplification, superposition, and innovation impacts, provided it has a solid basis for digitalization.

The robustness test results and analysis
Empirical research
Pilot businesses were randomly assigned in this research using a placebo test, following the approach. This study set out to further disprove the hypothesis that "National Pilot Zone for Innovative Development of the Digital Economy" policy outcomes were being impacted by unobservable factors. Specifically, this investigation used 500 random samples. A total of 1,178 companies were evaluated; 600 were assigned to the experimental group, while the other enterprises were assigned to the control group. The policy positively and significantly impacted businesses' ESG performance in the pilot region. The reason for this is that the ESG of businesses was not substantially impacted by the pseudo-policy factors that we constructed, as confirmed by random sampling [42]

Figure 3 shows the distribution of the estimated regression coefficients and accompanying p-values for the time-treatment pseudo-interaction term [43]. Since it follows the normal distribution, the sampling is shown to be random by the kernel density function. Simultaneously, the majority of the calculated pseudo-interaction term coefficients cluster around zero and have significance values greater than 0.1. The bulk of the randomly selected samples did not show any statistically significant regression findings, according to the research. Contrary to most of the sample findings, the regression coefficient for the real interaction term is 0.460 (for details, see Table 3). You can see it in the dotted vertical line. All of the preceding evidence points to the conclusion that the National Pilot Zone for Creative Development of the Digital Economy policy does, in fact, boost enterprises' ESG performance. This effect is resistant to placebo and other confounding factors.

PSM-DID

A number of Chinese provinces and regions have been designated as "pilot zones" to foster innovation in China's digital economy. However, there's a problem with sample self-selection since the settings of the pilot locations and the treatment group's firms weren't picked at random. This self-selection bias in the sample keeps the prospect of endogeneity problems alive. In order to make the empirical results more trustworthy, this research uses the PSM-DID, which is based on the approach of Sun et al. [44]. The interaction term (Time × Treat) is first tested in a Logit regression with all control variables as covariates. Finally, there's evidence that the control variables may influence whether or not a company's location is inside the pilot zone. The next stage is to compute a propensity score using all matching criteria to ascertain the probability of each firm's position inside the pilot zone. Lastly, the study employs the closest-neighbor matching strategy to guarantee that the treatment and control samples are similar, hence minimizing the influence of endogenous selection bias. This ensures that there will be no discernible difference between the treatment and control groups. Following PSM's closest neighbour 1:4 matching, this study adds a DID regression test to the dataset. Column 1 of Table 5 displays the regression analysis findings. At the 5% level of significance, the Time × Treat interaction term has a positive coefficient. Propensity Score Matching (PSM) successfully removes self-selection bias from business samples, ensuring that the findings are still strong [45].

Not include any other policies for the same time frame

This research mainly aims to address the issue of conflicting digitalization initiatives. At the 2016 G20 Summit in Hangzhou, China, the digital economy was recognized as the main driver of creative economic development, marking a significant turning point. After that, the Chinese government launched a slew of initiatives to promote digitalization in the subsequent years. Some successful programs and efforts include the National Big Data Thorough Pilot Zone, the Special Action Program for Digital Empower of Small and Medium-ESG Pd Companies, and the Action on Encouraging "Use Cloud, Use Digital, which is an Empowering Intelligence [46].

The report also takes a look at how environmental rules may play out. As a result of many rules enacted in reaction to repeated demands for action in China's Thirteenth and Fourteenth Five-Year Plans, the nation has recently achieved great strides in environmental preservation. Evidence suggests that a variety of regulations have a substantial impact on companies' ESG performance. Carbon emission trading schemes, environmental protection taxes, and green credit programs are all examples of such measures. This study takes into consideration the outcomes of two Chinese laws pertaining to environmental protection levies; one passed in 2018 and the other in 2016, namely the National Big Data Comprehensive Pilot Zone policy [47].

In this study, we construct the policy variable (Big-dada) for the National Thorough Experimental Zone of Big Data using the difference-in-differences model shown in equation (1) of section 4.2. This approach allows us to manage the effects of the digitization policy simultaneously. In this research, the full "tax payable" records of the sample firms were used to calculate the environmental taxes paid since 2018. The objective of the compilation of this data was to assess the outcomes of these tax collections [48]. The present research quantifies the collection of environmental tax by using the entire assets of the company (Env_tax). Both of these variables are used as control variables in the regression analysis model.

The regression results after accounting for the Big Data Pilot Zone and the ecological tax charge are shown in Column (2) of Table 5. According to the statistical significance coefficient of the relationship term (Time × Treat) at the 5% confidence level, the pilot zone plan for digital economy innovation and development does really affect the ESG performance of firms. The environmental protection tax, known as the Env tax, likewise has a statistically significant regression coefficient. Evidence suggests that the latest attempts by the government to control the environment have resulted in an enhancement of companies' ESG performance [49].

Table 4. Techniques for measuring the extent of digital development at the regional and provincial levels

Level 1 indicators	Associated Indicators	Secondary Indices	Unit	Property
Information System Base	The cellphone sector ESG_P	Distinct cell phone capacity	10,000 households	+
		Kilometres is the line length of long-distance fibre optic cables.		+
	Internet scale	Multiple ports for broadband Internet access Multiple ports for broadband Internet access		+
	Postal industry ESG_P	The total km of the postal route	The total km of the postal route	+
Digital Industry	The service level of the telecom sector	Total Business Dollars for the Telecommunications		+
		Number of cell phones per 100 people	Department/100 people	+
	Internet service level	Number of websites per 100 companies	pcs/hundred people	+
		Number of computers per 100 people	Table/100 people	+
	Service level for e-commerce	E-commerce sales	Billion	+
Digital Innovation	Technology innovation	Income from the selling of creative goods billion		+
		The number of R&D pieces that have successful innovation patents	The number of R&D pieces that have successful innovation patents	+
Digital Convergence	Inclusive finance	Index of Digital Inclusive Finance	/	+

Table 5. Results of testing for robustness.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Time_t \times Treat_i$	0.777**	0.459**		0.093*	0.536**	0.431**	2.378***	0.452**
	(0.352)	(0.195)		(0.051)	(0.224)	(0.197)	(0.786)	(0.189)
Big information		0.501*						
		(0.295)						
Env_tax		0.259*						
		(0.146)						
Digital			2.116**					
			(0.989)					
cons	48.977***	22.069***	20.738***	4.967***	24.106***	25.098***	17.899	23.849***
	(14.784)	(2.463)	(3.458)	(0.749)	(2.868)	(1.879)	(17.139)	(4.785)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓	✓	✓
Obs	3139	7207	7208	3199	5976	9758	595	7208
R^2	0.854	0.839	0.839	0.745	0.856	0.849	0.825	0.9

Evaluations of substituted variables

The results of this research confirm what was already suspected: that regional digitalization substantially boosts companies' ESG performance. In order to verify that the findings are consistent, this research starts a fresh analysis by reversing the order of the variables.

This study uses an entropy metric for the quantity of regional digitization (Time × Treat) rather than the interaction component in the DID model. No clear agreement on the scope, definition, or assessment criteria of regional digitalization has been made in the existing literature. Four groups—digital basis, digital industry, technological advancement, and digital integration—were chosen as indicators for the research because of their breadth and practicality. Indicators at each of the three levels of the province's digital development level measuring system ranged from four at the lowest level to twelve at the highest.

All of the information in Table 4 comes straight from the National Bureau of Statistics of China's official website. By utilizing the entropy approach to assign weights to the indicators objectively, the area's digital development index (Digital) may be calculated. Table 5, column 3 displays the regression results after the variables that are independent have been replaced. After controlling for the independent variables, a 2.11 regression coefficient is found, which is statistically significant at the 5% confidence level. This strengthens the reliability of the results from the benchmark regression and shows that the amount of regional digitization has a substantial impact on ESG incentives [14].

In earlier studies, Bloomberg's ESG ratings of companies served as the dependent variable. In this portion of the study, SYNTAO GREEN FINANCE ESG ratings are utilized instead of Bloomberg ESG. The ESG ratings were given values from 1 to 10, ranging from D to A+, with C+ being the highest and B− the lowest. Section 4 then used equation (1) to do a regression on the results. The regression results are shown in column 4 of Table 5. The findings are positively skewed since SYNTAO GREEN FINANCE's declared ESG scores serve as the variable that is dependent in the regression study.

Extra robustness tests

This section uses one-period-ago control variables to account for all independent variables, which helps to reduce the impact of endogeneity and consider the potential delayed influence of ESG performance on corporate performance. The regression results may be seen in Table 5, column 5. The results are still strong, and the interaction term's regression coefficient (Time × Treat) is 0.535 at the 95% confidence level, further indicating that it is significant [50].

This strategy circumvents typical process bias by prolonging a sample year and reusing the sample data. You can see the regression results in column 6 of Table 5. This study's sample years are now 2012–2022. The interaction terms' regression coefficients are positive and statistically significant at the 95% confidence level. The STAR Market and the Growth Enterprises Market, two A-share marketplaces in Shenzhen and Shanghai, China, provided the data used in this research. In column 7 of Table 5, you can see the regression findings. The interaction term regression coefficient is 2.379, which is statistically significant at the 99% level [51]. The findings may be regarded as reliable, nonetheless, since this study does not experience the frequent technique bias problem. The outliers' potential influence on the regression results is tested in this research by reducing the factors that are dependent and control variables by 1% bilaterally. Results from the regression analysis may be seen in Column 8 of Table 5. At the 5% level of certainty, the regression analysis produced a projected regression coefficient of 0.452. Since the outlier's coefficient is so near to the actual value of 0.460, it passes the durability test and does not affect the regression results.

More examination
Testing the mechanisms

According to the Theoretical Mechanisms section, regional digitization might be a powerful tool to improve ESG performance by encouraging corporations to disclose environmental information, increasing the magnitude of corporate gifts, and bolstering risk resilience. What this study achieved to bolster the validity of the impact of the above mechanisms is as follows.

Disclosure of Environmental Information

Lowering costs, enhancing efficiency, and luring investment from outside sources are two ways in which regional digitization contributes to environmental information disclosure for businesses. Therefore, in order to evaluate the efficacy of environmental information disclosure by corporations, this study uses the following metrics: (1) in the event that the company has released an environmental, social, and governance (ESG) report during the year; otherwise, (0). Data is used to depict disclosures on the environmental impact of corporations. This study employs a panel data-based Logit regression model to investigate how environmental information sharing works.

Table 6. Examining roles-based.

	(1)	(2)	(3)	(4)
Time$_t$ × Treat$_i$	0.731**	0.288**	0.895***	0.337*
	(0.366)	(0.115)	(0.314)	(0.186)
Data				2.259***
				(0.257)
Contribution				0.132***
				(0.026)
Hazard				0.012*
				(0.007)
frauds	−1.027	13.619	22.012***	−1.029
	(1.352)	(10.011)	(2.386)	(1.352)
Controls	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Obs	2256	7204	7204	3196
R²		0.468	0.680	0.843

Table 6, column 1 displays the results of the mechanism test. There was a statistically significant relationship between regional digitization and the sharing of environmental information by companies (r=0.731, p=.05). Thus, digitization may boost ESG performance by increasing the transparency of companies' environmental reporting.

Scale for business donations
Enterprise contribution behavior may be made more genuine and trustworthy by regional digitalization. Strategic corporate gifts within the domain of big data platforms may also provide promotional advantages for businesses, sending good signals to investors and customers. Specifically, this study aimed to compile data on corporate social contributions by analyzing the social responsibility information

revealed in the annual reports of listed firms, as well as their environmental, sustainability, corporate citizenship, and social responsibility reports. As a result of applying the natural logarithmic treatment, the Scale of corporate contributions may be represented by the symbol Donation. Table 6, specifically Column 2, shows the impact of regional digitization on the magnitude of corporate donations. At the 95% confidence level, the findings provide a statistically significant regression coefficient of 0.288. Digitization may boost corporate social contributions and make social responsibility more visible and easier to carry out. It demonstrates that corporate social giving is a powerful tool for influencing business ESG performance via regional digitization [51].

Resilience in the face of risk

Businesses may enhance their risk perception capabilities, fortify their risk resilience, and optimize their internal governance structures via regional digital building. Originally developed using data from American industrial enterprises, the Z-value model put out by Altman (1967) quickly gained widespread acceptance among academics who saw its potential applicability across a variety of sectors [4], for example, said that the model may be used for the Chinese stock markets in Shenzhen and Shanghai as well. To build the Z-value model of enterprise risk resilience, this study relates to the following studies:

$$ZScore_{i,t} = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.996X_5 \qquad (3)$$

The variable X5 represents the ratio of total sales to total assets; the variables represent the market value of equity to total liabilities, the ratio of retained profits to total assets, the ratio of EBITDA to total assets, and the ratio of working capital to total assets, all of which are included in equation (3). A bigger Z-value enhances an organization's operational efficiency and risk resilience. Risk is used in this study to mean the resilience of corporations to risk. The process of corporate risk resilience is detailed in column (3) of table 6. The interaction term's strongly positive outcomes show that regional digital transformation makes businesses more resilient and prepared to deal with hazards. This demonstrates how well the risk resilience mechanism works.

To further investigate the direct effect of region digitization on the ESG performance of companies, this research uses the process variable as the control variable in the regression model. The results of the regression analysis are seen in column 4 of Table 6. A very positive regression value of 0.337 for the interaction term indicates a great deal more variance than was there prior to the introduction of the mechanism variable. Once again, we see that the findings of the baseline regression are robust, and we establish that the mechanism variable has an influence. Results from the preceding tests support the second hypothesis.

Analyzing heterogeneity

Environmental issues for certain regions

According to Xu et al. [53] businesses see regional environmental concerns as a key external influence. Businesses are under subtle but significant pressure from the public to address environmental problems. Environmental investors and consumers are influenced by the extent to which corporations include environmental concerns in their decision-making processes. This study used the Baidu Haze Search Index to gauge the level of environmental consciousness in the city, drawing on the findings of Huang et al. [54]. There were two main reasons why this study chose this technique.

To start with, Baidu is the undisputed king of Chinese search engines, with unparalleled coverage and data availability. Secondly, people are more environmentally concerned when there is foggy weather, as opposed to when there is clear weather, which is why "environmental pollution" and "environmental protection" are less important. The data of businesses is first matched according to their cities in this study. Based on the median of the index, the matched enterprise data are split into two groups: high and low. Then, benchmark regression is applied to each set of samples separately. Table 8, columns (1) and (2) show the regression findings. The results for the group with less attention are shown in column (1), while those for the group with more attention are displayed in column (2). The results show that the interaction

term is favorably significant for the higher attention group at the 10% confidence level, while it is not significant for the lower group. Firms whose regional public environmental concerns are higher than those of firms whose citywide public environmental concerns are eligible to get an ESG performance boost from the pilot program, according to the statistically significant difference between the two sets of regression outcomes.

Executives' awareness of environmental issues

Among the many endogenous factors influencing business decisions are the perspectives of senior management on green competitive advantage, ESG, and perceived external constraints. Laws and environmental regulations significantly influence companies. Taking a cue from Zhang et al. [55], this part of the study uses textual analysis, a method that has been successful in assessing CEOs' environmental views, as its longitudinal research strategy. This study builds on previous work by using a set of keywords to evaluate executives' perceptions of green benefits, environmental protection requirements, as well as perceived external pressure as indicators of their green stance. According to Table 7, you can see the chosen keywords. One indication of executive environmental cognition is the frequency of keywords in the annual reports of publicly listed corporations from 2013 to 2022.

This study also uses the median level of executive cognition to divide the sample into high and poor groups, like in the previous one. Table 8, columns (3) and (4) show the regression findings. The regression findings for companies with less environmental consciousness among their executives are shown in column (3), while the results for companies with more awareness are shown in column (4). The results of the regression reveal that regional digitization policies significantly impact the ESG performance of companies whose executives have a higher level of environmental perception. In contrast, the group of companies whose executives have a lower level of perception does not show a significant coefficient for the interaction term. A greater degree of green cognition among CEOs is indicative of a more environmentally conscious management team and a more eager business community to do what is needed to keep the planet habitable.

Analyzing extensibility

The issue of information asymmetry may be efficiently addressed by high-quality information disclosure, which acts as a conduit of communication between firms and stakeholders. Corporate disclosure is now more accessible and faster than ever before because of regional digitization. Corporate image management, according to [56], might be the source of third-party agencies' evaluations of companies' environmental, social, and governance (ESG) performance. This would allow businesses to engage in "greenwashing" and gain support from investors and consumers. Innovation in the digital realm is intrinsically marked by substantial expenditure and considerable risk, according to the standpoint of digitization itself.

If a company does not adjust to the new ways of doing business and managing that digitalization has introduced, the whole company system will be in a state of chaos. Management now faces a much higher level of uncertainty as a result of this. Concurrently, the regional digital revolution has increased the openness of both internal and external data, which has reduced the space for "manipulation" by managers and forced them to use more subtle ways to influence disclosure. In order to meet the expectations of investors about the company's image, ESG performance could evolve into a transparency tool for management. This study aims to address this question by looking at the relationship between perception management and improved company ESG performance from two different angles.

Managing actual excess

When corporate managers develop actual trade activity or alter the timing of key business activities, they are engaging in real surplus management. This is done to impact how external stakeholders perceive the firm's situation, as shown by its accounting surplus. This kind of thinking is often linked to being too focused on the here and now.

Table 7. Executives' opinions about possible environmental hazards

Measurement	Keywords
An Competitive Benefit of Eco-Friendly	Progress in ecological technology
	Environmental Management Agency
	The three areas of environmental preservation, education, and training are
	Environment Protection Facility
	environmental domain
	advancements in environmental technology
	The Environmental Management Agency
Environmental protection responsibilities	strategy for the environment
	Cut down on energy use to lessen pollution.
	Environmental Theory
	Environmental protection and energy saving low-carbon and environmentally friendly
	Reduction of pollution in the environment
	Cut down on energy use to lessen pollution.
Perception of External Pressure	conducting an examination of environmental regulations
	Inspection for the Preservation of the Environment
	Environmental policy management
	Governing for the benefit of the environment
	conducting an examination of environmental regulations
	legislation and regulations pertaining to environmental preservation

Table 8. Analyzing diversity.

Environmental Concerns from the Outside		Environmental Awareness for Executives	
(1)	(2)	(3)	(4)
0.423	0.529*	0.385	0.553*
(0.274)	(0.276)	(0.294)	(0.285)
22.167***	19.307***	11.401***	30.882***
(3.512)	(3.692)	(3.305)	(4.245)
✓	✓	✓	✓
✓	✓	✓	✓
✓	✓	✓	✓
3494	3681	3347	3288
0.809	0.862	0.838	0.867

According to Abhayawansa et al. [57], management's lack of long-term planning becomes increasingly apparent as the enterprise's genuine surplus management rises. Instead of making improving ESG practices a top strategic priority, some businesses may use formal ESG impression management strategies to boost the public's perception of the firm. To be more precise, this study divides businesses in the study region into two categories: high and low, according to the median genuine surplus management. Table 9 shows the results of the regression in columns (1) and (2). Column 2 shows companies with high levels of actual surplus management, whereas Column 1 shows companies with lesser levels. According to the data, enterprises with lower levels of genuine surplus management benefit much more from regional digitization than enterprises with greater levels of true surplus management. Looking at it from the perspective of corporate governance, this proves that the drive to improve ESG performance is derived from something other than corporate image management.

Funds allocated for ecological preservation
According to the previously indicated analysis, this study demonstrates via mechanism testing that regional digitalization may improve corporate ESG performance by increasing risk resilience and encouraging corporate social contributions. However, the environmental protection method still needs further evaluation. Businesses demonstrate their dedication to environmental responsibility and their willingness to put their words into action by investing in and spending money on environmental preservation. By enhancing their ESG performance, businesses may improve their reputation in the

investment and finance sectors and inspire other businesses to join them in sustainably protecting the environment.

Table 9. An analysis of extensibility.

	Actual Management of Surplus		Activities to Protect the Environment	
	(1)	(2)	(3)	(4)
Time × Treat	0.547*	0.383	0.129*	0.128*
	(0.308)	(0.299)	(0.072)	(0.072)
cons	23.059***	21.758***	−1.086	−1.147*
	(4.096)	(3.637)	(0.674)	(0.674)
Controls	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Obs	3307	3559	7206	7206
R^2	0.857	0.849	0.558	0.558

Businesses' environmental investment is mainly indicated by the number of environmental construction projects that are currently underway, according to this research. The study finds the environmental protection cost of the firm by adding the environment preservation charge, improving fee, and sewage fee. It then analyzes the investment as an investment in capital, which backs up its conclusions. This sum is then included in the company's administrative expenditures. A model of regression using the aforementioned two variables as dependent ones is ultimately used in the study. Table 9, columns (3) and (4) show the regression findings. In this case, environmental investment (column 3) and spending (column 4) are the dependent variables. Investments and expenditures on environmental protection have a positive and statistically significant correlation with regional digitalization at the 10% confidence level, according to regression coefficients. Because regional digitization makes it easier for businesses to execute environmental protection measures, their ESG metrics may improve. This proves once again that improving ESG performance is not some abstract goal of public relations but rather an essential aspect of real business practices.

Conclusion and potential consequences
Analysis
The National Pilot Zone for Innovative Growth of the Digital Economy is supporting a quasi-natural experiment in which a number of A-share listed businesses from Shenzhen and Shanghai, China, are participating. The testing period extends from 2013 until 2022. This approach looks at how regional

digitalization affects an organization's ESG performance. While previous research has focused on the micro-level effects of various digital technologies (, this publication is unquestionably important for studying how the outside world is becoming digital. According to the study, when companies digitalized their regions, their ESG performance improved. Furthermore, this research looked at three ways in which regional digitization influences ESG performance in corporations: risk resilience, corporate environmental information disclosure, and the number of social contributions. Here, we have the three channels that make up a company's ESG performance: E for environmental performance, S for social performance, and G for governance performance. In order to build systems of environmental governance, achieve social inclusion, and ensure sustainability, regional digitization is crucial, as this illustrates. Traditional approaches have typically treated ESG as a singular notion in earlier studies on the mechanisms of ESG performance in organizations. When looking at the effect of regional digitization on ESG performance, this study takes a three-pronged approach that is consistent with the ESG framework. By doing so, it hopes to provide a more comprehensive understanding of ESG

In addition, the correlation between digitalization construction and ESG performance in corporations is shown to be very variable in this article. When considering the external environment, the impact consequences vary according to public concern for the environment. Regional digitization has a stronger influence on business ESG performance in areas where the public places a high value on environmental protection. From an internal governance perspective, the effect of digital growth in different regions on ESG performance differs according to the degree to which corporate leaders are environmentally conscious. This enabling impact will be stronger in companies with environmentally conscious leaders.

Finally, our research found that certain academics manage the firm's perspective by using corporate ESG performance, as identified throughout the literature review. In fact, it's evidence of strong ESG and internal governance practices at work. Responding to the researchers above' bias towards corporate ESG, this study investigates the two sides of management's motivation for manipulating disclosure and companies' substantive environmental activities is a practical and efficient method for encouraging long-term development for businesses.

Consequences

An examination of how regional digitalization could enhance company ESG performance broadens the application of conventional business theories, including principal-agent, stakeholders, and data asymmetry theories. The study employs signal theory, strategic giving theory, and organizational learning theory to substantiate the three impact mechanisms that lead to regional digitalization and enhance corporate ESG results. Transitioning theoretical use to the digital age has marked a substantial advancement.

This study's findings greatly benefit the advancement of the digital economy and sustainable development. From a governmental perspective, the federal government should recognize its critical role in driving digitization at the regional level. Agencies within the government should continue to support the growth of digital infrastructure while also working to define better data ownership, security, and other relevant institutional protections. The goal of this strategic approach is to make data components' value-added potential known and to increase that potential as data is used and circulated.

In order for companies to meet their social commitments, they must continue to advance their digital transformation, adapt to the more streamlined digital external landscape, and skillfully use digital technology. Environmental concerns should be prioritized by corporate leadership, which should increase environmental awareness and facilitate the disclosure of environmental data using methods such as systematic, automated, big data processing, and others in order to drive the green transformation of companies. In terms of the social realm, business leaders should act in accordance with the enterprise's setting, making use of online charitable platforms to undertake appropriate social giving programs and actively participate in social welfare projects. When it comes to corporate governance, upper management should concentrate on improving the enterprise risk management system, increasing the efficiency of corporate governance, and strengthening internal and external supervision by digitally monitoring production and services thoroughly.

Potential and constraints

Several limitations are included in this investigation. Despite the current upsurge in regional digitization in China, the impact of this trend on companies' ESG profiles is complicated due to the slow adoption of necessary institutional measures, such as laws protecting data property rights and regulations for data trading. Therefore, more validation is needed to see whether the study's findings can be applied to various countries. Additionally, different ESG rating agencies use different indicators, which is not taken into account in this work. Possible future research directions include looking at how regional digitalization affects business ESG performance and whether or not similar effects are seen in other developing economies. In order to improve and clarify our knowledge of ESG principles, it is critical to determine whether the observed consequences are due to competing interpretations caused by rating discrepancies.

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