

Article

Navigating Sustainable Value Creation Through Digital Leadership Under Institutional Pressures: The Moderating Role of Environmental Turbulence

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Abstract: This study aims to examine the role of digital leadership in mediating the relationship between institutional pressures (regulatory, normative, and cognitive) and sustainable performance (economic, social, and environmental) from an institutional perspective. It further examines the moderating effect of environmental turbulence as uncertainty rises. Using a sample of 508 Chinese listed firms, this research empirically investigates the mediating role of digital leadership between institutional pressures and sustainable performance. Additionally, it outlines the moderating influence of environmental turbulence between institutional pressure and digital leadership, as well as between digital leadership and sustainable performance. Our findings indicate that enhanced digital leadership under institutional pressures can boost sustainable performance. Moreover, environmental turbulence has been identified as a moderating factor that weakens the relationship between cognitive pressure and digital leadership, and between digital leadership and sustainable performance.

Keywords: institutional pressure; digitalization leadership; sustainable performance; environmental turbulence; triple bottom line



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1. Introduction

Recent overall management trends focus on improving sustainable development to protect the natural environment, fulfill social responsibilities, and achieve economic growth [1,2]. Previous studies on sustainable development emphasize that environmental, social, and economic performance should grow in balance and harmony [3,4]. These three pillars represent the ‘triple bottom line (TBL)’ used to inspect the sustainable value creation of firms [5]. At the center of this change, the concerns and interests of stakeholders regarding sustainability have a critical influence [6,7]. For example, in many countries, strong regulations on environmental pollution and promotion policies focus on green growth, and consumers increasingly consider the sustainability of products [8,9]. As tackling sustainability issues plays a pivotal role in business success or failure, firms are now finding that this trend cannot be ignored. This indicates a growing need to clarify the delicate relationship between institutional pressures on sustainability issues and corporate strategic behavior [10,11].

Institutional theory posits that pressures from the internal and external environment surrounding a firm support the legitimacy of an organization’s form, structure, or behavior [12]. This perspective indicates that institutional pressures significantly impact firms’ survival and development, influencing resource allocation and strategic decision-making [13]. The theory is grounded in three pillars: regulative, normative, and cognitive pressures [14]. Numerous studies based on these discussions concentrate on investigating

the impact of institutional pressures on corporate performance [11,15,16]. Colwell and Joshi [14] examine organization conformity and performance with institutional pressures, and Dubey, et al. [17] empirically analyze the association between institutional pressures and environmental performance within the context of Indian firms. Although the relationship between institutional pressure and corporate performance has been well-studied, there is a notable lack of empirical research specifically exploring how these pressures influence strategic behavior and performance outcomes.

In the meantime, the increasing penetration of digital technology is fundamentally altering how firms create value and offers new opportunities for sustainability. This shift is prompting many firms to redefine their strategic behavior toward digital leadership [8]. Digital leadership refers to a firm's strategy of leveraging digital technologies to drive innovation and explore opportunities for enhancing competitive advantage [18]. In the current turbulent business environment, characterized by events like the COVID-19 pandemic and climate change, digital leadership is crucial for firms aiming to increase sustainability [19]. Digital leadership can thus provide unique insights into the mechanisms by which institutional pressures influence corporate sustainable value creation [8]. However, research on the impact of digitalization on sustainable performance often presents conflicting results. Some studies suggest a positive relationship between digitalization and sustainable performance [20,21], while others argue that digitalization does not necessarily help firms achieve sustainable performance [22,23]. Given these contradictory findings, it is important for scholars and practitioners to better understand the relationship between digitalization strategy and sustainable performance. Unfortunately, the mediating role of digital leadership between institutional pressures and corporate performance has received less attention.

To bridge this research gap, this study aims to investigate the impact of institutional pressures on corporate sustainable performance, with a particular focus on the mediating role of digital leadership. Grounded in institutional theory, we assert that a firm's digital leadership significantly influences its ability to achieve sustainable performance amid institutional challenges. By analyzing the role of digital leadership, this study seeks to clarify the debated benefits of digitalization.

Additionally, it remains unclear whether environmental turbulence is particularly effective in leveraging digital leadership to improve sustainable performance under institutional pressures [24]. Environmental turbulence, defined as the rate of change in stakeholder preferences within a particular industry, is one of the most critical business environmental factors [25]. For instance, industries like computers, media, and telecommunications are often noted for their high turbulence, a situation expected to persist. However, all industries experience turbulence to varying degrees at some point [25]. Although firms consider environmental turbulence in their strategic behavior under external pressures, the existing literature often overlooks its potential to moderate the relationship between institutional pressures and digital leadership. Moreover, perspectives on the impact of environmental turbulence on performance vary, with some studies highlighting positive effects [26], while others note negative impacts [27].

Little research has examined environmental turbulence's role in the context of digitalization, yet one of the main goals of digital leadership is to leverage digital technologies (such as artificial intelligence, big data analytics, and the internet of things) to accurately predict stakeholder demand and provide efficient and effective products and services [28]. Therefore, we suggest that the additional pressure to survive in a turbulent business environment further drives digital leadership toward sustainable performance.

Our study advances corporate sustainable development by addressing the empirical gaps discussed earlier. First, this study uncovers the mechanism linking institutional pressures to sustainable performance and identifies digital leadership as a strategic behavior for addressing sustainability challenges. We build upon previous research on digitalization driven by institutional pressures and apply it at the firm level by illustrating how a firm's digital leadership can foster sustainable value creation [9,29].

Second, we uncover environmental turbulence as a crucial contingency factor between digital leadership and the sustainable nexus of institutional pressures. This highlights the triggers that drive organizational and business model transformation under institutional pressures and supports recent discussions suggesting that firms in dynamic environments can operate more effectively by digitalizing their organizational and business models [30]. This aligns recent digital leadership and sustainable management perspectives with existing resource scholars' views, explaining how corporate management decisions and competitive advantage can be sustained in a turbulent business environment [8,31,32]. Our research thus provides new insights into the role of environmental turbulence in institutional pressures, digital leadership, and sustainable performance.

2. Theoretical Background

2.1. Institutional Theory

Institutional theory is frequently employed to explain external pressures that push firms toward more sustainable and effective practices [33,34]. This theory suggests that an organization's structure is shaped not by external environmental or internal technical factors specific to individual firms, but by what the institutional environment deems appropriate [35]. Institutions refer to established norms, rules, and beliefs that shape social behavior and organizational practices. These institutions create an environment that dictates what is considered appropriate or legitimate, influencing how organizations operate and make decisions. From this perspective, corporate strategic behavior acts as a link between institutional pressures and performance [12]. Adopting a formalized structure can enhance an organization's legitimacy by demonstrating to both internal and external stakeholders that the organization is rational and compliant [36]. Institutional components are typically categorized into regulatory, normative, and cognitive elements [37].

First, a regulatory factor refers to implicit norms, such as laws and regulations enacted by the government and the stipulated rules of the association. A regulatory factor plays an important role when an actor can enforce a particular rule by force. Second, a normative factor is one that members of society take for granted as rules to follow. These rules exist because there are behaviors that other social actors expect of social actors. Informal punishment is imposed on individuals or organizations that violate the norms. The regulatory factor is distinguished from the normative factor in that formal punishment is imposed for deviant behavior. The main reason why firms accept the normative factor is that it benefits them to follow the norm. Finally, the cognitive factor is a shared semantic system of who can do something, what value to pursue when doing it, and what to do to pursue it. When there is a socially agreed-upon and shared semantic system, actors accept things they take for granted.

DiMaggio and Powell [12] argue that force from these institutional factors results in an isomorphism in the structure and behavior of firms; this force is institutional pressure [37]. Drawing on these discussions, this study categorizes the institutional pressures encountered by firms into three pillars: regulatory, normative, and cognitive pressures. This classification approach is widely acknowledged by many researchers [11,15,16].

2.2. Digital Leadership

In recent years, the growing importance of digitalization-based sustainable development topics, such as implementing digital strategies [38], digitalizing business models [39], and transitioning to digital value creation [40], has led to the rise of digital leadership as a strategic direction for firms pursuing sustainable development in strategic management [41,42]. Firms with strong digital leadership can enhance their products, services, or solutions using digital technologies to create added value for their customers, meet market demands, and generate substantial revenue [18]. Consequently, some scholars have recently highlighted digital leadership as a critical strategic behavior for achieving a sustainable competitive advantage [42,43]. In line with this, an increasing number of practitioners are encouraging managers to move beyond individual technology initiatives

and embrace digitalization as a strategic opportunity to maximize its potential as a driver of ‘technology eco-advantage’ [44]. In most industries, firms are adopting digital leadership to tackle these challenges [32].

2.3. Environmental Turbulence

With technological innovation and the COVID-19 pandemic speeding up changes in the business environment, firms have shown increasing interest in environmental turbulence [45]. This turbulence is marked by ongoing shifts in stakeholder preferences and demands [27], as well as in the composition and structure of business models. It can also result from the dissolution of traditional industry boundaries [26]. Corporate managers often see environmental turbulence, caused by increasing uncertainty, as a threat that challenges past decisions and routine behavior [46]. However, it can also provide benefits by acting as a catalyst for replacing inefficient or outdated policies [45]. Environmental turbulence thus presents businesses with both challenges and opportunities. Consequently, an increasing number of studies recognize environmental turbulence as a crucial external factor affecting strategy and management performance [47] and empirically analyze its role in relation to corporate strategic behavior, capabilities, and outcomes [27,48]. Moreover, some research suggests that sustainable development can be achieved by promoting digital orientation, enabling firms to quickly adapt to uncertainty in a turbulent business environment [28,49].

2.4. Sustainable Performance

Since the ‘Brundtland Report’ introduced the concept of sustainability, it has garnered growing interest from many scholars [50]. In particular, stakeholder concerns about rapid changes in the business environment compel firms to consider sustainable development in their behaviors [50]. In this context, Elkington [5] introduced the TBL as a way to create three pillars supporting sustainable development by aligning economic development with environmental protection and social responsibility. Specifically, within the TBL framework, Elkington [5] identifies three interrelated strategic values that firms should pursue: economic, social, and environmental values. Economic performance focuses on corporate financial growth; social performance involves pursuing the well-being of stakeholders; and environmental performance aims at reducing environmental damage and protecting against resource exploitation. Each of these dimensions eventually relates to corporate performance, driving sustainable development in one way or another. Various studies examine business sustainability in terms of the TBL concept [51,52].

This study explores how firms strategically leverage digital leadership to respond to institutional pressures and improve sustainable performance across the TBL pillars of economic, social, and environmental performance. We hypothesize that digital leadership acts as an important intermediary, converting institutional pressure into sustainable behavior, thus influencing sustainable performance. Additionally, we examine how environmental turbulence can moderate the relationships between institutional pressures and digital leadership, as well as between digital leadership and sustainable performance. Through this, our research aims to contribute to a more nuanced understanding of the factors governing corporate decision-making in sustainability.

3. Hypothesis Development

3.1. The Mediating Role of Digital Leadership

Institutional theory explains that organizations should meet institutional demands because three dimensions of pressure are considered legitimate [12]. Previous studies have found that institutional pressures can stimulate technological innovations to reduce costs and improve product quality. Porter and Linde [53] argue that government regulations can increase environmental benefits and competitiveness by encouraging firms to recognize and utilize opportunities to stimulate innovation. This hypothesis is tested by a number of institutional perspective studies [11,54]. As environmental challenges intensify and well-being-seeking social trends emerge, stakeholders increasingly expect firms to offer eco-

friendly products and services, which puts normative pressure on firms to adopt sustainable development practices [55]. Consequently, firms often align their values with stakeholder demands to maintain normative legitimacy. Furthermore, Dai, et al. [56] observe that if the strategy of a rival is perceived favorably by customers, other firms in the same ecosystem can strategically mimic the behavior of rivals. These cognitive pressures can cause firms to mimic the innovative behavior of leading firms [57].

Firms are expected to adhere to institutional norms within their business environment to avoid legal penalties or market exclusion. However, many firms still violate regulations, causing environmental and social issues, which is clearly unsustainable [34]. This has led to criticism of the argument that compliance with institutional demands inherently creates value that ensures organizational stability and long-term survival. Oliver [58] examines organizational responses to institutional pressures from a strategic perspective, emphasizing that firms should focus on strategic behavior that directly addresses institutional influences to create value. Drawing from Oliver's key contribution to institutional theory, we propose that digital leadership mediates the relationship between institutional pressures and corporate sustainable performance. In other words, based on the notion that organizations actively and strategically respond to institutional pressures rather than passively accepting them [59], we argue that firms adapt their capabilities and resources to address these pressures and fully leverage digitalization benefits.

Digital leadership is increasingly seen as a remedy for corporate sustainability challenges [39,43,60]. Many firms develop digital leadership to achieve both efficiency and effectiveness, thereby alleviating institutional pressures and promoting sustainable development [43]. Digitization contributes to reduced resource consumption, enhanced raw material recycling, and increased resource utilization [39]. Some researchers have explored strategic behavior arising from the positive effects of digitalization [20,61]. Various studies suggest that firms can achieve sustainable growth by developing new green products and implementing technological changes in production processes through digital strategies. For instance, George, Merrill, and Schillebeeckx [8] outline specific ways for firms to leverage digitalization to address climate change and drive sustainable development. Empirical studies have also confirmed that the use of digital technology positively impacts corporate economic performance and environmental value creation [24,61].

Through these discussions, we predict that digital leadership can reduce pollution and enhance productivity by improving business processes and fostering innovation. While many studies validate the relationship between corporate digital strategies and sustainable performance [43,62,63], the mediating effect of digital leadership between institutional pressures and organizational performance has not been thoroughly examined. We argue that digital leadership can help firms increase production efficiency, practice environmental protection, remain socially relevant, and boost productivity. Thus, we hypothesize the following:

Hypothesis 1. *A high level of digital leadership strengthens the positive relationship between institutional pressures (i.e., regulatory, normative, and cognitive pressures) and sustainable performance (i.e., economic, social, and environmental performance).*

3.2. The Moderating Role of Environmental Turbulence

Business environments are often marked by instability and dynamism, a phenomenon known as environmental turbulence, which encompasses development, change, and uncertainty [43]. Rapid and unpredictable shifts in technology and customer demands can create new market opportunities but also threaten to render existing technologies, products, resources, and capabilities obsolete [64]. Therefore, environmental turbulence is generally regarded as a crucial factor in corporate activities, affecting strategy development and performance achievement [27].

Environmental turbulence is examined across various business contexts and behavioral mechanisms, such as competitive intensity, market turbulence, and technical turbulence,

primarily in its moderating role [30,43,48]. Our research focuses on how environmental turbulence moderates the effects between institutional pressures and digital leadership, as well as between digital leadership and sustainable performance.

As previously discussed, institutional pressures drive firms toward strategic behavior in the digital era to achieve business legitimacy. Firms seeking digital leadership exhibit varying levels of acceptance based on the institutional pressures from rapid technological changes or customer demands in their business environment. In a turbulent business environment, firms must enhance their digital leadership and allocate significant resources to respond to rapid changes promptly. Consequently, firms pursue digital transformation to address rapidly changing customer preferences or market technologies, paying close attention to government-enacted laws and support. As a result, the tension between institutional pressures and digital leadership intensifies in a turbulent business environment.

Hypothesis 2. *Environmental turbulence moderates the impact of institutional pressures on digital leadership.*

Moreover, firms continuously reallocate resources towards digitalization to address opportunities and threats and sustain management activities in a turbulent business environment [8]. In such contexts, firms with digital leadership are more effective in allocating resources to identify customers and seize opportunities for sustainable innovation [43]. Consequently, environmental turbulence can amplify the positive impact of digital-oriented businesses on sustainable performance [48]. In other words, the more turbulent the business environment, the more crucial digital leadership becomes.

Additionally, environmental turbulence disrupts existing corporate competitive advantages, compelling firms to adopt new strategies in a dynamic business environment [65], which often leads to new opportunities to enhance their digital leadership [18]. In this regard, firms with digital leadership are likely to digitally transform their business models to respond to external environments, accelerating sustainable performance. Thus, the relationship between digital leadership and sustainable performance can be further strengthened. Against this backdrop, we explore the moderating role of environmental turbulence in this study.

Hypothesis 3. *Environmental turbulence moderates the impact of digital leadership on sustainable performance.*

The proposed hypotheses and theoretical frameworks are depicted in Figure 1.

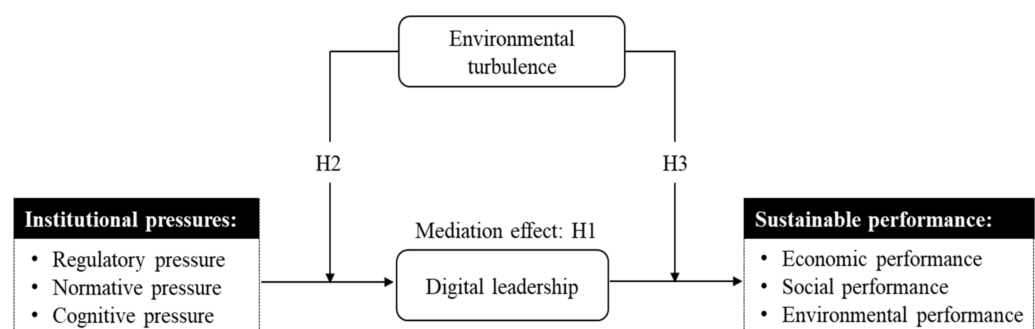


Figure 1. Research model.

4. Methodology

4.1. Research Context and Sample Collection

The target for hypothesis verification in this study is listed firms in China, selected for several reasons. First, China has achieved rapid economic development driven by government-centered industrial policies, but it has also faced criticism for worsening environmental pollution due to indiscriminate development [66,67]. In response, the

Chinese government has committed to environmental protection by implementing stringent environmental regulations and policies [68]. Second, China boasts the second-largest digital consumer market in the world [69] and is one of the most prominent countries accelerating digital development [48]. Third, changing market dynamics and global supply chain fluctuations pose significant challenges to the Chinese industry [70]. Listed firms in particular are under constant scrutiny by stakeholders and must respond swiftly to market changes. Therefore, China provides a rich context to examine how institutional pressures affect corporate digital leadership and sustainable performance.

By the end of 2022, the China Stock Exchange had 5067 listed firms. To efficiently gather data, we partnered with a market research agency in China. This agency specializes in the strategic management of Chinese firms and has established strong relationships with many listed firms. This collaboration allowed us to efficiently identify and select random representative samples with a track record of digitalization or digital transformation. From this information, we randomly selected 1000 listed firms and invited them to participate in the survey. We chose senior managers with broad organizational responsibilities and firm-level information as informants (e.g., CEOs, vice presidents, and general managers). The market research agency then contacted the selected firms via email and asked them to fill out the enclosed questionnaire. We thoroughly explained the purpose, necessity, and confidentiality of the research to encourage participation. Firms that did not respond within a month were once again encouraged to participate in the survey via fixed-line telephone. A total of 508 corporate managers provided useful responses, resulting in a response rate of 50.8%. The survey was conducted over approximately four months, from mid-December 2023 to the end of February 2024.

The questionnaire was initially developed in English and then translated into Chinese by a bilingual researcher [71]. Both versions of the questionnaire were reviewed by a professor with considerable research experience in related fields in China and fluency in both languages to confirm their conceptual equivalence. Before conducting the formal survey, we conducted a preliminary test with senior managers from 10 firms. We asked them to identify and verify the relevance and completeness of the items included in the questionnaire. During this process, several respondents suggested modifications to some items for clarity, and we finalized the questionnaire to reflect these suggestions.

Table 1 summarizes the profiles of the responding firms. The sample includes manufacturing industries ($n = 249$, 49.0%), service industries ($n = 139$, 27.4%), and other industries ($n = 120$, 23.6%). Most firms have between 500 and 999 employees ($n = 212$, 41.7%), and 71.4% of the firms ($n = 363$) are under 20 years.

Table 1. Sample demographic.

Variable	Frequency (N)	Percentage (%)
Industry type		
Manufacturing	249	49.0
Service industry	139	27.4
Others (construction, transportation, energy, etc.)	120	23.6
Firm size (number of full-time employees)		
Less than 100 people	46	9.1
100–199	86	16.9
200–499	70	13.8
500–999	212	41.7
More than 1000 people	94	18.5
Firm age		
Less than 10 years	182	35.8
10–19	181	35.6
20–29	47	9.3
More than 30 years	98	19.3
N	508	100

4.2. Measures

The survey questionnaire includes measurement items adapted from established studies in the field. Respondents are asked to rate their perceptions on a seven-point Likert scale (one = strongly disagree, and seven = strongly agree).

Independent variables: To measure institutional pressures under three categories (regulatory, normative, and cognitive pressures), we designed the measurement items based on the study by Colwell and Joshi [14], using three questions for each category.

Mediator variable: Following Shin, et al. [72], we measured digital leadership using four questions.

Moderator variable: Environmental turbulence, as defined by Kohli and Jaworski [47], was assessed by asking about market and technological turbulence in the business environment.

Dependent variables: Corporate sustainable performance was evaluated across economic, social, and environmental dimensions. Based on the tools proposed by Lee, Pak, and Roh [3], we measured three items each for economic performance, social performance, and environmental performance.

Control variables: The study also controlled for industry type, firm size [73], and firm age [11].

The scale items are presented in the Appendix A.

4.3. Common Method Bias Test

This study employs various methods to check for common method bias (CMB). First, participants are assured of anonymity and confidentiality at the beginning of the survey. Additionally, it is emphasized that there are no predetermined correct or wrong answers, encouraging honest responses [74]. Second, following Harman's single-factor analysis [75], the principal component analysis results show that the explanatory power of a single factor is approximately 24.12%, which is below the 50% threshold. Third, as suggested by Kock [76], the results of multicollinearity show that the minimum variation inflation factor (VIF) value is 1.000, and the maximum value is 1.608, both of which are below 3.3. Based on these findings, it can be concluded that the CMB of the latent variable in this study is low.

4.4. Analysis Methods and Measurement Assessment

To analyze the collected data, we employ structural equation modeling (SEM), which is considered a robust and powerful statistical tool across various disciplines, including management studies [77]. There are two main approaches to conducting SEM: covariance-based SEM (CB-SEM) and partial least squares SEM (PLS-SEM). PLS-SEM is more suitable for exploratory research or when predicting target constructs, dealing with complex structural models, and when constructs are formatively measured [77]. Additionally, PLS-SEM is known to have higher statistical power compared to CB-SEM [78]. Therefore, we selected PLS-SEM to test the proposed research model and analyzed it using SmartPLS4.

Table 2 presents the reliability and validity verification results. First, Cronbach's alpha coefficient for all constituent concepts is 0.70 or higher ($0.905 < \text{all alpha coefficients} < 0.964$). Second, the factor weights and factor loadings of all variables are significant, and the average variance extracted (AVE) values for all configurations are greater than 0.50 ($0.812 < \text{all AVE values} < 0.932$). The composite reliability (ρ_a) values are also greater than 0.7 ($0.905 < \text{all } \rho_a \text{ values} < 0.964$), providing strong evidence of the discriminant and convergent validity of this research model [79]. Furthermore, this study shows that all AVE estimates are larger than the square of the correlation coefficients between all configurations.

Table 2. Reliability and validity verification results.

Construct	01	02	03	04	05	06	07	08
01. RP	0.942							
02. NP	0.261	0.917						
03. CP	0.273	0.730	0.952					
04. DL	0.299	0.646	0.660	0.906				
05. ET	0.307	0.615	0.576	0.657	0.901			
06. ECP	0.350	0.695	0.687	0.704	0.701	0.939		
07. SOP	0.352	0.695	0.689	0.750	0.695	0.802	0.966	
08. ENP	0.316	0.681	0.659	0.723	0.672	0.766	0.806	0.962
Cronbach's alpha	0.937	0.905	0.949	0.927	0.923	0.933	0.964	0.960
rho_a	0.948	0.905	0.952	0.929	0.923	0.933	0.964	0.960
AVE	0.887	0.840	0.907	0.821	0.812	0.882	0.932	0.926
R2				0.611		0.623	0.662	0.616
Q2				0.593		0.595	0.609	0.578
HTMT < 0.85	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The square roots of the AVE values are shown on the diagonals and printed with bold; non-diagonal elements are the latent variable correlations. All correlations are statistically significant at $p < 0.01$. rho_a = Dijkstra and Henseler's composite reliability, RP = regulatory pressure, NP = normative pressure, CP = cognitive pressure, DL = digital leadership, ET = environmental turbulence, ECP = economic performance, SOP = social performance, ENP = environmental performance.

The proposed research framework indicates that the R^2 of endogenous variables is 0.611 for digitalization orientation, and it is shown to be 0.623 for economic performance, 0.662 for social performance, and 0.616 for environmental performance. The Q^2 of all endogenous constructs used in this study is greater than 0.35, suggesting that the predictive relevance of the PLS-SEM is high [80–82].

4.5. Hypotheses Tests

Table 3 presents the hypothesis verification results based on path analysis. This study examines the mediating effect of digital leadership between institutional pressures and sustainable performance (Hypothesis 1) using bootstrap methods [77]. We performed 5000 re-samplings, and the bias-corrected confidence interval (BCCI) did not include 0, indicating that the bootstrap results are significant [77].

The direct effects between Institutional pressures (i.e., regulatory, normative, and cognitive pressures) and digital leadership, as well as between digital leadership and sustainable performance (i.e., economic, social, and environmental performance), are significant for all direct paths except for regulatory pressure and digital leadership.

The indirect effects of digital leadership on institutional pressures and sustainable performance are as follows: The indirect effect of digital leadership on regulatory pressure and sustainable performance is not statistically significant. However, the indirect effects of digital leadership between normative pressure and sustainable performance are significant at the 0.1 level, and between cognitive pressure and sustainable performance at the 0.001 level. According to Baron and Kenny [83], we find that digital leadership has a significant partial mediating effect between normative or cognitive pressures and sustainable performance. Thus, Hypothesis 1 is partially supported.

We also analyze the moderating effect of environmental turbulence to verify Hypotheses 2 and 3. First, the moderating effect of environmental turbulence between institutional pressures and digital leadership is significant only between normative pressure and digital leadership, showing a negative effect ($\beta = -0.121$, $p < 0.01$). Second, the moderating effects of environmental turbulence on digital leadership and sustainable performance are all significantly negative at both the 0.001 and 0.01 levels. This indicates that the more severe the environmental turbulence, the more challenging it is to transition from normative pressure to digital leadership and to achieve sustainable performance through digital leadership. Thus, Hypothesis 2 is partially supported, and Hypothesis 3 is fully accepted.

Table 3. Significance testing of path effects with bootstrap.

Path	β	S.E.	<i>t</i> -Statistic	<i>p</i> -Value	BCCI
RP → DL	0.006	0.032	0.180	0.857	
NP → DL	0.130	0.044	2.967	0.003	
CP → DL	0.222	0.043	5.111	0.000	
DL → ECP	0.313	0.040	7.761	0.000	
DL → SOP	0.400	0.047	8.527	0.000	
DL → ENP	0.383	0.038	10.009	0.000	
ET → DL	0.209	0.056	3.707	0.000	
ET → ECP	0.306	0.048	6.412	0.000	
ET → SOP	0.243	0.043	5.625	0.000	
ET → ENP	0.237	0.043	5.464	0.000	
RP → DL → ECP	0.002	0.010	0.178	0.859	−0.017, 0.023
RP → DL → SOP	0.002	0.013	0.177	0.860	−0.021, 0.031
RP → DL → ENP	0.002	0.012	0.178	0.859	−0.021, 0.028
NP → DL → ECP	0.040	0.016	2.587	0.010	0.013, 0.074
NP → DL → SOP	0.052	0.020	2.553	0.010	0.017, 0.097
NP → DL → ENP	0.050	0.019	2.666	0.008	0.017, 0.089
CP → DL → ECP	0.069	0.017	4.047	0.000	0.038, 0.105
CP → DL → SOP	0.089	0.022	3.959	0.000	0.048, 0.136
CP → DL → ENP	0.085	0.019	4.502	0.000	0.050, 0.123
RP × ET → DL	−0.012	0.019	0.642	0.521	
NP × ET → DL	−0.121	0.046	2.637	0.008	
CP × ET → DL	−0.052	0.041	1.274	0.209	
DL × ET → ECP	−0.126	0.023	5.454	0.000	
DL × ET → SOP	−0.126	0.023	5.592	0.000	
DL × ET → ENP	−0.122	0.021	5.878	0.000	

Meanwhile, examining the impact of control variables, such as for industry type, firm size, and firm age on sustainable performance, did not yield statistically significant results.

5. Discussion and Implications

5.1. Discussion

This study finds that institutional pressures are beneficial to digital leadership, which in turn significantly enhances sustainable performance. Additionally, the study reveals that environmental turbulence negatively impacts cognitive pressure, digital leadership, and sustainable performance.

Firstly, the study underscores the importance of digital leadership in the nexus between institutional pressures and sustainable performance within China. Numerous scholars advocate for the promotion of digitalization by firms to tackle the growing institutional pressures associated with sustainable development [9,84] and to evaluate the impact of corporate digital leadership on sustainable performance [85]. The existing literature also suggests that digital leadership plays a role in knowledge sharing and performance enhancement [86]. In particular, as digitalization becomes more prominent in sustainable development, digital leadership focuses on utilizing digital technology to establish communication channels and platforms that generate shared value [87]. In this context, digital leadership can lower costs and protect the environment by optimizing the business life cycle. Firms should leverage digital technology to enhance their business operations and proactively adapt to sustainable development changes through digitalization. However, the driving force behind how firms assume this leading role remains unclear. This study can address this gap by empirically demonstrating that digital leadership acts as a crucial mediator between institutional pressures and sustainable performance in firms.

Second, our empirical results show that environmental turbulence weakens the pathways between normative pressure and digital leadership. Regarding institutional impact, the moderating effect of environmental turbulence is not statistically significant in the relationship between regulatory and cognitive pressures and digital leadership, but it is

significant for normative pressures. Our findings suggest that the more severe the environmental turbulence, the more firms tend to seek stability rather than new challenges (e.g., digitalization) under normative pressure. This helps explain the mechanisms by which environmental turbulence affects the development of digital leadership in firms.

Thirdly, environmental turbulence appears to weaken the linear relationship between digital leadership and sustainable performance, such as economic, social, and environmental performance. This moderating effect of environmental turbulence may contradict research suggesting that digital leadership positively moderates corporate performance [88,89]. Compared to these studies that find environmental turbulence has a positive moderating effect on corporate performance in the context of China, this study discovered that market turbulence may weaken sustainable performance. One possible explanation is that post-COVID-19, in a turbulent environment, firms are facing increasing uncertainty, and digital leadership is now lagging behind this shift. Therefore, firms should move beyond digital leadership in this turbulent environment to implement practices that enable them to quickly achieve sustainable value through digitalization capabilities development. Firms that fail to seize new business opportunities through digitalization capabilities may lose the chance to survive in an increasingly uncertain market. It is crucial to recognize that firms unable to transform their businesses based on digitalization capabilities are likely to be eliminated in a highly turbulent business environment.

5.2. Theoretical Contributions

Existing institutional perspective research suggests that developing appropriate strategic actions is essential to pursue benefits under increased institutional pressures [58]. Digital leadership aids firms in optimizing or enhancing resource allocation and utilization, making it a strategic behavior that can drive sustainable performance [21,90]. Our findings indicate that digital leadership is a crucial strategic behavior for achieving sustainable performance in a business environment with growing institutional pressures. This study extends institutional theory and underscores the role of digital leadership in sustainable development.

Understanding the impact of environmental turbulence is crucial, because corporate operations and performance are influenced by the surrounding business environment. Specifically, given that a firm's growth is anchored in its surroundings, particularly the market environment [34,88] or technological advancements [91,92], understanding how environmental turbulence may influence corporate performance is essential. However, existing studies present conflicting views on the moderating effect of environmental turbulence on corporate performance, with some suggesting a positive effect [89] and others a negative effect [93]. Based on an analysis of 508 Chinese listed firms, our study finds that environmental turbulence weakens digital leadership under cognitive pressure. Additionally, similar to the findings of Zhou, Mavondo, and Saunders [93], increasing environmental turbulence can negatively impact digital leadership and sustainable performance. Thus, our study contributes to the existing literature by providing new insights into the moderating role of environmental turbulence in affecting sustainable performance.

5.3. Practical Implications

This study suggests that a high level of digital leadership enables strategic behavior that can alleviate institutional pressures and achieve sustainable performance. Digital leadership is crucial for developing and enhancing capabilities for sustainable development in a turbulent business environment. It is also essential to recognize and capitalize on new opportunities for digital transformation, including business model innovation. As a result, corporate managers should acknowledge the importance of digital leadership in addressing sustainability issues. This study provides evidence that strong digital leadership can improve sustainable performance under increasing institutional pressures.

To achieve sustainable development, firms should pay attention to technological and market changes in their business environment [94]. Prior studies indicate that, in a rapidly changing business environment, firms should adopt strategic behaviors focusing

on the impact of digital leadership on sustainable performance. However, our study demonstrates the need for digital capabilities development based on digital leadership due to rapid environmental turbulences after COVID-19. This suggests that digital capabilities, driven by digital leadership, should adapt to environmental changes to positively impact sustainable performance. Thus, corporate managers need to foster digitalization capabilities to quickly identify and seize the right time for digital transformation.

5.4. Limitations and Future Research Directions

Despite these contributions, this study has certain limitations. First, the study uses a limited sample of firms in China, which makes it difficult to generalize the research results. Therefore, additional verification studies based on samples from other countries should be conducted. Second, this study focuses on the moderating role of environmental turbulence, but since many factors can affect the business environment, it is necessary to include additional moderators through more detailed elements in future studies. Third, this study is based on cross-sectional data that may not fully capture research relationships that may change over time. Accordingly, this limitation can be addressed by utilizing longitudinal and experimental designs in future research. Finally, institutional pressures can vary in strength by industry and firm characteristics. This highlights the need to investigate differences between firms based on type, size, and age. Future studies can provide more meaningful support for theoretical and managerial implications by focusing solely on manufacturing or by providing statistical evidence of differences between firms categorized by industry type, firm size, and firm age.

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Appendix A. Measurement and Factor Loadings

Constructs	Measures	Loadings
Regulatory pressure [14]		
- Adhering to the government's stringent regulations is crucial for our firm.		0.946
- Government policy (e.g., preferential tax) increases our firm's willingness to implement innovation.		0.958
- Implementing innovation makes it beneficial for our firm to receive the local government's favorable treatment.		0.922
Normative pressure [14]		
- Customers put pressure on our firm's management to adopt practices.		0.924
- Suppliers put pressure on our firm's management to adopt practices.		0.910
- The actions of our competitors have put pressure on our management to adopt practices.		0.916

Cognitive pressure [14]	
- Awareness of eco-friendly strategies of producers of the same or substitute products.	0.943
- Awareness of industry best practices.	0.966
- Customers' environmental consciousness.	0.949
Digital leadership [72]	
- Awareness of employees about the risks associated with digital technology.	0.901
- Awareness of the digital technology that can be used to improve organizational processes.	0.898
- Efforts to reduce resistance to digital technology innovation.	0.942
- Efforts to share experience and know-how on technical possibilities.	0.884
Environmental turbulence [47]	
- Customer tastes and preferences in our market are highly unpredictable.	0.909
- Our market faces intense competition.	0.908
- The technology in our industry evolves rapidly.	0.871
- Technological advancements present significant opportunities in our industry.	0.916
Economic performance [3]	
- Our profit growth outperforms major industry competitors.	0.938
- Our return on investment growth exceeds that of industry leaders.	0.953
- Our return on sales growth surpasses that of key industry competitors.	0.926
Social performance [3]	
- Reduces social inequality, including polarization and regional income disparity.	0.965
- Promotes social values such as labor rights and revitalization of local communities.	0.968
- Improves worker or community health and safety.	0.963
Environmental performance [3]	
- Reduces energy consumption.	0.958
- Decreases waste emissions, including air, water, and solid waste.	0.959
- Minimizes the environmental impact of its products or services.	0.969

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