

## Article

# Board Composition and Social & Environmental Accountability: A Dynamic Model Analysis of Chinese Firms

Muhammad Kaleem Khan <sup>1</sup>, R. M. Ammar Zahid <sup>2,\*</sup>, Adil Saleem <sup>3</sup> and Judit Sági <sup>4</sup>

<sup>1</sup> School of Economics and Management, East China Jiaotong University, Nanchang 330013, China; mkaleemkhan@yahoo.com

<sup>2</sup> School of Economics and Finance, Xi'an Jiaotong University, Xi'an 710049, China

<sup>3</sup> Doctoral School of Economics and Regional Sciences, Hungarian University of Agriculture and Life Sciences, H-2100 Gödöllő, Hungary; saleem.adil@phd.uni-szie.hu

<sup>4</sup> Faculty of Finance and Accountancy, Budapest Business School, University of Applied Sciences, H-1149 Budapest, Hungary; sagi.judit@uni-bge.hu

\* Correspondence: amrzahid@gmail.com; Tel.: +92-3214976079

**Abstract:** This research contributes to the existing corporate governance (CG) and social and environmental accountability (SEA) literature by exploring the impact of CG mechanisms (board independence, board size, CEO duality, and board gender diversity) on Chinese firms' environmental performance, sustainability performance, and environmental information disclosures (EID). Furthermore, the investigation consequently ascertains the amount to which the CG–SEA connection is influenced by CEO qualities. Using a dynamic model of a SysGMM regression model, we found that board size, independence, and gender diversity in board and CEO duality are all favorably connected to Chinese enterprises' environmental performance over a window of 10 years (2010–2019). Additionally, our findings imply that the analyzed CEO characteristics positively moderate the relationship between CG and SEA. Our findings have significant consequences for all stakeholders, including environmentalists, corporate regulators, CEOs, policymakers, and regulators.

**Keywords:** corporate governance; board composition; CEO duality; environmental performance; sustainability performance; environmental information disclosures



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## 1. Introduction

Whether a firm perceives itself as accountable or not depends on how it is led and controlled. Corporate governance (CG) is vitally crucial for adopting ethical conduct in an organization's entire structure and its relationships with all stakeholders. Recently, the demand for corporate accountability, especially regarding environmental and sustainability performance, has been raised because of massive industrialization, dwindling resources, damaged ecosystems, and exploited labor. The United Nations has also shown serious concern for global environmental and sustainable issues and has developed 17 global sustainable development goals (SDGs) comprising 169 targets. Sustainable development basically comprises economic, social, and environmental aspects. Griggs et al. [1] redefined it as “the development that meets current needs while safeguarding the earth's life-support system, upon which the welfare of current and future generations is contingent.”

Corporate governance (CG) acts as a key determinant of corporate environmental and sustainable accountability (SEA), and we could find scant literature highlighting their theoretical relationship [2]. Nevertheless, this literature is subject to certain shortcomings; more work is required to account for the empirical link, especially in emerging markets, as research so far has yielded mixed results [2,3]. We examined the effective CG mechanisms that make firms accountable on environmental and social grounds. In particular, we determined the impact of board compositional characteristics, including board size, board independence, board gender diversity, and CEO duality, on social and environmental

accountability. The duty to account for the actions for which an entity is held accountable is defined as accountability [4]. The nature of the accountability relationship and the associated rights to information are contextually decided by society, manifested most visibly in legislative statutes and norms established by statutory organizations [5]. To ascertain the extent of SEA, we employed the firm-level information of sustainability performance, environmental performance, and environmental information disclosure (EID) of listed Chinese firms. Moreover, we analyzed whether various CEO-related attributes (CEO gender) affect the relationship of the CG–SEA nexus. Our study drew insight from agency theory and stakeholder theory.

We concentrated on China since the globe has recently seen a remarkable change toward environmental challenges and laws in China, partly due to the negative environmental consequences of the country's phenomenal economic expansion. Increasing environmental deterioration has been connected to the economy's growth by business strategists and intellectuals [6]. This concerning scenario in China has prompted us to investigate corporate-level SEA. Environmental organizations in China began emphasizing the terms "harmonious society" and "greener GDP" in the mid-2000s due to the worsening environmental conditions and climate change [7,8]. Chinese firms were encouraged to implement environmentally friendly practices capable of reversing the deteriorating environmental conditions. The Chinese government formed the Environmental Protection Law and State Environmental Protection Administration agencies, while other entities set about developing the Global Reporting Initiative, designed to improve environmental reporting [9]. Furthermore, China accepted the Paris Climate Agreement to demonstrate its pledge to improve China's poor environmental position, as well as the worldwide situation in September 2016. Despite these efforts, SEA in China lags behind developed countries, probably because of weak CG in Chinese firms [10,11].

Although a massive stream of research has tried to explore different issues of CG and accountability, very few have tried to link one with other. CG research in finance is mainly governed by profitability and value maximization; very few researchers have tried to study their impact on SEA (e.g., [2,12]). CG mechanisms, especially internal governance structures, play a significant role in fostering commitment to environmentally friendly activities. Board structure and composition are important elements of the CG mechanism and a number of studies have tried to analyze the effect of board composition variables on sustainability performance in the Chinese corporate sector [13–15]. However, either these studies have not explored all major board compositions (board independence, board structure, board gender diversity, CEO duality) as the present study has done, or have not incorporated the more than one aspect of accountability. Our study fills this gap by presenting multifaceted SEA with different aspects of board composition. The evidence for the effect of CG on SEA is even scarcer in the research, using various issues related to CEO attributes and functions as moderators. Our study fills this gap, too. In sum, this study adds value in the literature by merging the insights of agency theory and stakeholder theory.

From the Chinese perspective, a number of studies has examined the country's environmental performance in a single dimension. For example, a few researchers have examined environmental performance [16,17], sustainability [18,19], and environmental information disclosure indexes [9,20] for China. They have also left out other important components of accountability while studying just one. A recent investigation on Chinese data [17] examined different sustainability attributes with CEO characteristics, but it ignored EID, whereas another [16] did not include both sustainability performance and EID. To the best of our knowledge, no other study has paired multiple CG mechanisms with various accountability features while integrating various CEO characteristics as moderators. Therefore, we add to the literature by having developed a multi-faceted metric that encompasses all conceivable aspects of SEA, including (a) sustainable performance, (b) environmental performance, and (c) environmental information disclosure. This study will aid in assessing the overall effectiveness of China's institutionally driven sustainable development/environmental policies and regulations.

The current study adds to the existing literature in the following unique ways. First, it evaluates the effect of board compositional characteristics on various accountability-related outcomes, such as environmental performance, sustainability performance, and disclosures. In this analysis, the board size, independence, gender diversity, and CEO duality are major drivers. Based on agency theory, our findings indicate that the compositional qualities of boards are crucial for the determination of the SEA of Chinese companies. In general, our findings indicate that all four critical board compositional characteristics are significantly connected to accountability performance. The average board size in Chinese enterprises is eight to nine members. Both board size and independence of the board in Chinese companies had a substantial positive relationship with environmental, sustainability, and EID performance. Further gender diversity on boards also affected the environmental and sustainability performance and EID. CEO duality and sustainability were significantly detrimental. However, there was no substantial link between environmental and CEO dualism and EID. Third, this was the first study to investigate the specific relationship between China's predominant corporate governance structures and business responsibility while considering the mediating functions of CEO attributes. Moreover, this was one of the first studies to analyze Chinese enterprises' sustainable and environmental performance using a dynamic model based on recent and complete panel data. Our results are not prone to endogeneity criticism because we used a dynamic model and a system generalized method of moments (SysGMM) technique. Additionally, our study can be utilized to bolster firms sustainable performance.

The study possesses very strong implications for regulators. The findings may help them reach the most effective CG mechanism to make firms accountable. Moreover, the findings will guide which kind of CEO attribute should collaborate with a particular corporate governance mechanism to make firms accountable to society. These directions will help the Chinese economy to attain a greener GDP. It has been advised that firms develop their corporate governance processes to encourage accountability, such as strengthening board gender diversity and independence, maintaining an appropriate board size, and introducing sustainability reporting.

Section 2 discusses the theoretical foundation and related literature in detail. Data and research model details are in Section 3, followed by a discussion of the results and conclusions in Sections 4 and 5, respectively.

## 2. Theoretical Discussions and Hypothesis Development

In the 21st century, corporate accountability has gained great prominence. Furthermore, concentration has diverted from the conventional profit orientation perspective to social, cultural, and environmental levels [21]. Corporations strengthen accountability to achieve the varied expectations of their stakeholders, which is why they succeed. When a corporation talks to its stakeholders about its financial, social, and environmental initiatives, it educates, informs, and changes perceptions and prospects [22]. Sustainable efforts tell more about a business's brand and identity [3].

The literature presents the different theories to explain the accountability concept, but no single theory can adequately explain it fully [23]. The current study took insight from agency theory [24] and stakeholder theory [25] to explain the governance and accountability nexus. Stakeholder theory [26] strengthens a company's connection with its stakeholders [27]. Freeman (1984) supported the engagement of top management in CSR and mentioned that corporations can use CSR to resolve conflicts among stakeholders such as managers, shareholders, employees, and customers [25]. The notion of stakeholders encourages us to think about the methods by which a corporation achieves societal legitimacy. Accountability is an important part of stakeholder relationships in normative stakeholder theory. That is, the firm and its managers are accountable not just to shareholders, but also to stakeholders. All stakeholders have a right to information about how this accountability is being discharged. CSR, from this perspective, is the responsibility of organizations rather than being demand-driven. Practically, a more managerial focus should be embraced by

the researchers to explain the activities of corporate management. This is associated with different ethical justifications. Information, including information about social and environmental performance, which is provided to stakeholders, can represent a powerful tool. This tool is used by an organization to control, manage, influence, or even manipulate various stakeholders. “Information—including financial accounting and social accounting—is a major element that can be deployed by the organization to manage (or manipulate) the stakeholder to gain their support and approval (or to distract their opposition and disapproval)” [28]. Based on stakeholder theory, the top executives have incentives to make CSR investments to meet stakeholders’ comforts. Senior managers must be responsible for stakeholders, together with shareholders. In decision-making, executives need to consider CSR, such as environmental protection, product quality, relationships with employees, and community.

Agency theory explains the relationship between CG and accountability [2]. According to agency theory, managers’ private interests may influence their accountability and reporting. In this scenario, the board of directors is an important CSR instrument [29]. Firm-level accountability results from the board’s decisions [30]. The board of directors looks out for all stakeholders, not just stockholders [25]. Socially and environmentally responsible firms have a broader purpose than just shareholder wealth creation [31]. There must be a push for board members to press management on CSR. This means that boards help firms behave in the best interests of all stakeholders [32]. Management should attempt to guarantee that selections are in the best interests of shareholders. Therefore, manager’s opportunism’ is being regulated by the board of directors [33]. By utilizing agency theory [24], researchers have argued that top management and the board get themselves involved in CSR activities to build their personal reputation [34], to generate support from society and environmentalists [35], to signal product quality [36], and to maximize goal congruence between management and other stakeholders [37–40].

### 2.1. Board Composition and Accountability

In the current era, organizations are expected to be accountable and they need to provide accounts demonstrating that they are good corporate citizens and possess the intangible assets required for future good financial performance [41]. Social and environmental accountability (EA) means that “one is responsible for one’s own actions and the consequences of those actions that affect the natural environment and wider society” [42]. Accountability is more related to social legitimation than economic legitimation, and is “more closely related to public pressure variables than economic ones” [43]. By engaging in the presentation of information by means of bias and selectivity, organizations compromise transparency about their social and environmental impacts and perpetuate a myth of accountability [44].

The function of the board of directors in corporate responsibility is crucial. It is expected that effective boards will serve and cater to the requirements of all stakeholders, regardless of their composition [29]. Board directors supervise firms’ connections with stakeholders, create the social agenda for the firms, contribute significant information, and formulate strategy. Many entities (regulators and significant stakeholders) have pushed firms to be more responsible, which has raised the value of good community relations and sustainable development plans [45]. Companies with successful boards are expected to support and facilitate sustainable engagement and disclosure to achieve long-term commercial success [46]. Empirical studies have documented that well-structured boards are capable of helping organizations create value and long-term strategic advantage by serving as sources of stakeholder interactions and company understanding [47]. Furthermore, board members have been more welcoming of investment in and reporting on sustainable development strategies to foster public participation [48,49].

To strengthen the board’s power to influence and report on stakeholder acceptance, sustainable development initiatives are meant to assist enterprises in achieving sustainable competitive advantage. The board of directors serves as a defense mechanism for investors,

and effective boards must consider the many stakeholder groups and their surrounding areas. Different characteristics of board structure may affect the reporting and accountability decisions.

## 2.2. Board Independence

Board independence is essential to corporate governance, serving as a check and balance on management and protecting the interests of shareholders [50]. According to agency theory, independent director boards have more monitoring and control over management [12]. Independence and clarity around CSR issues are in the agency's best interests [51]. Furthermore, according to stakeholder theory, independent directors attempt to meet social demands, causing businesses to invest more in sustainability [52].

There are different conclusions about the association between accountability and independent directors. Independent directors demonstrate great awareness of social and environmental issues and present themselves as liable to solve those issues [53]. The other members are internally focused on making money and less concerned with advertising the company's social and environmental responsibility. Independent boards help foster transparency, meaning independent directors support and encourage participation in long-term and profitable social initiatives [12,51,53]. Firms can give higher-quality information and better openness in their reporting to stakeholders with improved board independence [54]. Independent directors are also connected to better environmental and social performance [55]. An increase in the number of independent directors on a board increases the accountability [56,57], which results in long-term performance goals [53]. The presence of independent directors with significant seats on the board reduces the risk of conflicts of interest and helps to engage external stakeholders [58]. It is vital to monitor and regulate sustainable development challenges with board independence. Independence is likely to lead to new perspectives on environmental and social issues [59]. Following these arguments, we hypothesize a positive association between board independence and environmental and sustainability performance and EID.

**Hypotheses 1.** *Board independence is positively associated with SEA.*

## 2.3. Board Gender Diversity

Women's personal and professional aspirations and ethical standards differ from men's [60,61]. Empirically, women are more sensitive and cooperative than men, and they are better equipped to appraise a company's social and environmental concerns [62]. The stakeholder theory holds that when firms choose women for their board of directors, society may perceive that the company is more concerned with sustainability and environmental issues, as women are thought to be more accountable due to having more optimism than male counterparts [63]. Harjoto et al. [64] demonstrated that board gender diversity is consistent with stakeholder theory.

The corporations with a higher number of women on the board possess more accountability, as they demonstrate more disclosure [60]. As a result, the quality of decisions is improved due to independent perspectives [65]. Increasing the number of female directors improves the quality of board debate and decision-making. Women on boards generally ensure demographic diversity and reflect the socioeconomic environment's variety, promoting better knowledge of the corporate environment [66]. Female board membership and its effects on CSR disclosure are less explored, especially in developing markets [30]. However, some available studies have shown that board gender diversity correlates with sustainability [67] in emerging markets such as China, India, Indonesia, Korea, Malaysia, and Thailand. Most sample companies had just one or two women on their boards, which indicates that men prefer to rule and women are a minority without influence in CSR or other issues [68]. Firms with a bigger percentage of female directors had enhanced sustainability performance and an increased number of assurance reports to go along with such disclosure [69,70]. Contrarily, Muttakin et al. [71] found a negative relationship

between the number of women on boards of directors and sustainability for Bangladeshi companies.

Women are more concerned about social and environmental issues than men, making them less likely to sacrifice their quality of life for financial gain [72]. In terms of communication ability, personality, dedication, diligence, and being less self-interested, women differ from men on boards of directors [73]. Therefore, women's presence on the board of directors is likely to affect a company's social and environmental profile [72]. As a result, it is envisaged that female-dominated boards will better respond to and report on a company's social and environmental responsibilities.

**Hypotheses 2.** *The presence of female directors on the board is positively associated with SEA.*

#### 2.4. Board Size

Boards with fewer directors benefit from better communication and cooperation, resulting in better management monitoring and control [74,75]. Contrary to this, boards with a small number of directors may face increased workloads and duties, impairing their monitoring function [76]. Additionally, due to a lack of diverse expertise and backgrounds, the quality of advice and control supplied by tiny boards may be compromised [77]. Moreover, the size of the board of directors reflects the complexity of the business [78,79]. Given the scale and complexity of the Chinese market and companies, it is expected that larger boards will be more effective in influencing firms' sustainability and environmental performance (in terms of work allocation and responsibility distribution).

**Hypotheses 3.** *Board size is positively associated with SEA.*

#### 2.5. CEO Duality

The CEO duality concept (i.e., merging the chairman of the board and the CEO of the firm) has been a source of contention among corporate governance specialists for the last couple of decades. Agency theory dictates that CEOs' private interests are likely to influence their participation in and disclosure of CSR initiatives. CEO duality could be considered a technique for exercising management authority. It lessens the board's and management's essential independence, resulting in a detrimental influence on performance [80], and fosters sustainability to please powerful stakeholders and decrease oversight or improve tenure and compensation [12]. Dualism enables more focused and adaptive leadership, which improves organizational effectiveness in a potentially unpredictable corporate environment [81]. On the other hand, the board's impartiality as a monitoring body is harmed by the CEO duality, as the chairman can set the agenda, choose members, and keep crucial information hidden from other board members [78]. CEO dualism is thought to have a negative impact on monitoring, according to past studies [82]. According to certain studies, voluntary disclosure is lower when there is CEO duality [56,57].

Previous research on the link between CEO duality and accountability was inconclusive. Dias et al. [83] found a positive link between CEO dualism and sustainability performance. Contrarily, Gul and Leung [84] found that CEO duality reduces total accountability and hence makes firms less transparent, not only for shareholders but also for all stakeholders. From the perspective of developing markets, a positive relationship was found for Saudi Arabia [85], whereas no association between CEO duality and voluntary disclosure was discovered in others like Bangladesh, Malaysia, Singapore, and Hongkong [86–89].

Based on the above discussion, and keeping in mind the Chinese corporate world where CEOs usually use their powers to drive the firms as per the directions given by the Communist Party, we hypothesize a positive relationship between CEO duality and environmental and sustainability performance EID.

**Hypotheses 4.** *CEO duality is positively associated with SEA.*

### 3. Data and Methodology

The purpose of the current study was to analyze the association between board compositional characteristics (i.e., board size, independence, gender diversity, and CEO duality) on various accountability-related outcomes, such as environmental performance, sustainability performance, and environmental sustainability disclosures.

#### 3.1. Data and Sample

For this purpose, data from 4132 A share-issuing non-financial firms listed on the Shanghai and Shenzhen stock exchanges from 2010 to 2019 were analyzed. The dataset was mainly downloaded from China Stock Market & Accounting Research (CSMAR). Furthermore, financial firms were removed from the dataset, and the variables of continuous observations were arranged with a 1% tail to minimize potential outlier issues.

One of the primary challenges when examining Chinese firms' accountability is the cross-sectional environmental and sustainability data [18]. However, a longitudinal data examination of organizations' environmental initiatives can provide a complete picture [72,90]. By combining longitudinal and time-series data simultaneously, this study enabled us to make more informed conclusions. This research examined the CG mechanism in a dynamic framework. It considered probable correlations between accountability, performance, current governance traits, and other business-specific variables. To be more precise, we used SysGMM to estimate relationships in a dynamic model. Because SysGMM relies on lagged values of both dependent and explanatory variables, we eliminated firms with three consecutive years of missing values. The final sample consisted of an unbalanced panel of 3052 firms, constituting 20,651 firm-year observations, ranging from 1373 in 2010 to 2649 in 2018 (lowest to highest).

#### 3.2. Dynamic Research Model

The following dynamic model describing the BC–SEA relationship for firm  $i$  in period  $t$  was used:

$$SEA_{it} = BC_{it}\beta_{BC} + C_{it}\beta_C + Z_{it}\beta_Z + X_{it}\delta + \rho SEA_{i(t-1)} + \zeta_i + \epsilon_{it} \quad (1)$$

where  $SEA$  is firm social and environmental accountability, represented by environmental performance, sustainability performance, and environmental information disclosure (EID), alternatively;  $BC$  is a vector of board composition used as corporate governance mechanisms that include board independence, board size, board gender diversity, and CEO duality;  $C$  is a vector of control variables that includes CEO-related control variables like CEO gender, and retiring CEO, as well as other governance- and firm-related variables; and  $X$  is a vector of firm-related control variables that may affect the managerial decision regarding  $SEA$  like firm size, return on assets, and leverage ratio. The pairwise interactions between elements of the  $BC$  and  $C$  vectors are shown by the  $Z$  vector.  $\beta_{BC}$ ,  $\beta_C$ ,  $\beta_Z$ , and  $\alpha$  are conformable parameter vectors;  $\zeta_i$  represents unobservable firm heterogeneity;  $\epsilon_{it}$  is the idiosyncratic error term; and the subscripts  $i$  and  $t$  indicate firm and year, respectively. For ease of exposition, we presumed an AR (1) process in firm performance with first order correlation  $\rho$ .

Complications in estimating Equation (1) could arise since current levels of the explanatory variables may be linked to the unobserved firm heterogeneity factor  $\zeta_i$  and may depend on past sea level (dynamic endogeneity). As a result, traditional pooled OLS and panel fixed-effects estimators are skewed and inconsistent. The system generalized method of moments (SysGMM) accounts for both dynamic endogeneity and unobserved heterogeneity in panel data models [91,92]. A stacked system of level and first difference equations is estimated using the SysGMM estimator. The system can be written as follows, in our case:

$$SEA_{it} = BC_{it}\beta_{BC} + C_{it}\beta_C + Z_{it}\beta_Z + X_{it}\delta + \rho SEA_{it-1} + \zeta_i + \epsilon_{it} \quad \Delta SEA_{it} \Delta BC_{it}\beta_{BC} + \Delta C_{it}\beta_C + \Delta Z_{it}\beta_Z + \Delta X_{it}\delta + \rho \Delta SEA_{i(t-1)} + \Delta SEA_{it} + \epsilon_{it} \quad (2)$$

Model (2) assumes that including the one period lag of performance is sufficient for dynamic completeness for the sake of exposition. Instruments are thus ideal candidates for lags greater than one. The level and first difference equations' instrument sets are:

$$(\Delta BC_{i(t-2)}, \dots, \Delta BC_{i[t-(t-2)]}, \Delta C_{i(t-2)}, \dots, \Delta C_{i[t-(t-2)]}, \Delta Z_{i(t-2)}, \dots, \Delta Z_{i[t-(t-2)]}, \Delta X_{i(t-2)}, \dots, \Delta X_{i[t-(t-2)]}).$$

and

$$(CG_{i(t-2)}, \dots, CG_{i[t-(t-2)]}, CEO_{i(t-2)}, \dots, CEO_{i[t-(t-2)]}, Z_{i(t-2)}, \dots, Z_{i[t-(t-2)]}, X_{i[t-(t-2)]}),$$

respectively.

The initial difference formulation in Equation (2) results in significant data losses in the case of unbalanced panels with sample gaps.  $\Delta SEA_{it}$  and subsequently  $\Delta SEA_{i(t+1)}$  will be missing if  $SEA_{it}$  is missing. Arellano and Bover (1995) developed the forward orthogonal deviations alternative to the first difference equations in response to the sample gaps and data loss problem [91]. The orthogonal deviations technique subtracts the average of all possible future values of the variable from the contemporaneous value for each of the variables, rather than the one period lag. Only the latest observation is lost, regardless of the number of gaps. The lags can still be used as instruments because the forward deviations have no delay.

Before going any further, it is worth mentioning the benefits of SysGMM estimation. SysGMM contains firm fixed effects to account for unobservable firm heterogeneity, unlike typical pooled OLS estimation. The technique, on the other hand, goes beyond the typical fixed-effects model by allowing historical levels of firm performance to influence current values of  $BC$ ,  $C$ ,  $Z$ , and  $X$ . SysGMM is also robust to firm-specific heteroscedasticity and serial correlation patterns, as well as sample gaps in unbalanced panels. For endogeneity issues, it is appropriate to utilize a set of "internal" instruments, i.e., lagged values and changes in  $BC$ ,  $C$ ,  $Z$ ,  $X$ , and accountability. This eliminates the requirement to obtain suitable external instruments.

### 3.3. Variables Definitions and Measurement

#### 3.3.1. Dependent Variables

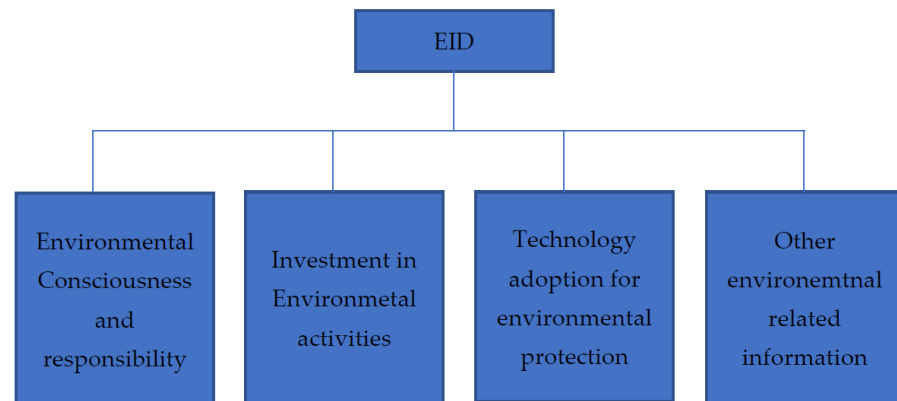
We used three distinct measures of sustainability as the proxy of SEA. We used two variables, (a) "*Sus\_Perf*" and (b) "*Env\_Perf*," as measures of the quality rating scores of "sustainable performance" and "environmental performance," respectively. *Sus\_Perf* and *Env\_Perf* are assessed by independent rating agencies (e.g., *HEXUN-RKS*). Sustainable performance refers to a company's overall sustainable, social, and environmental performance as measured by its participation in sustainable and environmentally friendly activities over the course of a year. The amount to which a company engages in only environmentally friendly procedures and activities over the course of a year is referred to as environmental performance. These are continuous variables that range from 0 to 100 (lowest to highest rating score) and were extracted from the *HEXUN* database.

The data about the third variable, environmental information disclosures (EID) were manually collected from firms' annual, semiannual, and CSR reports. This measure captured the involvement of each firm in corporate-level EID [93]. Ten activities of Chinese firms relating to environment were taken based on the concept model [94] in Figure 1 and Table 1. They summarized it into two categories: environmental financial (quantitative) and non-financial (qualitative) information. These two categories include 10 components. When the firm disclosed any general qualitative information, point 1, point 2 for specific environmental information, and point 3 were assigned for quantitative information. When firms disclosed no environmental information, then 0 was given. Using monetary- and non-monetary-related environmental disclosure is an effective tool to gauge levels of corporate EID [95]. Each firm received a score for evaluating its level of EID based on Equation (3).

$$SEID_i = \sum_{j=1}^n SCID_j \quad (3)$$



where  $SEID_i$  is the total score of EID for the firm  $i$ , and  $SCID_i$  is the score of the  $j$ th component for the firm  $i$ , in which  $j = 1, 2, \dots, 10$ .



**Figure 1.** Environmental information disclosures (EID) components.

**Table 1.** Activities contributing to EID measurement.

Activity	Definition	EID-Related Central Aspect
A <sub>1</sub>	Firm's environmental investment expenditure for technology development	Investment
A <sub>2</sub>	Government-appropriate funds, finance allowance, and taxes abatement related to the environment	Investment
A <sub>3</sub>	Disposal and treatment of generated waste, recycling, and integrated utilization of waste products	Technology
A <sub>4</sub>	Information related to ISO environmental system authentication	Consciousness and responsibility
A <sub>5</sub>	Construction and operation of environmental improvement	Technology
A <sub>6</sub>	Influence of government environmental protection policy	Consciousness and responsibility
A <sub>7</sub>	Loans related to environmental protection	Investment
A <sub>8</sub>	Lawsuit, atonement, penalty, and bounty related to environmental protection	Consciousness and responsibility
A <sub>9</sub>	Firm's environmental protection policies, strategies, and goals	Consciousness and responsibility
A <sub>10</sub>	Other environmental-related information (environmental education, tree planting, biodiversity conservation, and other environmental projects to promote public welfare)	Others

### 3.3.2. Independent Variables

Our independent variable was corporate board composition, which represents the corporate governance mechanism. The study took four independent variables, including board size (number of sitting individuals on BoD), board independence (the proportion of board members who were independent directors), board gender diversity (the proportion of board members who were female), and CEO duality (and a dummy variable equal to 1 if the CEO also served as board chair).

### 3.3.3. Control Variables

Based on prior studies [17], we used a set of control variables to account for other CG mechanism effects and firm-related factors. The board-related control variable was the number of board meetings in a year. CEO-related control variables were CEO gender

(a dummy variable equal to 0 if the CEO was female) and retiring CEO (a dummy variable equal to 1 if the CEO was going to retired in a given year). Firm-level control variables were return on assets, debt-to-assets ratio, and firm size (natural log of total assets).

#### 4. Results and Discussion

The descriptive statistics show that the average sustainability performance, environmental performance, and EID scores for Chinese firms were 23.331, 1.391, and 0.046, respectively. These poor average ratings and lack of environmental disclosure show that Chinese companies are still lagging in terms of implementing sustainable and environmental policies. Nonetheless, these poor average sustainable and environmental performance scores, as well as the low proportion of environmental reporting, are in accordance with prior research in China [16,17,19]. Moreover, Chinese firms had around eight to nine individuals on the BoD and they held around nine meetings a year. The descriptive statistics for the control variables were similarly consistent with previous studies [16,19], although we have chosen not to address them in detail due to length. Appendix A has the detailed summary statistics (Table A1).

The process that underpins the dynamic findings provided below is detailed here in the spirit of transparency. First, a strict exogeneity test, as described by Wooldridge [96], was performed in panels with  $T > 2$ . Briefly, the following equation was specified:

$$SEA_{it} = BC_{it}\beta_{BC} + C_{it}\beta_C + Z_{it}\beta_Z + X_{it}\delta + W_{i(t-1)}\delta + \zeta_i + \epsilon_{it} \quad (4)$$

where  $W_{i(t-1)}$  is a vector containing the one-period lead values of BC and the elements of the C, Z, and X vectors (or of a subset thereof). Strict exogeneity of any  $W_i$  requires that  $\delta_i = 0$  and can be tested by estimating Equation (3) using standard fixed effects with robust and clustered standard errors. Industry and year dummies were included as well. Estimates of the  $\delta_i$ s for each of the three performance equations are reported in Table 2.

Table 2. Strict exogeneity tests.

Variables	Environmental Performance	Sustainable Performance	Environmental Information Disclosure (EID)
Board Size ( $t + 1$ )	0.159 ** (0.0727)	0.760 *** (0.214)	0.00530 ** (0.00242)
Board Independence ( $t + 1$ )	0.761 (1.790)	5.069 (5.199)	0.0254 (0.0597)
Board Gender Diversity ( $t + 1$ )	−3.041 *** (0.762)	−10.09 *** (2.389)	−0.101 *** (0.0254)
CEO Duality ( $t + 1$ )	−0.167 (0.156)	−0.391 (0.479)	−0.00556 (0.00521)
Board Meetings ( $t + 1$ )	−0.0244 * (0.0135)	−0.142 *** (0.0424)	−0.000813 * (0.000449)
CEO Gender ( $t + 1$ )	−0.0590 (0.328)	−0.407 (0.940)	−0.00197 (0.0109)
CEO Retiring ( $t + 1$ )	−0.331 (0.287)	−0.732 (0.948)	−0.0110 (0.00955)
Debt to Assets ( $t + 1$ )	0.706 (0.429)	−6.097 *** (1.417)	0.0235 (0.0143)
ROA ( $t + 1$ )	0.856 (0.756)	10.76 *** (2.422)	0.0285 (0.0252)

Table 2. Cont.

Variables	Environmental Performance	Sustainable Performance	Environmental Information Disclosure (EID)
Size—Total Assets ( $t + 1$ )	−0.568 *** (0.0894)	−0.376 (0.275)	−0.0189 *** (0.00298)

Notes: 1. Where \*\*\*, \*\*, and \* show the significance levels at  $p < 0.01$ ,  $p < 0.05$ , and  $p < 0.1$ , respectively. 2. Parentheses show the robust standard errors. 3. The following equation was used to test the exogeneity:  $SEA_{it} = BC_{it}\beta_{BC} + C_{it}\beta_C + Z_{it}\beta_Z + X_{it}\beta + W_{i(t-1)}\delta + \zeta_i + \epsilon_{it}$  (Equation (4)), where  $W_{i(t-1)}$  is a vector containing the one-period lead values of BC and the elements of the C, Z, and X vectors (or of a subset thereof). Strict exogeneity of any  $W_i$  requires that  $\delta_i = 0$ .

The values of the exogeneity tests in columns 2, 3, and 4 of Table 2 represent that across all measures there is evidence that board size, board gender diversity, and board meetings were not strictly exogenous for all the three dependent variables, whereas debt to assets, ROA, and size were not strictly exogenous for any one or two of the our three dependent variables. For all other variables, the null hypothesis of strict exogeneity cannot be rejected.

#### 4.1. System GMM Parameter Estimates

Table 3 reports the System GMM parameter estimates along with all relevant diagnostic tests and  $p$ -values. Columns 2, 3, and 4 provide the results of board composition impact on environmental performance, sustainable performance, and EID, respectively.

Table 3. System GMM parameter estimates.

Variables	Environmental Performance	Sustainable Performance	Environmental Information Disclosure
Board Size	0.164 *** (0.0241)	0.513 *** (0.0691)	0.00547 *** (0.000802)
Board Independence	2.816 *** (0.746)	8.607 *** (2.145)	0.0939 *** (0.0249)
Board Gender Diversity	−2.384 *** (0.320)	−2.620 *** (0.917)	−0.0795 *** (0.0107)
CEO Duality	−0.129 (0.0788)	−0.433 * (0.226)	−0.00430 (0.00263)
Board Meetings	−0.0334 *** (0.00911)	−0.0710 *** (0.0262)	−0.00111 *** (0.000304)
CEO Gender	−0.0592 (0.144)	0.0491 (0.415)	−0.00197 (0.00481)
CEO Retiring	−0.258 (0.232)	−0.998 (0.666)	−0.00861 (0.00773)
Debt to Assets	0.257 (0.198)	−1.277 ** (0.573)	0.00858 (0.00660)
ROA	1.723 *** (0.618)	81.72 *** (1.793)	0.0574 *** (0.0206)
Size—Total Assets	0.358 *** (0.0345)	2.106 *** (0.102)	0.0119 *** (0.00115)
Constant	−8.678 *** (0.763)	−37.91 *** (2.213)	−0.289 *** (0.0254)
No. of Observations	14,913	14,913	14,913

Table 3. Cont.

Variables	Environmental Performance	Sustainable Performance	Environmental Information Disclosure
Number of ID	2838	2838	2838

Note: 1. Where \*\*\*, \*\*, and \* show the significance levels at  $p < 0.01$ ,  $p < 0.05$ , and  $p < 0.1$ , respectively. 2. Parentheses show the robust standard errors. 3. The following equation was used:  $SEA_{it} = BC_{it}\beta_{BC} + C_{it}\beta_C + Z_{it}\beta_Z + X_{it}\delta + \rho SEA_{i(t-1)} + \zeta_i + \epsilon_{it}$  (Equation (1)), where  $SEA$  is the firm's social and environmental accountability, represented by environmental performance, sustainability performance, and environmental information disclosure (EID), alternatively.  $BC$  is a vector of board composition used as a corporate governance mechanism that includes board independence, board size, board gender diversity, and CEO duality.  $C$  is a vector of control variables that includes CEO-related control variables like CEO gender and retiring CEO, as well as other governance- and firm-related variables.  $X$  is a vector of firm-related control variables that may affect the managerial decision regarding  $SEA$  like firm size, return on assets, and leverage ratio. The pairwise interactions between elements of the  $BC$  and  $C$  vectors are shown by the  $Z$  vector.  $\beta_{BC}$ ,  $\beta_C$ ,  $\beta_Z$ , and  $\alpha$  are conformable parameter vectors;  $\zeta_i$  represents unobservable firm heterogeneity;  $\epsilon_{it}$  is the idiosyncratic error term; and the subscripts  $i$  and  $t$  indicate firm and year, respectively.

We found a positive and significant relationship between board size and board independence and all three measures of SEA. Agency theory and stakeholder theory support our findings. Agency theory says that independent directors promote transparency and influence the divulgation of sustainability [51,88]. Stakeholder theory also claims that independent directors tend to focus more on stakeholders' interests since they are more responsive to social pressures and therefore motivate businesses more to participate in sustainable development [52]. Our evidence is similarly consistent with the results obtained by Khan et al. [87], who indicated that CSR disclosure is positively affected by board independence in emerging market economies. Our results are also in accordance with earlier research done in developed nations (for instance, [97]), which suggests that independent directors have a beneficial impact on CSR disclosure. In addition, independent managers can pressure companies to take part in CSR disclosure to ensure congruence between the organization's actions and the values of society [97,98]. Therefore, our findings imply that board size and independent board directors play an active role in the management monitoring of SEA issues in both emerging and developed markets.

Board gender diversity came out to be negatively and significantly associated with all three measures of accountability. The findings are consistent with Muttakin et al. [71], who found a negative link between female managers and CSR disclosure in emerging-market countries and identified the following potential causes for this negative relationship: (a) a lack of qualifications and educational experience of female directors, which may negatively affect CSR reporting, and (b) the family ties of directors, who prioritize family interests over sustainability. However, not all aspects of board diversity promoted CSR disclosure for Malaysian companies [99], the reason being the lack of female directors on boards in emerging-market economies [100,101]. Most boards in our sample were likely to be controlled by male directors, and so female directors' participation in decision-making was limited. Our findings contradict those of studies conducted in industrialized countries [49,102,103]. Furthermore, some features of sustainability difficulties in emerging markets may differ from those in developed economies' contexts, norms, and regulations, resulting in this relationship not necessarily presenting a positive sign, as indicated by agency theory and stakeholder theory. According to both views, female directors can promote CSR issues by encouraging companies to provide CSR information.

Finally, the number of board meetings was negatively associated with sustainability performance, environmental performance, and EID. CEO duality was insignificantly related to EID and environmental performance but negatively and significantly related to sustainability performance. Prior studies also concluded that it limits certain governance tasks, such as CSR disclosure (from the stakeholder theory and agency perspective, separation of the roles of chairperson and CEO is preferable) [104,105]. The CEO's dominant position is connected to personal gain rather than sustainable business practices, resulting in less SEA [106]. As a result, CEO dualism can harm SEA, since management, including the CEO, can employ CSR initiatives against the demands and interests of shareholders and stakeholders. These findings hold for other emerging countries; for instance, Malaysian

companies' CEO duality on boards had a detrimental impact on CSR reporting [105]. The authors believe that if the CEO is also the chairwoman, job duality affects the board's independence, making the directors' monitoring function less effective. Similarly, another study on Chinese companies documented that CEO duality on the boards had a detrimental impact on CSR reporting [107]. The findings are also consistent with those of Uyar [108], who found a negative relationship between CEO dualism and various metrics of accountability. All the indicators of accountability show that CEO gender and retiring CEO had no meaningful relationship. In contrast, ROA and size were found to have a substantial positive relationship with all three SEA metrics.

#### 4.2. Testing the Moderating Effect of CEO Gender on the CG–SEA Nexus

Table 4 presents the moderating effect of CEO gender on the CG–SEA nexus. For this purpose, we developed the interaction terms of “retiring CEO” and “CEO gender” with each variable of CG. The results shows that the CEO gender had a significant positive moderating effect on all the board characteristics (board size, board independence, board gender diversity, CEO duality) and SEA indicators. Therefore, consistent with prior studies, we conclude that CEO gender positively impacts the CG–SEA nexus. Female CEOs may have a more favorable attitude toward environmental and social issues since they act more sensitively and cooperatively than male ones [62].

**Table 4.** Moderating effect of CEO gender on the CG–SEA nexus.

Variables	Environmental Performance	Sustainable Performance	Environmental Information Disclosure
Board Size	−0.0540 (0.115)	−0.186 (0.330)	−0.00180 (0.00383)
Board Independence	−3.769 (3.101)	−11.98 (8.912)	−0.126 (0.103)
BoardGender Diversity	0.180 (1.296)	5.321 (3.726)	0.00602 (0.0432)
CEO Duality	−0.351 (0.325)	−1.093 (0.935)	−0.0117 (0.0108)
B_Size*CEO_Gend	0.226 * (0.117)	0.724 ** (0.337)	0.00753 * (0.00391)
B_Inde*CEO_Gend	6.939 ** (3.196)	21.75 ** (9.185)	0.231 ** (0.107)
B_Gend_Div*CEO_Gend	−2.716 ** (1.344)	−8.454 ** (3.863)	−0.0905 ** (0.0448)
Duality*CEO_Gend	0.236 (0.335)	0.716 (0.962)	0.00786 (0.0112)
Board Meetings	−0.0334 *** (0.00911)	−0.0708 *** (0.0262)	−0.00111 *** (0.000304)
CEO Gender	−3.903 ** (1.989)	−12.18 ** (5.718)	−0.130 ** (0.0663)
CEO Retiring	−0.245 (0.232)	−0.967 (0.666)	−0.00817 (0.00772)
Debt to Assets	0.253 (0.198)	−1.278 ** (0.574)	0.00843 (0.00661)
ROA	1.801 *** (0.618)	81.91 *** (1.793)	0.0600 *** (0.0206)
Size	0.356 *** (0.0345)	2.098 *** (0.102)	0.0119 *** (0.00115)
Constant	−4.968 ** (2.035)	−26.15 *** (5.857)	−0.166 ** (0.0678)
Observations	14,913	14,913	14,913
Number of ID	2838	2838	2838

Note: 1. Where \*\*\*, \*\*, and \* show the significance levels at  $p < 0.01$ ,  $p < 0.05$ , and  $p < 0.1$ , respectively. 2. Parentheses show the robust standard errors. 3. Moderating variable: CEO gender.

## 5. Conclusions and Policy Implementations

This study establishes a link between the corporate governance (CG) mechanism with various environmental and social accountability (SEA) measures like sustainability performance, environmental performance, and environmental information disclosures. Moreover, this study found the extent to which various CEO-related attributes moderate the CG–SEA nexus. Using dynamic panel data estimations, we found that board size, independence, and gender diversity in board and CEO duality were all favorably connected to Chinese enterprises' environmental performance. Additionally, our findings imply that the analyzed CEO characteristics positively moderate the relationship between CG and SEA. We hope to add to the existing literature in the following novel ways. First, we evaluated the impact of board compositional characteristics on various accountability-related outcomes, such as environmental performance, sustainability performance, and disclosures. We considered size, independence and gender diversity on the board, and CEO duality as primary determinants in this analysis. Based on agency theory, our findings indicate that these board compositional characteristics are critical in determining the SEA of Chinese enterprises. In general, our findings indicate that all four critical board compositional characteristics (board size, board independence, CEO duality, and board gender diversity) are significantly connected to accountability performance. Thirdly, this is the first study to analyze the unique relationship between China's prevalent corporate governance mechanisms and business accountability while incorporating the mediating roles of CEO attributes. Moreover, this is one of the first studies to analyze Chinese enterprises' sustainable and environmental performance using a dynamic model based on recent and complete panel data. Our results are not prone to endogeneity criticism because we used a dynamic model and a system generalized method of moments technique. Additionally, our study can be utilized to bolster firms' sustainable performance.

The study possesses very strong implications for regulators. The findings may help them to reach the most effective CG mechanism to make firms accountable. Moreover, the findings will guide the kind of CEO attribute that should collaborate with corporate governance mechanisms to make firms accountable to society. These directions will help the Chinese economy to attain a greener GDP. To encourage corporations to be accountable, corporations should develop their corporate governance systems, including improving board gender diversity and independence, maintaining an appropriate board size, and implementing sustainability reporting.

Finally, despite insightful contributions and robust findings, the study possesses some limitations, too. The study was conducted in China, which has a financial system and a corporate governance system that are different from rest of the world due to the unique socialism in the characteristic Chinese economic system. As for what the characteristics of the governance–accountability nexus in other developing and developed countries are, we leave that question for future researchers. Moreover, future research may take insights from upper echelon theory and may study CEO-level attributes as moderators while establishing the relationship between governance and social and environmental accountability.

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## Appendix A

Table A1. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min.	Max.
Sustainability Performance	20,643	23.331	14.961	−3.82	73.31
Environmental Information Disclosures (EID)	20,643	0.046	0.151	0	0.767
Environmental Performance	20,643	1.391	4.537	0	23
Board Size	20,651	8.569	1.699	0	20
Board Independence	20,633	0.374	0.052	0.333	0.571
CEO Duality	20,651	0.291	0.454	0	1
Number of Board Meeting	20,651	9.611	3.941	0	56
CEO Gender	20,651	0.938	0.242	0	1
Retiring CEO	20,651	0.023	0.149	0	1
CEO Duality	20,651	0.291	0.454	0	1
Debt to Assets Ratio	20,651	0.415	0.215	0.049	0.944
Return on Assets	20,651	0.037	0.065	−0.299	0.191
Size (Total Assets)	20,651	21.941	1.204	19.639	25.565

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