An Empirical Study of Sustainable Information Security Disclosure

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Abstract
Information security spans the social and governance aspects of Environment Social Governance (ESG), with firms disclosing their investments and outcomes in sustainability reports. However, academic research on this disclosure remains in its early stages. This study explores the relationship between information security disclosure in sustainability reports and corporate market value. Additionally, the role of institutional investors will be analyzed. The findings are expected to provide valuable insights for industry, government, and academia, contributing theoretical and practical implications for sustainable corporate management and investment decision-making.

Keywords: ESG, information security disclosure, market value

1. Introduction

Among the recent hot management issues, Environment-Social-Governance (ESG) is a vital management structure for enterprises to plan and execute actively. This framework not only enables internal management to think about multi-faceted management layouts but also helps other stakeholders better understand the risks and opportunities of corporate continuity (Reig-Mullor et al., 2022; Yadav, 2022; Barros et al., 2024). Under this trend, companies prepare corporate sustainability reports to communicate ESG investment and effectiveness with stakeholders.

The relevant measures of ESG investment by enterprises are often expressed through the disclosure of corporate sustainability reports so that the enterprise stakeholders can better understand. Bhimavarapu et al. (2022) pointed out that investors should refer to the relevant reports of the target company before making investment decisions to reduce the errors caused by information asymmetry. Gold and Heikkurinen (2018) argue that ESG disclosure reflects the stakeholders' requirements for the company to a certain extent, thereby increasing the company's accountability as a whole. Reber et al. (2022) argue that to reduce information asymmetry with external stakeholders and avoid adverse events affecting the company, companies will proactively disclose their ESG investments and achievements.

However, in the past literature on the impact of ESG disclosure on enterprises, there has been little discussion on information security disclosure contained in corporate sustainability reports. While enterprises rely heavily on information technology, information security has become an indispensable management mechanism (Puhakainen & Siponen, 2010; Barlow et al., 2018; Shiau et al., 2023). The primary research motivation of this study is to determine whether companies have relevance to corporate value while disclosing their information security investments and achievements in ESG sustainability reports.

The firm's value that this study focuses on is the market value that differs from traditional accounting performance indicators. Regarding the market value measurement component, Tobin's Q has been a widely used performance indicator in many studies, mainly reflecting companies' long-term earnings expectations (Rahmati et al., 2021; Yang & Basile, 2022; Anderson et al., 2023). Tobin's Q indicator measures the market value of a firm's assets as a proportion of the replacement cost of assets (Core & Packard, 2022). Tobin's Q has also been used in different research fields to discuss many topics, such as detecting the correlation between customer orientation and Tobin's Q, the correlation between the structural power of information chief and organizational performance, and the ability of enterprise supply chain cooperation networks and firm performance (Hoobler et al., 2018; Feng et al., 2021; Wang et al., 2021). Kashmiri and Mahajan (2017) consider Tobin's Q a risk-adjusted, forward-looking measure compared to traditional accounting measures of firm performance.

In addition to focusing on whether the disclosure of sustainable information security by enterprises correlates with enterprise value, this study also aims to test the multiplication effect of institutional investors in this correlation. Past studies have shown that institutional investors are usually large shareholders of firms. From the perspective of their motivations, they have a more potent dominant force than retail investors to supervise and influence the company's policies and development direction (Gillan & Starks, 2000). Aguilera (2005) also points out that institutional investors have an important role in external governance and that the influence of ownership can reduce the inefficiency of regulatory authorities. Geetika et al. (2017) found that foreign institutional investors have a stronger correlation with CSR when examining the relationship between institutional investors and CSR. Maqbool (2019) found a positive relationship between institutional investors and CSR and pointed out that CSR creates long-term organizational value. From the above, it can be seen that institutional investors have the function of supervising enterprises. Another research motivation for this study is whether the company's current sustainability information security control status is disclosed in its sustainability report and whether this external role urges the institutional investors whether it will lead to an increase in market value.

Summarizing the above research motivations, and since information security content has gradually become more commonly disclosed in corporate sustainability reports, the primary purpose of this study is to explore whether corporate sustainability information security disclosure will affect this market value (Tobin's Q indicator) and to explore the correlation between corporate sustainability information security disclosure and market value of proactive disclosure. In addition, the secondary purpose of this research plan is to examine the multiplier effect of institutional investors' correlation between corporate sustainability information security disclosure and market value.

2. Literature Review and Research Hypotheses

With the growing trends of globalization, mergers and acquisitions, and outsourcing, business transactions have become increasingly complex. Coupled with the reliance on information technology among supply chain participants, this has drawn heightened attention to the issue of sustainable information security (Tang & Whinston, 2020; Shiau et al., 2023). Recent studies on information security have shifted from an organizational-level focus to the level of public policy. Romanosky et al. (2011) noted that government initiatives and related information security legislation not only protect consumer trust in corporate information security but also drive firms to improve their security practices. In the current wave of rapid digitalization, firms that fail to effectively manage and control information security face severe risks and losses. Tang and Whinston (2020) further pointed out that the shift toward remote work and virtual meetings brought about by the COVID-19 pandemic has intensified cybersecurity threats arising from increased dependence on networks. Deficiencies in corporate information security management not only harm the firm itself but also expose other stakeholders to security risks. In particular, vulnerabilities in supply chain networks constitute one of the greatest breaches, jeopardizing the operations of all related parties (Bakshi & Kleindorfer, 2009).

Corporate engagement in social responsibility can generate competitive advantages for firms themselves (Wellalage et al., 2019). Ntim and Soobaroyen (2013) argue that firms with better corporate governance performance are more likely to see their top executives commit to greater corporate social responsibility (CSR) practices. Yadav (2022) notes that an increasing number of investors believe that ESG engagement can reduce investment risks and even lead to higher investment returns. Prior studies also support that companies with stronger ESG ratings often deliver superior returns to their investors (Juddoo et al., 2023). Wong et al. (2021) examine the influence of external third-party ESG ratings on firms' financial performance. On the other hand, recent research has investigated whether ESG can assist firms in navigating uncertain economic environments (Tiwari et al., 2021). Fuadah and Kalsum (2021) find that firms with stronger ESG performance are able to maintain resilience and secure customer trust even during periods of high operational uncertainty.

Mehmood et al. (2020) and Khanchel et al. (2023) have demonstrated that the ability of firms to disclose information in corporate governance entirely often improves the firm's supervisory capabilities, which in turn contributes to the improvement of firm performance. However, some studies have found that disclosing CSR information brings many advantages to organizations but does not increase corporate value (Sampong et al., 2018; Oktaviani et al., 2019). In order to meet the needs of their partners, corporate management will also focus on the disclosure of corporate ESG messages and thereby increase the company's stock price (Murashima, 2020).

With the rapid development of informatization and digitalization, enterprises are paying more and more attention to information security, in addition to regarding information security as a part of ESG sustainability issues and disclosing information security-related management and control in corporate sustainability reports. Martínez-Ferrero et al. (2016) found that corporate commitment to social responsibility also affects the quantity and quality of CSR information disclosed. On the other hand, recent empirical evidence has also found that companies with ESG strengths can enhance their corporate value by strengthening their ESG disclosure (Chouaibi & Affes, 2021). Based on the above, the plan establishes hypothesis 1 as follows:

H1: Firms with higher levels of sustainable information security disclosure exhibit greater market valuation

Institutional investors pay attention to both financial and non-financial reporting when making investment decisions (Maqbool & Zamir, 2021; Xiong et al., 2023). Previous studies have examined the supervisory and influential role of institutional investors across various issues, including earnings management, dividend payout policies, and executive compensation (Abramova et al., 2020; Ilhan et al., 2023). Hutchinson et al. (2015) investigated financially distressed firms during the global financial crisis and found that institutional investors exerted a positive effect on firm performance during this period. Active institutional investors have also been shown to increase their shareholdings to curb the decisions and actions of overconfident CEOs (Ilhan et al., 2023). These findings indicate that institutional investors may already possess partial control comparable to that of boards of directors. Compared with domestic institutional investors, foreign institutional investors are generally considered to have stronger monitoring functions and a greater emphasis on promoting corporate governance, thereby enhancing firms' governance mechanisms (Xiong et al., 2023). Ferreira et al. (2009) further suggest that, because foreign institutional investors do not maintain strong loyalty ties with firms, their monitoring role is often more effective than that of domestic institutional investors.

Abramova et al. (2020) found that in addition to the impact of institutional investor ownership on the intensity of corporate information supervision, institutional investors also communicate their preferences to the management authorities. Ilhan et al. (2023) show that institutional investors strongly demand climate risk disclosure and will actively demand that portfolio companies improve their climate risk disclosure. Some studies have found that CSR and other related information do not affect the investment choices of institutional investors (Dyck et al., 2019). However, Xiang et al. (2021) discussed the relevance of institutional investors to CSR, arguing that the extent to which institutional investors urge companies to participate in CSR will depend on institutional investors' consideration of the impact of CSR on shareholder wealth. Based on the above, it can be seen that institutional investors have a specific function of supervision over enterprises. Suppose an enterprise makes a complete disclosure on sustainable information security, coupled with the supervision of institutional investors. In that case, it can be expected that the management and control of information security will be more effective and bring positive market value to the enterprise. Therefore, this study plans to establish hypothesis 2:

H2: The positive relationship between sustainable information security disclosure and market value is strengthened when institutional investor ownership is high

3. Research Methodology

3.1 Sample

This study is expected to focus on Taiwanese-listed companies in 2022. The main reason for choosing this study period is that the FSC released Corporate Governance 3.0 in 2020, emphasizing the need for enterprises to strengthen the disclosure of ESG and other sustainability content and announcing the operating measures for preparing corporate sustainability reports from 2021.

3.2 Research Model

This study mainly explores the correlation between sustainable information security disclosure and market value. A regression model (shown below) is planned to test the hypothesis. Through the analysis of these regression models, in addition to testing the direct impact of sustainable information security disclosure on market value, we can further understand the moderating impact of variables such as voluntary disclosure and institutional investor shareholding on the market value of enterprises.

$$\text{Tobin's } Q_{it} = \alpha_0+\alpha_1 \, SISDM_{it} +\alpha_2 \, IIO_i +\alpha_3 \, SISDM * IIO_i +\alpha_4 \, AGE_{it} +\alpha_5 \, LNTA_{it} +\alpha_6 \, DEBT_{it} +\alpha_7 \, ROA_{it} +\alpha_8 \, GROWTH_{it} +\varepsilon_{it}$$

3.3 Research Variables

- Dependent variable
  - Tobin's Q (TOBINSQ): In the market value variable measurement part, this study plans to measure Tobin's Q indicator, which is calculated as the market value of a company's stock divided by the book value of a company's assets (Feng et al., 2021).
- Independent variable
  - Sustainability Information Security Disclosure (SISDM): This study aims to collect information security disclosure status from listed companies' corporate sustainability reports. In the sustainability report disclosed by the company, there are 16 items, covered by the Information Communication Security Control Guidelines for listed companies (Taiwan Stock Exchange, 2021), and each item disclosed can be awarded 1 point, with a maximum of 16 points. The information disclosed in the policy area includes (1) information security policies, organization, and objectives; (2) information security management investment resources; (3) information security risk management framework; (4) information security incidents; (5) network security management; (6) information system management; (7) information security emergency response mechanism; (8) personal information protection and management; (9) confidentiality and trade secret protection; (10) related party information security management; (11)

information security audit and review; (12) information security certification and maturity; (13) the business continuity plan; (14) the results of the implementation of information security measures; (15) information security training and publicity; (16) information security environment and equipment management. In this study, it is estimated that the disclosure score of each year will be calculated based on the enterprises that have published corporate sustainability reports, and the median disclosure score of each enterprise exceeding the other samples in that year will be set to 1. Otherwise, it will be 0.

- Institutional Investor Shareholding (IIO): The measurement of institutional investor shareholdings is based on data obtained from the Taiwan Economic Journal (TEJ) database. The institutional ownership percentage is calculated by dividing the total number of shares held by institutional investors (including foreign institutional investors, domestic mutual funds, and dealers) by the company's total number of shares outstanding, and then expressing the result as a percentage.

Table 1 summarizes the definitions of variables.

Table 1: Variable Definition

Variable		Definition
Dependent variable	TOBINSQ	The market value of a company's stock divided by the book value of the company's assets
Independent variable	SISDM	In the sustainability report disclosed by the company, there are 16 items, covered by the Information Communication Security Control Guidelines for listed companies (Taiwan Stock Exchange, 2021), and each item disclosed can be awarded 1 point, with a maximum of 16 points.The degree of disclosure of sustainable information security, the median disclosure score of each enterprise in the year exceeding other samples, is set to 1. Otherwise, it is 0.
	SISDM*IIO	The degree of disclosure of sustainable information security is multiplied by the shareholding ratio of the company's institutional investors.
	IIO	The proportion of shares held by institutional investors of the enterprise
Control variable	LNAT	The total assets of the enterprise are taken as the natural logarithm.
	DEBT	Total liabilities divided by total assets
	ROA	Net Profit After Tax / Average Total Assets
	GROWTH	(Net Sales for This Year - Net Sales for The Last Year)/ Net Sales for The Last Year
	AGE	Years of company establishment

4. Findings and Discussion

The primary sample of this study consists of 971 firms listed on the Taiwan Stock Exchange in 2022. This study first collected corporate sustainability reports from the Market Observation Post System. After excluding firms that did not publish a sustainability report in 2022, the sample was reduced to 634 firms. Subsequently, this study further excluded five firms with missing values in other research variables, resulting in a final sample of 629 firms.

This study explores the relevant variables affecting the market value of enterprises (Tobin's Q) through descriptive statistical analysis, including the degree of sustainable information security disclosure (SISDM), the proportion of institutional investors (IIO), the interaction between the two (SISDMIIO), and several control variables (AGE, LNTA, DEBT, ROA, GROWTH). Table 2 shows descriptive statistical analysis.

Table 2: Descriptive Statistical Analysis

Variable	Minimum value	Maximum value	Average	Standard Deviation
TOBINSQ	0.020	8.490	1.085	0.795
SISDM	0.000	1.000	0.470	0.499
IIO	0.040	0.990	0.524	0.212
SISDM*IIO	0.000	0.980	0.261	0.312
AGE	0.000	76.000	37.885	16.267
LNTA	13.390	23.210	17.072	1.618
DEBT	0.010	0.980	0.481	0.200
ROA	-41.960	48.950	5.366	8.533
GROWTH	-372.450	16.500	-0.662	15.409
N=629				

This study explores the key factors influencing the market value of enterprises (Tobin's Q) through regression analysis, with a particular focus on the degree of sustainable information security disclosure (SISDM), institutional investor ownership (IIO), and their interaction (SISDM*IIO). The regression analysis results in Table 3 show that the impact of SISDM itself on Tobin's Q is not significant ($p = 0.180$), indicating that the degree of information security disclosure may not directly affect the market value, and the market may not have fully incorporated this factor into the enterprise evaluation mechanism. Additionally, this result may reflect the current limitations in how the market perceives and incorporates information security disclosure into firm valuation. As information security disclosure is still evolving in practice and may lack standardized formats or comparability across firms, investors may find it difficult to assess its direct economic value. In contrast, IIO has a significant positive relationship with Tobin's Q ($p < 0.001$), indicating that companies with a higher proportion of institutional investors' shareholding have relatively higher market value, which is in line with the Investor Monitoring Hypothesis, that is, institutional investors can improve the quality of corporate governance through the supervision mechanism, thereby increasing market value. The findings contribute to the literature by showing that IIO continues to serve as a credible signal of firm quality, even when integrated with newer ESG dimensions such as sustainable information security disclosure. In addition, the interaction between SISDM and IIO (SISDM*IIO) has a nearly significant impact on Tobin's Q ($p = 0.088$), indicating that information security disclosure and institutional investor behavior may play a specific role in market value assessment. This study indicates that institutional investors may play a catalytic role in strengthening the valuation relevance of information security disclosure. This finding provides new insights into how investor behavior and ESG disclosure dimensions jointly influence market perceptions, contributing to the literature on stakeholder engagement and sustainable corporate governance.

In sum, one possible explanation for the lack of a strong direct effect lies in the contextual environment of Taiwan's capital market. Information security disclosure is still a relatively new issue, and compared with more mature markets, investors in Taiwan may not yet systematically incorporate such disclosure into their firm valuation process. As a result, disclosure alone may not generate a significant impact on market value. Furthermore, from a theoretical perspective, although information security disclosure is categorized under the ESG, current disclosure practices may be more compliance-driven signals by the market.

Table 3: Results of Regression Analysis

Variable	Coefficient	t value	p-value
(Constant)	3.617	11.249	0.000
SISDM	-0.197	-1.344	0.180
IIO	0.834	4.583	0.000
SISDM*IIO	0.441	1.711	0.088
AGE	-0.006	-3.765	0.000
LNTA	-0.150	-7.010	0.000
DEBT	-0.616	-3.770	0.000
ROA	0.022	6.473	0.000
GROWTH	-0.001	-0.629	0.529

5. Conclusion

This study finds that institutional investor ownership has a key impact on market value and supports the effectiveness of institutional investor oversight mechanisms. In addition, although information security disclosure itself has no direct impact, the interaction with the shareholding ratio of institutional investors may play a specific role, indicating that the market is still in the development stage of evaluating the value of information disclosure and future research can further explore the moderating effect of different industrial characteristics or market environment on this relationship.

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