

## TECHNOLOGY AND ARTIFICIAL INTELLIGENCE'S IMPACT ON ESG REPORTING QUALITY

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### ABSTRACT

*When it comes to communicating a company's performance in terms of sustainability, ESG reporting, which is an acronym that stands for environmental, social, and governance reporting, is a key component. On the other hand, there are still issues with standards, data quality, and consistency requirements. The purpose of this study is to investigate the ways in which digital technology and artificial intelligence (AI) have the potential to enhance environmental, social, and governance (ESG) reporting by resolving these issues. For the purpose of streamlining data collecting, improving quality, and simplifying communication, digital technology and artificial intelligence employ a broad variety of complex approaches. Some examples of these methods include blockchain technology, data analytics, machine learning, and natural language processing. Using regression analysis and data collected from A-share listed companies between the years 2012 and 2021, this study investigates the relationship between digital transformation and the environmental, social, and governance (ESG) performance of businesses. The study has an emphasis on the repercussions that are associated with artificial intelligence, digital technology, and ESG reporting (environmental, social, and governance). A number of different aspects, including corporate governance, risk assessment, shareholder value, and corporate responsibility, are all affected by these ramifications. For any business that aspires to grow, develop, become more efficient, and maintain a competitive advantage over its rivals, digital technology and artificial intelligence are indispensable tools. The reporting of environmental, social, and governance (ESG) issues contributes to the advancement of sustainable development and has a beneficial impact on the risk profile, reputation, performance, and total value of entities. As a result of a comprehensive study, methodological inquiry, and analysis, this research provides useful insights and ideas for enhancing environmental, social, and governance (ESG) reporting via the use of digital technology and artificial intelligence. It is discovered that the application of digital technology and artificial intelligence results in ESG reporting that is more comprehensive and has a better degree of confidence.*

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**Keywords:** ESG, AI Reporting, Digital Technology, Blockchain Technology, Machine Learning.

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### Introduction

Sustainability reporting, also known as environmental, social, and governance (ESG) reporting, is a kind of corporate disclosure that aims to provide stakeholders with information on the performance and impact of a firm in terms of sustainability. The environmental, social, and ethical elements of a company's activities are represented in ESG reports, which touch on a wide range of topics such as diversity, climate change, human rights, ethics, and governance. ESG reports are a reflection of the business's operations. The practice of ESG reporting has transitioned from being optional and qualitative to becoming required and quantitative as a result of the growing attention that is being paid to environmental, social, and governance (ESG) issues on a global scale, as well as the requirement for reliable and comparable ESG data. In 2022, 92% of the world's largest corporations submitted environmental, social, and governance (ESG) reports, which is an increase from 72% in 2011. This is

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according to a survey conducted by KPMG. In addition, Deloitte discovered that environmental, social, and governance (ESG) data has the potential to impact the behaviors of a wide variety of other stakeholders, including as shareholders, customers, workers, government officials, and the general public.[1]

Nevertheless, there are a great deal of challenges to be conquered in the realm of environmental, social, and governance (ESG) reporting. These challenges include the fact that ESG information is not standardized, consistent, or validated, and that the process of collecting, processing, and evaluating ESG data is both difficult and costly. According to the many ESG reporting frameworks and standards that have developed throughout time, there is a lack of coherence and alignment among them. This lack of cohesion and alignment leads both ESG reporters and consumers to be confused and inconsistent. In addition, it is difficult to collect, assess, and authenticate environmental, social, and governance (ESG) data since information is often scattered across a wide variety of sources, formats, and languages. The legitimacy and validity of environmental, social, and governance (ESG) reports are further undermined by the fact that ESG data often lacks essential information, is incorrect, or is out of date.

This project aims to assess whether or if digital technology and artificial intelligence (AI) have the potential to enhance environmental, social, and governance (ESG) reporting by making ESG data more accessible, accurate, and efficient to maintain and analyze. Additionally, the research will investigate how these technologies could accomplish this improvement. Artificial intelligence (AI) and digital technology make use of sophisticated instruments and techniques such as data analytics, cloud computing, blockchain, natural language processing, and machine learning in order to collect, process, analyze, and communicate environmental, social, and governance (ESG) data. By enhancing the quality and dependability of environmental, social, and governance (ESG) data, automating and simplifying its collection and processing, providing insights and recommendations based on ESG data, and making it simpler to disclose and communicate ESG data, digital technology and artificial intelligence can assist ESG reporters and users in overcoming the challenges that are associated with ESG reporting.[2]

### **Methodology of ESG Scoring**

Keeping score ESG scoring is a method that analyzes and contrasts the environmental, social, and governance (ESG) performance and effects of various companies by using measures such as environmental impact, social impact, governance quality, and sustainability plan measurements. Obtaining an ESG score is essential in order for investors, customers, workers, and other interested parties to assess the environmental, social, and governance (ESG) performance and consequences of a firm. Companies are also able to evaluate their environmental, social, and governance (ESG) performance and effects in comparison to those of their rivals.[3] One of the many challenges that ESG scoring must surmount is the fact that it is vulnerable to subjectivity and bias on the part of those who score it. The lack of consistent and defined frameworks, procedures, and indicators is another problem that has to be addressed. This section will thus focus on the ESG grading system and the ways in which digital technologies like as artificial intelligence have the potential to improve it.

### **Objectives**

- To study technology and artificial intelligence's
- To study impact on ESG reporting quality

### **Research Methodology**

The following hypothesis is proposed according on the findings of the theoretical study presented in this paper:

### **Data Collection**

This study uses a sample of data from A-share listed organizations from 2012 to 2021 in order to investigate the relationship between digital transformation and the environmental, social, and governance (ESG) performance of corporations.[4] When it comes to the company's environmental, social, and governance (ESG) performance statistics, Bloomberg is the source, whereas China Stock Market & Accounting Research is the original data source for everything else.

- During the processing of the data, the following criteria are utilized:
- Businesses operating in the financial industry are not included in this list.
- A company is not considered included if it does not have key variable data.
- In order to eliminate any statistically significant outliers, the Winsorize procedure is applied to all continuous variables.

- Businesses that do not publish environmental, social, and governance facts are not included.
- Over the course of the years 2012 through 2021, a total of 1463 sample observations are gathered for the purpose of this article.[5]

### **Variable Definition and Pre-processing**

This research investigates the connection between environmental, social, and governance (ESG) performance and the results of corporations. When evaluating environmental, social, and governance (ESG) performance, academic institutions all over the globe often use either self-constructed multi-dimensional indicator systems or scoring systems developed by third-party agencies.[6] In order to make the situation more impartial, this research makes use of the environmental, social, and governance (ESG) performance ratings of publicly traded companies that are in the Bloomberg database. These ratings are collected from sources that are free to the public, such as websites of corporations, annual reports, and corporate social responsibility reports.[7] When making their decision, they take into account the three interconnected parts of governance, which are society, the environment, and the environment. Depending on the circumstances, scores might range anywhere from 0.1 to 100, with higher values indicating a greater degree of fulfillment of commitments. The letter 'E' represents environmental responsibility, the letter 'S' represents social responsibility, and the letter 'G' represents corporate governance; these three components assist businesses in accomplishing their ESG objectives.[8]

### **Explanatory variable: Enterprises' Use of AI Technology and Digitalization**

The study assesses how well firms are performing in these areas by using agency ratings from the Bloomberg database. These ratings examine the three components of ESG (environmental), S (social), and G (governance), and they rate how well corporations are doing in each of these categories.[9] There is a range of values from 0.1 to 100, and a greater score reflects a higher degree of responsibility fulfillment. The study also employs text mining methods on data that is accessible to the public in order to investigate the extent to which firms make use of artificial intelligence and digitalization. It is possible for us to determine the extent to which artificial intelligence and digitalization are prevalent by extracting a collection of keywords from annual reports that are related to these technologies and their digital transformation.[10] A logarithmic adjustment is applied to the frequency counts, and an additional one is added to them in order to ensure that the analysis is accurate.

### **Data Source Justification**

Because of China Stock Market & Accounting Research (CSMAR) thorough collecting technique, the data sources for AI technology and digitalization measures obtained from the CSMAR database are very credible. By employing sophisticated web scraping methods, CSMAR is able to extract data from annual reports of A-share listed businesses, with a particular emphasis on topics pertaining to artificial intelligence and digitization. This technique allows for a detailed knowledge of how these technologies are being debated and prioritized inside business strategy, in addition to covering a large range of firms. A valid and meaningful proxy for analyzing the influence of AI and digitalization on ESG performance may be found in the dependence on actual word use in company disclosures. This gives a concrete indication of corporate commitment and attention on these technologies.

### **Modeling Strategy**

An explanation of the reasoning for the use of the multiple linear regression model in this work is provided below. To begin, the linear model is compatible with its assumptions since the environmental, social, and governance (ESG) variable that is being studied is a continuous variable. Both digitalization and artificial intelligence are continuous variables, which means that they can be easily integrated into regression models. This brings us to the second argument. In conclusion, the linear model is able to properly test the hypothesis presented in the research since it is uncomplicated and simple to comprehend. The following is a list of the considerations that were taken into account while deciding whether to include or exclude certain criteria. The selection of artificial intelligence (AI) and digitalization as explanatory variables was informed by the literature review and research aims of this work. It is predicted that these elements would have a favorable impact on the dependent variable ESG. Second, in order to choose the control variables, we make use of the information that is currently available on the factors that influence the environmental, social, and governance (ESG) performance of corporations. These factors include firm size, profitability, leverage, and growth. Third, if the variance inflation factor (VIF) reveals that the variables are highly multicollinear, then the variables are not taken into consideration any further. Presented here is the precise equation for regression:

In the equation, represents the digitalization level of the i-th enterprise in the t-th year, is the word frequency of AI technology in the enterprise report of the i-th enterprise in the t-th year; represents the ESG performance of the i-th enterprise in the t-th year; represents the firm size of the i-th enterprise in the t-th year; represents the financial leverage level of the i-th enterprise in the t-th year; represents the separation of two positions of the i-th enterprise in the t-th year: represents the intangible asset ratio of the i-th enterprise in the t-th year; represents the enterprise value index of the i-th enterprise in the t-th year; represents the enterprise value index of the i-th enterprise in the t-th year.[11]

**Data Analysis and Testing**

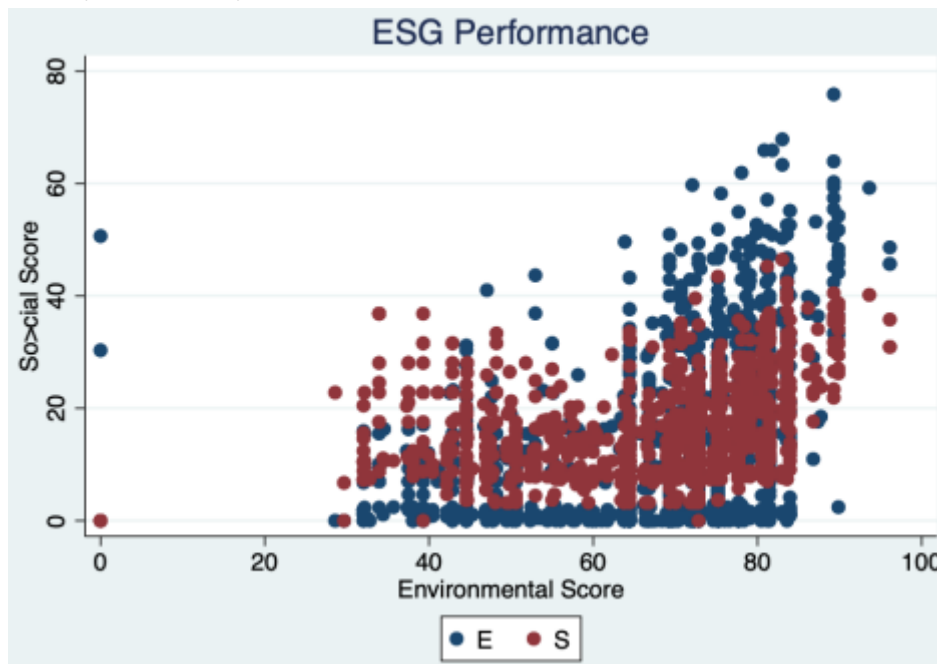
**Data Description**

**Table 1: Summary Statistics**

Var Name	Obs	Mean	SD	Min	Median	Max
ESG	1463	31.3994	9.646	9.09	29.45	68.58
AI	1463	3.9884	18.516	0	0	258
Di	1463	1.8368	1.477	0	1.79	5.99
Size	1463	22.0136	1.554	16.65	21.8	29.41
Lev	1463	1.3879	2.727	-7.65	1.06	63.1
Dual	1463	5.0122	8.196	0	0	41.37
Intangible_Assets	1463	0.0481	0.065	0	0.03	0.65
	1463	2.5789	2.303	0.69	1.8	27.24

The purpose of this part is to investigate the trend of the sample companies' use of digital technology and artificial intelligence. As can be seen in Figure 4, which illustrates the histogram of the word frequency, the enterprise report makes relatively few references to artificial intelligence technology. Only a handful of the companies have a high frequency of references to this technology. 3.9884 as the mean and 3.9884 as the highest possible which is a histogram of the word frequency of digitalization phrases that is shown in the enterprise report, the distribution is more even, despite the fact that it is still skewed to the right. When measured on a scale, the values vary from 5.99 to 1.8368.[12]

The scatter and distribution charts of the major variables are shown below, along with a descriptive analysis of those symbols.



**Figure 1: Distribution of ESG Outcomes**

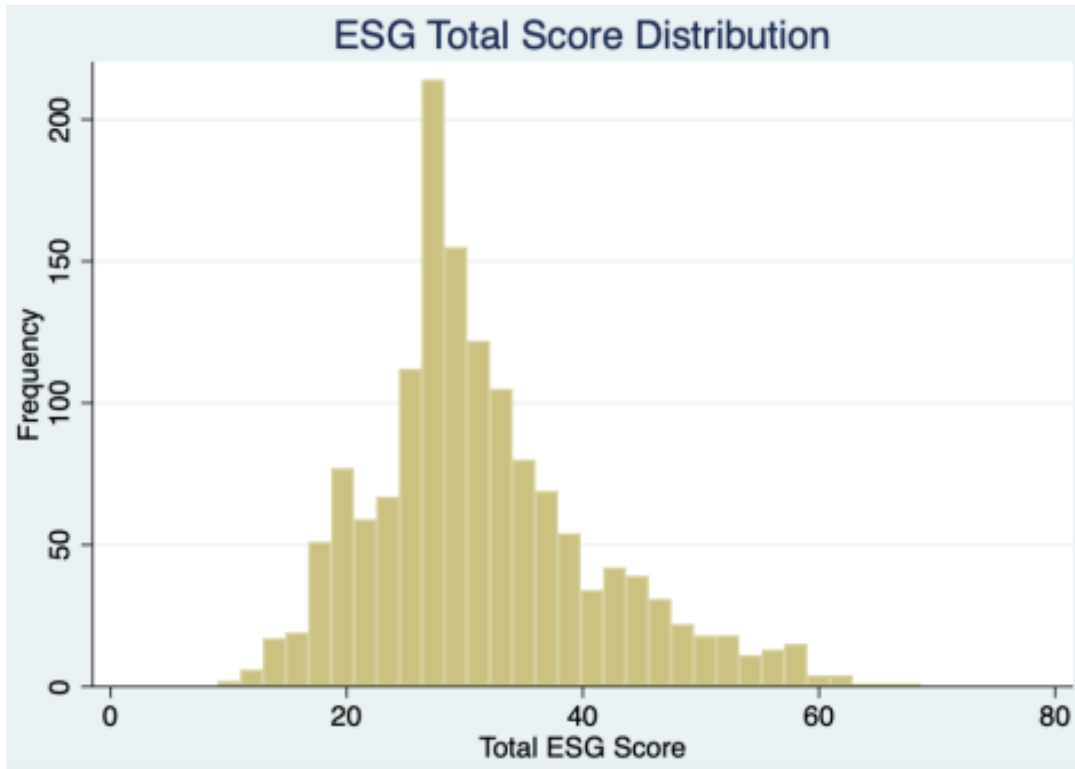


Figure 2: Distribution of ESG Total Score

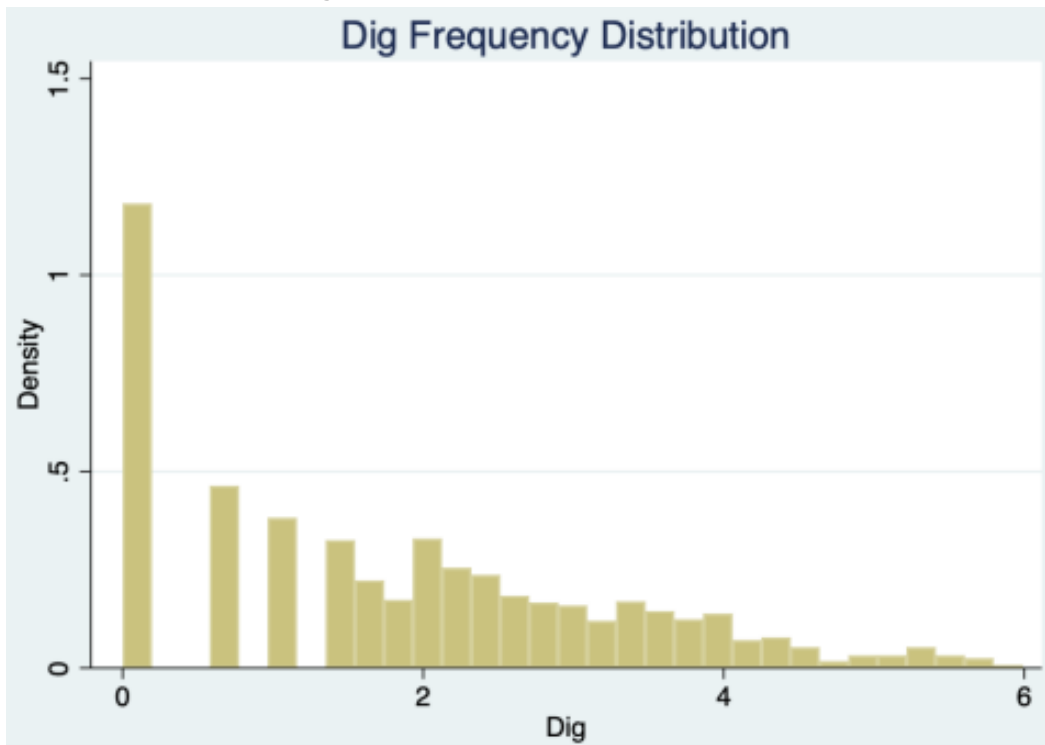
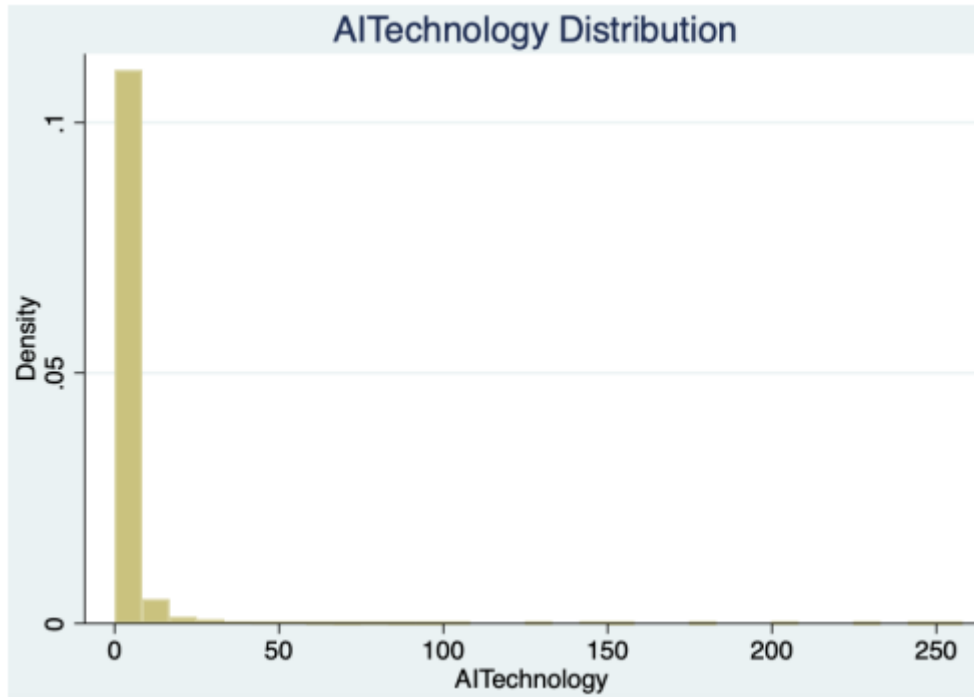


Figure 3: Distribution of Digitalization Word Frequency



**Figure 4: Distribution Word Frequency of AI Technology**

**Validation of Model Assumptions**

Whether the model is normal, heteroscedastic, or multicollinear is something that we investigate. When analyzing the error term, both heteroscedasticity and non-normality of distribution are taken into consideration. For the purpose of addressing these issues, robust standard errors are used. The robustness tests that were carried out in the research using a variety of measures of environmental, social, and governance (ESG) performance and control variables yielded results that were consistent and stable. The validity of the hypothesis is further supported by this new evidence.[13]

**Model Estimation**

Table 2 gives us a breakdown of the key findings that emerged from the model regression, which are shown in the following table. As seen by the revised R-squared value of 0.049, this model is able to properly account for about 4.9% of the variation in the dependent variable ESG. The F-statistic for the model is 9.76, and the p-value is 0.000, which indicates that the model is significant overall.

**Table 2: Regression Results**

Var Name	Coefficient	t-statistic	p-value
AI Technology	1.0411	2.7955	0.005
Dig	1.2358	6.5617	0
Size	0.4742	2.9758	0.003
Lev	-0.1946	-2.1443	0.032
Dual	-0.01	-0.3275	0.743
Intangible Assets	10.9412	2.8448	0.004
Tobin	-0.4999	-4.5622	0
Constant	19.9383	5.6101	0
N	1463		
adj. R <sub>2</sub>	0.049		
F-statistic	9.76		0

Through the use of regression analysis, one is able to get a comprehensive understanding of the many ways in which various factors influence ESG (environmental, social, and governance) performance. Because of the significant levels of the coefficients, we are able to infer the type of the

connections between the variables as well as the size of those correlations. The offered interpretation suggests that the use of AI technology has a statistically significant and detrimental impact on environmental, social, and governance (ESG) performance. It is possible that there are risks and challenges associated with artificial intelligence technology, which might potentially impede environmental, social, and governance (ESG) goals. It is possible that this is due to the fact that artificial intelligence (AI) technology has the potential to significantly increase sustainability; nevertheless, when it is put into reality, it leaves a significant carbon footprint, which in turn creates direct rebound effects.[14]

On the other hand, the positive coefficient that is shown in Table 2 is in direct opposition to this. In order to limit the impact of any unintentional bad results, it may be possible to determine, via an in-depth investigation of the use of AI technology in ESG situations, where it may be employed more effectively. A positive coefficient for digitalization demonstrates that the use of digital technology may improve environmental, social, and governance (ESG) performance.[15] Improved communication leads to a rise in the transparency of information, a reduction in the costs incurred by the agency, and the cultivation of goodwill. As a result of the positive association that exists between size and environmental, social, and governance (ESG) performance, larger organizations may be better equipped to deploy their resources. It is possible that there is a compromise between satisfying financial obligations and making investments in environmental, social, and governance (ESG) issues if the coefficient for leverage is negative. As can be observed from the fact that the coefficient for Dual is not significant, leadership structure seems to have a little influence on environmental, social, and governance performance. With a significant positive correlation between intangible assets and environmental, social, and governance (ESG) performance, innovation and engagement in ESG practices are shown. Given that the coefficient for Tobin's Q is negative, it would seem that higher market values do not always equate to improved environmental, social, and governance performance. The whole investigation demonstrates how many various factors may have an effect on environmental, social, and governance (ESG) performance, as well as how essential it is to have a plan that is well-balanced. Further inquiry into these links is required in order to develop targeted programs for the improvement of environmental, social, and governance (ESG) factors.[16]

## **Results and Discussion**

### **Key Findings**

The purpose of this research was to investigate the impact that digital technologies and artificial intelligence (AI) have on the quality of environmental, social, and governance (ESG) reports. The effectiveness of environmental, social, and governance (ESG) disclosures was assessed based on two distinct criteria: the extent of the disclosures, which was determined by how comprehensive they were, and the level of assurance that was provided. An in-depth analysis of the dataset led to the discovery of a number of significant findings, including the following:

A game-changer that has increased the range of environmental, social, and governance (ESG) reporting is the use of digital technologies and artificial intelligence. We found a substantial correlation between the usage of these technologies by corporations and a larger variety of environmental, social, and governance (ESG) variables that were reported by the companies. According to this relationship, digital technology and artificial intelligence play a significant role in assisting businesses in collecting, analyzing, and sharing a larger variety of environmental, social, and governance (ESG) data in a more logical and effective manner.

Additionally, it was shown that the enhancement of ESG reporting confidence was a positive consequence that was brought about by the use of digital technology and AI. A high association between these technologies and an enhanced likelihood of environmental, social, and governance (ESG) disclosures receiving external confirmation is shown by statistical data, which provides support for the regression model used in this work. This demonstrates that artificial intelligence and digital technology have the potential to significantly simplify audit and validation processes, which in turn increases the validity and credibility of environmental, social, and governance (ESG) reports.

Artificial intelligence (AI) and digital technology have emerged as significant elements that influence the quality of environmental, social, and governance (ESG) reporting. Additionally, additional control variables such as firm size, industry, profitability, leverage, and location have been found to have a significant effect. They achieve this by resonating with and verifying the findings of earlier studies in the subject, which lays the groundwork for future study into the variables that impact the quality of environmental, social, and governance (ESG) disclosure.

## Discussion

On the other hand, the beneficial effects that digital technology and artificial intelligence have had on the integrity of ESG reports.

This study contributes to the ongoing academic discussion about environmental, social, and governance (ESG) reporting and artificial intelligence (AI) by presenting empirical data that demonstrates how AI and digital technologies enhance the dependability of ESG reporting. No concrete data has been supplied in any of the previous studies, despite the fact that there has been significant debate about the possibilities and problems of employing artificial intelligence and digital technologies in environmental, social, and governance reporting. To fill up that information vacuum, this study used a large sample size and two indices of the quality of environmental, social, and governance (ESG) reporting.

Artificial intelligence (AI) and digital technology have enhanced the honesty of environmental, social, and governance (ESG) reports in a number of different domains. To begin, these technologies make it possible for businesses to collect and analyze environmental, social, and governance (ESG) data in a more comprehensive manner, which in turn enhances the dependability and accuracy of their reports. Second, the use of digital technology and artificial intelligence makes it possible to do exhaustive evaluations and studies, which in turn extract valuable environmental, social, and governance (ESG) information and signal dangers that investors should take into consideration when making choices. Also, these technologies improve the depiction of environmental, social, and governance (ESG) performance, which means that reports are simpler to understand and apply. Finally, artificial intelligence and digital technology automate data validation and audit processes, which in turn enhances trust among stakeholders. This boosts credibility and openness, which in turn increases transparency.

Generally speaking, auditors are encouraged to deliver high-quality environmental, social, and governance (ESG) assurance services by using digital technology and artificial intelligence. This is a positive development for both the businesses that issue ESG reports and the auditors themselves.

Artificial intelligence (AI) and digital technology's limitations in impacting the quality of ESG reports.

By using artificial intelligence and digital technology as explanatory variables, this study contributes to the current literature on factors impacting the quality of ESG disclosure. While several factors have been recognized as influencing the quality of ESG reports, the influence of AI and other digital technologies has so far been ignored. The study offers a new viewpoint by demonstrating how artificial intelligence and digital technologies are driving ESG disclosure quality.

In conclusion, companies may successfully traverse responsibility and sustainability by using digital technology and artificial intelligence into ESG reporting. Organizations may improve their data collecting, analysis, risk assessment, and reporting skills in ESG reporting by using these technologies. In light of the ever-increasing need for sustainability investments, this allows them to satisfy the rising standards of ethics and environmental responsibility among their clientele, workers, and investors.

## Conclusion

The purpose of this study is to investigate the impact that various forms of digital technology and artificial intelligence (AI) have had on the quality of environmental, social, and governance (ESG) reporting across a variety of enterprises and industries. The study makes a substantial contribution to the current body of knowledge by providing evidence that digital technology and artificial intelligence have the potential to enhance the level of detail and accuracy achieved by ESG disclosures. As a result of these technological improvements, companies have found it simpler to collect and exchange precise environmental, social, and governance (ESG) data, which has led to an increase in the dependability of that data. A new variable, artificial intelligence and digital technology, is added to the current body of literature on the factors that influence the quality of environmental, social, and governance (ESG) disclosures as a result of this study. Blockchain technology improves the credibility of both the data gathering process and the sharing of information. One other advantage of digital technology is that it may help identify and address environmental, social, and governance (ESG) concerns immediately. However, it is important to highlight that the study does have some limitations, such as the fact that it relied on secondary data. Additionally, it is recommended that other aspects that influence the connection between ESG reporting quality and artificial intelligence and digital technologies be examined further. Taking the entire thing into consideration, the research calls for more research into the complex interaction that exists between technology and corporate reporting, as well as draws attention to the revolutionary potential that artificial intelligence and digital technology provide in environmental, social, and governance (ESG) reporting.



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