
| RESEARCH ARTICLE

Digitalisation and Its Impact on Corporate ESG Performance in Middle East Countries

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| ABSTRACT

Digitalisation, ESG (environment, social, and governance) practices have gained importance in recent years. Firms have to mandatorily implement initiatives for ESG. This paper examines digitalisation and corporate ESG performance in Middle East Countries. Digitalisation is about using digital and online methods to frame ESG metrics performance; provide information about ESG to regulatory authorities, and investors, and to track the corporate performance. Since ESG has three dimensions environment, social, and governance. This paper examines the impact of these three dimensions collectively and individually on firm performance, and attitude of investors and firm owners. Three hypothesis were drawn and tested. A panel data of 439 firms from fifteen Middle East countries was drawn and observations were made for 12 variables for the years 2013- 2023. Twelve value relevance models were created, tested, and the data was subjected to regression analysis using SPSS. The findings indicate that except for environment dimension, the other two dimensions give relevant information that digitalisation helps investors to take investment decisions, thereby impacting the firm market value significantly and positively. Digitalisation has a positive and significant relation with ESG performance.

| KEYWORDS

ESG performance, ESG dimensions, digitalisation, value relevance, firm value, Middle East firms.

| ARTICLE INFORMATION

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1. Introduction

The advent of digital technology and the rise of the digital economy have reshaped conventional industries. Innovative production and operational approaches characterised by digital transformation are quickly gaining traction amongst businesses. For companies, digital transformation plays a critical role in driving better ESG performance internally. It is crucial for businesses to embrace digital transformation in order to pioneer new production models, foster fresh productivity, and create new economic structures. By widely implementing digital technologies, companies can achieve data-driven and intelligent management of production whilst improving their internal oversight (Liu et al., 2023).

Organisations encounter significant challenges when trying to enhance their ESG practices, including insufficient external incentives and a lack of internal motivation to improve as well as limited capacity to implement ESG initiatives. On one hand, corporate environmental and social responsibilities often clash with the conventional objective of maximising profits, and the effort to enhance ESG performance frequently incurs substantial costs, which greatly diminishes companies' intrinsic motivation; on the other hand, there is a prevalent asymmetry of information between investors and companies, particularly regarding inadequate disclosure of financial and ESG data, making it difficult for regulatory bodies to access ESG information, thus hindering the development of ESG practices in the Middle East. Additionally, a general imbalance of information exists between investors and companies, especially due to the insufficient disclosure of financial and ESG information by companies, whilst regulators struggle to obtain ESG data from these firms, which further obstructs the advancement of ESG in the region (Nasis et al., 2024).

ESG (environment, social, and governance) are metrics used to evaluate a firm's commitment for social responsibility, sustainability of the environment, and practices used for governance (Al-Hiyari and Kolsi, 2024). Three practices and their interrelations will be discussed in this paper. These are ESG, digitalisation, and the effect on corporate performance of Middle East firms.

Elidrisy (2024) explains that ESG has gained importance since it helps them to manage risks and their performance of operations. Certain sectors such as oil and gas, coal and mining that are often criticised for harming the environment can use ESG metrics to evaluate their carbon footprint and sustainability. ESG is slightly different from Triple Bottom Line that is broader in scope and examines the impact of operations on people, planets and profits. ESG focuses on defined metrics related to the corporate practices on governance, environment, and social equity measures.

El Khoury et al. (2023) argue that for profit firms operate with the objective of increasing revenue, profits, reduce losses and expenses. With the rise in ESG awareness, the impact of investment in these practices on corporate performance has become an issue of increased concern. The growth of the nation, stakeholders, and market depends on the profits of a firm. Higher the profits, more is the money shared with employees, shareholders, increase in tax revenues, and so on. Digitalisation is about using data for governance to increase energy optimisation, increase transparency of supply chains, optimise logistics, use advanced analytics for risk management, transparent reporting, and enhancing cyber security.

2. Literature Review and Hypothesis

Digital technology plays a crucial role in the processes of development and management, offering technical assistance for companies to enhance their ESG practices. During digital transformation, businesses employ digital technology throughout the entirety of production, operations, and management, increasing efficiency and improving the quality of their products and services, thereby fostering a significant shift in their developmental approach (Cambrea et al., 2023).

This approach effectively captures, identifies, and analyses stakeholders' value demands, offering a range of solutions, which significantly aids in the optimisation and enhancement of corporate governance structures and improves the efficacy of organisational management practices. Conversely, within the framework of a digital community and sharing of information, companies have intensified their engagement with stakeholders, necessitating a more holistic and systematic incorporation of the "co-creation" concept into their operational and management strategies, whilst proactively committing to environmental and social responsibilities to provide stakeholders with not only economic advantages but also enhanced environmental governance and social responsibility, along with other comprehensive values (Alkaraan et al., 2022).

The following hypotheses is drawn:

H1. Corporate digital transformation can effectively improve corporate ESG performance.

The ongoing advancement of big data and cloud computing offers significant technological and scientific support to decrease information asymmetry and ease financing challenges, fostering better information exchange amongst enterprises which enhances information sharing and transparency, reduces information asymmetry, and thereby alleviates financing constraints. Addressing financing limitations for enterprises can facilitate quicker access to affordable funds, thereby encouraging green innovation, enhancing environmental performance, and ultimately improving both ecological and economic outcomes (Luo et al., 2023).

Li et al. (2023) further indicated that the digital transformation process can help alleviate financing constraints faced by small and medium-sized enterprises (SMEs), encouraging green transformation and enhancing investment in eco-friendly projects. Li et al. (2023) also highlighted that digital transformation can ease the financial barriers for SMEs, enabling them to pursue green initiatives and augment their capacity for funding green projects, which further enhances their ESG performance. Beyond contributing positively to corporate environmental responsibilities, alleviating financing constraints can also enhance the quality of internal controls within corporations, bolster their ability to meet social responsibilities, and increase external investors' trust in these companies. In summary, when corporate financing constraints are reduced, the available funds for enterprises grow, which can facilitate a reduction in carbon emissions, boost green performance, enable charitable donations to enhance corporate reputation, fulfil social obligations, improve internal control systems, and strengthen corporate governance, ultimately leading to enhanced corporate ESG performance (Cheng et al., 2023).

The following hypotheses:

H2. Corporate digital transformation can alleviate corporate financing constraints, thus contributing to corporate ESG performance.

Concerns raised by analysts are crucial for both companies and market investors. To begin with, analysts possess a higher level of professionalism and better skills in gathering and analysing information compared to regular investors. Acting as significant information intermediaries in the financial market, they can supply sufficient information to the market (Khan et al., 2022). Consequently, heightened attention from analysts can not only lessen information asymmetry but also effectively influence corporate information processing, serve as a form of external oversight, encourage businesses to take on social responsibility, enhance corporate reputation, and motivate companies to mitigate negative behaviours from stakeholders. This external oversight pressure will further decrease agency costs, uplift the standards of internal control, and strengthen corporate governance (Hao et al., 2023).

The following hypotheses:

H3. Enterprise digital transformation can increase analysts' attention, which will have a contributing effect on enterprise ESG performance.

Elamer and Boulhaga (2024) explain that since the past few years, Environment, social and governance performance has gained importance in the media. Stockholders, the public, investors now show strong expectation from firms to act in environmentally and socially responsible ways. Influence of external entities forces firms to take up ESG initiatives at some cost. Firms operate in competitive markets, rigid regulatory scrutiny. Whilst ESG initiatives are good, the influence they have on the market performance is important. Dedyansyah and Ulfa (2023) explain that investors and stockholders gain information on non-financial resources are sustainability reports. However, accounting numbers and analysis is not sufficient to understand the market value. The effect of non-financial information on evaluating the firm value has gained importance.

Therefore, it is essential to research the relevance and importance of ESG performance and if it is value relevant, useful for shareholders in the investment decisions. Research by other scholars is not clear and conclusive. A review of the research indicates that studies show a significant and positive impact of ESG performance on the value of a firm in the market (El-Diftar and Elkalla, 2019; El Khoury et al., 2023; Haniffa and Hudaib, 2021). Verbeeten et al. (2016) on the other hand reports a negative relation for firm value and ESG performance. Hassan et al. (2009) report that no significant link between the two variables was observed. Therefore, the market value of a firm, investment decision based on ESG initiative, and the firm performance are not clear and not answered empirically. This research aims to fill this gap.

Kao (2023) explains that ESG is built on three pillars and these are environment, social, and governance. Environmental dimension is about the actions taken by a firm to reduce energy use, waste, reduce use of resources such as water, cause less pollution and ensure that greenhouse gas emissions is reduced to allowed values. However, certain industries are energy intensive and waste generation, pollution cannot be avoided. In such cases, the firm needs to move to cleaner fuel, reduce material, water, chemical use, and manage waste disposal. These initiatives need investment and firms are reluctant to invest if the initiatives do not bring profits. They are also reluctant to invest unless firm performance improves, stock market is positive and, the market performance increases.

According to Landau et al. (2020), social dimension has become important for workers, stakeholders, and the management. Terms such as social justice, fairness in wages, work allocation, opportunities are important. Inclusivity becomes critical and people from all ethnic groups should be given access to work. Unions demand and can get new contracts, and firms want to keep their staff happy so that they work and produce more. Investors are motivated to trade in stock when they know that a firm treats staff well, since strikes and disputes are reduced, and quality output is consistent. Miralles-Quirós et al. (2020) explain the importance of governance. The dimension covers transparency, no corruption, and ethics, following regulations, and complying with the law. Investors trust firms that have good governance practices, and the market value would appreciate.

Several studies that support and some that do not agree to the positive relation between firm value and ESG performance are available. A study by Verbeeten et al. (2016) evaluates the CSR notifications and value relevance in 140 German firms in a study run for four years. The study indicates positive links between ESG disclosures and the interest shown by stock buyers. In another study of a large sample of UK organisations from 2004 to 2013, Li et al. (2018) examined is ESG activities impact the value of the firm. They report that investors are attracted to stocks that reveal their investments and activities in ESG, and this was seen in longer financial performance. Moneva and Cuellar (2009) studied Spanish stocks and their findings show that stock returns and trade improved when ESG disclosures were made. Lee et al. (2020) in their study of Taiwan firms concluded that the value of the firm is increased when stockholders and market participants review the ESG reports.

Mooneeapen et al. (2022) speak about socio-political theories and the negative impact on stock prices when ESG is implemented. Legitimacy theory suggests that firms invest in ESP to meet society expectation. Stakeholder theory explains that managers take up ESG to gain approval of stockholders and regulators. However, manipulation and false reporting, exaggerating certain initiatives are seen.

2.1 Gaps in the literature

Some gaps are evident in the literature. It is not clear if digitalisation improves corporate ESG performance. ESG practices in the Middle East firms and the nature of impact on firm performance is not clear. ESG has three main dimensions and several components. It is not clear if all these dimensions have an equal impact, if some have more, less, negative or no impact. These gaps will be addressed in this research.

3. Research Methods

The methods recommended and used by some researchers (Nirino et al., 2021; Elamer and Boulhaga, 2024; Kao, 2024) are used in this paper. Details of the samples and model applied are described in this section. SPSS was used to run the regression and other analysis tests.

3.1 Research sample

For this study, private and public sectors firms listed on the Saudi Arabia Stock Exchange or Tadāwul and Abu Dhabi Securities Exchange were the focus. Firms with headquarters in Middle East nations were selected. Data for these firms during 2013- 2023 were extracted. Source of data was taken from data sources such as LSEG formerly Refinitiv Datastream, Thomson Reuters Eikon database, and country specific data World Bank. It was seen that for some firms, SEG daJta and control variables were not available. One of the reasons is that during the initial years, ESG information was not available.

Some firms from the financial sector were not considered since the working capital structure, regulatory authorities were different (Jena et al., 2023). After elimination, a final list of 439 firms was considered as the sample composition, as per the Global Industry Classification Standard (GICS). Table 3.1 gives the sectors of the sample firms, and the number of observations for each.

Table 3-1: Sample composition of sectors and number of observations

Country	No. of Obs	Percentage
Panel A: No. of Obs for sector		
Communication services	90	20.50
Consumer discretionary	36	8.20
Consumer staples	32	7.29
Energy	23	5.24
Health care	9	2.05
Industrials	79	18.00
Information technology	6	1.37
Materials	78	17.77
Real estate	67	15.26
Utilities	19	4.33
	439	100.00

From the table, it is seen that the maximum observations are from communication services whilst industrials sector is 79. Table 3.2 gives the number of firms from each country.

Table 3-2: Number of Observations for each Country

Country	No. of Obs	Percentage
Panel B: Readings per country		
Bahrain	14	3.19
Kuwait	47	10.71
Qatar	41	9.34
Saudi Arabia	52	11.85
Turkey	43	9.79
UAE	43	9.79
Israel	59	13.44
Egypt	32	7.29
Morocco	14	3.19
Jordan	18	4.10
Cyprus	23	5.24
Oman	26	5.92
Lebanon	8	1.82
Iraq	11	2.51
Iran	8	1.82
	439	100.00

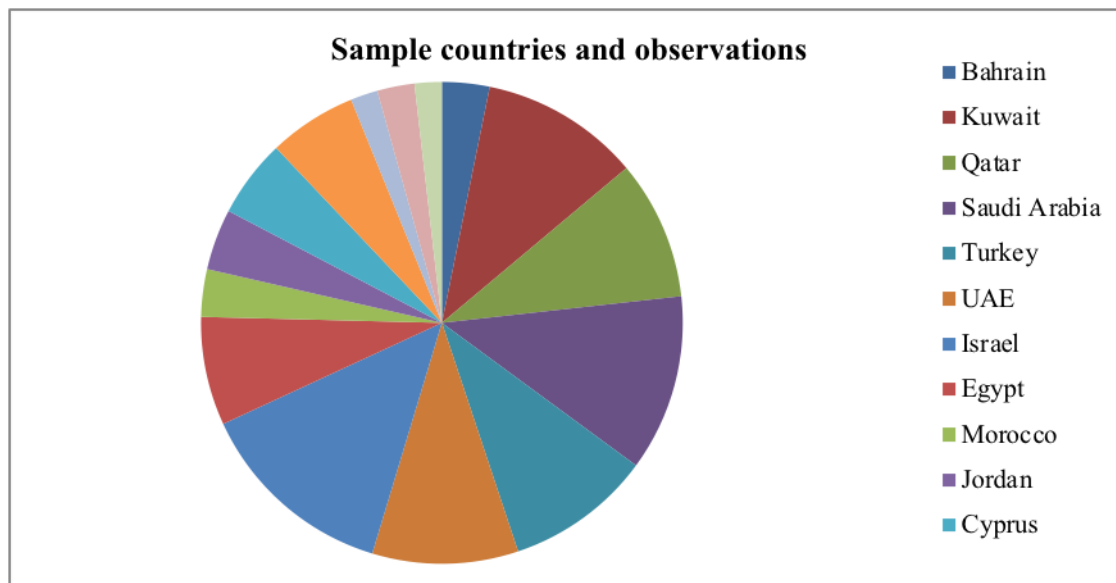


Figure 3-1: Sample countries and observations

3.2 Variables

Dependent variable: Corporate ESG performance (ESG): This paper selects the ESG rating results of listed companies to measure the overall performance of corporate ESG. The CSI ESG index rating system consists of three first-level indicators of environment, society, and governance and three levels of underlying data indicators under the framework, which systematically evaluates the ESG level of all A-share listed companies in the selected nations. Nine grades of ratings ranging from "AAA"- "C" to "C" from good to bad. The nine grades of "AAA"- "C" are assigned from best to worst.

Independent variables: Digital Transformation (Digital) : The text analysis method is used to measure the digital transformation, and based on the previous practice, a word bank related to the digital transformation of enterprises is established, and the standard terms include Big Data, Cloud Computing, Internet of Things, E-commerce, and Artificial Intelligence. The digital

transformation index is constructed to measure enterprises' digital transformation degree. We download the annual reports of the sample companies from the Wind database, add up the total number of word frequencies in the reports based on the mapping, and then construct a digital transformation indicator to measure the degree of digital transformation of the enterprises, which is measured by the proportion of the total number of word frequencies to all sentences in the "Management Discussion and Analysis" section.

Control variables: To control for the effects of other factors, this paper controls for the following variables: nature of property rights (Soe), sales growth rate (Growth), profitability (Roa), gearing ratio (Lev), operating cash flow (OCF), firm years of age (Age), firm size (Size), and two-employment (Plu), and controls for the year effect (Year) and the industry effect (Ind).

Table 3.3 provides a summary of the variables that underpinned the study.

Table 3: Definition and measurement of variables

Variable type	Variable name	Variable symbol	Definition
Dependent	Corporate Performance	ESG	ESG
			Nine ratings from "AAA" to "C", assigned from 1 to 9 in descending order.
Independent variable	Digital Transformation	Digital	Constructing metrics based on text analysis and word frequency statistics
Control variable	Nature of property rights	Soe	State-owned enterprises take the value of 1, otherwise 0
	Sales growth rate	Growth	(Sales revenue for the period - sales revenue for the period)/Total assets of the enterprise
	Profitability	Roa	Total Assets Net Margin = Net Profit/Average Total Assets
	Gearing	Lev	Total liabilities/total assets
	Operating cash flow	OCF	Operating cash flow = net cash flow from operating activities/total assets
	Years in business	Age	The number of years the listed company has been listed, calculated as $\ln(1 + \text{the number of years the company has been listed})$
	Enterprise size	Size	Natural logarithm of total assets of listed companies at the end of the year
	Two jobs in one	Plu	If the chairman and general manager are the same person, take 1, otherwise 0.

3.3 Model Used

Two sets of models are designed. One for the digitalisation measurement, and other for ESG and corporate performance.

3.3.1 Digitalisation Models

To examine the impact of enterprise digital transformation on enterprise performance, the following regression model is constructed:

$$ESG_{i,t} = \alpha_0 + \alpha_1 Digital_{i,t} + \beta Control_{i,t} + \sum Ind + \sum Year + \epsilon_{i,t} \text{ ---- 1}$$

3.3.2 ESG Models

Dedyansyah and Ulfa (2023) recommend the value-relevance research model. This model is suited for research of financial and non-financial data for equity valuation. The model helps to understand the relevance of information to the stock price returns. When the information has an association that is predicted to have association with the equity value, then the value is relevant. Almagtome and Abbas (2020) explain that the intent of value relevance model is to increase the understanding of the stakeholder about the reliability and relevance of disclosure methods, alternative accounting as seen in equity values.

Ertuğrul (2020) have examined the value relevance of financial reports such as income statement and balance sheet variables. The author used price based valuation that considers the market value of an organisation as a function of the net income, BVE (book value equity), and non-financial information. The model uses the model of residual income valuation suggested by Ohlson (1995). The Ohlson model is:

$$P_{it} = 20 + 21 BVE_{it} + 22 EPS_{it} + \epsilon \text{ ----- (2)}$$

Where:

P_{it} = the is natural log of stock rate/ share, 90 days after balance sheet in the year t

BVE_{it} = the equity/ share of the book value of firm i after the year end t

EPS_{it} = Net income obtained for each share of i at year end t

ϵ = Error value

Barth and Clinch (2009) recommend using the method of scaling all independent variable for the outstanding common stock 90 days after the balance sheet release. This method can solve the problems of heteroscedasticity, and scale effect. As per the work of Al-Dhamari and Chandren (2018), effects of co-related but omitted variable bias are controlled by using explanatory variables that can possibly impact stock prices. Lin et al. (2009) showed the accounts of Big 4 firms have greater value relevant financial measures to shareholders when compared to that of smaller firms. Therefore an indicator variable called BIG4 is used to control the quality of audit.

As per Hayn (1995) temporary losses that are considered by shareholders have less information than profits. This process happens since shareholders can sell off the stock when the losses are expected to further increase. When a firm is facing losses, stockholders give importance to the balance sheet than the statement of income information. Therefore, a dichotomous variable called LOSS is used. This is 1 when the firm has faced losses in the year t, else it is 0.

Pittman and Zhao (2020) explain that firms that have a ratio of high debt to asset would show more inclination to misstate revenue. They may do this to manage the risk that can occur when the debt covenants are breached. Chamberlain and Sarkar (2024) argue that firms with high debt would face increased scrutiny from lenders. These firms provide more value relevant data. It is possible that the ratio of total liabilities to total assets or debt to asset ratio is included in the regression models. Tobibah and Firmansyah (2024) insist that size of the firm is considered in the model since it would be logical to expect that bigger firms would have more data since higher regulatory scrutiny is given to these firms. The firm size is therefore important to estimate the stock returns. The firm size is measured as a natural logarithm of the total assets.

As per the research of Sarhan et al. (2019), country level control variables are used in the regression model. They can impact the utility of corporate disclosures and reports. The Worldwide Governance Indicators (WGI) provided by the World Bank is used to run the quality of governance at the country level. WGI examines six governance quality dimensions and these are control of corruption, rule of law, government effectiveness, regulatory quality, voice and accountability, and political stability. To overcome possible co linearity of individual dimensions, these are integrated into a composite score of the quality of governance called NIQ.

The Ohlson (1995) model will have the control variables discussed in (1) as:

$$P_{it} = 20 + 21 BVE_{it} + 22 EPS_{it} + \sum \beta_3 CONTROLS + \epsilon_{it} \text{ ---- Model 1}$$

To examine the ESG performance value relevance score to the equity valuation of Middle East capital markets, Model 2 is used.

$$P_{it} = 20 + 21 BVE_{it} + 22 EPS_{it} + 22 ESG_{it} + \sum \beta_4 CONTROLS + \epsilon_{it} \text{ ---- Model 2}$$

If the 23 values are positive and significant, then the ESG performance scores have a value relevant data to valuation of equity in the capital markets. To refine the value relevance of ESG performance, the subcategories of ESG information is studied. The following three models are developed.

$$Pit = 20 + 21 BVEit + 22EPSit + 22ENVit + \sum B4 CONTROLS + \epsilon it \text{ ---- Model 3}$$

$$Pit = 20 + 21 BVEit + 22EPSit + 22SOCit + \sum B4 CONTROLS + \epsilon it \text{ ---- Model 4}$$

$$Pit = 20 + 21 BVEit + 22EPSit + 22GOVit + \sum B4 CONTROLS + \epsilon it \text{ ---- Model 5}$$

Where:

ENVit it is the environment dimension score at year end t

SOCit is the social dimension score at year end t

GOVit is the governance dimension score at year end t

The primary coefficients of interest are the environment dimension (23), social pillar B3, and governance pillar (23). The negative or positive estimates are as per the concept that shareholders consider ESG pillars as important factors when examining the market value.

4. Results

The data obtained was cleaned and regression tests were run. This section presents results from the tests.

4.1 Results for digitalisation impact tests

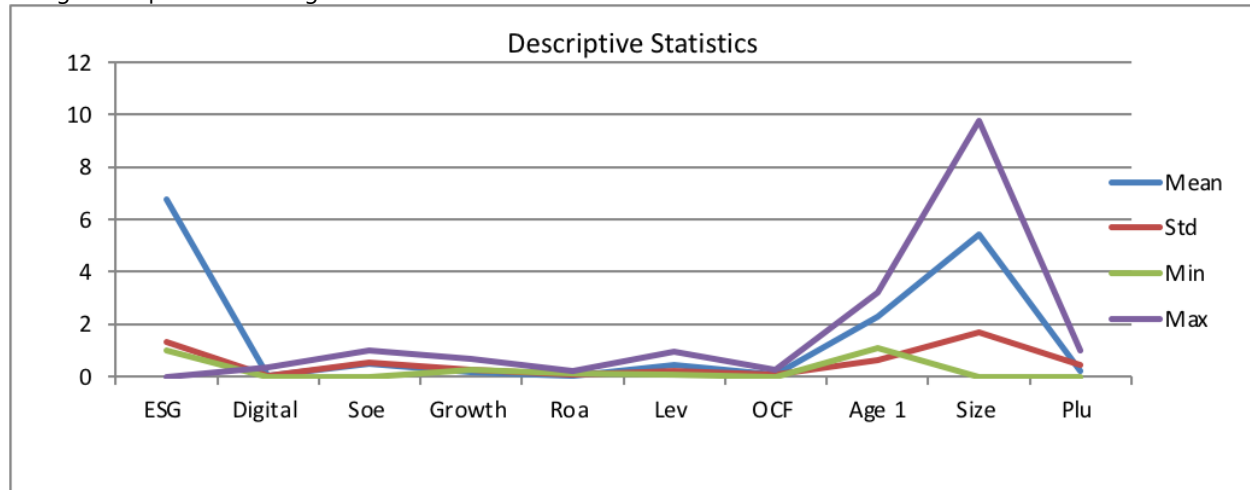
4.1.1 Descriptive statistics

Table 4.1 presents the analysis of the descriptive statistics. The ESG values range from a minimum of 1 to a maximum of 9, revealing a considerable gap. With a standard deviation of 1.324, it shows that there are notable variations in ESG performance amongst the enterprises in the sample, whilst the average value is 6.753, suggesting that, on the whole, the ESG performance of the enterprises is positioned at a middle to upper level and demonstrates a positive development trend. The Digital variable has a minimum value of 0 and a maximum value of 0.339, indicating substantial disparities in the degree of digital transformation amongst the enterprises in the sample. There are substantial differences in the degree of digital transformation between the enterprises included in the sample.

Table 4-1: Digitalisation Impact Descriptive Test

	N	Mean	Std	Min	Max
ESG	18,975	6.753	1.324	1	1 9
Digital	18,975	0.015	0.012	0	0.339
Soe	18,975	0.473	0.512	0	1
Growth	18,975	0.146	0.253	0.267	0.651
Roa	18,975	0.037	0.049	0.137	0.193
Lev	18,975	0.436	0.225	0.053	0.958
OCF	18,975	0.047	0.063	.. 0.192	0.246
Age 1	8,975	2.287	0.626	1.075	3.231
Size	18,975	25.446	1.705	18.438 2	9.753
Plu	18,975	0.223	0.447	0	1

The findings are represented in Figure 2.



Therefore, H1. Corporate digital transformation can effectively improve corporate ESG performance is verified and found to be true.

4.1.2 Baseline regression

Formula (1) to evaluate how enterprise digital transformation affects enterprise performance, ultimately determining the model through panel data analysis which includes conducting the F test, BP test, and Hausman test. Based on the results of these tests, the article adopts the RE model for empirical analysis. The findings presented in table 4.2 indicate that the coefficient for Digital is significantly positive at the 1% significance level, which signifies that enterprise digital transformation can substantially enhance enterprise ESG performance, thereby validating hypothesis H1. This phenomenon can be understood by the fact that the establishment of digital communities and the exchange of information have strengthened enterprises' interactions with stakeholders, compelling them to adopt a more holistic and systematic approach in addressing the requirements of all parties. This process involves integrating the idea of "co-creation" into their operational and management practices, and willingly assuming their environmental and social responsibilities, allowing them to provide not just economic advantages but also improve the overall value pertaining to environmental governance and social responsibility for their stakeholders.

Table 4-2: Regression Results for Digitalisation Impact

	-1	-2	-3
	OLS	FE	RE
Digital	0.175*** -7.358	0.153*** -6.94	0.169*** -7.03
Soe	0.135*** -4.98	0.109*** -3.97	0.112*** -5.63
Growth	0.416*** -4.26	0.237*** 4.41	0.229*** 4.85
Roa	0.447*** 6.69	0.462*** 8.32	0.395*** 7.78
Lev	3.283*** 6.39	3.506*** 5.68	4.015*** 5.72
OCF	0.367 1.23	0.375 1.21	0.293 0.97
Age	0.053 1.18	0.062 1.29	0.077** 2.21
Size	0.019***	0.015***	0.021***

	6.75	(3.32	5.43
Plu	1.073*** 3.39	1.165*** 3.74	0.927*** (4.57
Ind	Yes	Yes	Yes
Year	Yes	Yes	Yes
Cons	2.735*** 8.66	3.278*** 8.05	3.066*** 9.17
N	439	439	439
Adj R2	0.426	0.407	0.395

Therefore, H2. Corporate digital transformation can alleviate corporate financing constraints, thus contributing to corporate ESG performance is verified and found to be true.

4.1.3 Endogeneity Test

This study develops instrumental variables related to enterprise digital transformation for regression analysis. A comprehensive index of digital economy development is created based on five aspects: the number of employees engaged in Internet-related jobs, the rate of Internet penetration, output associated with the Internet, the advancement of digital inclusive finance, and the quantity of mobile Internet users, which is utilised to assess the digital economy level in each province (Index_IV) and is incorporated into the regression model as an instrumental variable. The rationale for selecting the level of digital economy is that a higher level of development increases the likelihood that local enterprises will undertake digital transformation to boost their competitiveness, whilst the impact of individual enterprise digital transformation on the province's digital economy level is less pronounced. The test outcomes (Table 4.3) indicate that the signs of the regression results remain consistent, confirming the robustness of the main findings of this paper.

Table 4-3: Endogeneity Tests

	(1) Digital	(2) ESG
Index_IV	7.329*** -7.63	
Digital		1.354***
Soe	0.025*** 4.43	0.018*** 3.79
Growth	0.587*** 4.38	0.536*** 3.97
Roa	0.427*** 7.35	0.421*** 7.16
Lev	6.495*** 11.59	3.073*** 12.21
OCF	0.439 1.13	0.225 0.82
Age	0.056* 1.27	0.069 1.13
Size	0.036*** 5.37	0.039*** 5.22
Plu	1.108*** 3.29	1.075*** 3.66
Cons	6.396*** 6.73	7.327*** 8.59
N	439	439
Adj.R2	0.217	0.229

Therefore, H3. Enterprise digital transformation can increase analysts' attention, which will have a contributing effect on enterprise ESG performance is verified and found to be true.

4.1.4 Mechanical analysis

This paper conducts a mediation effect analysis by establishing an index for corporate financing constraints. Building on prior methodologies to create the SA index, this index significantly reduces endogeneity compared to alternative measures. Consequently, it provides a more precise assessment of corporate financing constraints, with a higher SA value indicating greater challenges in corporate financing. The results of the tests reveal that digital transformation can effectively mitigate corporate financing constraints, and this alleviation can substantially enhance corporate ESG performance.

Companies can significantly raise analyst interest through digital transformation, making it easier to boost investments in social responsibility, enhance corporate image, and improve ESG performance. As shown in Table 4.4, the findings demonstrate that digital transformation can effectively increase analysts' attention, and this heightened attention can significantly enhance corporate ESG performance.

Table 4-4: Mechanical Testing

	-1 ESG	-2 SA	-3 ESG
SA			3.293***
Digital	0.325*** 3.92	0.027*** 4.85	0.389*** 3.89
Soe	0.072*** 3.74	4.49 0.079***	0.086*** 4.63
Growth	0.238*** 4.97	4.42 0.356***	0.079*** 5.43
Roa	0.062*** 7.31	0.083*** 9.32	0.076* 9.25
Lev	5.483*** 5.18	5.545*** 6.57	5.026*** 5.03
OCF	0.043 1.29	0.047 1.22	0.059 1.18
Age	0.035* 1.75	0.095 1.29	0.073 1.18
Size	0.053*** 5.19	0.026*** 5.31	0.013*** 5.25
Plu	0.097 1.26	0.075*** 3.09	0.077 1.27
Ind	Yes	Yes	Yes
Year	Yes	Yes	Yes
Cons	11.952*** (3.76)	21.59*** 4.35	19.08 1.38
N	439	439	439
Adj.R2	0.467	0.593	0.275

4.2 Results of univariate tests and descriptive tests

Tests were run for descriptive tests and the results are given in table 4.5. As seen, the table, the scores of ESG performance varies from 8.78 to 89.23%. Median value is 41.93%, and the standard deviation is 19.50. The variability is high indicating that whilst some firms show more score, others have low scores. Following the observations of Tamimi and Sebastianelli (2017) the descriptive statistics indicate the governance GOV has the largest median score of 48.24%. Next is social SOC at 39.41%,

Environmental with 39.91%. It is possible that Middle East firms have released governance codes to increase performance of this information in disclosures.

It is seen in table 4.5 that skewness is caused by some big firms since the mean values are larger than the median. To overcome this skewness, natural log transformation is used for the problem variables to remove the problem of distribution. Since all winsorising has happened to the two person bottom and top of the distribution in later analysis. Average share price (P) in the study period is 39.18 but the median is 11.85. EPS median and mean values are 0.67 and 2.49. BVE median is 6.57 and mean is 20.37, whilst the maximum EPS is 224.22 and minimum is -60.85 whilst the maximum BVE is 490.5 and minimum is 0.09.

For control of variables at the firm level, value of SIZE the mean natural log of total assets is 16.44, with a max value of 19.96. LEV or the leverage ratio has an average of 52%, with maximum of 90%, and minimum of 1%. The existence of Big 4 organisations is seen since 71% of observations are audited by certified independent public accounts. About 10% of the firms have seen losses for the study period. Considering the country level variable as the national institutional quality (NIQ). The mean is 51.05% and median is 46.45%. Saudi Arabia has the highest score of 72.45% whilst Turkey has the lowest score of 21.52%. Sarhan et al. (2019) had derived a mean value of 49.37%.

Table 4-5: Descriptive Statistics

Variable	Mean	Median	Std. Div.	Min.	Max.
P	39.18	11.85	97.58	0.12	864
EPS	2.49	0.67	13.67	-60.85	224.22
BVE	20.37	6.57	56.92	0.09	490.45
ESG	41.93	37.5	19.5	8.78	89.23
ENV	38.91	31.82	24.43	2.91	96.43
SOC	39.41	37.81	23.62	3.17	92.39
GOV	48.24	48.68	20.79	4.85	93.21
NIQ	51.05	46.45	14.25	21.52	72.45
LEV	0.52	0.54	0.21	0.01	0.9
SIZE	16.44	16.71	1.72	10.81	19.96
BIG	4 0.71				
LOSS	0.1				

In table 3.2:

i is the firm considered

t is the year of balance sheet

P_{it} is the natural log of the firm i of the stock rate per share 90 days after balance sheet in year t

BVE_{it} is book value of equity/ share

EPS_{it} is net income per share of firm

ESG_{it} is the firms environmental, social and governance performance score

ENV_{it} = firm i 's environment pillar score

NIQ_t is the national institutional quality. This is the mean of 6 dimensions of governance

LEV_{it} is the debt ratio, or the ratio of total liabilities by total assets

$SIZE_{it}$ is the natural logarithm of total assets at balance sheet

$BIG4_{it}$ is a dichotomous variable equal to 1 when a firm is audited by a Big N auditor, and 0 otherwise

$LOSS_{it}$ is a variable equal to 1 for negative earnings, and 0 otherwise

4.3 Pearson correlation coefficient

The Pearson correlation coefficient is given in table 4.6 for the dependent and independent variables used in the price model. As noted by Wasiuzzaman and Mohammad (2020), ESG dimensions have strong links between themselves. ESG pillars have a positive correlation with P the share prices. The pair wise correlations indicate that the ESG performance score as data for the Middle East market players. It is essential to obtain specific conclusion about the link between ESG performance scores and the dependant variable. This relation is obtained through multivariate regression analysis over controls that impact multiple independent variables on stock prices.

Pairwise correlations in the explanatory variables are used to understand multi-co linearity. As explained by Al-Hiyari and Kolsi (2020), severe co-linearity is seen when the correlation is more than that cut-off of 0.8. The results in table 4.2 have more co linearity in excess of 0.8 for the ESG dimensions of GOV, SOC, and ENV. Since these variables are not included concurrently in the model, the high value of correlation does not impact the study. A study of the variance inflation factor -VIF for the empirical model was also done. The maximum VIF value is 1.93 and this is less than the minimum value of 10 as indicated by Vörösmarty and Dobos (2020). Therefore, the assessment if that multi-co linearity is not an issue for this study. Please refer to table 4.6 Correlation Matrix of Variables.

Table 4-6 Correlation Matrix of Variables

	P	ESG	ENV	SOC	GOV	EPS	BVE	NGI	LEV	SIZE	LOSS	BIG4
P	1.000											
ESG	0.219***	1.000										
ENV	0.100***	0.863***	1.000									
SOC	0.272***	0.850***	0.834***	1.000								
GOV	0.265**	0.602***	0.390***	0.396***	1.000							
EPS	0.595***	0.137***	0.148***	0.182***	0.003	1.000						
BVE	0.523***	0.048	0.024	0.022	0.147***	0.523***	1.000					
NGI	0.040	0.103**	0.108**	0.014	0.014	0.106**	0.239***	1.000				
LEV	0.197***	0.128***	0.176***	0.130***	0.089*	0.003	0.162***	0.035	1.000			
SIZE	0.569***	0.157***	0.212***	0.236***	0.060	0.211***	0.246***	0.061	0.231***	1.000		
LOSS	-0.025	-0.064	-0.045	-0.030	-0.017	-0.294***	0.065	0.034	0.199***	0.071	1.000	
BIG4	0.095**	0.289***	0.247***	0.281***	0.141***	0.018	0.087*	0.210***	0.110**	0.010	0.089*	1.000

In the above table, superscripts *, ** and *** show the significance at the 0.10, 0.05 and 0.01 levels, respectively.

5. Conclusions

The paper examined digitalisation and corporate ESG Performance in Middle East Countries. A sample of 439 firms from fifteen Middle East countries was drawn from LSEG formerly Refinitiv Datastream, Thomson Reuters Eikon database, and country specific data World Bank. Three hypothesis were drawn, twelve models were created, tested, and the results were subjected to regression analysis using SPSS. The results show a strong link between digitalisation and ESG performance.

With the rapid-fire development of digital technology in recent times, enterprises have extensively explored the in- depth integration of digital technology and traditional diligence, and digital metamorphosis has come decreasingly a significant strategic choice for enterprises, which can effectively promote their sustainable and high- quality development. This paper selects A-share listed companies the Middle East from 2013 to 2023 as a sample to explore the relationship between commercial

digital metamorphosis and commercial ESG performance. It's set up that enterprise digital metamorphosis can significantly ameliorate enterprise ESG performance; it can palliate enterprise backing constraints, increase judges' attention, and ameliorate enterprise ESG performance. Starting from the perspective of digital metamorphosis, the composition incorporates digital metamorphosis and enterprise ESG performance into the same exploration frame, and from the perspective of internal motorists to enhance enterprise ESG performance, it explores the impact of digital metamorphosis on enterprise ESG performance in the current digital environment, broadens the exploration ideas on the part of digital metamorphosis in promoting enterprise non-economic benefits, and provides new exploration directions and perspectives for promoting enterprises to carry out digital metamorphosis and enhance enterprise ESG performance.

The results indicate a significant and positive link between the market value of the firm and the ESG performance scores. ESG performance shows value important data for market players. Testing of ESG pillars was done to correctly find the independent effect from each pillar on the market value. The results indicate that except environmental performance other factors give value relevant information that is useful in taking investment decisions. The results also show that shareholders in Middle East firms do not give too much importance to environmental dimensions performance. These dimensions include resource usage and reduction, product or process innovation, greenhouse gas emissions, sustainability measures.

5.1 Study implications

The findings can have implications for stakeholders, managers, and regulatory authorities. It is seen that digitalisation and ESG performance are held with regard by shareholders. The results can motivate managers to give detailed and accurate ESG information. This practice can enhance the firm reputation, market value, and performance. Since firms have less accountability and transparency, managers need to bring to focus, the environmental issues for the firm. For stockholders, the result can show the manner in which they can invest netter by considering ESG factors. The results may also be considered by regulatory authorities to help them frame rules for mandatory ESG reporting. In general, the market and stakeholder are impacted by information of environmental risks, and the opportunities for corporate sustainability.

5.2 Study limitations

The study has some limitations. The sample size is small and the generalisation of results to all firms and sectors in the Middle East may not be correct. This issue can be overcome in subsequent research by including more samples. The sample does not consider banking and financial services since they have different operations and regulations. The next research should consider this sector also. ESG scores were obtained from standard data centre. It is possible that some bias may have occurred due to the discretion of some ESG dimension.

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References

- [1] Abdelaziz, H., Rim, B., & Helmi, H. (2020). The interactional relationships between credit risk, liquidity risk and bank profitability in MENA region. *Global Business Review*.
- [2] Al-Bassam, W. M., Ntim, C. G., Opong, K. K., & Yvonne, D. (2018). Corporate boards and ownership structure as antecedents of corporate governance disclosure in Saudi Arabian publicly listed corporations. *Business and Society*, 57(2), 335–377.
- [3] Al-Dhamari, R. A. A. & Chandren, S. (2018). Audit partners gender, auditor quality and clients value relevance. *Global Business Review*, 19(4), 952–967.
- [4] Al-Hiyari, A. & Kolsi, M.C., (2024). How do stock market participants value ESG performance? Evidence from Middle Eastern and North African Countries. *Global Business Review*, 25(4), pp. 934–956.
- [5] Alkaraan, F., Albitar, K., Hussainey, K., & Venkatesh, V. G. (2022). Corporate transformation toward Industry 4.0 and financial performance: The influence of environmental, social, and governance (ESG). *Technological Forecasting and Social Change*, 175, 121423. <https://doi.org/10.1016/j.techfore.2021.121423>.
- [6] Almagtome, A. & Abbas, Z., (2020). Value relevance of financial performance measures: An empirical study. *International Journal of Psychological Rehabilitation*, 24(7), pp. 6777–6791.
- [7] Barth, M. E. & Clinch, G. (2009). Scale effects in capital markets-based accounting research. *Journal of Business Finance and Accounting*, 36(3–4), 253–288.
- [8] Boolaky, P. K., Omoteso, K., Ibrahim, M. U., & Adelopo, I. (2018) The development of accounting practices and the adoption of IFRS in selected MENA countries. *Journal of Accounting in Emerging Economies*, 8(3), 327–351.
- [9] Buallay, A., (2022). Toward sustainability reporting in the MENA region: the effects on sector's performance. *Managerial Finance*, 48(8), pp. 1137–1155.
- [10] Câmara, P., (2022). The systemic interaction between corporate governance and ESG. In *The Palgrave handbook of ESG and corporate governance* (pp. 3-40). Cham: Springer International Publishing.

- [11] Chamberlain, T.W. & Sarkar, S., (2024). *Debt Covenant Violations and Risk Shifting Behavior*. Available at SSRN 4893462.
- [12] Cheng, L. T., Sharma, P., & Broadstock, D. C., (2023). Interactive effects of brand reputation and ESG on green bond issues: a sustainable development perspective. *Business Strategy Environment*, 32 (1), 570–586.
- [13] Dawar, I., Dutta, A., Bourri, E., & Saeed, T., (2021). Crude oil prices and clean energy stock indices: Lagged and asymmetric effects with quantile regression. *Renewable Energy*, 163, pp. 288–299.
- [14] Dedyansyah, A. F. & Ulfa, M. A., (2023). Value relevance in assessing the quality of financial reports: A systematic literature review. *Journal of Enterprise and Development (JED)*, (3), pp. 625–642.
- [15] Dunham, L. M. & Grandstaff, J. L., (2022). The value relevance of earnings, book values, and other accounting information and the role of economic conditions in value relevance: a literature review. *Accounting Perspectives*, 21(2), pp. 237–272.
- [16] Elamer, A. A. & Boulhaga, M., (2024). ESG controversies and corporate performance: The moderating effect of governance mechanisms and ESG practices. *Corporate Social Responsibility and Environmental Management*. John Wiley & Sons Ltd., DOI:10.1002/csr.2749
- [17] El-Diftar, D. & Elkalla, T. (2019). The value relevance of accounting information in the MENA region: A comparison of GCC and non-GCC country firms. *Journal of Financial Reporting and Accounting*, 17(3), 519–536.
- [18] Elidrisy, A., (2024). Examining the Impact of ESG on Organizational Performance: The Literature Review on Investment Sectors of the Middle East and North Africa (MENA). *American Journal of Economics and Business Innovation*, 3(1), pp. 40–49.
- [19] El Khoury, R., Nasrallah, N., & Alareeni, B., (2023). The determinants of ESG in the banking sector of MENA region: a trend or necessity?. *Competitiveness Review: An International Business Journal*, 33(1), pp. 7–29.
- [20] Elton, E. J., (2024). Expected return, realized return and asset pricing tests. *Annals of Operations Research*, pp. 1–19.
- [21] Ertuğrul, M., (2020). How should the value relevance research employ book value of equity?. *İşletme Araştırmaları Dergisi*, 12(2), pp. 2031–2039.
- [22] Haniffa, R. & Hudaib, M. (2021). Locating audit expectations gap within a cultural context: The case of Saudi Arabia. *Journal of International Accounting, Auditing and Taxation*, 16(2), 179–206.
- [23] Hassan, O. A. G., Romilly, P., Giorgioni, G., & Power, D. (2009). The value relevance of disclosure: Evidence from the emerging capital market of Egypt. *International Journal of Accounting*, 44(1), 79–102.
- [24] Hayn, C. (1995). The information content of losses. *Journal of Accounting and Economics*, 20(2), 125–153.
- [25] Huang, F. L., Wiedermann, W., & Zhang, B., (2022). Accounting for heteroskedasticity resulting from between-group differences in multilevel models. *Multivariate Behavioral Research*, 58(3), pp. 637–657.
- [26] Jena, J.R., Biswal, S.K., Shrivastava, A.K. et al. A bibliographic overview of financial engineering in the emerging financial market. *Int J Syst Assur Eng Manag* 14, 2048–2065 (2023). <https://doi.org/10.1007/s13198-023-02123-8>
- [27] Kao, F. C., (2023). How do ESG activities affect corporate performance?. *Managerial and Decision Economics*, 44(7), pp. 4099–4116
- [28] Landau, A., Rochell, J., Klein, C., & Zwergel, B., (2020). Integrated reporting of environmental, social, and governance and financial data: Does the market value integrated reports?. *Business Strategy and the Environment*, 29(4), pp. 1750–1763.
- [29] Lee, C. H., Chen, R. C. Y., Hung, S. W., & Yang, C. X. (2020). Corporate social responsibility and firm value: The mediating role of investor recognition. *Emerging Markets Finance and Trade*, 56(5) 1043–1054.
- [30] Li, Y., Gong, M., Zhang, X., & Koh, L. (2018). The impact of environmental, social, and governance disclosure on firm value: The role of CEO power. *British Accounting Review*, 50(1), 60–75.
- [31] Li, C., Ba, S., Ma, K., Xu, Y., Huang, W., & Huang, N., (2023). ESG rating events, financial investment behavior and corporate innovation. *Econ. Anal. Policy*, 77, 372–387.
- [32] Liu, S., Zhao, H., & Kong, G., (2023). Enterprise digital transformation, breadth of ownership and stock price volatility. *Int. Rev. Fin. Anal.* 89, 102713.
- [33] Lu, Y., Xu, C., Zhu, B., & Sun, Y., (2023). Digitalization transformation and ESG performance: evidence from China. *Bus. Strat. Environ.*
- [34] Luo, C., Wei, D., & He, F., (2023). Corporate ESG performance and trade credit financing—evidence from China. *Int. Rev. Econ. Finance*, 85, 337–351.
- [35] Mahmood, Z. & Alsayegh, M. F., (2020). The governance of corporate sustainability in the Middle East: preliminary insights. *Journal of Business and Social Review in Emerging Economies*, 6(2), pp. 715–731.
- [36] Miralles-Quirós, M. M., Miralles-Quirós, J. L., & Gonçalves, L. M. V. (2018). The value relevance of environmental, social, and governance performance: The Brazilian case. *Sustainability*, 10(3), 574.
- [37] Moneva, J. M. & Cuellar, B. (2009). The value relevance of financial and non-financial environmental reporting. *Environmental and Resource Economics*, 44(3), 441–456.
- [38] Mooneapen, O., Abhayawansa, S., & Mamode Khan, N., (2022). The influence of the country governance environment on corporate environmental, social and governance (ESG) performance. *Sustainability Accounting, Management and Policy Journal*, 13(4), pp. 953–985.
- [39] Moumen, N., Ben Othman, H., & Hussainey, K. (2015) The value relevance of risk disclosure in annual reports: Evidence from MENA emerging markets. *Research in International Business and Finance*, 34, 177–204.
- [40] Nasis, A., Siouziou, I., & Toudas, K., 2024. Digital Transformation and ESG Investing as the Driving Force for Sustainable Development. *Theoretical Economics Letters*, 14(5), pp. 2066–2080.
- [41] Nirino, N., Santoro, G., Miglietta, N., & Quaglia, R. (2021). Corporate controversies and company's financial performance: Exploring the moderating role of ESG practices. *Technological Forecasting and Social Change*, 162, p. 120341.
- [42] Omojolaibi, J. A. & Nathaniel, S. P. (2020). Assessing the potency of environmental regulation in maintaining environmental sustainability in MENA countries: An advanced panel data estimation. *Journal of Public Affairs*.
- [43] Ohlson, J. (1995). Earnings, book values, and dividends in equity valuation. *Contemporary Accounting Research*, 11(2), 661–687.
- [44] Pittman, J. & Zhao, Y. (2020). Debt covenant restriction, financial misreporting, and auditor monitoring. *Contemporary Accounting Research*, 37(4), pp. 2145–2185.
- [45] Ramalingowda, S., Utke, S., & Yu, Y., (2021). Common institutional ownership and earnings management. *Contemporary Accounting Research*, 38(1), pp. 208–241.

- [46] Raza, W., Hayat, K., Zahir, S., & Muhammad, N., (2021). Moderating Role Of Board Size And Its Effect On Default Risk And Earning Response Coefficient (ERC). *Multicultural Education*, 7(7).
- [47] Rechsteiner, R., (2021). German energy transition (Energiewende) and what politicians can learn for environmental and climate policy. *Clean technologies and environmental policy*, 23, pp. 305–342.
- [48] Sarhan, A. A. & Ntim, C. G. (2019). Corporate boards, shareholding structures and voluntary disclosure in emerging MENA economies. *Journal of Accounting in Emerging Economies*, 9(1), 2–27.
- [49] Sarhan, A. A., Ntim, C. G., & Al-najjar, B. (2019). Antecedents of audit quality in MENA countries: The effect of firm- and country-level governance quality. *Journal of International Accounting, Auditing and Taxation Antecedents*, 35, 85–107.
- [50] Tamimi, N. & Sebastianelli, R. (2017). Transparency among S&P 500 companies: An analysis of ESG disclosure scores. *Management Decision*, 55(8), 1660–1680.
- [51] Tobibah, L. & Firmansyah, D., (2024). The effect of receivables turnover and firm size on profitability. *Jurnal Ekonomi, Manajemen Dan Akuntansi*, 2(2), pp. 277–288.
- [52] Verbeeten, F. H. M., Gamerschlag, R., & Möller, K. (2016). Are CSR disclosures relevant for investors? Empirical evidence from Germany. *Management Decision*, 54(6), 1359–1382.
- [53] Vörösmarty, G. & Dobos, I., (2020). Green purchasing frameworks considering firm size: a multicollinearity analysis using variance inflation factor. *In Supply Chain Forum: An International Journal*, 21 (4), pp. 290–301.
- [54] Wasiuzzaman, S. & Mohammad, W. M. W. (2020). Board gender diversity and transparency of environmental, social and governance disclosure: Evidence from Malaysia. *Managerial and Decision Economics*, 41(1), 145–156.
- [55] Xiaoli, Hao . Yuhong, Li . Siyu .Ren . Haitao, Wu. Yu, Hao.(2023).The role of digitalization on green economic growth: Does industrial structure optimization and green innovation matter? *Journal of environmental management, Elsevier*, <https://doi.org/10.1016/j.jenvman.2022.116504>.
- [56] Zittis, G., Almazroui, M., Alpert, P., Ciais, P., Cramer, W., Dahdal, Y., Fnais, M., Francis, D., Hadjinicolaou, P., Howari, F., & Jrrar, A., (2022). Climate change and weather extremes in the Eastern Mediterranean and Middle East. *Reviews of geophysics*, 60(3), p. e2021RG000762.
- [57] Zumente, I. & Bistrova, J., (2021). ESG importance for long-term shareholder value creation: Literature vs. practice. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(2), p. 127