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The Sustainable Development Goals and corporate sustainability performance: Mapping, extent and determinants

Raneem Khaled, Heba Ali, Ehab K.A. Mohamed *

Faculty of Management Technology, German University in Cairo, New Cairo City, 11835, Cairo, Egypt

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ABSTRACT

This study develops a novel framework by hand-mapping the Sustainable Development Goals (SDGs) and their targets with a firm's sustainability practices, reflected in its Environmental, Social and Governance (ESG) scores. Our mapping provides an actionable solution for firms to identify where the SDGs are connected with their ESG performance and accordingly tangibly measure their progress towards achieving the SDGs. We show that there are particular SDGs and targets which are more relevant to the business sector than others. We also investigate how firm-specific characteristics can help explain variation in corporate sustainability performance and find that profitable, larger and less leveraged companies are more likely to exhibit better corporate sustainability performance. These findings carry significant implications for academics, firms, and investors. The mapping can be used as a guide to understand the linkages between ESG issues, corporate sustainability performance and the SDGs, and to quantitatively evaluate firms' progress towards implementing the SDGs using available ESG performance indicators. Our study also contributes to research on corporate sustainability performance in the context of emerging markets.

1. Introduction

In September 2015, the United Nations (UN) adopted a global plan of action for sustainable development named "Transforming Our World: The 2030 Agenda for Sustainable Development", with a broad scope incorporating 'Five P's' namely, planet, people, prosperity, peace, partnership. The 2030 Agenda is a global scheme incorporating 17 Sustainable Development Goals (SDGs) and 169 related targets addressing global challenges of climate change, social inequality and environmental degradation. The SDGs call for worldwide action among governments, businesses and civil society organizations to achieve shared and sustainable prosperity. However, the corporate sector still exhibits relatively slow progress with regards to working towards a sustainable world (Van der Waal and Thijssens, 2020). For example, according to PricewaterhouseCooper (PwC, 2019), 72% of companies publicly mention SDGs in their reporting publications, yet only 20% of companies set quantitative targets linked to achieving the goals, and only 8% of these companies, (only 1% of the overall sample) are reporting quantitative measures to show their progress towards targets.

These findings raise another important question related to the challenges the corporate sector faces when tangibly measuring and tracking their contributions. Therefore, it is crucial to explore potential frameworks that would guide companies on how they can align their strategies as well as measure and communicate their contribution to the SDGs. In response, several initiatives have been emerging to help companies align and report on the SDGs, including the 'UN Global Compact' and the 'SDG Compass'. The 'UN Global Compact' offers a practical framework for companies to engage in issues covered by the SDGs, suggesting that organizations are expected to seek to provide solutions that positively contribute to the SDGs, through integrating environmental and social aspects within core business activities (UN Global Compact, 2015). In related context, the 'SDG Compass' was launched in 2015, proposing a five-step guide that assists organizations in maximizing their contribution to the SDGs via: (1) understanding the SDGs, (2) defining relevant SDGs and mapping them against existing business indicators, (3) setting goals that positively contribute to the SDGs, (4) integrating sustainability into the core business, and (5) reporting corporate sustainability practices (SDG Compass, 2015; DeMates and Phadke, 2017).

Despite these initiatives that attempt to map existing business indicators to the SDGs, assisting companies in engaging in the SDGs and embedding them into their practices, empirical findings have so far

* Corresponding author.
E-mail addresses: raneem.ahmed@guc.edu.eg (R. Khaled), heba.abbas-ali@guc.edu.eg (H. Ali), ehab.kamel@guc.edu.eg (E.K.A. Mohamed).

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proved that measuring the level of corporate engagement in the SDGs is associated with various methodological difficulties, mainly related to the selection of indicators, data availability and interpretation/linking of the results (Fleming et al., 2017; Lior et al., 2018). Thus, existing attempts to answer the question of how firms can best assess the degree to which their actions impact contributing to the SDGs remain inconclusive. One way of assessing firms' progress towards achieving the SDGs from an impact point of view is to measure the impact on SDGs in relation to corporate sustainability performance (i.e., assessing how firms' sustainable practices and activities are helping achieve the SDGs). Empirically, sustainability performance of firms has been widely measured in the literature using Environmental, Social, and Governance (ESG) scores (Tamimi and Sebastianelli, 2017). ESG practices and disclosures form new accountability measures that reflect voluntary commitment to non-financial goals and sustainable development, creating value for the firm's investors, other stakeholders and the society (Arayssi et al., 2019). ESG scores provide users with readily available data regarding a company's sustainability performance. However, the lack of connection between these scores and the SDGs makes it difficult for firms to articulate how their ESG activities are directly contributing to specific SDGs and targets.

Therefore, there is a need for mapping ESG scores against the SDGs, to provide companies seeking to align their sustainability practices with the SDGs with an actionable solution to track and assess their impact on contributing to the SDGs and to enable a level of accountability and reporting that demonstrates to investors and other stakeholders how companies are helping achieve these goals. However, mapping studies in this regard are scarce. These studies include DeMates and Phadke (2017), Betti et al. (2018) and Consolandi et al. (2020) who mapped the 30 Sustainability Accounting Standards Board (SASB) ESG issues to specific SDGs/targets and accordingly analyze how firms contribute to the SDGs. Accordingly, this study seeks to contribute to the emerging research on SDGs by providing a comprehensive framework that maps/links the SDGs with well-established measures of corporate sustainability, namely, ESG Scores. More specifically, this study aims at providing companies with a detailed and well-integrated guide that assists them in identifying and prioritizing SDGs and targets that are most relevant to their sustainable business practices, helping companies understand how organizational-level sustainable practices contribute to the realization of the global goals and targets. Therefore, this study develops its first research objective aiming to map a firm's sustainability practices (ESG scores) with the SDGs via mapping the three ESG pillar scores, their 10 categories and the relevant underlying measures with the 17 SDGs and their 169 targets.

In our mapping, we consider all the goals, rather than limiting our mapping to specific selected goals/targets, as we believe that this approach can help provide a comprehensive framework that provides a useful way for companies to eliminate confusion around where the SDGs are connected to their ESG activities, and allows - via either directly assessing the relevant ESG scores or calculating different sets of indices - to track progress towards the goals and their associated targets, and accordingly prioritize goals that firms could have the greatest impact upon and identify where specific gaps might exist. To the best of our knowledge, no prior studies have provided a mapping to the SDGs at such exhaustive level, and so this study attempts to fill in this gap in the literature. This paper also contributes to the research literature by using Refinitiv ESG scores to map with the SDGs. Refinitiv ESG scores are advantageous measures of a firm's ESG performance and are commonly utilized as a proxy for corporate sustainability performance in literature (e.g., Garcia et al., 2017; Rajesh, 2020; Uyar et al., 2020). Therefore, providing the findings of our mapping will enable researchers to link their future findings on sustainability performance (micro-level) to the achievement of SDGs (macro-level), which allows for better understanding of corporate engagement in the SDGs.

However, while we propose the mapping of a company's ESG scores with the SDGs, we still recognize that most companies are distinct in the way they approach their role towards contributing to the SDGs and sustainability performance. Hence, the question arises as to how various factors help explain variation in corporate sustainability performance. When investigating the adoption of new corporate sustainability practices, most of the literature tends to focus on the effects of regulatory and institutional pressures (e.g., Rosati and Faria, 2019a), whereas the influence of internal organizational factors on sustainability performance is often under researched. In this study we aim to fill this gap by investigating the firm-specific characteristics that may impact a company's sustainability performance, hence, influencing its contribution towards the achievement of the SDGs. In doing so, we intend to contribute to the literatures on the agency, legitimacy, stakeholder and institutional theories by providing a study that identifies some of the firm-specific characteristics that may impact an organization's contribution to the SDGs.

Unlike other mapping studies (e.g., Betti et al., 2018; Consolandi et al., 2020), this study goes a step further and investigates potential associations between firm-specific characteristics and corporate sustainability performance using regression analysis to explore the firm's performance on the three ESG dimensions. We did not focus on specific selected measures but rather we consider the ESG scores (overall and pillar scores) to provide an overall picture of firms' role towards contributing to the SDGs and sustainability performance. Nevertheless, we are still aware of the fact that not all the SDGs targets could be mapped with the ESG issues. For this purpose, data on ESG scores and firm-specific factors for a sample of 1105 companies listed in the Morgan Stanley Capital International (MSCI) Emerging Markets Index across 25 emerging markets were collected over the period from 2002 to 2018. An emerging markets context is specifically chosen for this study because while the relationship between firm-specific factors and corporate sustainability performance has been widely studied in the context of developed markets (e.g., Artiach et al., 2010; Braam et al., 2016), examining this relationship in emerging markets is a less explored question. Therefore, this research contributes to existing literature via conducting out-of-sample tests of this relationship in a different setting rather than developed markets.

The paper is structured as follows. The next section reviews the literature. Section 3 discusses data collection and research methodology. The results are presented and discussed in section 4 and 5 provides summary & conclusions.

2. Literature review

Since the 2030 Agenda for Sustainable Development was adopted by world leaders in 2015, literature has paid more attention to studying corporate engagement in the SDGs. Some studies explore the potential role of corporate activities in supporting the SDGs (e.g., Topple et al., 2017; Vildasen, 2018; Boiral et al., 2019; Goubran, 2019; Ike et al., 2019; Pineda-Escobar, 2019), examine the factors (firm or country-specific) that affect companies' engagement in the SDGs (e.g., Van Zanten and Van Tulder, 2018; Rosati and Faria, 2019a; Rosati and Faria, 2019b; Van der Waal and Thijssens, 2020), and discuss the motivations, opportunities, and barriers for firms to work towards achieving the SDGs (e.g., Fleming et al., 2017; Haas et al., 2019). Other studies also explore interactions between the goals and targets (e.g., Le Blanc, 2015; Nilsson et al., 2018; Allen et al., 2019). A summary of related studies is provided in Appendix A.

The overall findings of these studies reveal that corporate engagement in implementing the SDGs is still limited and intentional more than actual. They also reveal that the measurement of the level of corporate engagement in the SDGs is associated with various methodological difficulties, mainly related to the selection of indicators, data availability and interpretation/linking of the results (e.g., Fleming et al., 2017; Lior et al., 2018). Therefore, other studies have attempted to propose general frameworks to map the generic ESG issues to the SDGs, and accordingly assess how firms can contribute to the SDGs based on their ESG

performance. This mapping approach was first explored by DeMates and Phadke (2017), who mapped the 30 SASB ESG categories with the 17 SDGs, linking corporate sustainability activities with the SDGs. Likewise, Betti et al. (2018) mapped the 30 SASB ESG issues to the SDGs and their targets, finding that some ESG issues are more relevant to the SDGs and their targets than others. Similarly, Consolandi et al. (2020) mapped the SDGs and their targets to the 30 SASB ESG issues, and analyzed how health care companies contribute to SDG 3, highlighting how firms can contribute to the SDGs.

Theoretically, literature has identified different incentives for firms to engage in sustainable practices. The agency theory suggests that firms provide sustainability disclosure to reduce information asymmetries between firms and investors, creating value for shareholders (Phillips et al., 2003; Alotaibi and Hussainey, 2016), while the legitimacy, stakeholder, and institutional theories interpret how corporate sustainability performance is affected in response to particular pressures exerted by stakeholder groups, communities or institutions, respectively (Islam and Deegan, 2008). In specific, the stakeholder theory proposes that companies engage in sustainability practices to meet the interests of its various stakeholders, while the legitimacy theory, offering a wider perspective, focuses on external pressures exerted on organizations for sustainability performance, set by the norms and regulations of the societies they are operating in. The institutional theory links the extent to which organizations adopt sustainable practices to changing institutional pressures and expectations (Pistoni and Songini, 2013). Deegan and Blomquist (2006) suggest that these theories provide interrelated, yet slightly different insights into the factors that motivate corporations to engage in sustainability initiatives. Islam and Deegan (2008) therefore advocate for the joint consideration of all three theories because such consideration provides a basis for a deeper understanding of corporate sustainability behavior than would be possible when considering each theory in isolation.

If firms' contribution towards sustainability is related to their needs to decrease asymmetric information or to respond to exerted pressures, then differences in corporate sustainability performance imply differences in firm-specific characteristics related to that level of information asymmetry or the heterogeneity in these pressures/demands in terms of expectation and importance. In this regard, the impact of firm-specific characteristics with respect to profitability, firm size, and leverage has been proposed and investigated in the literature. The legitimacy theory suggests that profitable companies tend to undertake more sustainability activities to manifest their contribution to the society's well-being and to legitimize their existence (Muttakin and Khan, 2014). From a stakeholder perspective, it is suggested that profitable firms work harder to preserve their positive reputation, continuously needing to address their stakeholders' expectations. Contrarily, the agency theory suggests that in periods of relatively low profitability, firms engage in more sustainable practices as a mean of convincing financial stakeholders that current sustainable initiatives will result in long-term prosperity and competitive advantage (Reverte, 2009).

With respect to firm size, advocates of the stakeholder and legitimacy theories posit that larger firms normally have larger stakeholder groups, thus, receive greater attention from the public. Therefore, such firms may be subject to greater pressure to disclose more sustainability information to meet the informational needs of their different stakeholders and to legitimize their business activities to the society (Alsaeed, 2006). Consistently, the agency theory suggests a positive association between firm size and the extent of sustainability performance and disclosure, proposing that large firms usually have higher agency costs due to information asymmetry between managers and shareholders, thus, are more likely to disclose sustainable-related information to portray that their actions are legitimate and consistent with good corporate citizenship (Giannarakis, 2014).

Regarding financial leverage, prior literature suggests two conflicting views on the effect of financial leverage on corporate sustainability performance and disclosure. The first view builds on the agency theory and suggests a positive relationship between a firm's level of leverage and its sustainability performance and disclosure; stating that highly leveraged firms tend to disclose more sustainability information in order to reduce agency costs generated as a result of their higher debt levels (Jensen and Meckling, 1976). In contrast, the stakeholder theory postulates that firms are more likely to address the concerns of debtholders, as a powerful stakeholder group, rather than the concerns of less powerful stakeholders, such as the community. Therefore, firms with high indebtedness are expected to pay less attention to sustainability activities (Artiach et al., 2010; Lourenço and Branco, 2013).

3. Research methodology

3.1. Data and variables

The study's sample includes all companies listed in the MSCI Emerging Markets Index over the time period (2002–2018). An initial sample of 1202 companies across 25 emerging markets is identified. After cleaning duplicate, and missing values, a total of 97 firms are dropped from the sample, resulting in a final sample of 1105 companies. Firms are sorted into 11 industrial groups based on Industry Classification Benchmark (ICB) Industry/Datastream Level 2 classification. Table 1, Panel A, shows that financials (20.72%) and industrials (13.67%) account for the largest proportion of the sample. While, firms operating in the telecommunication (4.71%) and utilities (5.16%) industries account for the lowest proportion of the sample. Finally, Panel B demonstrates that the region of Asia (Americas) has the largest (lowest) number of companies (76.83% and 9.23%, respectively).

The data are collected from several databases. Annual ESG scores are collected from Refinitiv, which specializes in providing objective, relevant, and comparable ESG performance of a company. Although there are several rating agencies providing ESG scores for firms, ESG scores offered by Refinitiv are a popular measure of corporate ESG performance (Rajesh, 2020), and therefore, commonly utilized as a proxy for corporate sustainability performance in the literature (e.g., Garcia et al., 2017; Uyar et al., 2020). More specifically, Refinitiv ESG scores capture and calculate over 400 company-level ESG measures, of which a subset of 178 measures of the most comparable and relevant indicators are selected to power the overall scoring process. These measures are then grouped into 10 categories (resource use, emissions, innovation, workforce, human rights, community, product responsibility, management, shareholders, and CSR strategy), to be further organized into three pillars: the environmental, social, governance pillar scores (Refinitiv, 2019).

Table 1
Sample summary statistics.

Panel A: Sample Distribution by Industry		
Industry	N	Percent
Basic Materials	102	9.23
Consumer Discretion	144	13.03
Consumer Staples	90	8.14
Energy	69	6.24
Financials	229	20.72
Health Care	68	6.15
Industrials	151	13.67
Real Estate	64	5.79
Technology	79	7.15
Telecommunications	52	4.71
Utilities	57	5.16
Total	**1105**	**100.00**
Panel B: Sample Distribution by Region		
Region	**N**	**Percent**
Asia	849	76.83
Americas	102	9.23
Europe, Middle East & Africa	154	13.94
Total	**1105**	**100.00**

Accordingly, we utilize ESG performance as a proxy for firms' sustainability performance and their contribution towards the SDGs. As we consider the pillars scores, four dependent variables are used (as a proxy for corporate sustainability performance): Overall ESG, environmental, social, and governance performance. With regards to the independent variables, we use variables usually adopted in the finance literature (Giannarakis, 2014): profitability, firm size and financial leverage. We also control for other well-documented variables, such as book-to-market value, macroeconomic and institutional factors (De Villiers and Marques, 2016; Oliveira et al., 2019). The variables are listed in Table 2. Data on firm-specific independent variables are obtained from Refinitiv Datastream, while other country-specific factors, employed as control variables, are obtained from multiple databases, including the World Bank and the World Bank Worldwide Governance indicators.

3.2. Method

To achieve our aim at providing a concrete framework to help identify firms' position and engagement in sustainable practices, and assess their contributions to the SDGs, we first map an organization's sustainability practices, reflected in its ESG scores, with the 17 SDGs. We then explore these linkages, at a more exhaustive level, through mapping the three ESG pillar scores, their 10 categories and the relevant underlying measures with the 17 SDGs and their 169 targets. In our analysis, we consider all the goals, rather than limiting our mapping to specific selected goals/targets, as we believe that this approach can help provide the basis for a comprehensive framework that allows, via either assessing the ESG scores/underlying measures or calculating different sets of indices, to track progress towards the goals and their associated targets, and accordingly prioritize goals that firms could have the greatest impact upon and identify where specific gaps might exist.

Table 2
List of all variables.

Variables	Definition	Measurement
Dependent Variables		
ESG	ESG score	Overall company score based on verifiable reported information in the environmental, social, and governance pillars. Ranges from 0 to 100.
Env	Environmental pillar score	Includes emissions, innovation, resource use categories. Ranges from 0 to 100.
Soc	Social pillar score	Includes community, human rights, product responsibility, workforce categories. Ranges from 0 to 100.
Gov	Governance pillar score	Includes CSR strategy, management, shareholders categories. Ranges from 0 to 100.
Independent Variables		
ROA	Return on Assets	Net income/total assets
Ln TA	Firm size	Natural logarithm of total assets
TL/TA	Total liabilities to total assets	Total liabilities/total assets
Control Variables		
BTMV	Book to market value ratio	Book value of equity/market value of equity
GDP	Gross domestic product growth rate	Annual GDP growth rate, World Bank
FDI	Foreign direct investments	Net inflows (% of GDP), World Bank
RQ	Regulatory quality	Percentile rank, World Bank
VA	Voice and accountability	Percentile rank, World Bank

As demonstrated in Fig. 1, the mapping process undertaken by this study is as follows. First, we start by identifying the SDG that we wish to map or link to the ESG scores. Second, the different targets related to each SDG are identified.[1] Afterwards, we attempt to map these targets with the most relevant underlying measures out of the 178 measures of the ESG score, based on their description provided by Refinitiv. Due to the breadth of the SDGs targets, each of them encapsulates several underlying measures. Nonetheless, not all SDGs targets could be linked/mapped to relevant underlying measures (because many of these targets are focused on governmental rather than business actions).

Finally, following the mapping of the targets with the underlying measures, we identify the category and pillar relevant to the selected underlying measures, based on which we consequently map the SDG with the relevant ESG pillar score. Then, to measure the extent to which each SDG is mapped with the ESG underlying measures, we calculate, at goal level, the total number of relevant ESG underlying measures that could be mapped/linked with the each SDG_j (Num. of relevant ESG measures for SDG_j), and estimate the ESG Relevance Index (ERI) as the ratio of that number to the total number of ESGs underlying measures (178), as follows:

$$ERI_j = \frac{\text{Num. of relevant ESG measures for } SDG_j}{178} \quad (1)$$

To assess the impact of firms in achieving the SDGs, we utilize the ESG performance as a proxy for the extent to which firms contribute to the SDGs. Prior studies, including Betti et al. (2018) and Rajesh (2020), reveal supportive evidence in favor of using ESG scores as an indicator of sustainability performance and SDGs impact. Therefore, after identifying the ESG issues that contribute to the SDGs (via our mapping), we explore the firm-specific characteristics that may impact an organization's ESG performance, hence gaining more insight into an organization's contribution to the SDGs, estimating the following models:

$$ESG_{it} = \alpha + \beta_1\, Profitability + \beta_2\, LnTA + \beta_3\, TL/TA + \beta_4\, BTMV + \beta_5\, GDP + \beta_6\, FDI + \beta_7\, RQ + \beta_8\, VA + \varepsilon_{it} \quad (2)$$

$$Env_{it} = \alpha + \beta_1\, Profitability + \beta_2\, LnTA + \beta_3\, TL/TA + \beta_4\, BTMV + \beta_5\, GDP + \beta_6\, FDI + \beta_7\, RQ + \beta_8\, VA + \varepsilon_{it} \quad (3)$$

$$Soc_{it} = \alpha + \beta_1\, Profitability + \beta_2\, LnTA + \beta_3\, TL/TA + \beta_4\, BTMV + \beta_5\, GDP + \beta_6\, FDI + \beta_7\, RQ + \beta_8\, VA + \varepsilon_{it} \quad (4)$$

$$Gov_{it} = \alpha + \beta_1\, Profitability + \beta_2\, LnTA + \beta_3\, TL/TA + \beta_4\, BTMV + \beta_5\, GDP + \beta_6\, FDI + \beta_7\, RQ + \beta_8\, VA + \varepsilon_{it} \quad (5)$$

Before running the regression models, we test for multicollinearity among the explanatory variables through the use of variance inflation factor (VIF). According to the results, no multicollinearity is observed since the inter-correlations among the explanatory variables are low (see Appendix B). We then run our regression analyses. To capture the variation within the cross-sectional data and time effects in the panel data, this study follows Garcia et al. (2017) and Uyar et al. (2020), employing a panel regression. Hausman's specification test is employed to determine whether a random or fixed-effects panel regression best fits our examined sample. The result reports a p-value of 0.000 (p-value $<$ 0.005), thus, the null hypothesis is rejected, recommending the use of fixed effects (see Appendix B).

However, such result provides evidence of a correlation between the regressors (explanatory variables) and the regression error (error term),

[1] For full details, see https://www.un.org/sustainabledevelopment/sustainable-development-goals/.

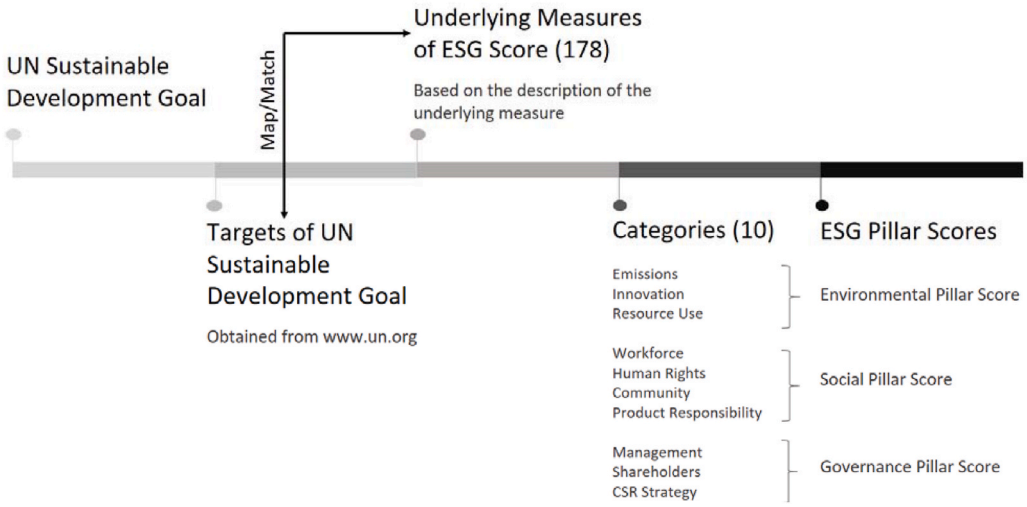

Fig. 1. Detailed mapping process of ESG scores with SDGs.

suggesting the presence of an endogeneity problem (Garcia et al., 2017; Lahouel, 2019). Accordingly, this study checks for endogeneity issues that may be present in the regression analyses resulting from omitted variables bias or reverse causality concerns. We find that theoretical arguments and empirical evidence suggest that higher profitability would lead to increased ESG performance. Meanwhile, the impact on ESG activities may also significantly enhance profitability because of a possible enhancement in firms' reputation, suggesting that the direction of causality between profitability and ESG performance could run in both ways (Brogi and Lagasio, 2019). Consequently, following Fatemi et al. (2018), Li et al. (2018), and Yu et al. (2018), we supplement our fixed-effects regressions with a two-stage least squares (2SLS) estimation method, mitigating concerns over endogeneity stemming from reverse causality and further strengthening our claims regarding the directionality of our results. We investigate this by instrumenting our profitability variable (ROA) with the industry-year average ROA, following Chen et al. (2011), El Ghoul et al. (2017), Aouadi and Marsat (2018), and Eliwa et al. (2019).

4. Findings and analysis

4.1. Mapping ESG scores with UN SDGs

Table 3 provides the results of our mapping of the 17 SDGs and their associated targets with the three ESG pillars, the 10 categories and their relevant underlying measures. In Table 4 and Fig. 2, we can observe a substantial variation in the extent to which each SDG is mapped with the ESG underlying measures. For example, the ERI ranges from 1.1% for SDG 1 and SDG 14 to 10.7% for SDG 12, showing that some ESG issues are more relevant to the SDGs than others; it would be expected that some SDGs, e.g., SDG 12 (responsible consumption and production), to be more important to the business sector than other goals, such as SDG 4 (quality education). In this regard, it is important to note that the number of mapped targets varies across the SDGs, ranging from only one in SDGs (1, 11, 13 and 17) to 6 in SDG 12, which suggests that, at goal level, not all targets are as equally important/relevant. Our analysis also shows that out of the 169 targets of the SDGs, the total number of targets that could be mapped are only 40, meaning that only around 24% of the SDGs targets could be captured by relevant ESG indicators, which should be unsurprising as many targets are focused on government rather than business actions.

4.2. Descriptive statistics

To assess the role of firms in achieving the SDGs, we utilize the ESG scores as proxies for the extent to which firms contribute to the SDGs. Table 5 reports the descriptive statistics of the variables used in the study. During 2002–2018, the overall ESG score averaged 50.7 whereas the Environmental score averaged 51.11, the Social (Governance) score averaged 49.25 (51.86). The ESG scores were highly volatile, ranging from 7.9 to 95.5. Similar findings are also observed across the ESG pillar scores. The results demonstrate that the sample firms exhibit dissimilar characteristics, and are operating in countries with diversified macroeconomic and institutional environments.

Table 6 reports the average ESG scores across industries, examining the degree to which each industry implements policies and initiatives aligned with ESG issues. Similar to prior studies (Lourenço and Branco, 2013; Garcia et al., 2017), findings indicate that companies operating in environmentally and socially sensitive industries (i.e., those subject to more social/moral/political debates and those that are more likely to cause social and environmental damage, such as energy and telecommunications) exhibit overall better ESG performance. Surprisingly, companies operating in the technology industry seem to exhibit superior performance. This is consistent with Gandia (2008), suggesting that companies operating in industries requiring significant investment in intangibles, such as technology, tend to undertake more ESG activities.

4.3. Regressions

Table 7 presents regression coefficients for the regression models estimated in equations (2)–(4), investigating the impact of the previously identified firm-specific determinants on the extent of corporate ESG performance. Model (I)-Panels A-C report the fixed-effects regression analyses, while Model (II)-Panels A-C report the relevant 2SLS results. Findings reported in Model (I)-Panels A-C, demonstrate that profitability exhibits a significantly positive influence on ESG, environmental and social performance, which agrees with the legitimacy and stakeholder theories, predicting that profitable companies, continuously being monitored by their diverse stakeholders, tend to manifest their contribution to their stakeholders' and society's well-being through increased ESG activities (Muttakin and Khan, 2014). However, Panel D indicates no significant association between profitability and governance performance, as found in Garcia et al. (2017). As expected, we also find that firm size carries robustly positive coefficients; larger companies, having more resources for engaging in sustainability activities and receiving greater attention from the public and regulatory

Table 3
Mapping ESG categories and measures with SDG targets.

ESG categories	ESG underlying measures	SDGs targets
Environmental pillar score		
Resource Use	Water Recycled	6.4
	Water Use	**6.4**
	Policy Water Efficiency	**6.4**
	Targets Water Efficiency	**6.4–12.2**
	Renewable Energy Use	**7.2**
	Energy Use	**7.3**
	Policy Energy Efficiency	**7.3**
	Targets Energy Efficiency	**7.3–12.2**
	Policy Sustainable Packaging	**12.1**
	Product Impact Minimization	**12.1**
	Environmental Materials Sourcing	**12.4**
	Toxic Chemicals Reduction	**12.4**
	Env Supply Chain Partnership Termination	**12.7**
	Policy Environmental Supply Chain	**12.7**
	Environmental Supply Chain Mgt	**12.7**
	Environmental Supply Chain Monitoring	**12.7**
	Land Environmental Impact Reduction	**15.3**
Emissions	Biodiversity Impact Reduction	**2.4–14.2–15.1**
	Policy Emissions	**3.9–11.6–13.2**
	Discharge into Water System	**3.9**
	Waste Recycling Ratio	**3.9–11.6–12.4**
	Discharge into Water System	**6.3–14.1**
	Cement CO2 Equivalents Emission	**9.4**
	Estimated CO2 Equivalents Emission Total	**9.4**
	VOC or Particulate Matter Emissions Reduction	**11.6–13.2**
	Hazardous Waste	**12.4**
	E-Waste Reduction	**12.5**
	Climate Change Commercial Risks Opportunities	**13.2**
	Targets Emissions	**13.2**
	Ozone-Depleting Substances	**13.2**
	NOx and SOx Emissions Reduction	**13.2**
	Environmental Partnerships	**17.16**
Innovation	GMO Products	**2.5**
	Water Technologies	**3.9–6.4**
	Renewable/Clean Energy Products	**7.2**
	Renewable Energy Supply	**7.2**
	Sustainable Building Products	**7.3**
	Nuclear Production	**7.3**
	Environmental Products	**8.4–12.1**
	Product Impact Minimization	**8.4**
	Organic Products Initiatives	**8.4**
	Env R&D Expenditures to Revenues	**9.5**
	Hybrid Vehicles	**12.1**
	Labeled Wood Percentage	**15.1**
	Equator Principles or Env Project Financing	**17.16**
Social pillar score		
Workforce	HIV-AIDS Program	**3.3**
	Health & Safety Policy	**3.4**
	Health & Safety Training	**3.4**
	Training and Development Policy	**4.4**
	Average Training Hours	**4.4**
	Supplier ESG training	**4.7–12.7**
	HRC Corporate Equality Index	**5.1–10.3**
	Policy Diversity and Opportunity	**5.1–10.3**
	Targets Diversity and Opportunity	**5.1–10.3**
	Women Employees	**5.1–16.7**
	Flexible Working Hours	**5.4**
	Day Care Services	**5.4**
	Women Managers	**5.5**
	Net Employment Creation	**8.5**
	Announced Layoffs to Total Employees	**8.5**
	Employees with Disabilities	**8.5–16.7**
	Injuries	**8.8**
	Occupational Diseases	**8.8**
	Trade Union Representation	**10.4**
	Women Managers	**16.7**
Human Rights	Policy Child Labor	**8.7**
	Policy Forced Labor	**8.7**
	Policy Human Rights	**8.7**
	Policy Freedom of Association	**8.8**
	Fundamental Human Rights ILO UN	**8.8–17.16**
Community	Product Sales at Discount to Emerging Markets	**1.4**
	Diseases of the Developing World	**3.3**
	Policy Bribery and Corruption	**16.5**
	Policy Business Ethics	**16.5**
	Improvement Tools Business Ethics	**16.5**
	Whistleblower Protection	**16.5**
	OECD Guidelines for Multinational Enterprises	**17.16**
Product Responsibility	Product Access Low Price	**1.4**
	Policy Fair Trade	**2B**
	Policy Customer Health & Safety	**3.4**
	Retailing Responsibility	**3.5**
Governance pillar score		
Management	Executive Members Gender Diversity	**5.5**
	Female on Board	**5.5**
Shareholders		
CSR Strategy	CSR Sustainability Report Global Activities	**12.6**
	CSR Sustainability Reporting	**12.6**
	GRI Report Guidelines	**12.6**
	Global Compact	**17.16**

Table 4
ESG relevance index.

SDGs	Targets of SDGs	Num. of ESG pillars	Num. of ESG categories	Num. of relevant ESG underlying measures	ESG Relevance Index (ERI).
SDG 1	1.4	1	2	2	1.1%
SDG 2	2.4, 2.5, 2B	2	3	3	1.7%
SDG 3	3.3, 3.4, 3.5, 3.9	2	5	10	5.6%
SDG 4	4.4, 4.7	1	1	3	1.7%
SDG 5	5.1, 5.4, 5.5	2	2	9	5.1%
SDG 6	6.3, 6.4	1	3	6	3.4%
SDG7	7.2, 7.3	1	2	8	4.5%
SDG 8	8.4, 8.5, 8.7, 8.8	2	3	13	7.3%
SDG 9	9.4, 9.5	1	2	3	1.7%
SDG 10	10.3, 10.4	1	1	4	2.2%
SDG 11	11.6	1	1	3	1.7%
SDG 12	12.1, 12.2, 12.4, 12.5, 12.6, 12.7	3	5	19	10.7%
SDG 13	13.2	1	1	6	3.4%
SDG 14	14.1, 14.2	1	1	2	1.1%
SDG 15	15.1, 15.3	1	3	3	1.7%
SDG 16	16.5, 16.7	1	2	7	3.9%
SDG 17	17.16	3	5	5	2.8%

bodies, tend to have better ESG performance (Alsaeed, 2006; Garcia et al., 2017). With regards to financial leverage, the negative coefficients imply that highly leveraged companies, due to fund limitations and increased debt obligations, might lack sufficient resources to support

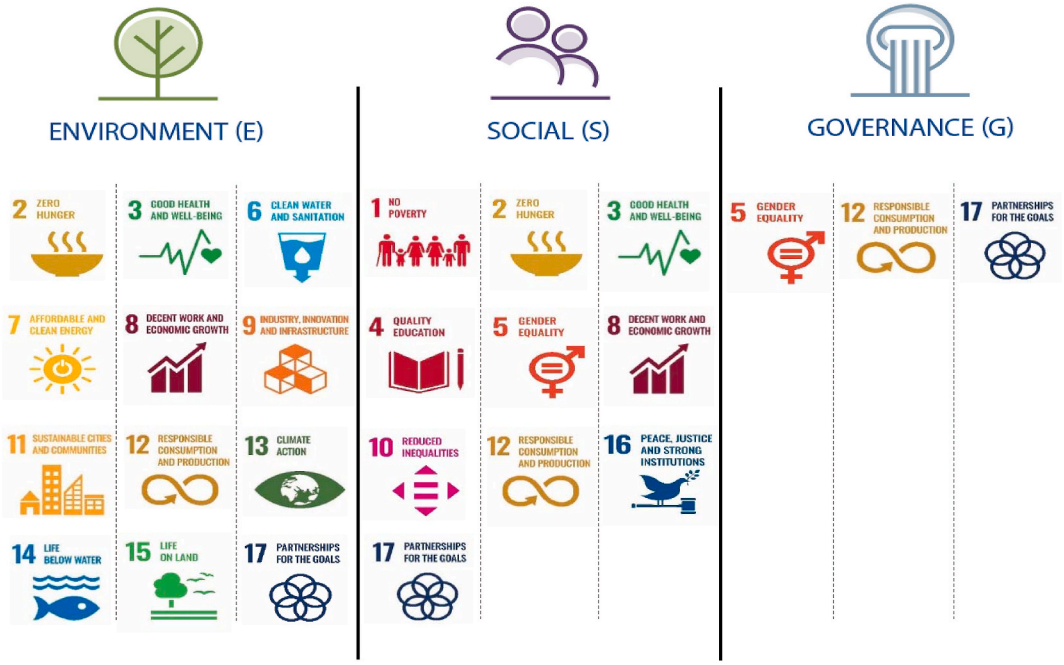

Fig. 2. Mapping of ESG pillars with the 17 SDGs.

Table 5
Descriptive statistics.

Variables	Mean	Std. Dev.	Min.	Max.
Dependent				
ESG	50.68	18.02	7.91	95.47
Environmental	51.11	23.14	2.72	98.38
Social	49.25	23.11	3.56	98.60
Governance	51.86	20.09	2.60	97.84
Independent				
ROA	6.90	6.00	−5.76	34.30
Ln TA	16.40	1.61	11.05	22.11
TL/TA	0.58	0.22	0.00	1.06
Control				
BTMV	0.67	0.549	−6.66	7.69
GDP	3.97	2.90	−9.13	19.59
FDI	8.63	14.42	−46.12	58.59
RQ	69.60	21.07	17.30	100.00
VA	52.47	23.25	2.34	87.01

their ESG activities (Artiach et al., 2010; Lourenço and Branco, 2013).

Interestingly, we find that GDP growth rates negatively impact the overall ESG and environmental performance, while the FDI negatively impacts all three scores. This may be attributed to the fact that governments in emerging markets tend to prioritize their economic welfare at the expense of sustainable development, demanding businesses to contribute to the local GDP and secure capital investment, compromising their ability to undertake sustainability initiatives (Lauwo et al., 2016). We also reveal that a country's strong regulatory quality has a positive impact on the ESG, environmental and social scores (De Villiers and Marques, 2016); in contrast, there is a negative association between ESG performance and a country's level of transparency and accountability, which suggests that firms operating in emerging markets characterized with poor transparency might be keen to disclose more sustainability information (and so enhance their ESG performance) in order to reduce asymmetric information and moral hazard associated with the lack of transparency and accountability.

Model (II)-Panels A-C report the 2SLS regression results, which are consistent with our main predictions regarding the impact of profitability and firm size on the extent of ESG performance, suggesting that endogeneity is not driving our main findings. However, findings reveal that leverage positively impacts ESG performance, supporting the agency theory which suggests that highly leveraged firms tend to undertake and disclose more sustainability information in order to reduce

Table 6
Mean ESG scores - by industry

Industry	N	ESG	Environmental	Social	Governance
Sensitive Industries					
- Environmentally Sensitive					
Basic Materials	102	51.499	52.326	49.559	52.835
Energy	69	58.175	64.358	59.842	49.34
Industrials	151	44.89	43.356	41.418	50.641
Utilities	57	45.463	44.339	46.427	45.59
- Socially Sensitive					
Consumer Discretionary	144	47.907	48.052	46.456	49.435
Consumer Staples	90	48.236	46.65	48.378	49.844
Financials	229	53.225	54.479	51.493	53.84
Telecommunications	52	54.258	52.257	53.35	57.547
Non-sensitive Industries					
Real Estate	64	45.041	45.017	43.361	47.014
Technology	79	59.419	60.392	57.508	60.546
Health Care	68	45.493	44.908	41.457	50.833

Table 7
Regression analysis for ESG performance.

	Panel A: ESG score		Panel B: Environmental pillar		Panel C: Social pillar		Panel D: Governance pillar	
Model	(I) FE	(II) 2SLS	(I) Fixed	(II) 2SLS	(I) Fixed	(II) 2SLS	(I) Fixed	(II) 2SLS
Constant	−124.3***	−72.15***	−200.8***	−119.1***	−145.2***	−82.18***	−14.72*	−8.066
	(-21.09)	(-8.301)	(-25.06)	(-10.55)	(-19.06)	(-7.653)	(-1.786)	(-0.858)
ROA	0.0812**	2.330***	0.178***	3.110***	0.116**	2.714***	−0.0675	1.013***
	(2.136)	(7.694)	(3.446)	(7.908)	(2.366)	(7.253)	(-1.270)	(3.094)
Ln TA	10.41***	5.348***	15.26***	7.306***	11.00***	5.870***	4.333***	2.555***
	(30.05)	(21.16)	(32.38)	(22.26)	(24.57)	(18.80)	(8.945)	(9.350)
TL/TA	−3.951**	20.59***	−5.180**	25.70***	−1.701	23.84***	−5.218*	11.08***
	(-2.075)	(5.546)	(-2.000)	(5.332)	(-0.691)	(5.199)	(-1.959)	(2.762)
BTMV	1.281***	6.770***	2.094***	10.94***	1.052**	7.242***	0.639	1.570
	(3.752)	(6.264)	(4.511)	(7.792)	(2.385)	(5.424)	(1.338)	(1.343)
GDP	−0.142***	−0.683***	−0.302***	−0.747***	−0.101	−1.016***	−0.00913	−0.225**
	(-2.721)	(-7.816)	(-4.269)	(-6.581)	(-1.507)	(-9.403)	(-0.126)	(-2.380)
FDI	−0.122***	−0.295***	−0.111***	−0.410***	−0.192***	−0.368***	−0.0528*	−0.0816***
	(-5.437)	(-11.84)	(-3.635)	(-12.67)	(-6.627)	(-11.96)	(-1.684)	(-3.029)
RQ	0.344***	−0.000125	0.453***	0.0533	0.496***	−0.102***	0.0442	0.0588**
	(8.743)	(-0.00465)	(8.475)	(1.531)	(9.763)	(-3.080)	(0.803)	(2.027)
VA	−0.330***	0.146***	−0.525***	0.174***	−0.364***	0.226***	−0.0737	0.0221
	(-8.698)	(8.467)	(-10.17)	(7.752)	(-7.414)	(10.61)	(-1.388)	(1.182)
P-value	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001

T-statistics (in parentheses), with *, **, *** denoting statistical significance (two-tailed) at the 1%, 5%, and 10% levels, respectively.

agency costs generated as a result of their higher debt levels (Jensen and Meckling, 1976). Overall, the results show that endogeneity concerns are not likely to be driving our primary findings.

5. Summary and conclusion

As an initial step in directing businesses towards effectively contributing to the achievement of the SDGs, this study develops a comprehensive framework that hand-maps the SDGs and their targets with a firm's sustainability practices, reflected in its ESG scores. In this analysis, we consider all the goals and their 169 associated targets, rather than limiting our mapping to specific goals/targets, to provide a comprehensive analysis of the linkages between the SDGs and ESG issues. Our mapping also provides an actionable solution for firms to identify where the SDGs are connected with their ESG performance and accordingly tangibly measure their progress towards achieving the SDGs via assessing the ESG scores/underlying measures or calculating different sets of indices. Our study shows that some SDGs and targets are more relevant to the business sector than others, finding that only 40 targets (out of 169 targets) could be captured by relevant ESG indicators, which should be unsurprising as many targets focus on government, rather than business actions.

Unlike other mapping studies (e.g., Betti et al., 2018; Consolandi et al., 2020), this study goes a step further and investigates how firm-specific characteristics help explain variation in corporate sustainability performance. We did not focus on specific selected measures but rather we consider the ESG scores (overall and pillar scores) to provide an overall picture of firms' role towards contributing to the SDGs and sustainability performance. Nevertheless, we are still aware that not all SDGs/targets could be mapped with the ESG issues. To do so, we analyze the firm's performance on the three ESG dimensions, and thereafter investigate potential associations between firm-specific characteristics and corporate sustainability performance. Our findings indicate that profitable and larger companies are more likely to exhibit better sustainability performance, which is consistent with prior studies. Findings also reveal that financial leverage has a significant impact on the level of corporate ESG performance (Lourenço and Branco, 2013; Garcia et al., 2017).

We believe our findings are helpful for corporates, academics and investors. We provide businesses with a well-structured practical framework that links their ESG performance with the relevant SDGs and targets, and eliminates confusion around where the SDGs are connected with their ESG activities. Accordingly, firms are able to prioritize goals that they could have the greatest impact upon and identify where specific gaps might exist. Academically, we hope that our mapping findings will contribute to more understanding of the linkages among the ESG issues, corporate sustainability performance and the SDGs, and allow for quantitatively evaluating firms' progress towards the SDGs using available ESG performance indicators. Our findings also contribute to the debate over the effect of firm-specific characteristics on corporate sustainability performance in the context of emerging markets, which extends the literatures on the agency, legitimacy, stakeholder and institutional theories. For investors and other stakeholders, using available ESG performance indicators, they can assess their firms' impact on contributing to the relevant SDG at both target and goal levels.

This research has certain limitations, which can be extended as directions of future work. Firstly, in the scope of this study, we utilize ESG measures as proxies for firms' impact on the SDGs; however, they obviously do not directly measure that impact. "True measures of impact are difficult to obtain since they require data from outside the company. Impact measures are about positive and negative externalities being created by a company's operation" (Betti et al., 2018, p.16). In addition, we utilize the ESG scores provided by Refinitiv. It will be instructive to consider other sustainability scores provided by other rating agencies, such as Dow Jones sustainability indices, and compare the results. Also, instead of using secondary data on ESG scores, surveys and interviews can be utilized to collect primary data on sustainability performance, and accordingly a comparative study of the results can make a contribution considering future studies. Finally, our study utilizes a sample of only large and mid-cap stock-listed companies, hence, including firms of smaller size can provide more insights into the results.

CRediT authorship contribution statement

Raneem Khaled: Data curation, Methodology, Writing – original draft, Validation. **Heba Ali:** Methodology, Software, Writing – original draft, Validation. **Ehab K.A. Mohamed:** Conceptualization, Writing – review & editing, Validation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence

the work reported in this paper.

Appendix A. Summary of Related Studies

Study	Objective	Key Findings
Corporate role in achieving UN SDGs		
Topple et al. (2017)	Understand how multinational enterprises (MNEs) engage with sustainable business practices and how the SDGs may be better implemented by MNEs in the region of the Association of South-East Asian Nations.	Incorporating of SDGs within MNE practices can be achieved through the use of international sustainability standards and guidelines (such as the Global Reporting Initiative standards).
Vildasen (2018)	Understand how companies integrate the SDGs in their business operations.	The SDGs framework is a well-suited platform for debating social and environmental concerns with societal stakeholders. However, customers may see the generic nature of the SDGs as irrelevant when it comes to specific business operations.
Boiral et al. (2019)	Explore the initiatives for community engagement implemented by extractive organizations and their possible alignment with the framework of the 2030 Agenda for sustainable development.	Providing a broader perspective on the specific sustainability challenges faced by extractive organizations operating in remote areas.
Goubran (2019)	Explore the role of construction and real estate activities in supporting the SDGs and their targets.	Results show that 17% of the SDG targets are directly dependent and 27% of the targets are indirectly dependent on these sectors' activities, allowing for their contribution to the SDGs.
Ike et al. (2019)	Explore how multinational enterprises in Japan achieve the SDGs when establishing, or expanding, subsidiary operations in the Philippines, Indonesia, Thailand and Vietnam.	Findings show that policy makers in the host countries should ensure SDGs such as education and strong institutions are in place to attract multinational enterprises to their shores.
Pineda-Escobar (2019)	Explore SDGs implementation in Colombia.	Results indicate that companies show a general interest in adopting the SDGs as part of their sustainability strategies, yet very few would go deeply into the analysis of the SDG targets.
Van Zanten and Van Tulder (2018)	Explore MNEs' engagement with SDGs in Europe and North America based on their home/host-countries and their industrial sectors.	MNEs engage more with SDG targets that are actionable within their operations than those outside of it, and more with SDG targets that ''avoid harm'' than those that ''do good''.
Rosati and Faria (2019a)	Analyze country-level institutional factors related to the decision to address the SDGs in sustainability reports.	Organizations reporting on the SDGs are more likely to be located in countries with higher levels of climate change vulnerability, national corporate social responsibility, spending on tertiary education, indulgence and individualism, and lower levels of market coordination, employment protection, power distance and long-term orientation.
Rosati and Faria (2019b)	Investigate the relationship between early adoption of SDG reporting and a series of organizational factors.	Early adoption of SDG reporting is related to a larger size, a higher level of intangible assets, a higher commitment to sustainability frameworks and external assurance, a higher share of female directors, and a younger board of directors.
Van der Waal and Thijssens (2020)	Investigate potential associations between SDG involvement and company specific factors.	SDG involvement is inspired by a mixture of legitimacy and institutional motives.
Motivations, opportunities and barriers affecting corporate engagement in SDGs		
Fleming et al. (2017)	Explore the motivations and barriers for companies to work towards implementing the SDGs in Australia.	Corporate and personal values are the key component driving the company's positive responses to the SDGs.
Haas et al. (2019)	Explore different opportunities for large-scale commercial fishing sector to engage with the different targets of SDG 14.	Results suggest that the fishing industry has the opportunity to implement practices that can help to reduce marine pollution or bycatch.
Interactions between SDGs and targets		
Le Blanc (2015)	Explore how the SDGs and targets can be seen as a network.	Results indicate that the SDGs are unequally connected, with some goals being connected to many other goals through multiple targets, while other goals are weakly connected to the rest of the system.
Nilsson et al. (2018)	Map and assess interactions between the SDGs (both positive and negative), analyzing how interactions depend on factors such as geographical context, resource endowments, and governance.	The pilot application of the SDG interactions framework is associated with a difficulty in identifying and assessing all key interactions comprehensively. Therefore, it is crucial to carefully select targets for analysis.
Allen et al. (2019)	Assess the prioritization of SDG targets in the Arab Region and identify target interlinkages.	The highest five ranked targets in terms of interlinkages were: 13.1 climate change resilience), 7.3 (energy efficiency), 12.2 (sustainable resource use), 7.2 (renewable energy), and 2.4 (sustainable food production).

Appendix B

Appendix B.1. Variance Inflation Factor (VIF)

	VIF	1/VIF
RQ	2.784	.359
ROA	1.914	.523
Tl/TA	1.887	.53
FDI	1.855	.539
Ln TA	1.85	.541
VA	1.79	.559
BTMV	1.399	.715
GDP	1.222	.818
Mean VIF	**1.838**	

Appendix B.2. Hausman's Specification Test

	ESG Score	Environmental Score	Social Score	Governance Score
	Coef.	Coef.	Coef.	Coef.
Chi-square test value	652.327	760.845	598.888	38.125
P-value	0.000	0.000	0.000	0.000

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