



Sustainability Reporting in 4th Industrial Revolution: Evidence from Manufacturing Companies in Bangladesh

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Abstract

This paper aims to depict the voluntary sustainability reporting scenario of manufacturing companies in Bangladesh. Annual reports of 19 listed companies from Dhaka Stock Exchange were analyzed. Annual reports from EY2017–2019 were analyzed to prepare a sustainability reporting score and identify its determinants, utilizing EY2018 data specifically to assess the current scenario of voluntary reporting. Analysis reveals that zero companies under the study have adopted GRI framework for sustainability reporting, while 10.53% of companies adopted the <IR> framework. No companies committed to United Nations Global Compact initiative. 15.79% recognize climate change, and only 5.26% align their activities with Sustainable Development Goals set out by United Nations. 26.32% of companies recognize Corporate Sustainability aspects through 3Ps or ESG approach. 68.42% perform CSR activities but fail to communicate the impact of their business on communities. 31.58% include information on health and safety of employees. 36.84% report on their environmental actions. However, none of the companies provide any performance measures regarding their social and environmental actions, such as not reporting on CO₂ emissions or energy consumption. Regression analysis reveals Ratio of Foreign Directors have a statistically significant positive, and Company Profitability (ROA) and Ratio of Female Directors have a statistically significant negative association with number of voluntary sustainability disclosures made. These findings are supported by resource dependency theory, proprietary cost theory, legitimacy theory, female director family affiliation in Bangladesh, and critical mass theory. Thus, stakeholders should focus on these factors to improve status quo.

Keywords: Voluntary, 3P, ESG, Sustainability reporting, SDG, Bangladesh

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Introduction

The dawn of 4th Industrial revolution (4IR) is fundamentally altering the way we live, work and socialize. There is no historic precedent of the exponentially faster pace of innovation brought to us by 4IR leading to transformations unlike anything humankind has ever experienced (Schwab, 2016). The first world is already on the bandwagon and reaping the fruits of the ongoing revolution, but for least developed countries the challenges to access its potential is substantial. Appropriate infrastructure, future-proof skills, affordable technologies are a requirement to take part in the revolution. Just as important are policies, regulations and frameworks to support actions. According to an article published in World Economic Forum, “The 4IR requires good policy and regulation,

and will only be possible through coordinated action from various ministries” (Adhikari, 2019). Bangladesh is one of the fastest growing economies in the world with a forecasted GDP growth of 8% in 2020 (Asian Development Bank (ADB), 2019, p. 20). With an above Asian average GDP growth, Bangladesh places 105th in The Global Competitiveness Report 2019 (World Economic Forum, 2019, p. xiii) and is on track to graduate from the UN’s Least Developed Countries (LDC) list in 2026 (World Bank, 2021). This extraordinary growth is said to be propelled by growing manufacturing and construction sector (Lightcastle Analytics Wing, 2019). 19.89% of contribution in the Bangladesh Economy comes from manufacturing industries (Bangladesh Bureau of Statistics). Such massive contribution in the economy is certain to have impact on the living standards, society, and environment of the country.

It is essential that economic growth is accompanied by sustainable practices to ensure better living. Bangladesh is currently ranked 175 out of 180 countries in the Environmental Performance Index with one of the worst Air Quality, Water Resource, and Treatment, Environmental Health rankings (Block et al., 2024). Bangladesh also ranks 130 out of 193 countries in Human Development Index (United Nations Development Programme, 2025). As of 2016, 24.3% of the population still lives below National Poverty Line (Asian Development Bank, 2019). Bangladesh ranks 150 out of 181 countries in Corruption Perception Index (Transparency International e.V., 2025). Thus, despite economic prosperity, Bangladesh is yet to improve in other areas and translate that prosperity to meet environmental and social goals. Members of United Nations adopted the Sustainable Development Goals (SDG) in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. The UN Secretary General has called on all sectors of society to mobilize actions for the fulfilment of SDGs (2020). The United Nations Global Compact (UNGC) issued Communication on Progress (CoP) policy for companies to report on adoption of UNGC principles that focus on Human Rights, Labor, Environment, and Anti-Corruption. As of 2017, 93% of the top 250 companies (based on revenue) now report their sustainability practices with most now following the Global Reporting Initiative (GRI) standards which provides a universally applicable set of standards that aims to assist organizations in communicating their impact on critical sustainability issues. The same survey links Corporate responsibility reporting to SDGs and claims businesses strongly resonate with it. It states 43% of the top 250 companies (based on revenue) link their responsibility activities with SDGs. Such adoption within only two years of SDG announcement suggests it will have a growing profile over time (KPMG, 2017).

Addressing core issues like climate change, inequality, affordable technologies to allow everyone to participate in the new world is the promise of 4IR, which can only be achieved through ensuring sustainable development. Bangladesh as a country has already aligned its 7th Five Year Plan with the SDGs and is seeing improvements in almost all SDG indicators. There is also a dire need of non-financial information by stakeholders that goes beyond the regulatory requirements. 59% experts believe sustainability strategies can add value to the organization (EY, 2014). 78% wants companies to address important social justice issues (Komornicki, 2017). So, the need for information regarding sustainability issues and reporting on them is clear. With the continuous steep fall of Dhaka Stock Exchange Index, reporting on sustainability issues might help restore trust in investors too.

The global landscape of sustainability reporting has shifted dramatically, as the integration of the Fourth Industrial Revolution (4IR) and ESG metrics becomes mandatory in many jurisdictions (Fagbemi et al., 2025). Recent studies emphasize that while for manufacturing sectors ESG adoption is growing, maturity remains uneven with significant reporting gaps (Verma & Panwar, 2026). In the transition toward IFRS S1 and S2 in the emerging economies, firms are still not ready for their adoption (Fianko et al., 2025). This study fills a critical gap by providing a baseline assessment of the manufacturing sector’s readiness for these impending shifts, particularly as the Bangladesh Securities and Exchange Commission (BSEC), Financial Reporting Council (FRC) moves toward mandatory ESG requirements (Mahmud, 2026).

The adoption and alignment mechanism of SDGs and reporting of sustainability issues by private sectors in Bangladesh is quite unknown. There is also no comprehensive regulation on private

sector or listed companies to report on sustainability issues. Thus, the status of reporting on disclosure on an Environmental, Social, and Governance level is still mostly voluntary. Dhaka Stock Exchange Limited (DSE) issued a Guidance on adopting Sustainability Reporting for Listed Companies in 2018, with technical support from Global Reporting Initiative (GRI). The guideline urges to integrate reporting on Environmental, Social, and Governance (ESG) and advises on how companies can adopt sustainability reporting framework like GRI. Understanding the current status of sustainability reporting is vital to forming regulations regarding such reporting, designing incentives and punishment, and generating interest in information on sustainable practices which can add to the analysis of company valuation as well. Given that sustainability reporting is still a voluntary act; which companies choose to do it, what information do they provide and to what extent, and how are they looking forward to establishing sustainable business models in the 4IR are questions this paper aims to answer by identifying reporting companies and their voluntarily reported sustainability disclosures, and analyzing company factors to identify what affects such disclosures. This paper aims to explore and analyze the voluntary sustainability reporting practices by (manufacturing) companies listed in DSE and factors affecting such practice. For this purpose, annual report of the companies under the scope were analyzed to identify: Reporting Framework adopted by companies, Commitment to UNGC Corporate Sustainability Initiative through CoP, Reporting Voluntarily on Corporate Sustainability, Adoption and alignment of company affairs with SDGs, Factors that may influence voluntary disclosure of sustainability practice issues.

Literature Review

Sustainable Development, Corporate Sustainability and 4th Industrial Revolution

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Commission, 1987). According to the same source, sustainable development contains within it two key concepts: The concept of need, specifically the essential need of the poor, which get overriding priority and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs. A sustainable development strategy refers to adopting policies which allow for economic advancement while retaining the long-term value of the environment. Sustainability or sustainable development for corporations is often defined by three pillars (3Ps); People, Planet, Profit being social, environmental, and economic sustainability respectively. This concept is also identical to as ESG; or Environmental, Social, and Governance. The economic sustainability meaning generating wealth through proper governance and risk management. Reporting on governance includes reporting on management structure, employee relation, welfare and compensation. Economic sustainability also concerns responsible investment of equity by management. The management and those charged with the responsibility to run the business should have aligned interest with the shareholders by whom they are employed (Stockholder Theory). This is the first bottom line. But an organization has more stakeholders than just shareholders. This not just includes the internal stakeholders like employees and direct stakeholders like customers and suppliers; but encompasses a broad range of parties from the external environment (Stakeholder theory). Organizations directly or indirectly in many ways affect the society that allows it to operate and thus is implicitly responsible to society (Social Contract Theory).

Meeting the challenges such as; diversity, human rights exercise, consumer protection are important social issues that businesses should tackle and report on. Meeting society's expectations and reasonable demands and, giving back to the community is another bottom line for sustainable development. Organizations also have impact on the environment through its operations. From using natural resources to discarding waste and pollution is expected. Businesses also have impact on climate change, wildlife preservation for which it should account for. Returning the environment to its prior condition and compensating for the environmental costs a business incurs is the third pillar of sustainability. However, while these three might be the biggest focus of corporate ESG reporting, sustainable development is a broader concept. Conserving resource for future generation is an important part of sustainable development policy, which is referred to as intergenerational equity.

Overall sustainable development goals are to ensure long-term stability. For which, United Nations and all its members adopted the Sustainable Development Goals – SDGs. In 2015, member states of the United Nations, in a bid to end poverty, protect the planet and ensure all people enjoy peace and prosperity adopted Sustainable Development Goals (SDGs); also known as Global Goals. 17 integrated SDGs were adopted, and a pledge was taken to ensure no one is left behind. They replace the previous Millennium Development Goals (MDGs) of 2000. SDGs are designed to cover issues that affect all and the goal is to build a more sustainable, safer and prosperous planet for humanity.

4IR promises the realization of these sustainable goals mainly through remediation of climate change – a zero-carbon world; establishment of equality through digital transformation, access to knowledge, power and technologies, and other breakthrough in the way to work and live through artificial intelligence, internet of things, nanotechnology, robotics etc. resulting in sustainable productions, ethical supply-chain, satisfactory work-life, guaranteed health and safety and ultimately a better future. Corporations being in charge of most resources have the biggest responsibility and opportunity to implement the exponentially innovative technologies and solutions for sustainable development, bearing the fruits of 4IR.

Need for Corporate Sustainability Reporting

Corporate Sustainability reporting is defined as “an organization’s practice of reporting publicly on its economic, environmental, and/or social impacts, and hence its contributions – positive or negative – towards the goal of sustainable development. Through this process, an organization identifies its significant impacts on the economy, the environment, and/or society and discloses them in accordance with a globally-accepted standard.” (GRI, 2020). The UN Secretary General has called on all sectors of society to mobilize actions for the fulfilment of SDGs (2020). United Nations Global Compact (UNGC) with an aim to unite businesses for a better world, has taken the largest corporate sustainability initiative in a call to companies to align strategies and operations with SDGs and advance them. Since companies have a considerable impact on economy, environment and society; responsible and sustainable business can drive the achievement of SDGs. UNGC urges businesses to do responsible business and investing and explains how and why companies should work towards meeting the 17 SDGs. UNGC issued ten principles for businesses to do business responsibly, implement the SDGs and contribute to societal advancement. The ten principles focus on Human Rights, Labor, Environment and Anti-Corruption. Companies can commit to the UNGC by communicating on their progress through issued Communication on Progress (CoP) Policy. UNGC also collaborates with many frameworks, such as Global Reporting Initiative (GRI) so that meeting requirements of one framework can help comply with CoP. Global Reporting Initiative is a universally applicable set of standards through which reporting organization can publicly make disclosure on their economic, environmental and social impact. Integrated Reporting (IR) is a similar framework to guide corporations to provide high-quality information in annual reports in addition to what regulators require. Integrated Reporting <IR> framework aims to help business disclose on their operations in an integrated way so that, businesses can communicate how they create value; on short, medium and long term.

The need for corporate sustainability reporting is ever rising, as it is the way corporate can communicate on their sustainable practices to consumers. In a global survey conducted by Nielsen in 2015, 66% of respondents said they would pay more to buy from companies who are committing to positive social and environmental impact; which is up from 55% percent of previous year. 3 out of 4 millennials are willing to pay extra (Nielsen, 2015). As consumers are beginning to practice sustainable behaviors, they expect companies to do the same. Most of the investment firms described meaningful steps their firms are taking to integrate sustainability issues into their investing criteria (Eccles & Klimenko, 2019). Investors now believe addressing ESG issues will protect and enhance portfolio returns. 88% of Limited Partners in survey believe that there is added value in responsible investment; 83% that better management of ESG factors will either improve return or reduce risk and 19% attempts to quantify the impact of their General Partners responsible investment efforts (PricewaterhouseCoopers, n.d.). Aside from consumers and investors’ expectations on sustainability

reporting; companies can also benefit from it through better understanding risks, developing long-term plans, improving operations and processes, improving brand-value and reputation, and demonstrating how they influence sustainable practices and development.

Sustainability Reporting Context in Bangladesh & Worldwide Status

Bangladesh has two stock exchanges; Dhaka Stock Exchange Limited (DSE) and Chittagong Stock Exchange Limited (CSE). Both are Partner Exchanges in Sustainable Stock Exchange Initiative (SSE). SSE is a United Nations Partnership program which aims to provide a global platform for exploring how exchanges, in collaboration with investors, companies (issuers), regulators, policymakers and relevant international organizations, can enhance performance on ESG issues and encourage sustainable investment, including the financing of the UN Sustainable Development Goals. However, none of the stock exchanges in Bangladesh require ESG reporting for the listed companies. Listing regulations mandate for reporting on Corporate Governance Code (CGC) of the Bangladesh Securities and Exchange Commission in their Annual Reports. Banking industry is required to report on Corporate Social Responsibilities (CSR) in their Annual Reports under Bangladesh Bank (central bank) guideline. DSE with technological support from GRI published guidelines for sustainability reporting that highlights importance of sustainability reporting in context of Bangladesh and how companies can adopt a sustainability reporting framework, such as GRI. SSE reports that both exchanges provide training regarding ESG issues (Sustainable Stock Exchange Initiative (SSE), n.d.).

In response to the Rana Plaza disaster in April 2013; the “Compact for Continuous Improvements in Labour Rights and Factory Safety in the Ready-Made Garment and Knitwear Industry” in Bangladesh was launched with technical support from International Labor Organization (ILO) in July 2013 which seeks to improve labor, health and safety conditions, and encourage responsible behavior in RMG sector. For financial sectors, Bangladesh Bank issued Policy Guidelines for Green Banking, which acknowledges global warming and climate change and advises banks on financing projects that are environmentally sustainable/reduces pollution. It also issued guidelines for CSR activities, address environmental risks, introduce green services, report on green banking activities. Bangladesh Bank rewards financial institutions on their green activities by giving scores in CAMELS ratings, awards & preference in opening new branches.

According to The Environment Conservation Rules, 1997 [Rule 7(1&2)], industrial units are categorized based on their local environmental impact to provide environmental clearance certificate. The Renewable Energy policy 2009 is committed to facilitate both public and private sector investment in Renewable Energy projects. Bangladesh also enforces tax levies to encourage environment friendly practices. However, there is not policy or guideline that encourages or incentivizes reporting on sustainable practices. Thus, there is also no clear picture of the actual practice of companies regarding sustainability issues. A KPMG study on Corporate Responsibility reveals that worldwide, 75% of studied 4900 companies produce sustainability reports. 78% of the surveyed Asian companies produce sustainability reports. Industry-wise study reveals Oil & Gas (81%), Chemicals (81%), Forestry & Paper (77%), Utilities (74%), Food & Beverage (73%), Financial Services (71%), Construction & Materials (69%), Industrial, Manufacturing & Metals (68%). Top reporting countries have a mix of government regulation, stock exchange requirements and voluntary efforts behind such adoption (KPMG, 2017).

Sustainability Issues and Indicators

The three main sustainability concerns in corporate sustainability reporting are environmental, social, and governance sustainability. Companies may or may not align their activities with these issues. Companies also may or may not report on these issues. Reporting on sustainability requires them to disclose activities performed by companies regarding these issues, as well as disclose indicator measurements that reveal the impact, both positive and negative of their activities, on these issues. For example, GRI Standards require disclosure of economic value generated, financial implication

of climate change, benefit plan obligations and other retirement plans, financial assistance received from government for disclosure and measurement of economic sustainability (GRI Standards 200 series). For accounting environmental sustainability companies have to include consumption of materials, recycled materials used, energy consumption, reduction in energy consumption, water consumption and discharge, habitats protected and restored, Green House Gas (GHG) emissions, reduction in GHG emissions, waste disposal method, water bodies affected by wasted disposal etc (GRI Standards 300 series). For accounting social sustainability companies must disclose on, new employment, turnover, employee benefits, health and safety measurements, work related injuries, ratio of basic salary of men to women, violation of rights on indigenous communities, health and safety impact of product and services, product and service information labeling, customer data privacy, political contribution, negative social impact in supply chain, local community engagement and impact etc (GRI Standards 400 series). Companies who do not follow GRI standards have to include similar performance indicators that can quantify and clearly communicate the impact of their activities regarding sustainability issues, for it to be considered as reporting on sustainability. All information provided should be verifiable, comparable, material, complete and true, and provided on time.

Factors Influencing Voluntary Sustainability Disclosures

Evidence from Turkey implies that companies in Turkey are becoming increasingly aware of sustainability reporting. However, the percentage of companies which did not produce a separate sustainability is still relatively high. Findings revealed that listing on the Corporate Governance Index (CGI), having a sustainability committee, the type of industry, the size of the company and profitability are significant determinants of stand-alone sustainability reporting, whereas leverage is not (Kılıç & Kuzey, 2017, pp. 1–3). Evidence from resources industry in Australia found significant positive correlations were found between sustainability disclosures and company size, company financial performance, proportion of independent directors, multiple directorships and women directors on the board (Hoon Ong, 2016, pp. 1–3). Study done in Pakistan reveals that practice of sustainability reporting in emerging countries like Pakistan are driven by external forces. Foreign buyers, international professional associations and standard-setting organizations are playing a pivotal role in the emergence and development of sustainability. Sustainability Reporting Awards also play a role. The study also identifies, structural and cultural condition, weak government structure, lack of awareness and interest, lack of regulation, lack of enforcement capabilities, lack of political wills are main barriers to sustainability reporting (Mahmood, Kouser, & Masud, 2019, pp. 1–3). Study conducted in Indonesia shows that size and leverage have a positive impact on sustainability reporting, while board size is insignificant. It also states that sustainability reporting has significant effect on financial performance (Fuadah, Safitri, & Yuliani, 2019, p. 53). Another study conducted in Indonesia found leverage and Governance Committee variables have a significant effect on sustainability reporting, while firm size, profitability, liquidity and type industry variables have no significant effect on sustainability reporting disclosure (Ariyani & Hartomo, 2018, pp. 1–3).

Research Methodology

Research Design

This study utilizes content analysis, a research technique widely accepted as the gold standard for investigating corporate social and environmental disclosures (Krippendorff, 2018; Guthrie et al., 2004). Annual reports were selected as the data source because they serve as the primary, authoritative document for stakeholder communication in Bangladesh (Belal & Cooper, 2011). To quantify the disclosure level, a Sustainability Reporting Score (SRS) was developed based on a binary index, a method frequently employed to ensure reliability and comparability across diverse firms (Haniffa & Cooke, 2005).

Annual reports of DSE listed manufacturing companies are from Cement, Ceramics, Paper & Printing, and Tannery industry. These industries combined include 21 listed companies. Missing data

were handled through elimination of records. Univariate analysis is done on the annual reports of Year Ending 2018 (EY2018), as at the time of the study, this was the most complete year in record. In total, for univariate analysis, out of 21 records, 19 were available and analyzed. For multivariate analysis, data from EY2017-2019 were used to draw conclusion, and out of 63 records, 48 were available and analyzed. The study does not validate the completeness, accuracy, and timeliness of the information reported which are assumed to be true and fair, and represent company affairs.

Primarily, the reporting framework of the annual reports was identified. The reports were categorized as follows: 1. GRI Framework, 2. Integrated Reporting <IR> Framework, 3. Basic Framework. Annual reports were also analyzed to see if companies adopted Communication on Progress (CoP) corporate sustainability initiative by United Nations Global Compact (UNGC). Furthermore, annual reports were analyzed to see if companies include information on CSR activities, provide Key Performance Indicators (KPI) for social impact, environmental actions, provide KPI for environmental impact, stakeholder recognition, employee welfare, supply chain assessment, alignment of activities with SDGs.

For the multivariate analysis, Ordinary Least Squares (OLS) regression was employed to identify the disclosure determinants. OLS is the preferred method for cross-sectional data analysis in corporate governance research as it allows for the simultaneous examination of multiple independent variables, such as board composition and profitability, while controlling for firm size and leverage (Hair et al., 2019). This approach provides robust statistical evidence of which firm-level characteristics significantly influence reporting behavior in the digital era.

Annual Report Content Analysis

Annual Reporting Framework

Identification of usage of GRI framework in preparation of an annual report was done from company acknowledgement of usage of GRI framework. Companies can report in accordance with the GRI standards either through Core or Comprehensive options. Using GRI core options requires companies to comply with the 3 universal GRI standards (GRI 101: Foundations, GRI 102: General Disclosures (partially) and GRI 103: Management Approach) and comply with all reporting requirements of at least one topic specific standards (GRI 200 Series: Economic, GRI 300 Series: Environmental, GRI 400 Series: Social). Using GRI comprehensive option requires companies to fully comply with all GRI standards, including 3 universal and 30 topic specific standards. Additionally, companies can use specific GRI standards, or section of it and claim GRI referenced. GRI referenced does not mean they use GRI framework for reporting. Users of GRI framework also must inform GRI about its usage. Furthermore, Content analysis of annual report was conducted to see if it complies with available GRI Standards and meets the GRI reporting principles for reported content.

Identification of usage of Integrated Reporting <IR> Framework is recognized through the reporting of content elements as mentioned by <IR> framework. Annual reports that use <IR> framework must include: 1. Organizational overview and business model; 2. Operating context, including risks and opportunities; 3. Strategic objectives and strategies to achieve those objectives; 4. Governance and remuneration; 5. Performance; 6. Future outlook.

An annual report is categorized as Basic if it is prepared to meet only regulatory requirements and/or does not fall into the category of GRI or <IR> framework. A basic annual report of a DSE listed company includes: Directors' Report and Declaration, Corporate Governance Compliance Certificate/Report, Audit Committee Report, Declaration by Chief Executive of Management, Auditor's Report and Audited Financial Statements including notes and relevant disclosures. Basic annual reports are prepared in accordance with the Companies Act (Bangladesh) – 1994, The Securities and Exchange Commissions Act – 1993, Securities and Exchange Ordinance – 1969, Securities Exchange Commission Rules – 1987, International Financial Reporting Standards (IFRS)/International Accounting Standards (IAS) as adopted in Bangladesh by Institute of Chartered Accountants of Bangladesh (ICAB), Corporate Governance Code – 2018, Financial Reporting and Disclosure Notification, 2018 issued by Bangladesh Securities and Exchange Commission (BSEC), Secretarial Standards issued by Institute of Chartered Secretaries of Bangladesh (ICSB) and Dhaka

Stock Exchange (Listing) Regulations – 2015. An annual report under this framework may include more information, including on sustainability. Those information are identified separately to evaluate voluntary sustainability disclosures.

Compliance with Communication on Progress (CoP)

An annual report complies with CoP policy if it meets the minimum requirements. Meeting minimum requirements categorizes the company as GC Active, while implementation of advance criteria and best practice along with meeting minimum requirements categorizes the company as GC Advance. Not meeting one or more minimum requirements categorizes company as GC Learner. Companies can get these statuses through UNGC provided self-assessment materials. The minimum requirements on CoP policy are: 1. Statement by Chief Executive (of the company) expressing continued support for the UN Global Compact and renewing the company's ongoing participation to the initiative; 2. A description of practical actions taken by company to ensure implementation of ten principles of UNGC in four areas; 3. A measurement of outcomes. The ten principles of UNGC are divided into four areas: 1. Human Rights, 2. Labor, 3. Environment, 4. Anti-Corruption. The ten principles can be found on UNGC website.

Corporate Sustainability Reporting Elements

Reporting on Social and Environmental issues include a) detailed reporting on company operations and actions taken by the company regarding such issues, including: how company operation is affecting society and environment, what actions are being taken, why such actions are undertaken and how they are implementing such actions; and b) reporting of relevant performance indicators that sufficiently measure and quantify the positive and negative impact of company operation and undertaken actions, in turns reflect the outcome of such operation and actions in a specific manner. Additionally, if companies recognize corporate sustainability (through Environmental, Social, and Governance - ESG or People, Planet. and Profit - 3Ps), climate change, include information on employee turnover, training, health and safety, diversity issues, identify and align activities with SDGs, include value-added statements were also identified.

Factors Affecting Sustainability Reporting Disclosures

Multivariate analysis with longitudinal data (from EY2017-2019) was done to identify if there is any association of Company Specific Factors with adoption of voluntary sustainability disclosures made. We derive the following hypotheses from this statement:

Table 1: List of Hypotheses

Hypothesis No.	Hypothesis Statement
H1 _A	Company Size (Ln Total Assets) is associated with number of voluntary sustainability disclosures made.
H2 _A	Profitability (ROA) is associated with number of voluntary sustainability disclosures made.
H3 _A	Ratio of Foreign Directors is associated with number of voluntary sustainability disclosures made.
H4 _A	Ratio of Female Directors is associated with number of voluntary sustainability disclosures made.

The analysis considers the company revenue and debt-equity ratio as control variables. The model for the analysis of sustainability score is:

$$\text{Sustainability Reporting Score (SRS)} = \alpha + \beta_1 \text{Ln(Total Assets)} + \beta_2 \text{ROA} + \beta_3 \text{Ratio of Foreign Directors} + \beta_4 \text{Ratio of Female Directors} + \beta_5 \text{Ln(Revenue)} + \beta_6 \text{Debt-Equity Ratio} + \epsilon$$

Correlation analysis is conducted to establish the association of the above variables, at a significance level = .05. Each company specific factor is individually evaluated to see if they have any association with the dependent variables. For variables with a p value ≤ 0.05 , multiple linear regression analysis was conducted to conclude on the relationship of company specific factors and number of voluntary disclosures made.

Company specific factors regarded in this study are Ratio of foreign directors in board, Ratio of female directors in board, company size (Ln Total Asset), leverage (Debt-Equity Ratio), Ln of Revenue, and profitability (Return on Assets). Total Assets (in BDT) (TA) is the book value presented in the Statement of Financial Position in the Annual Report, Ln transformed for analysis. Leverage is calculated as debt-equity ratio; $D/E = \text{Book Value of Long-Term Debt} / \text{Book Value of Equity}$. Revenue is the Gross Revenue from main operations reported in the Statement of Profit and Loss, Ln transformed for analysis. Profitability is calculated as Return on Assets; $ROA = \text{Net Profit After Tax} / \text{Book Value of Total Assets}$. Ratio of Foreign Directors has been calculated as Number of Foreign Directors divided by Total Board of Directors. Similarly, Ratio of Female Directors has been calculated as Number of Female Directors divided by Total Board of Directors.

Sustainability reporting disclosures, considered in this study are Environmental Sustainability Disclosures, Social Sustainability Disclosures, Governance related Sustainability Disclosures. Since it is already mandatory for companies to comply with the Corporate Governance Code, which covers a lot of the governance related sustainability issues such as risk identification, discussion on outlook and industry insights, economic scenario etc. we did not consider them as voluntary disclosures. The sustainability reporting disclosures are considered dependent variables. In total, 16 factors were identified to represent voluntary corporate sustainability reporting. These are: Corporate Sustainability Recognition, Value-Added Statements, Impact of Operations on Society, CSR Activities, Key Performance Indicators on Social Impact, Impact of Operations on Environment, Environmental Actions, Key Performance Indicators on Environmental Impact, Recognition of Climate Change, CO₂ Emissions, Energy Consumption, Identification and Alignment with SDGs, Employee Training, Employee Turnover, Employee Health and Safety, Employee Diversity. Through linear combination, these 16 factors are summarized into one dependent variable called Sustainability Reporting Score, which is used for multivariate analysis with company related factors. These 16 factors do not represent a complete list of issues covered in ESG reporting, but the

ones that are considered for the purpose of this study only. Sustainability Reporting Score (SRS) is representative of number of voluntary sustainability disclosures made that are considered in this study.

Results and Analysis

This section discusses the status of voluntary sustainability reporting status, followed by the analysis on the factors affecting the number of voluntary sustainability reporting disclosures made (SRS).

Voluntary Sustainability Reporting Status

Of the 19 out of 21 companies with accessible annual reports, Cement industry has the biggest composition with 7 companies; followed by Ceramics (5), Tannery (4), and Paper & Printing (3). According to the Annual Reports of EY2018, the study reveals that none of the companies listed under these industries adopted the GRI Framework for preparation of their annual reports. Only 2 companies (10.53%) adopted the <IR> Framework, one from Cement and one from Ceramics industry. None of the companies show commitment to United Nations Global Compact though Communication on Progress. Only 3 companies (15.79%) recognize Climate Change, and 1 Company (5.26%) aligns its activities with Sustainable Development Goals.

Table 2: Adoption of Frameworks and Sustainability Aspects

Industry	<IR> Framework	CoP Adoption	Corporate Sustainability	Climate Change	SDG Alignment
Cement	1	0	4	2	0
Ceramics	1	0	1	1	1
Paper & Printing	0	0	0	0	0
Tannery	0	0	0	0	0
Total	2	0	5	3	1

Source: Author's construction from data gathered through Annual Reports of EY2018

Only 5 companies (26.32%) recognize Corporate Sustainability aspects through people, planet, and profit or environmental, social, and governance approach. Although, none of the companies recognize their social impact of doing business, as in the negative and positive effect their business operations have in the society, most do recognize corporations have responsibilities towards the society they operate in. 13 out of 19 (68.42%) companies report on their CSR activities through annual report. However, none of the companies report any social KPIs that sufficiently measure the performance of their CSR activities. 11 companies (57.89%) provide at least some form of information on training of their employees; while 6 companies (31.58%) provide information on employee health and safety, including at least one action or measurement taken to ensure such. Zero Companies provide information on employee turnover rates and only 1 company (5.26%) reports on employee diversity and actions they are taking to address such issues. 7 Companies (36.84%) recognize that their business operations have an impact on the environment, who also reports on their environmental actions and policy. None of the companies report any Environmental KPIs that sufficiently measure the performance of their environmental actions and policy. Zero Company reports on CO₂ emissions and Energy Consumption.

Table 3: Voluntary Sustainability Disclosures

Industry	Social Impact	CSR	Social KPI	Employee Training	Health & Safety	Employee Turnover	Diversity
Cement	0	6	0	5	3	0	0
Ceramics	0	2	0	2	1	0	1
Paper & Printing	0	2	0	2	2	0	0
Tannery	0	3	0	2	0	0	0
Total	0	13	0	11	6	0	1

Industry	Env. Impact	Env. Action	Env. KPI	CO ₂ Emission	Energy Consumption	Value Added Statement
Cement	4	4	0	0	0	3
Ceramics	1	1	0	0	0	2
Paper & Printing	2	2	0	0	0	0
Tannery	0	0	0	0	0	2
Total	7	7	0	0	0	7

Source: Author's construction from data gathered through Annual Reports of EY2018

Factors Affecting Adoption of Voluntary Sustainability Reporting

Annual Report from EY2017 to EY2019 were used to determine if there is any association of company variables with voluntary sustainability disclosure variables.

Table 4: Sample Distribution

Industry	Annual Report Year			Total
	2017	2018	2019	
Cement	6	7	5	18
Ceramics	5	5	4	14
Paper & Printing	1	3	3	7
Tannery	2	4	3	9
Total	14	19	15	48

Source: Author's construction

Correlation analysis reveals Company Size (LnTA), Revenue (LnREV), and Ratio of Foreign Directors (RATIO_FO) has a moderate to strong positive association with number of voluntary sustainability disclosures made (Sustainability Reporting Score), and p-value is statistically significant ($p \leq 0.05$). Ratio of Female Directors (RATIO_FE) is statistically significant at 10% and has a negative association.

Table 5: Correlation of Company Specific Factors with Sustainability Reporting Score

		LnTA	LnREV	D/E	ROA	RATIO FO	RATIO FE
SRS	Pearson Correlation	.596**	.579**	0.022	0.139	.492**	-0.269
	Sig. (2-tailed)	0.000	0.000	0.882	0.345	0.000	0.065
	N	48	47	48	48	48	48

Source: Author's construction from data gathered through Annual Reports of EY2017-19

Multiple Linear Regression reveals, profitability (ROA), Ratio of Foreign Directors (RATIO_FO), and Ratio of Female Directors (RATIO_FE) are statistically significant predictors of number of voluntary sustainability disclosures made (SRS). The regression model explains 50.3% of variances ($R^2_{Adj} = 0.503$) in the dependent variable SRS. Significance value in ANOVA shows that the regression model is statistically significant ($p < .001$).

Table 6: Multiple Linear Regression Summary – Sustainability Reporting Score

Model Summary						
Model		R	R Square	Adjusted R Square	Std. Error of the Estimate	
1		.754	0.568	0.503	1.827	
ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	175.700	6	29.283	8.772	p<0.001
	Residual	133.534	40	3.338		
	Total	309.234	46			
Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-18.960	5.174		-3.665	0.001
	lnTA	0.676	0.549	0.319	1.230	0.226
	lnREV	0.343	0.519	0.181	0.661	0.512
	D/E	0.054	0.119	0.052	0.451	0.655
	ROA	-17.736	8.156	-0.310	-2.175	0.036
	RATIO FO	5.865	1.538	0.501	3.814	0.000
	RATIO FE	-5.164	2.281	-0.248	-2.264	0.029
Dependent Variable: SRS						
Predictors: (Constant), RATIO FE, RATIO FO, lnTA, D/E, ROA, lnREV						

Source: Author's construction from data gathered through Annual Reports of EY2017-19

Thus, when controlling for other factors, the study rejects the null hypotheses and concludes that profitability (ROA) (H2A), ratio of foreign directors (H3A), and ratio of female directors (H4A) have a statistically significant relationship with number of voluntary sustainability disclosures made (Sustainability Reporting Score). While Ratio of Foreign Directors ($\beta = 5.865$) have a positive relationship, Profitability ($\beta = -17.736$) and Ratio of Female Directors ($\beta = -5.164$) have a negative relationship. There is insufficient evidence to conclude on company size (Ln Total Assets).

Table 7: Summary of Findings

Hypothesis No.	Hypothesis Statement	Statistics	Decision
H1 _A	Company Size (Ln Total Assets) is associated with number of voluntary sustainability disclosures made.	$\beta = 0.676$ $p = 0.226$	Not Supported
H2 _A	Profitability (ROA) is associated with number of voluntary sustainability disclosures made.	$\beta = -17.736$ $p = 0.036$	Supported
H3 _A	Ratio of Foreign Directors is associated with number of voluntary sustainability disclosures made.	$\beta = 5.865$ $p < 0.001$	Supported
H4 _A	Ratio of Female Directors is associated with number of voluntary sustainability disclosures made.	$\beta = -5.164$ $p = 0.029$	Supported

Discussion and Implications

The empirical results from the regression model provide a complex narrative regarding the drivers of sustainability reporting in Bangladesh's manufacturing sector. While some findings align with global trends, others highlight the specific institutional nuances of an emerging economy. The highly significant positive relationship between the Ratio of Foreign Directors (RATIO_FO) and sustainability reporting ($p < 0.001$) supports Resource Dependency Theory. According to this theory, boards act as a mechanism to manage external interdependencies and reduce uncertainty by acquiring critical resources, such as international expertise (Hillman et al., 2009). Foreign directors act as "knowledge conduits," bringing international best practices, technical expertise, and familiarity with sustainability reporting to Bangladeshi boards. In the context of 4IR, where manufacturing firms are

increasingly integrated into global supply chains, foreign directors may provide the necessary Legitimacy to attract international investors and satisfy stringent ESG requirements.

The significant negative relationship between ROA and sustainability disclosure ($p = 0.036$) suggests a “proprietary cost” or “legitimacy theory” shielding effect. Proprietary Cost Theory posits that firms may limit disclosure if the information could potentially alter the firm's future earnings or reveal strategic secrets to competitors (Verrecchia, 1983). In Bangladesh, highly profitable firms may feel they already possess sufficient market legitimacy and thus avoid the high costs, both financial and strategic, of voluntary sustainability reporting. Conversely, Legitimacy Theory suggests that organizations seek to ensure they are perceived as operating within the bounds and norms of their respective societies (Suchman, 1995). Less profitable firms may use enhanced sustainability disclosures as a strategic tool to signal long-term viability and distract stakeholders from short-term financial underperformance. In a 4IR environment, where R&D and automation require heavy capital investment, profitable firms may be prioritizing internal technological upgrades over the administrative burden of GRI-standard reporting.

The negative relationship between the Ratio of Female Directors (RATIO_FE) and sustainability reporting ($p = 0.029$) is a notable finding that may appear unusual but aligns with specific studies on the Bangladeshi corporate landscape. This can be explained through two lenses: Family Affiliation - In many DSE-listed manufacturing firms, female directors are often appointed based on family ties (sponsors/founders) rather than independent professional expertise (Biswas et al., 2022). These “affiliated” directors may prioritize family interests, which often lean toward financial secrecy, over the transparency required for sustainability reporting. Tokenism and Critical Mass - According to the Critical Mass Theory, the impact of a minority group depends on its size; when representation is low, members are treated as “tokens” with little power to influence decisions (Konrad et al., 2008). Without reaching a “critical mass”, female directors in Bangladesh may struggle to pivot the board’s focus from traditional financial metrics to modern ESG disclosures.

The findings of this study offer significant implications for multiple stakeholders. For managers, the positive relationship between foreign directors and disclosure highlights the importance of board internationalization as a strategic resource. In the context of 4IR, managers should prioritize recruiting board members with international ESG expertise to act as “knowledge conduits” for global reporting standards like GRI (Hillman et al., 2009). For policymakers and regulators, such as the BSEC, the 0% adoption of GRI frameworks suggests that voluntary reporting mechanisms are insufficient. To accelerate Bangladesh’s alignment with global 4IR standards, policymakers should transition from voluntary to mandatory ESG disclosure frameworks. Furthermore, introducing fiscal incentives such as tax rebates for companies that adopt digital sustainability tracking could bridge the gap identified between high profitability and low disclosure (Verrecchia, 1983).

Finally, this research advances current literature by establishing a 4IR-readiness baseline for manufacturing firms in an LDC context. By linking board composition theories (Resource Dependency and Critical Mass) to the digital reporting requirements of 2025-2026, this study provides a theoretical bridge between traditional corporate governance and the technological demands of the modern industrial era. It challenges the assumption that profitability automatically leads to transparency, providing a new empirical lens for future studies in emerging markets.

Research Limitation and Future Direction

Despite its contributions, this study has several limitations. First, the sample size of 19 listed manufacturing firms is relatively small, which may limit the generalizability of the findings to the broader economy. Second, the study focuses exclusively on annual reports; future research should incorporate dedicated sustainability reports and corporate websites to capture a more holistic view of digital disclosures in the 4IR era.

Future studies should also conduct longitudinal analyses to compare reporting behaviors pre- and post-the 2023-2025 BSEC Corporate Governance Code updates. Additionally, research could explore the role of specific 4IR technologies, such as the impact of AI adoption on the accuracy and

frequency of environmental reporting. Expanding the scope to include the banking and service sectors would also provide valuable cross-sectoral comparisons on mandatory vs. voluntary sustainability practices.

Conclusion

This study concludes that while the discourse surrounding the Fourth Industrial Revolution is prevalent in Bangladesh, the actual practice of sustainability reporting among manufacturing firms remains significantly underdeveloped. The analysis reveals a stark absence of GRI framework adoption and a lack of quantifiable performance measures for social and environmental impacts. The regression results indicate that board internationality is the primary driver of disclosure, whereas profitability and female representation currently show a negative correlation, likely due to proprietary costs and family-affiliated tokenism. To enhance reporting and eventually transition from the voluntary phase government should form policies on a stock exchange, regulatory, and industry scale to ensure sustainability. The government may: facilitate the foreign direct investment landscape and in-turn the foreign director oversight in Bangladeshi companies; improve female director participation by requiring female directors with appropriate professional qualifications and independence; provide interest rebates and extend loan periods to those who commit to sustainability; provide subsidies; reduced tax rates to encourage adoption; provide incentives to CEO (MD), board chairman to initiate sustainability measures in their companies, including renovating management structure and internal reporting; involve international parties such as UN and urge their technical and financial support for such implementation; formulate industry specific policies and mandate specific disclosures regarding sustainability issues; update stock exchange listing and membership rules to better fit sustainability needs. As Bangladesh matures into a middle-income economy, focuses on sustainable development goals, increased inflow of foreign investments, and a strong capital market; the transition from voluntary to mandatory reporting is essential to maintain international competitiveness and satisfy the growing demands for global transparency.

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