Lean-Driven ESG Reporting for Enhanced Competitiveness in Manufacturing Firms

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Abstract—**This paper looks into how manufacturing companies can support ESG (Environmental, Social, and Governance) reporting while increasing competitiveness through the integration of lean manufacturing initiatives. Companies are facing increasing pressure in today's business environment to operate sustainably and show stakeholders that they are accountable by implementing transparent ESG practices. They must be operationally efficient and contend with fierce competition at the same time. Lean manufacturing provides a useful strategy for accomplishing these two objectives with its emphasis on waste reduction, process standardization, and value creation.**

In order to create a systematic approach that complements both strategic initiatives, the study investigates the synergy between Lean principles and ESG frameworks. To find Lean tools that can support important ESG aspects like environmental compliance, employee engagement, and governance transparency, a thorough literature review was carried out. The study offers a conceptual framework for combining Lean and ESG, as well as a workable implementation schedule for manufacturing companies.

The study comes to the conclusion that Lean–ESG integration enhances ESG reporting quality and boosts long-term competitiveness by bringing operational excellence and responsible business practices into alignment. For manufacturing companies wishing to shift to sustainable operations without sacrificing productivity or profitability, this paper offers guidance.

Index Terms—**Lean Manufacturing, ESG Reporting, Competitiveness, Sustainability, Manufacturing Firms, Process Improvement**

I. INTRODUCTION

Environment, Society, and Governance (ESG) has evolved from sustainable investment philosophies and has become a crucial aspect of socially responsible investing. Over the past two decades, ESG reporting has become increasingly important, with the European Union (EU) mandating it and the Securities Exchange Commission (SEC) requiring carbon emissions reporting by 2026 as a part of annual company filings. Indian regulators are expected to follow suit, making ESG disclosures mandatory. For companies, particularly in manufacturing, adapting to these requirements is essential for securing credit, achieving better valuations, and meeting international standards. Failure to do so could result in a loss of competitiveness and hinder companies' growth, detrimentally affecting the government's much-coveted 'Make in India' initiative. The objective is to create awareness about implementing a framework for ESG reporting that integrates data collection already generated through lean initiatives and, if necessary, newer data-capturing methods that can be integrated into existing systems. This approach incentivizes ESG efforts and reduces costs, offering valuable management tools that enhance profitability and resource efficiency.

The "E" in ESG focuses on environmental factors such as energy efficiency, carbon footprint, and waste management. The "S" addresses social issues like labor standards, diversity, and community relations. The "G" governs the oversight of these areas, including corporate governance and compliance. With climate change becoming a critical concern, investors increasingly recognize the long-term benefits of ESG initiatives. The Business Roundtable, a group of corporate CEOs, has identified key stakeholders who benefit from ESG efforts, including customers, workers, and communities. ESG reporting is gaining traction in the financial world, with investors, lenders, and regulators emphasizing its importance. For manufacturers, integrating ESG data into their lean operations is beneficial and necessary to stay competitive in today's business environment. Internationally, several frameworks guide ESG reporting, including the Global Reporting Initiative, SASB, UNPRI, and UNSDG, all aiming to link sustainability with financial metrics. Organizations like MSCI and Sustainalytics, alongside traditional agencies like Moody's and S&P Global, play a key role in shaping regulations and public opinion. This study aims to raise awareness of adopting locally relevant frameworks for data collection, benefiting both lean initiatives and ESG reporting.

Industries, including mills and production units, often underestimate the risks posed by climate change, with inadequate guidance on financial disclosures. This paper shows the direct impact of energy consumption on operational costs, efficiency, and environmental sustainability. Water management also plays a critical role, as efficient usage ensures sustainability, and regulatory compliance, and demonstrates corporate social responsibility. Effective waste management, particularly through the adoption of the 5Rs—Refuse, Reduce, Reuse, Repurpose, Recycle helps companies cut costs and improve environmental outcomes. Monitoring air quality and carbon emissions is essential for regulatory compliance and maintaining corporate responsibility. The shift toward eco-friendly packaging is gaining momentum, driven by economic, environmental, and consumer demands.

In today's data-driven market, accurate customer data management is vital for enhancing engagement, yet many companies remain vulnerable to cyber threats due to weak data security measures. The Customer Protection Act 2019 emphasizes the need for stronger protection strategies. Meanwhile, the Environmental, Social, and Governance (ESG) framework stresses the importance of maintaining safe work environments, especially as the workforce becomes increasingly diverse. Transparency in management compensation also enhances corporate credibility and boosts long-term valuation. Ethical practices in global manufacturing, particularly in safeguarding human rights, are equally essential.

Effective risk management is the cornerstone of organizational resilience. While many companies rely on regulatory frameworks, a more proactive approach—engaging diverse stakeholders like frontline employees and managers—ensures better preparedness for emerging threats. In accounting and tax processes, collaboration between internal teams and auditors ensures compliance, financial integrity, and governance. Corporate boards, in turn, play a pivotal role in promoting ethical decision-making, preventing scandals, and aligning company goals with stakeholder interests. Furthermore, continued investment in research and development (R&D) is critical for fostering innovation, maintaining competitiveness, and identifying potential risks, signaling a company's long-term commitment to growth.

II. LITERATURE REVIEW

The impact of Environmental, Social, and Governance (ESG) initiatives on the financial performance of companies is a multifaceted topic, with research indicating both short-term challenges and long-term benefits. Overall, companies that prioritize ESG practices tend to enhance their financial standing over time, although the immediate effects can vary. Some studies, such as Chen's analysis of China's automobile industry, suggest that investments in ESG may initially lead to a decline in financial performance due to the costs associated with implementing these initiatives Thus, there could be a short-term decline in the company's financial performance [2]. Conversely, improvements in ESG performance are linked to long-term financial benefits, as companies gain investor recognition and market stability [2][3]. Research also highlights a positive correlation and complex relationships between Financial Metrics and ESG. Research indicates a significant positive impact of ESG scores on key financial metrics like return on assets (ROA) and return on equity (ROE) [5]. Zhou's study also highlights that governance aspects of ESG are particularly influential in sectors like banking [1]. Deng's findings suggest that the relationship between ESG performance and financial outcomes is not straightforward, indicating potential nonlinear interactions; and pointing out the possibilities of complex relationships [4]. In summary, while ESG initiatives may pose short-term financial challenges, they are increasingly recognized as vital for sustainable long-term growth and investor appeal. However, the complexity of these relationships warrants further investigation to understand the dynamics at playfully.

Compared to other Asian countries, India shows a slower adoption of sustainability reporting, indicating a need for enhanced commitment and frameworks to improve practices [14]. No clear policies for compliance with environmental norms in Indian corporates, need for more focus on voluntary environmental reporting practices. [15]. Sustainability issues are of high priority but in the nascent stage among Indian SMEs, the overall disclosure level of sustainability issues is moderate [16].

There are some methods and outcomes of ESG that have been implemented and discussed in the past. It is very helpful to consider and provide a consolidated overview or conclusion to the problem,

Investing in ESG (Environmental, Social, and Governance) practices not only fosters ethical behaviour but also enhances financial performance. Companies with high ESG scores have demonstrated resilience during crises, such as the 2008-09 financial downturn and the COVID-19 pandemic. Governance risks are generally stable across firms, while environmental and social risks vary by sector. High ESG scores offer significant advantages, including better crisis preparedness and reduced long-term risks [6]. The European Union is increasingly mandating ESG reporting for large companies, requiring it alongside traditional financial statements. Faccia et al. (2021) propose integrating ESG data with the XBRL framework to standardize reporting. They suggest that the Value-Added Income Statement (VAIS) could effectively link sustainability reports with financial data, addressing gaps in current ESG ratings. However, challenges such as high implementation costs and complex data entry processes need resolution [7]. Many ESG reports present a biased view by selectively highlighting favourable metrics. Kaplan et al. argue for a more comprehensive ESG reporting framework, particularly for greenhouse gas (GHG) emissions. A robust GHG accounting system, possibly enhanced by blockchain technology, could improve transparency and track emissions across value chains. Continuous governance assessment is also essential to maintain accountability [8]. As sustainable investments grow, the risk of ESG being misused for greenwashing threatens its credibility. Effective ESG reporting on Key Performance Indicators (KPIs) is crucial for transparency and meaningful progress. Challenges include ensuring data integrity and addressing methodological limitations. Integrating insights from ecology, engineering, and social sciences can strengthen ESG reporting, driving true progress in sustainable development [9]. Recent research on Environmental, Social, and Governance (ESG) reporting highlights its growing importance in corporate disclosure. A systematic review reveals that stakeholder theory, legitimacy theory, and institutional theory are the dominant theoretical frameworks underlying ESG disclosure studies [10]. Digital transformation plays a crucial role in enhancing ESG performance and reporting, with technologies improving data tracking and transparency [11]. Applied linguistics research on sustainability discourse has evolved to cover various ESG topics, employing diverse methodologies and data types [12]. In the banking sector, ESG risk integration, management, and reporting present both challenges and opportunities, particularly in emerging markets [13]. These studies collectively emphasize the need for further research on ESG issues, especially regarding strategy, governance, assessment, and reporting practices across different sectors and geographical contexts. This paper focuses on determining the main reasons for this and emphasizes the benefits of reporting each parameter to be taken care of.

III. METHODS

This study involved a comprehensive approach to gather insights on Environmental, Social, and Governance (ESG) initiatives within the manufacturing sector.

Firstly, the researchers developed a concise presentation aimed at key management personnel in various manufacturing firms. This presentation served to elucidate the significance of ESG initiatives and the evolving regulatory landscape that influences these practices. By providing relevant information, the researchers aimed to enhance the understanding and engagement of these personnel regarding ESG compliance and its potential benefits for their organizations.

Secondly, a survey was designed to solicit feedback from these key personnel regarding their experiences, and perspectives on ESG practices. The survey encompassed 31 firms, including textile, manufacturing, casting, food, and various sectors. It is important to note that the participants in this survey were not selected through any systematic method. This approach allowed for a diverse range of insights from various sectors within the manufacturing industry.

The survey included a series of questions aimed at assessing the current state of ESG initiatives within their firms, the challenges they face in implementation, and the support they require for effective reporting. Table 1 indicates the firms' knowledge about ESG Reporting and even though firms are aware of the benefits of ESG reporting, they tend to be not implementing it. Table 2 shows the parameters to be considered and recorded for ESG reporting.

IV. RESULTS:

The "E" (Environment) aspect of ESG closely aligns with operational optimization and lean manufacturing, a long-standing philosophy aimed at reducing resource consumption. The environmental components establish a symbiotic link between resource usage and manufacturing output, directly impacting profitability. However, it's important to distinguish between recording and reporting environmental data. Recording involves tracking and capturing relevant environmental metrics while reporting focuses on analyzing and communicating these metrics to stakeholders. Tables 3 and 4 highlight the number of firms that *record* environmental data and those that have implemented measures to improve their *data recording* processes, respectively.

The survey highlights the importance of tracking energy and water usage, managing waste, and monitoring air emissions to improve sustainability. However, many companies face challenges due to limited technology and manpower. Only 29 percent of companies track their daily energy use (Table 3), despite the crucial role of daily monitoring in maintaining energy efficiency. Many cite insufficient technology and a lack of manpower as the main barriers to this practice.

In terms of water usage, while most companies recognize its importance, only 48.4 percent actively monitor their water consumption (Table 3). Similarly, 48.4 percent have implemented initiatives to reduce water use (Table 4), such as water reuse, rainwater harvesting, and educating employees on responsible water use. However, few companies adjust their water consumption based on environmental conditions, indicating room for improvement in water management practices.

The survey shows that 74.2 percent of companies document the types of waste they produce, and 80.6 percent track the total amount of waste generated (Table 3). Furthermore, 67.7 percent of companies have adopted effective waste management strategies, including reusing materials, selling scrap, and optimizing production processes (Table 4). These actions reflect a growing commitment to sustainability within the industrial sector.

Although there is widespread support for air quality monitoring, only 40 percent of companies actively measure air emissions (Table 3). Encouragingly, 83.3 percent of companies are advocating for improved methods to record air emissions, which are crucial for assessing production efficiency and identifying opportunities for improvement (Table 4).

The use of eco-friendly and sustainable materials is another key finding, with 83.9 percent of companies incorporating them into their operations. Additionally, 90.3 percent of these companies find their packaging methods cost-effective (Table 3). However, 80.6 percent are still seeking ways to improve their sustainable packaging practices (Table 4). Companies not pursuing further improvements often believe their current methods are already efficient and economically viable.

"S" indicates society and the importance given to social factors is indicated in the reporting framework. The management of people, adhering to regulations, and providing a work environment that generally provides a more conducive environment for people to work with the company. The "S" factors include consumer protection, data security, working conditions, diversity and integration, compensation, human rights focusing on preventing child labor and labor exploitation, and education. Table 5 indicates the firms that maintain the parameters required for reporting the S factor.

Approximately 80.6 percent of industries actively engage customers, meticulously documenting interactions to track feedback and drive development (Table 5). These records also include complaint resolution details, yet only 51.6 percent capture the voice of the customer (VoC), leaving significant room for improvement (Table 5). Implementing VoC systems is essential for enhancing products and services. Furthermore, most industries prioritize customer rights in compliance with the Customer Protection Act of 2019.

The survey reveals that 77.4 percent of companies have established basic data security systems (Table 5), but many still depend on outdated practices, exposing them to potential breaches. Positively, almost every firm is committed to enhancing its security protocols.

All participating industries prioritize employee safety by implementing measures such as safe equipment, comprehensive training, and emergency management systems. Workers are provided with protective gear, and about 35.5 percent have in-house medical departments for emergencies, while others partner with local hospitals. Approximately 83.9 percent offer accident insurance and concessions to support workers in crises (Table 5).

Women's workforce participation has increased significantly, enhancing workplace diversity. About 80.6 percent of firms value diversity. Additionally, 79.3 percent benefit from age diversity, fostering knowledge sharing (Table 5). All industries follow the Child Labour (Prohibition and Regulation) Amendment Act 2016 ensuring no workers below the age of 14.

The survey indicates that Every firm maintains detailed employee records, including criminal history and identity verification, aiding in quality assessment and misconduct protection. All industries comply with the Payment of Wages Act, ensuring fair compensation and essential amenities like food and sanitation, reflecting a strong commitment to employee welfare (Table 5).

According to the survey, 77.4 percent of industries engage in community welfare, offering free education for underprivileged children and supporting local NGOs. However, only 51.6 percent provide paid maternity leave, despite high female employment. While job security remains robust, improved documentation of social initiatives could enhance understanding of social impact and boost public perception (Table 5).

The importance of Governance cannot be overemphasized, even for the big conglomerates. For instance, Volkswagen's emission scandal in the USA was one of the best examples of mismanaged governance and provided a strong indication of strong governance models. The risk of mismanaging governance is fatal to companies and should necessarily be reported. The Governance reporting framework includes risk management, corporate ethics, board members and their qualifications, accounting and taxes, and transparency in their R&D department investments.

Table 6 indicates the firms that maintain the parameters required for reporting the G factor. The survey about risk management indicates that only 71 percent of companies document risks and failed processes, which is a relatively low percentage. While many firms may employ risk analysis teams, maintaining records of past risks is crucial for identifying potential future problems. The survey reveals that 61.3 percent of companies have dedicated risk management departments, which is a reasonable figure considering the sample size (Table 6). Despite these challenges, a noteworthy number of companies are open to establishing or enhancing their risk management teams, while others provide valid reasons for their current status.

The survey findings concerning accounting and taxation practices reveal that All companies engage the services of external auditors. All companies surveyed consistently report their financial statements, but 30.7 percent record monthly (Table 6). This commitment to regular financial reporting, despite differences in frequency, underscores the importance of maintaining transparency and accountability in financial practices.

When examining investment in Research and Development (R&D), the survey indicates that 51.6 percent of companies actively allocate resources to this critical area. A minority consider such investments economically unfeasible. Companies renowned for their innovative approaches, such as Apple, have demonstrated how strategic R&D investments can revolutionize industries and maintain a competitive edge. Through the development of groundbreaking products like the iPad, Air Pods, and Apple Watch, these companies exemplify how R&D fosters market leadership, effective cost management, and alignment with evolving trends, thereby attracting investors and facilitating growth even for smaller firms.

Single ownership can facilitate swift decision-making, albeit with a potential bias toward the owner's perspectives. Conversely, companies with multiple owners benefit from a diversity of viewpoints, which can lead to more balanced and informed decision-making processes. Furthermore, transparent reporting of board member contributions plays a vital role in enhancing corporate governance practices, extending beyond conventional approaches.

Insights from the survey on stakeholder management indicate that 61.3 percent of companies actively engage both internal and external stakeholders. Additionally, 77.4 percent adhere to specific criteria when selecting potential suppliers, underscoring a systematic approach to stakeholder relationships. Notably, 41.9 percent of companies demonstrate agility in responding to stakeholder feedback. Furthermore, 61.3 percent of companies ensure that both board members and stakeholders possess the requisite skills for effective collaboration (Table 6). Although these figures slightly fall below the global average, they emphasize the importance of tracking stakeholder contributions across various domains—such as finance, logistics, and human resources—as a fundamental component of organizational success.

V. DISCUSSION

The survey indicates that most firms recognize the benefits of ESG initiatives, yet a clearly defined framework for ESG reporting is still lacking in India. Although many firms adhere to key ESG parameters, the formal reporting of these metrics is not widely practiced. Therefore, implementing consistent reporting practices is crucial for these firms to enhance their ESG disclosures. The frequency of recording these parameters is vital for assessing a firm's performance relative to its competitors.

Integrating lean initiatives within this operational framework can significantly boost energy efficiency. By providing detailed energy cost analyses and generating daily data points, companies can achieve more effective consumption reporting, far exceeding traditional tracking methods. Analyzing this data reveals critical insights for improvement and risk mitigation. Industries that adopt comprehensive water and waste management strategies not only contribute to global conservation efforts but also enhance operational efficiency, reduce costs, and improve their corporate image. Lean principles, emphasizing waste reduction, play a crucial role in improving performance, gaining a competitive edge, and elevating customer perceptions.

Moreover, monitoring air quality is essential for safeguarding employee health and enabling organizations to make informed decisions to reduce emissions, thus minimizing their environmental footprint. Incorporating sustainable practices like emission tracking and sustainable packaging aligns business objectives with ecological responsibility. Regular monitoring of packaging and emissions data allows companies to benchmark against competitors, refine their sustainability strategies, and enhance their market positioning, ultimately leading to operational excellence.

As manufacturers increasingly align with evolving ESG standards, they must also prioritize consumer protection, cybersecurity, and workplace safety within their strategies. Implementing robust feedback systems and prioritizing consumer safety fosters continuous improvement and strengthens customer relationships. Addressing rising cybersecurity threats through advanced security measures and engaging employees in data protection helps companies safeguard valuable information and maintain data integrity. Additionally, promoting diversity and inclusion in the workplace—through language training and gender diversity initiatives—creates a more dynamic workforce and boosts productivity.

The survey also reveals that most companies either have or plan to establish risk management teams, underscoring the importance of a proactive approach to risk management. This strategy cultivates a culture of awareness, accountability, and communication, enabling organizations to anticipate and address potential challenges. Effective financial reporting is equally crucial, as it ensures compliance, improves efficiency and builds investor trust—key factors for long-term stability and growth. Investing in leadership roles and fostering collaboration across all organizational levels are essential for driving continuous improvement.

Furthermore, research and development (R&D) are critical for maintaining competitiveness by anticipating market trends and fostering innovation. While R&D requires significant investment, it often leads to cost savings, improved products, and potential tax benefits. Companies like Tata, known for their corporate governance and ethical transparency, illustrate how a diverse board can make balanced decisions that promote sustainable growth. Similarly, Starbucks demonstrates the value of stakeholder engagement through initiatives like C.A.F.E. Practices and "My Starbucks Idea," highlighting that collaboration and alignment with stakeholders are vital for long-term success.

VI. CONCLUSION

The awareness of ESG has been fairly low till it was introduced to the firms. Once introduced and explained about the benefits of ESG and their dual usage in managing lean operations, stakeholders were keen to implement the researcher's recommendations. Secondly, the stakeholders were also aware of regulatory disruptions and the risks associated with them and thus were quick enough to learn the benefits of ESG reporting. Thirdly, the benefits of data point creation with less capital-intensive initiatives by manufacturing firms would be the best beginning for collecting and collating data for reporting ESG initiatives.

In conclusion, by integrating environmental and social governance with operational strategies, companies can achieve significant improvements in sustainability, operational efficiency, and growth. Aligning business goals with responsible practices not only enhances its reputation but also drives innovation and strengthens its competitive position in the market.

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Tables and Figures:

Table 1. Awareness of ESG among the 31 firms

	Number of respondents who responded "Yes"	No. of responses (in %)
Awareness of ESG reporting	18	58
Awareness about the advantages of ESG reporting	30	96
Firms implemented ESG Reporting	0	0

Source: Primary data

Table 2. Parameters of ESG Reporting

		Climate Change
		Energy Consumption
	Environment	Water Management
		Waste Management
		Air Emissions
		Sustainable Packaging
		Customer Protection
		Data Security
		Working Conditions
ESG Parameters	Social	Diversity and Integration
		Compensation
		Human rights
		Social Welfare
		Risk Management
		Stakeholder Management
	Governance	Accounting and Finance
		CEO Characteristics
		R&D Investments
		Corporate Governance

Table 3. Firms Tracking Environmental Data

Parameter	Firms recording the data	Total Respondents	Percentage of response (%)
Daily Energy Consumption	9	31	29
Water Consumption	15	31	48.8
Types of Waste produced	23	31	74.2
Amount of Waste	25	31	80.6
Air Emissions	9	15	60
Sustainable Packaging	26	31	83.9
Cost Effective Packaging	28	31	90.3

Source: Primary data

Table 4. Firms Implementing Measures to Enhance Environmental Data

Parameter	Firms taken measures	Percentage of respondents (%)	Total responses
Water Consumption	15	48.4	31
Waste Management	21	67.7	31
Air Emissions	15	83.3	18
Sustainable Packaging	25	80.6	31

Source: Primary data

Table 5. Firms Maintaining Social Factor Parameters among 31 Respondents

Parameter	Firms following the parameter	Percentage of Response
Gender Diversity	25	80.6
Age Diversity	23	79.3
Medical Dispensary	11	35.5
Safe Working Environment	30	96.8
Insurance and concessions	26	83.9
Paid maternity leaves	16	51.6
Job Security	29	93.5
Data Security	24	77.4
Customer Relationships	16	51.6
Social Welfare	24	77.4
Payment of Wages Act	31	100

Source: Primary data

Table 6. Firms Maintaining Governance Factor Parameters among 31 Respondents

Parameter	Firms following the parameter	Percentage of response (%)
Stakeholder records	19	61.3
Supplier selection criteria	24	77.4
Risk management	19	61.3
Failure Data	22	70.9
R&D Investments	16	51.6

Board performance assessment	19	61.3
Stakeholder Feedback Response	13	41.9
Monthly financial reporting	31	100

Source: Primary data