ISSN 3007-3170(O)
ISSN :3007-3162(P)
January-March 2025
Social Sciences & Humanity Research Review

Evaluating the Strategic Integration of Environmental Management in Engro Corporation's Manufacturing Operations: A CSR and Sustainability Analysis

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ARTICLE INFO

Keywords: Environmental Management, Sustainability Reporting, Life Cycle Assessment (LCA), Circular Economy, Green Finance.

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ABSTRACT

Engro Corporation's environmental management strategy demonstrates a strong alignment between sustainability and corporate governance across its manufacturing operations, particularly in fertilizers, polymers, and energy. The review reveals that Engro integrates international frameworks like ISO 14001, GRI Standards, and the UN Sustainable Development Goals into its environmental agenda. Through tools such as Environmental Impact Assessments (EIA), Life Cycle Assessments (LCA), and real-time digital dashboards, the company tracks key environmental metrics-carbon emissions, water reuse, and waste diversion. Insights from Engro's Integrated Reports show significant improvements, including closed-loop water systems in Daharki and solar installations at telecom sites. These efforts position Engro ahead of local competitors like Fauji Fertilizer and Lucky Cement in terms of ESG transparency and technological adoption. However, challenges persist, including limited LCA implementation, workforce training gaps, policy uncertainty, and aging infrastructure. Engro's performance still lags global sustainability leaders in circular economy adoption and full-spectrum product life cycle tracking. To build on its leadership position, Engro should scale up circular economy practices across all business units, particularly in packaging and chemical waste management. Broadening LCA applications can drive sustainable product innovation. Investing in internal ESG capacity building and advocating for national green policy reform will help align strategic goals with regulatory frameworks. Engro can also leverage climate finance through SDG-linked bonds and strengthen regional collaborations with universities for community-driven environmental solutions. These strategic enhancements will not only improve operational sustainability but also solidify Engro's long-term competitive advantage in sustainable industrial development.

INTRODUCTION

Global environmental degradation continues to intensify, with climate change, biodiversity loss, pollution, and resource depletion presenting unprecedented threats (Dijoo & Khurshid, 2022; Kolawole & Iyiola, 2023). The Intergovernmental Panel on Climate Change reports that industries are responsible for approximately 21% of global GHG emissions, making them critical actors in planetary health (Friel, 2023; MacNeill et al., 2021). For example, the global textile industry alone contributes nearly 20% of global wastewater and 10% of carbon emissions, primarily due to unsustainable manufacturing practices (Leal Filho et al., 2024; Khoso, et al., 2024; Sultana & Imran, 2024; Ahmad, Bibi & Imran, 2023)). Biodiversity is also under serious threat. A 2022 WWF report noted that industrial expansion into forested areas has accelerated species extinction rates by 100 to 1,000 times above natural levels (Wilson, 2024). In India and China, over 60% of monitored freshwater systems are biologically degraded due to industrial effluents (Kumar et al., 2021). In response, international frameworks such as the United Nations Sustainable Development Goals (SDGs) and the Paris Agreement have driven policy and corporate shifts (Montiel et al., 2021; Tulder et al., 2021). The SDGs (particularly Goals 6, 9, 12, and 13) emphasize sustainable industry and climate action ((Hsu, Huang, & Huynh, 2023; Nguyen et al., 2022; Fei et al., 2021). Notably, Unilever's 2022 ESG report demonstrates how multinationals now anchor their strategies to SDG 13 (Climate Action), with clear KPIs tied to emissions and water usage (Narikiyo et al., 2025). ESG reporting has surged globally, with over 90% of S&P 500 companies now publishing ESG metrics (Ademi & Klungseth, 2022). Investors and regulators are increasingly relying on ESG data to assess long-term business viability, reinforcing the link between environmental performance and financial sustainability (Chen et al., 2023). Environmental management in business has evolved from philanthropic CSR to strategic environmental governance (Wu et al., 2021). Initially, CSR was treated as voluntary goodwill; now it is a risk and opportunity management tool embedded in boardroom decisions (Coulson-Thomas, 2024). For instance, Toyota has integrated Life Cycle Assessment (LCA) into its product design phase, reducing energy consumption in vehicle manufacturing by 35% between 2015 and 2022 (Rashid & Pagone, 2023; Wang & Tang, 2022). The adoption of ISO 14001 by global firms such as Nestlé and Siemens has shown that certified environmental management systems (EMS) reduce legal non-compliance, improve resource efficiency, and enhance stakeholder confidence (Ceko, 2024; Ijomah et al., 2024). Similarly, Environmental Impact Assessments (EIA) are mandated in jurisdictions such as the EU and Pakistan for large-scale projects (Ehtasham et al., 2021; Khan & Chaudhry, 2021). These tools help firms anticipate environmental risks before capital investment, preventing both regulatory delays and reputational damage (Khan & Chaudhry, 2024). Pakistan's industrial sector contributes nearly 19% to its GDP and is pivotal to employment and exports (Rathore et al., 2023; Khan, & Hassan, 2020; Khan, Sarfraz, & Tabassum, 2020; Khan, Sarfraz, & Tabassum, 2020; Khan, Sarfraz, & Afzal, 2019)). However, it is also a leading source of environmental degradation. Manufacturing alone contributes over 34% of the country's carbon emissions, and most factories in Punjab and Sindh discharge untreated wastewater into rivers (Parveen & Khan, 2023). Despite the Pakistan Environmental Protection Act (1997) and National Environmental Quality Standards (NEQS), enforcement remains weak (Asghar et al., 2024). The Securities and Exchange Commission of Pakistan (SECP) has issued ESG reporting guidelines, but only a fraction of publicly listed firms comply (Jalal & Zubair, 2025). Moreover, barriers include lack of awareness, expertise, and institutional coordination (Masud & Khan, 2024).

Pakistan's manufacturing sector is a double-edged sword: while vital to economic

development, it severely burdens environmental systems (Ullah, 2024). Only 245 of manufacturing firms in Pakistan had adopted international standards like ISO 14001 or LCA due to cost constraints and lack of government incentives (Hayat & Lohano, 2024). However, sustainability awareness is growing (Danish, Akhtar & Imran, 2025; Mankash, et al., 2025; Hafeez, Yaseen & Imran, 2019). Lucky Cement, for instance, achieved zero solid waste landfill targets in 2022 and integrated solar energy in its Karachi plant (Lucky Cement Limited, 2022). Similarly, Fauji Fertilizer has begun reporting its GHG emissions and water usage metrics under the GRI framework (Mahmood et al., 2016). Engro Corporation, a diversified industrial conglomerate operating in fertilizers, energy, petrochemicals, and food, represents one of Pakistan's most progressive examples of corporate environmental integration (Khan et al., 2023). According to its 2022 Integrated Report, Engro has aligned its sustainability strategy with seven SDGs, including Clean Water (6), Affordable Energy (7), and Climate Action (13). The company's Dawood Hercules Fertilizer Plant has ISO 14001 certification and uses recycled water systems to reduce freshwater intake by 40% (Ashraf, 2024). Engro also conducts EIAs before any capital expansion and regularly publishes ESG disclosures compliant with GRI Standards. Its selection as a case study is based on its transparent reporting, multisectoral operations, and strategic relevance in understanding the intersection of environmental and business decisions in Pakistan (Ashraf, 2024; Waheed et al., 2024). This study investigates how Engro Corporation incorporates environmental management into its manufacturing operations (Ali, et al., 2020; Ali, et al., 2020; Xu, et al., 2019). It highlights key sustainability initiatives and their alignment with corporate strategy and governance. The research evaluates the use of tools such as EIA, ISO 14001, and LCA to manage environmental impact. It assesses performance indicators like carbon footprint, water usage, and waste management. The study explores internal and external challenges Engro faces in executing environmental strategies. It identifies opportunities for improvement and innovation in sustainability practices. Finally, Engro's performance is compared with industry benchmarks and competitors in the manufacturing sector.

METHODOLOGY

This research adopts a narrative qualitative case study approach to explore Engro Corporation's Environmental Management (EM) system in relation to its manufactured product operations. The purpose of the methodology is to develop a deep and contextualised understanding regarding the company's sustainability practices, tools, and performance, particularly regarding the manufacturing industry in Pakistan. The study relies on secondary data which is sourced from publicly accessible materials such as Engro's Integrated Reports, Sustainability Reports, SECP regulatory filings, the corporation's ISO certifications, and other audits concerning ESG compliance. Supplementary academic articles and literature reviews were utilised to substantiate the corporate information and provide scholarly credibility. A systematic document analysis was conducted to retrieve pertinent information from these sources. The most important were Engro's corporate vision regarding the environment and the use of such tools as ISO 14001, Environmental Impact Assessment, and Life Cycle Assessment, along with other ESG reporting and carbon footprint measuring services, water usage, and waste management. Corporate governance alignment with international and national frameworks, including the UN Sustainable Development Goals (SDGs), the Pakistan Environmental Protection Act and the NEQS, was also considered. Coherency themes were triangulated to six major themes aligned with the objectives of the study: environmental strategy, performance metrics, tools, corporate alignment, comparative benchmarking, and challenges (opportunities). These themes contributed to coherent depth, ensuring rich systematic analysis. For assessing competitive position, Engro

underwent a benchmarking review against two major national competitors (Fauji Fertiliser Company and Lucky Cement) along with international peers Unilever and BASF for comparative ESG assessment. Benchmarking criteria included transparency of disclosures related to ESG frameworks, adoption of ISO standards, delineated energy and water efficiency measures, and the degree of commitment toward a circular economy.

KEY FINDINGS

Engro Corporation's Environmental Management Strategies

Engro's operations span three major sectors: fertilizers (Engro Fertilizers), petrochemicals (Engro Polymer & Chemicals), and food (FrieslandCampina Engro Pakistan) (Engro Fertilizers Limited, 2023a). Each business unit operates independently but under a shared sustainability vision. Engro Fertilizers, for instance, operates the largest urea plant in Pakistan at Daharki, which consumes significant energy and water resources (Rafique, 2025). Engro Polymer manufactures PVC-based polymers, which traditionally pose environmental risks, while the food subsidiary focuses on dairy and packaging-intensive operations (Engro Polymer & Chemicals Limited, 2025a). Engro's environmental vision emphasizes "inclusive and sustainable growth," prioritizing environmental performance alongside financial and social metrics (Nazeer et al., 2020). This policy reflects a commitment to the UN Sustainable Development Goals (SDGs), specifically SDG 6 (clean water), SDG 7 (clean energy), SDG 12 (responsible consumption), and SDG 13 (climate action) (Hassan et al., 2021; Zeewaqar, 2024). The corporation's risk-based sustainability approach integrates climate adaptation into enterprise-wide strategic decision-making (Agha & Ali, 2023).

Over the last 5–10 years, Engro has launched several flagship programs to mitigate environmental impacts (Shaikh & Hyder, 2023). One such program is the Waste Heat Recovery initiative at the Daharki fertilizer plant, which recycles flue gases to generate energy, significantly reducing CO_2 emissions (Rafique, 2025). Another is the Thar Foundation, which supports sustainable coal mining practices and rehabilitates ecosystems in Sindh through afforestation and community-based water management (Policy, 2025). Engro Energy's 660 MW Thar Coal power project uses supercritical technology, which emits lower CO_2 than conventional methods (Abro et al., 2021; Malik et al., 2025). Similarly, the fertilizer plant has adopted ammonia production processes using more efficient catalysts to reduce nitrous oxide emissions (Rafique, 2025). Moreover, Engro Polymer has shifted part of its power sourcing to renewable and hybrid energy solutions to decarbonize operations (Engro Polymer & Chemicals Limited, 2024). Engro's water recycling and conservation strategies are robust. Engro Polymer installed a Zero Liquid Discharge system, achieving 90% wastewater reuse (Lahnsteiner et al., 2024). In parallel, FrieslandCampina Engro has introduced closed-loop systems in its milk processing facilities, significantly reducing water withdrawal (FrieslandCampina, 2024). Additionally, the corporation has adopted drip irrigation systems in its corporate agriculture programs to optimize water use (Ashraf, 2024; Mehmood et al., 2025). In response to mounting plastic pollution concerns, Engro Foods reduced plastic consumption by 15% through packaging redesign for its flagship milk products like Tarang and Omung (Sattar, 2020a, 2020b). The company has also piloted biodegradable films for dairy packaging (Sattar, 2020b). On the supply chain front, Engro enforces environmental audits and carbon reporting for its upstream and downstream partners (Shaikh & Ali, 2025). A lifecycle analysis framework is applied to evaluate supplier performance, particularly in the chemical division (Farrukh et al., 2022). Environmental considerations are integrated at all levels of Engro's operational planning (Shaikh & Ali, 2025).

The Enterprise Risk Management (ERM) framework includes environmental risks such as climate volatility, regulatory compliance, and resource scarcity (Albasteki, 2021; Derah, 2020). Environmental KPIs are linked to executive performance reviews, incentivizing sustainable decision-making (Khan, 2023; Shaikh & Ali, 2025). Moreover, Engro uses Environmental and Social Impact Assessments (ESIA) before undertaking any major industrial expansion, as seen in the EnVen Urea Plant project (Rafique, 2025).

Alignment of Sustainability Goals with Corporate Strategy and Governance

Engro's strategic operational planning intricately demonstrates an integration of environmental considerations at all levels of the organisation within the context of sustainability (Azhar, 2024; Azhar & Imran, 2024; Azhar, et al., 2022). The business model incorporates infrastructure and renewable energy adaptations, notably in the projects carried out by Engro Energy that focus on the gasification of Thar coal and its subsequent solar energy transitions (Opitz-Stapleton et al., 2021). This alignment further supports Engro's adoption of circular economy principles along with sustainable agriculture through its subsidiary Engro Fertilisers, which aids in achieving SDG 2 and SDG 12 by fostering resource-efficient food production systems (Ashraf, 2024). Engro's alignment with the Pakistan Vision 2025, which places green growth and energy efficiency as a national priority, also demonstrates the commitment of the company towards national goals (Aslam et al., 2022). Engro demonstrates the integration of carbon risks and the development of low-carbon technologies, reinforcing the strategic sustainable profitability (Mako et al., 2022). At the governance level, Engro holds strong ESG oversight through board-level committees on sustainability and risk; thus, corporate governance is supported alongside top management and operational governance (Samans & Nelson, 2022). These governance frameworks provide top-down responsibility and ensure systematic incorporation of sustainability into corporate governance and organisation-wide decision-making (Mason, 2020). The presence of specialized ESG and audit committees within Engro facilitates compliance with regulatory and global frameworks such as the Companies Act 2017 and UN SDG indicators (Saleem et al., 2025; Shaheen, 2022). Notably, Engro's governance structures have also emphasized diversity and inclusivity on boards, particularly female representation, aligning with SDG 5 and improving strategic ESG outcomes (Shaheen, 2022). Engro adopts a participatory approach to stakeholder engagement that includes active dialogues with investors, communities, and policymakers (Khan, Khan & Shehzad, 2024; Kousar, Khan & Alam, 2024; Khan, Ann & Kahtoon, 2022). Through investor sustainability reports and transparency in ESG disclosures, the corporation attracts green finance and builds trust (Mako et al., 2022). In flood-affected regions, Engro implemented CSR and disaster relief programs that integrate SDG 13 on climate action and SDG 6 on clean water (Ashraf, 2024). Community development programs such as education and healthcare services reflect Engro's alignment with SDG 4 and SDG 3 and demonstrate the company's commitment beyond compliance toward shared value creation (UN ESCAP, 2017). Pakistan Vision 2025 emphasizes inclusive development, energy security, and sustainable growth, directly aligning with the UN SDGs. Engro's sustainability roadmap aligns its targets with Vision 2025 through investment in renewable energy, food security, and climate resilience (Aslam et al., 2022). The company's integrated reporting maps its initiatives to SDGs 6 (clean water), 7 (clean energy), 12 (responsible consumption), and 13 (climate action) (Saleem et al., 2025). Engro's climate resilience projects in Sindh and Baluchistan aimed at resolving water scarcity issues and energy deficiency, regarding them as exemplary cases of SDG localisation through corporate practice were analysed (Opitz-Stapleton et al., 2021). Moreover, involvement in the Pakistan Green Stimulus Package also emphasises Engro's participation in the national

green recovery initiatives (Keane et al., 2021). Within the organisation, Engro integrates ESG considerations into the frameworks of capital allocation, risk assessment, and project appraisal. Internal accountability is directed by sustainability dashboards and KPIs established within the GRI framework (Saleem et al., 2025). Moreover, projects undergo environmental impact assessments, climate risk scenario modelling, and other climate-related impact assessments throughout their lifecycle (Mako et al., 2022). Engro has operationalised sustainability by utilising carbon and water resource tracking systems as well as carbon-monitored data-driven systems in VoEST decision-making, demonstrating the integration of technology into ESG (Keane et al., 2021).

Evaluation of Environmental Management Tools (EIA, ISO 14001, LCA)

In Pakistan, an outline deals with the preliminary stages of any project, and expansion is conditioned on obtaining an Environmental Impact Assessment (EIA), which is a legal obligation (Opitz-Stapleton et al., 2021). Engro Fertilisers applied for an EIA while expanding their ammonia and urea complexes in Daharki, which posed risks to groundwater depletion; hence, they incorporated lined ponds coupled with reverse osmosis systems (Rafique, 2025). This led to a decrease in freshwater usage by 22%. Engro Polymer has submitted an environmental impact assessment for the expansion of its PVC plant located at Port Qasim (Engro Fertilizers Limited, 2021). Emission control, as well as reduction of vehicular traffic emissions, led to the adoption of rail-based logistics systems, implementation of vapour recovery units, and other steam recovery systems. Subsequent audits validated EIAs recommended changes, leading to the actual reduction of 15% in particulate matter emissions (Bhateria, 2024). The ISO 14001 standard structures environmental management through continuous improvement. Engro Fertilizers' Daharki and Enven plants achieved ISO 14001:2015 certification, incorporating SCADA-based emissions tracking and regular third-party audits (International Organization for Standardization, 2021). Engro Polymer's ISO implementation includes a real-time dashboard tracking pollutants like NOx and VOCs (Ntsasa et al., 2024). During the 2022 Karachi floods, this system enabled rapid response, resulting in no major non-conformities and a 12% improvement in resource efficiency (OCHA, 2023). This highlights how ISO 14001 extends beyond compliance to drive operational excellence (Engro Polymer & Chemicals Limited, 2025b). Life Cycle Assessment (LCA) is used to evaluate environmental impacts throughout a product's life cycle (Asif et al., 2022). Engro Polymer applied LCA to its VCM process and identified EDC cracking as emission intensive (Hu et al., 2022). The company responded with heat recovery and cleaner raw materials, reducing CO_2 emissions by 31% (Engro Corporation, 2025). Engro Fertilizers used LCA to assess different ammonia synthesis techniques (Rafique, 2025). Transitioning to a ruthenium-based catalyst system reduced global warming potential by 14% (Muller, 2023). This informed procurement and capital investment decisions, aligning with the company's ESG strategy (Janjua, et al., 2025; Faisal, Qureshi & Shah, 2025). These tools are fully embedded within Engro's governance frameworks (Shaikh & Ali, 2025). The Environmental Compliance Dashboard consolidates EIA conditions, ISO audit trails, and LCA metrics into a centralized SAP system. This allows for real-time deviation tracking and automated non-conformity reporting (Engro Polymer & Chemicals Limited, 2024). In 2021, VOC exceedances in Engro Polymer's EDC storage were traced using LCA records and ISO logs, leading to modifications in temperature controls. Such integration ensures that environmental data drives preventive actions rather than reactive fixes (Engro Polymer & Chemicals Limited, 2022**)**.

Assessment of Environmental Performance Metrics IV. Assessment of Environmental

Performance Metrics

A major component of Engro's performance monitoring is the measurement of Scope 1 and Scope 2 greenhouse gas (GHG) emissions (Ratasha et al., 2024). In its 2020 integrated report, Engro disclosed total GHG emissions of 7.58 million tons, a substantial increase from 2.72 million tons in 2019, largely due to operational expansion in its coal-based energy units in Thar. This increase included the first-ever accounting of fugitive emissions from coal mining operations as Scope 1 emissions (Engro Corporation, 2020). To mitigate its carbon impact, Engro reported the removal of 3,875 tons of CO_2 through a mix of renewable energy initiatives, afforestation projects, and technology upgrades across its subsidiaries (Ashraf, 2024; Jin, 2020). For example, Engro Enfrashare implemented solar energy systems at 446 telecom sites, producing over 151,800 units of clean energy since 2018-though this vertical was not included in the 2020 natural capital data (Engro Corporation, 2020). In terms of water usage and recycling, Engro Fertilizers implemented closed-loop cooling systems at its Daharki plant, significantly reducing freshwater withdrawals (Malik et al., 2025). Additionally, the company introduced biological treatment systems to process wastewater for reuse in operations, enhancing recycling rates and compliance with Pakistan's National Environmental Quality Standards (NEQS) (Ali, 2022). Waste management practices across Engro Polymer & Chemicals involve the reuse of plastic waste and minimizing landfill contributions (Shaikh & Hyder, 2023). In 2022, the company reported that its polymer operations diverted a substantial portion of operational waste to certified recycling vendors, helping achieve zero industrial hazardous waste landfill targets in several sites (Engro Fertilizers Limited, 2023b).

Engro has developed an internal digital dashboard system for real-time monitoring of environmental KPIs (Shaikh & Ali, 2025). These dashboards are operational at major facilities, including Engro Fertilizers Daharki, where utility consumption and emissions data are captured at process-level granularity. The dashboards support compliance monitoring, internal auditing, and data-driven decision-making (Engro Fertilizers Limited, 2024). Engro's annual environmental targets are tied to longer-term commitments such as alignment with the UN Sustainable Development Goals (SDGs), especially SDGs 6, 7, 12, and 13 (Engro Fertilizers Limited, 2021). The company's performance data, such as reduced freshwater consumption and carbon mitigation through solar energy, indicate steady progress (Ashraf, 2024; Malik et al., 2025). For instance, their investment in renewable solar infrastructure and GHG reduction projects contributes directly to Scope 2 emission mitigation while preparing the company for future carbon pricing regulations (Robinson & Sullivan, 2022).

Challenges and Opportunities in Strategy Implementation

Engro Corporation faces internal challenges like outdated infrastructure, limited ESG skills, and data gaps, but responds through solar integration, training, and digital tracking. External barriers such as weak regulation and supply chain disruptions are countered by partnerships and policy advocacy. Opportunities in green finance, public-private collaboration, and benchmarking help drive Engro's sustainable transformation (Table 1).

Table 1: Challenges and Opportunities in Environmental Strategy Implementation at Engro Corporation

Type	Category	Example	Implication	Response by Engro
Challenge	**Technical Limitations**	Limited capacity for solar integration in legacy manufacturing plants	Slows down low-carbon transition	Phased solarization plan for fertilizer and LNG terminals
	Infrastructure Gaps	Aging wastewater treatment at Daharki and Karachi sites	Risk of non-compliance with NEQS	Installed closed-loop cooling and biological treatment systems
	Workforce Training	Gaps in sustainability reporting skills among field engineers	Inconsistent data collection and reporting	ESG certification programs added for mid-management
	Cultural Resistance	Resistance to change in old chemical processing units	Hinders adoption of circular economy practices	Launch of "One Engro" cultural change initiative
	Data Management	Inconsistent data tracking in early years of ESG transition	Reduced comparability across facilities	Unified digital KPI dashboard deployed across business units
	Budget Constraints	Sustainability upgrades deferred due to capital reallocation	Delay in green tech deployment	Partnered with donors and climate funds for solar co-financing
Barrier	**Regulatory Weakness**	Limited monitoring by provincial EPA in Sindh	Compliance relies on voluntary efforts	Engro introduced internal audits and collaborated with local EPA
	Supply Chain Disruptions	Pandemic-related delays in procuring energy-efficient equipment	Slowdown of infrastructure upgrades	Diversified supplier base and engaged with local certified vendors
	Policy Uncertainty	Lack of consistency in carbon tax or green subsidy policy	Risk for long-term investment in renewables	Engro works with industry platforms to lobby for climate legislation
Opportunity	**Green Technology Investment**	Deployment of solar energy across 446 telecom towers	Reduces Scope 2 emissions, lowers long-term OPEX	Expanding solarization to fertilizer and LNG terminals
	Energy Efficiency Programs	Use of waste heat recovery in polymer plants	Cuts energy use and carbon intensity	Investment in heat recovery boilers and compressors

	Climate Finance Access	Interest from ESG-linked investors and DFIs	Enables green loans and bonds	Exploring SDG-linked sukuks and issuing green impact reports
	Public-Private Collaboration	Biodiversity restoration around Thar coal fields	Enhances reputation, offsets environmental degradation	Partnership with Sindh government and local communities
	Research Collaborations	Joint projects with LUMS/NUST on wastewater reuse	Enables adoption of cutting-edge treatment technologies	Piloting greywater recycling in Karachi processing units
	Industry Benchmarking	Engro benchmarked against Fauji Fertilizer and Lucky Cement	Identifies performance gaps and improvement areas	Used benchmarks to refine 2022–2025 ESG targets

Comparative Analysis with Industry Benchmarks and Competitors

Engro Corporation stands as one of Pakistan's most visible actors in corporate sustainability within the manufacturing sector, yet it operates in a competitive environment that includes national rivals like Fauji Fertilizer Company (FFC) and Lucky Cement, as well as international manufacturing peers (Ashraf, 2024). A comparative analysis of Engro's environmental, social, and governance (ESG) practices reveals both its pioneering strengths and areas needing improvement (Ngunjiri, 2025; Shaikh & Ali, 2025). Fauji Fertilizer Company, like Engro Fertilizers, is a major player in the agrochemical sector and has made considerable progress in ISO 14001 compliance. FFC has reported full ISO 14001 certification across all operational plants and has invested in a reverse osmosis water recycling system at its Mirpur Mathelo site (Ashraf, 2024; Sulehri et al., 2025). While Engro has also adopted ISO 14001, it was among the first in the sector to embed the standard across fertilizer and polymer plants (Rehman et al., 2021). Furthermore, Engro has demonstrated a more robust framework for ESG disclosures by publishing GRI-compliant integrated reports and engaging with external ESG rating agencies (Engro Fertilizers Limited, 2024). In contrast, FFC's public ESG information is limited to standalone sustainability statements and lacks third-party validation (La Torre et al., 2022).

Lucky Cement, representing the industrial construction materials sector, has taken significant strides in energy efficiency and alternative fuels (Beguedou et al., 2023). It has integrated waste heat recovery systems, contributing to a 27% reduction in energy intensity since 2018 (Lucky Cement Limited, 2023). Compared to this, Engro has focused its energy transition on solar energy integration, particularly through its telecom infrastructure subsidiary, Engro Enfrashare, and LNG terminals (Engro Fertilizers Limited, 2022). While both companies demonstrate innovative energy strategies, Lucky Cement's use of refuse-derived fuel aligns more closely with circular economy principles-an area where Engro is currently limited (Engro Fertilizers Limited, 2022; Lucky Cement Limited, 2023). On an international level, peers such as

Unilever and BASF serve as high benchmarks. Unilever's “Clean Future” initiative and BASF’s commitment to carbon-neutral growth post-2030 illustrate the growing global shift toward life cycle-based assessments (LCA) and circular economy frameworks (Kanoria et al., 2021; Konina & Sapir, 2023). Although Engro mentions LCA in strategic documents, its implementation is still at a pilot stage, especially in packaging and fertilizer product lines (Sattar, 2020b). Broader, product-wide LCA integration remains a gap compared to global leaders (Asif et al., 2022).

One of Engro’s notable strengths is its early and consistent ESG transparency (Ashraf, 2024). The company has published sustainability reports aligned with GRI, integrated into its financial reports, and subjected them to third-party audits. This level of disclosure has enhanced investor confidence, particularly among ESG-conscious funds (Engro Fertilizers Limited, 2021). Areas for improvement include the adoption of circular economy practices in waste management and a broader rollout of LCA across all product segments (Afzal & Hanif, 2022; Zoboli et al., 2020). Engro has made early moves, such as plastic reuse at Engro Polymer and renewable packaging in food businesses, but they remain fragmented compared to holistic circular strategies seen globally (Bor, 2020; Shaikh & Hyder, 2023).

CONCLUSION

Examining Engro Corporation’s environmental strategy reveals a deeply ingrained and dynamic commitment to sustainable manufacturing with a proactive vision for Pakistan. By employing a myriad of tools such as ISO 14001, EIAs, and LCAs, Engro integrated operational essential EIAs mitigating, quantifying, reporting, and surpassing its environmental footprint, which is strategically invaluable. The ESG governance integration, real-time monitoring, active compliance shifts enforcement of SDG-linked goals illustrates a move beyond compliance toward environmental proactive leadership. Context-specific challenges such as ageing infrastructure and weak regulatory enforcement frame while global standards inform realities guide versatile strategies working responsive frameworks. Despite these challenges, the company’s innovative resilience with solar energy, wastewater recycling systems, and circular packaging puts it ahead of competitors. Domestically, Engro differentiates itself from competing ESG frontrunners Fauji Fertiliser and Lucky Cement by leading ESG transparency and digital environmental tracking. However, domestically competing peers still outshine them as global counterparts in circular systems and full-spectrum LCA utilisation. The comprehensive use of real-time data combined with third-party audits, advancing frameworks, and setting national benchmarks positions Engro’s sustainability metrics as unparalleled in industrial environmental performance, surpassing peers. However, policy action, workforce strategy, and technology scalability, particularly regarding green approaches, demand further exploration. With the ecological and economic pressures confronting the manufacturing sector of Pakistan, Engro’s model shows how integrating technology and governance with stakeholder engagement can create enduring sustainability and a competitive edge.

Practical Recommendations

To strengthen its sustainability leadership, Engro Corporation should expand circular economy initiatives across its operations, adopting waste-to-value systems, closed-loop supply chains, and industrial symbiosis. Broader implementation of Life Cycle Assessment (LCA) can enhance green product design and procurement. Investing in ESG capacity building through internal academies will ensure consistent sustainability practices organization wide. Engro should actively advocate for coherent climate policies, including carbon pricing and green subsidies, while leveraging climate finance through SDG-linked green bonds and sukuks. Global

benchmarking and integration of external ESG ratings will elevate performance standards, and deepening partnerships with local universities and communities will enable region-specific solutions for water conservation and air quality improvement.

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