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The Influence of Environmental Regulations on the Global Supply Chain Strategies of Fast-Moving Consumer Goods (FMCG) Companies

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ABSTRACT
This study investigates how environmental regulations are reshaping the global supply chain strategies of Fast-Moving Consumer Goods (FMCG) companies, with a specific focus on firms operating in India. Amid mounting global and national mandates—such as Extended Producer Responsibility (EPR), the Plastic Waste Management Rules (2024), and international frameworks like the Paris Agreement and Sustainable Development Goals (SDGs)—FMCG firms are compelled to transform sourcing, logistics, packaging, and internal policy structures to achieve sustainability compliance and competitiveness. Using a secondary data methodology, this research examines regulatory frameworks, strategic responses, and challenges faced by FMCG firms including Hindustan Unilever, Nestlé, Dabur, ITC, and PepsiCo. The findings highlight a clear shift towards ethical sourcing, regenerative agriculture, carbon-efficient logistics, and biodegradable packaging innovations. However, barriers such as infrastructure gaps, regulatory complexity, and digital readiness persist. The study concludes with policy and industry recommendations aimed at harmonising regulations, enhancing digital traceability, supporting MSMEs, and fostering public-private partnerships to enable scalable, circular, and resilient supply chains. The paper contributes to the academic and industry understanding of sustainable supply chain transformation in the context of emerging economies.

Keywords: Environmental Regulations, FMCG Supply Chains, Extended Producer Responsibility (EPR), Sustainable Packaging, Green Supply Chain Management (GSCM)

I. INTRODUCTION & RESEARCH FRAMEWORK

1.1 Background of the Research

In recent years, environmental regulations have increasingly shaped the supply chain strategies of FMCG (Fast-Moving Consumer Goods) companies globally, particularly in emerging economies such as India. The Indian FMCG sector is now the fourth largest in the country's economy, valued at approximately US $56.8 billion in December 2022, and is projected to grow at a CAGR of nearly 27.9 per cent between 2021 and 2027 (Chishty, 2023). Meanwhile, the Indian government has introduced stringent environmental mandates—such as plastic recycling targets, Extended Producer Responsibility (EPR), and sustainable sourcing norms—that came into effect in 2024–25. These regulations coincide with global sustainability frameworks and consumer demand shifts towards green products; in India, around 45 per cent of consumers actively seek eco-friendly brands, and 71 per cent prioritise recyclable packaging (India Today, 2025). As a result, FMCG firms are rapidly revising sourcing, logistics, materials, and packaging strategies to align with both regulatory and consumer expectations. This study builds on the concept of Green Supply Chain Management (GSCM), which integrates environmental considerations across supply chain stages—from procurement to end-of-life recycling.

1.2 Justification of the Research

The mounting regulatory pressure on FMCG firms is not just an operational issue but also a strategic imperative. In India, the Securities and Exchange Board (SEBI) updated ESG disclosure mandates in 2023–24, requiring the top

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Volume 7, Issue 07 July 2025, pp: 885-894 www.ijaem.net ISSN: 2395-5252

250 listed firms to report sustainability across at least 75 per cent of their supply chain by 2025–26(Upadhyay& Dugal, 2025). These legal obligations, coupled with economic incentives, like, tax rebates for sustainable packaging and national targets (such as a 30 per cent reduction in waste by 2030), illustrate that environmental regulation is a critical driver of strategic transformation (Srivastava, 2024). Secondary data indicates major firms such as Hindustan Unilever (HUL), Dabur, and ITC are already investing in renewable energy, waste-to-energy plants, recyclable or compostable packaging, and circular economy practices (Dutta, 2025). However, challenges such as supply-side infrastructure gaps, traceability issues, and cost pressures still exist. A structured academic analysis is essential to understand how environmental regulation is reshaping strategic supply chain choices, particularly within the Indian FMCG landscape. This has implications for policymakers, industry leaders, and academia alike.

1.3 Aim and Objectives of the Research

The primary aim of this study is to explore how environmental regulations influence global supply chain strategies in FMCG firms operating in India. To accomplish this, the study pursues four objectives:

- To examine the scope and evolution of environmental regulations affecting FMCG supply chains, particularly in India.
- To analyse how FMCG companies are adapting their sourcing, logistics, packaging, and operational strategies in response to environmental regulations.
- To evaluate the challenges faced by FMCG firms and propose recommendations for improving sustainability alignment in supply chains.

These objectives are addressed using insights derived from up-to-date secondary sources including academic literature, industry reports, sustainability disclosures, and government regulatory notifications.

1.4 Research Questions and Brief Methodology

Guided by the aim and objectives, the study addresses the following **research questions**:

- What are the key environmental regulations—national (like EPR and Plastic Waste Management Rules) and international (such as the Paris Agreement and SDGs)—that impact the supply chain strategies of FMCG companies operating in India?
- How have leading FMCG firms revised their sourcing, procurement, packaging, and logistics strategies in response to environmental mandates such as EPR, recycling targets, and sustainability disclosures?
- What are the major challenges faced by FMCG companies in aligning with environmental regulations, and what policy and industry-level recommendations can enhance regulatory compliance and supply chain sustainability?

To answer these questions, the research relied exclusively on secondary data. The methodology includes:

- Literature review of recent academic papers, regulatory documents, and conceptual frameworks (e.g. GSCM theory).
- Industry analysis via sustainability reports, ESG disclosures, and market evaluation of Indian FMCG firms.
- Synthesis of regulatory announcements, government notifications, and regulatory impact assessments (such as SEBI's ESG rules).

Given its reliance on authoritative secondary sources and contemporary data (2023–25), this study offers a current and practical insight into how environmental regulation is impelling supply chain changes in Indian FMCG.

II. FMCG SECTOR AND SUPPLY CHAIN DYNAMICS

2.1 Overview of FMCG Sector

Fast-Moving Consumer Goods (FMCG), also referred to as Consumer Packaged Goods (CPG), are low-cost products purchased frequently and turned over quickly (e.g., packaged foods, beverages, toiletries, cosmetics, OTC medicines). As of 2024, the global FMCG market was valued at approximately USD 4.72 trillion, with growth projected to USD 4.94 trillion in 2025 and reaching USD 7.56 trillion by 2033—a CAGR of 5.44 percent (Straits Research, 2025; WK Information, 2025). The Asia-Pacific region leads with over 40 percent of sales, driven by rapid urbanisation in nations like India, China, and Indonesia (WiFi Talents, 2025; Straits Research, 2025). Major companies in this space include Unilever, Nestlé, Procter & Gamble, PepsiCo, Coca-Cola, Mars Wrigley, Reliance, Dabur, and ITC (Straits Research, 2025). Given their high-volume, low-margin model, FMCG firms rely on mass distribution via supermarkets, hypermarkets,

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Volume 7, Issue 07 July 2025, pp: 885-894 www.ijaem.net ISSN: 2395-5252

and convenience stores alongside emergent e-commerce platforms. In India, this sector is the fourth largest contributor to the economy and employs over three million people in downstream activities across urban and rural areas. Moreover, millennials and Gen Z—accounting for 60 percent of consumers in emerging economies—demand healthier, natural, and eco-friendly products, compelling FMCG brands to innovate (WiFi Talents, 2025). Clearly, FMCG companies play a pivotal role in global trade and consumer wellbeing, underlining the need to understand their dynamics in supply chain transformation.

2.2 Structure of Global Supply Chains

FMCG supply chains function as complex, multi-tiered networks comprising raw material suppliers, manufacturers, logistics providers, distributors, retailers, and e-commerce delivery systems (WK Information, 2025). The raw material stage includes suppliers of ingredients (e.g., Cargill, ADM) and packaging inputs (e.g., paper, plastics). Manufacturing is undertaken by both global giants (Nestlé, Unilever, P&G) and regional firms (Dabur, ITC) (WiFi Talents, 2025). The logistics tier encompasses warehousing, transportation, and inventory management—services often outsourced to third-party logistics providers operating hubs across regions (Mordor Intelligence, 2025; IMARC Group, 2024). Retail distribution mixes traditional bricks-and-mortar retail (supermarkets, convenience stores) with direct-to-consumer (D2C) channels and online grocery platforms (Amazon, Flipkart, Blinkit, Zepto) (Straits Research, 2025; Mordor Intelligence, 2025). Asia-Pacific now dominates FMCG logistics, accounting for nearly 50 percent of global volume due to rising e-commerce and urbanisation (IMARC Group, 2024; Fortune Business Insights, 2025). The logistics model typically follows a hub-and-spoke structure: centralised warehouses supply smaller distribution centres, which feed urban and rural outlets (Mordor Intelligence, 2025). These multi-tiered networks enable rapid product replenishment, but they also add complexity, increasing inventory, traceability demands, and the need for end-to-end coordination across borders. Such supply chain architecture is central to how FMCG firms adjust strategically in response to environmental and regulatory pressures.

2.3 Sustainability Challenges in FMCG Supply Chains

Environmental sustainability presents significant challenges across FMCG supply chains, especially in packaging, transportation, procurement, and waste handling. Packaging waste is one of the most critical areas: globally, single-use plastic accounts for about 60 percent of FMCG packaging (WiFi Talents, 2025), and only 20 percent of India's annual 62 million tonnes of solid waste is processed. While biodegradable and recyclable packaging adoption has increased by approximately 15 percent in recent years (Straits Research, 2025), companies face difficulty ensuring traceable, circular material streams. FMCG transport systems contribute substantially to carbon emissions, with logistics alone valued at over USD 1.2 trillion in 2024, anticipated to reach USD 1.64 trillion by 2033—a 3.4 percent CAGR (IMARC Group, 2024). The climate impact worsens when coupled with long-distance cross-border movements prone to trade disruptions, fuel price fluctuations, and geopolitical uncertainty (Guardian, 2025). Additionally, supermarkets and e-commerce models prompt overproduction and rapid turnover, generating overconsumption and food waste. Consumers in urban markets further drive demand for convenience-focused packaging like single-serve sachets and ready-to-eat meals, which are often not recyclable (Straits Research, 2025). In India, inadequate recycling infrastructure and fragmented informal recycling systems pose further sustainability challenges. As consumers increasingly prioritize ecological credentials—with over 70 percent indicating preference for brands with sustainable practices—FMCG companies must rapidly reconfigure material sourcing, logistics, and packaging designs (WiFi Talents, 2025). Addressing these sustainability pressures is vital not only for regulatory compliance but also for long-term brand reputation, cost control, and circular economy alignment.

III. GLOBAL ENVIRONMENTAL REGULATIONS LANDSCAPE

3.1 Types of Environmental Regulations

Environmental regulations impacting FMCG supply chains span diverse domains such as emissions, waste management, recycling, and sustainable sourcing. Emissions regulations include carbon pricing, emissions trading schemes, and vehicle emission standards. For example, the EU's Emissions Trading System (ETS) enforces caps on greenhouse gases in industries and transport, encouraging FMCG logistics to decarbonise via electric or hybrid vehicles and optimising transportation routes (European Green Deal, 2025).

Waste and recycling mandates are increasingly significant. In India, the Plastic Waste Management (Amendment) Rules 2024 enforce

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stringent requirements under Extended Producer Responsibility (EPR), obliging producers, importers, and brand owners to manage the post-consumer lifecycle of their packaging. They must ensure 70% recycling or reuse of plastic waste by 2026–27 and achieve 100% by 2028–29, in addition to mandating recycled content incorporation in packaging to support circular economy goals (ComplianceCalendar, 2025; Banyan Nation, 2025). Similar directives exist globally, such as the EU's Packaging and Packaging Waste Directive and Single-Use Plastics Directive, which ban numerous single-use plastic items and set recycling targets for packaging materials (European Single-Use Plastics Directive, 2021).

Sustainable sourcing regulations are another growing trend, driven by deforestation, biodiversity, and labour considerations. Though less prescriptive than plastic rules, schemes under the EU Green Deal address supply-chain transparency, pushing companies to source responsibly (such as RSPO for palm oil), and comply with due diligence laws. These regulations influence packaging inputs (e.g. paper, palm oil derivatives) to be traceable and sustainably certified. Together, these regulatory spheres—emissions, waste, recycling, sourcing—are reorienting supply chain strategies for FMCG firms worldwide.

3.2 Regional Differences in Regulations

Environmental regulations vary widely by region, reflecting policy priorities, enforcement frameworks, and political will. European Union regulations are among the most comprehensive. The European Green Deal seeks climate neutrality by 2050, setting interim targets such as a 55% emissions reduction by 2030 under the "Fit for 55" package. The EU enforces high recycling and waste reduction standards via directives on packaging, landfills, and single-use plastics. EPR schemes in textiles and food sectors mandate brand accountability for product waste, even for exporters targeting EU markets (FT, 2025).

United States regulation is comparatively fragmented, with environmental rules varying by state. Several states have adopted EPR laws for packaging, electronics, and other waste streams, though there is no federal-level EPR. The approach centres more on emissions (EPA frameworks) and waste management guided by the Resource Conservation and Recovery Act (RCRA).

India, as an emerging economy, has rapidly strengthened its regulatory framework over recent years. The 2021 amendment to Plastic Waste Management Rules banned single-use plastics and expanded EPR scope; the 2024 update tightened producer obligations to include all importers and brand owners, increased plastic bag thickness standards, mandated labelling, and boosted compliance enforcement (Times of India; DrishtiIAS, 2025). Regional states, such as Karnataka, have instituted local monitoring bodies to enforce single-use plastic bans and bottle recycling incentives (Times of India, 2025). Unlike in the EU or US, India faces infrastructure and informal sector integration challenges, necessitating innovations and digital tracking.

Emerging economies, such as those in Southeast Asia and Latin America, are catching up with national-level bans on SUPs (single-use plastics) and EPR frameworks for packaging and electronics waste. However, many are still improving recycling capacity and supply-chain traceability (Bangladesh, Brazil studies). Altogether, while the EU leads in regulatory breadth, India is making swift strides in EPR and plastic waste controls, even as infrastructure gaps and enforcement capacity lag behind developed regions.

3.3 Impact of Global Agreements

Global environmental frameworks like the Paris Agreement and United Nations Sustainable Development Goals (SDGs) influence national and corporate sustainability agendas. The Paris Agreement (2015) commits signatory nations to limit global warming to "well below 2°C," culminating in net-zero goals. Many countries, including India (2050–2070 net zero pledge), anchored their national climate policies and emissions caps to Paris targets. These cascaded into supply-chain strategies, with FMCG firms seeking carbon-neutral operations and transparent Scope 3 emissions reporting.

UN SDGs—particularly SDG 12 (responsible consumption and production), SDG 13 (climate action), SDG 14 (life below water), and SDG 15 (life on land)—encourage corporate commitment to sustainable materials, plastic waste reduction, and circular economy systems. India's Mission LiFE and Swachh Bharat Abhiyan further drive national engagement with SDGs via waste segregation, recycling targets, consumer awareness campaigns, and corporate participation (India Today, 2025).

At COP 29 (Baku, 2024), nations pledged legally binding measures to end plastic pollution and pursue circular economy targets. This international consensus is pushing countries to institutionalise frameworks like EPR, plastic credit

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Volume 7, Issue 07 July 2025, pp: 885-894 www.ijaem.net ISSN: 2395-5252

trading, deposit-return schemes, and cross-border waste tracking—forces that are now influencing FMCG packaging design and disposal systems (Srivastava, 2024).

Corporate sustainability frameworks such as the Ellen MacArthur Foundation's circular economy model and the Task Force on Climate-related Financial Disclosures (TCFD) further align private-sector reporting and strategy with global goals. Where countries tie corporate compliance to international agreements (e.g. via SEBI ESG mandates in India), FMCG firms are compelled to reconcile global policy frameworks with local regulation.

IV. STRATEGIC IMPACTS ON FMCG SUPPLY CHAINS

4.1 Sourcing and Procurement Changes

In recent years, FMCG firms have significantly shifted towards ethical and sustainable sourcing policies, aiming to align procurement with environmental and social responsibility objectives. Supplier audits have become commonplace, often requiring third-party verification programmes such as Fair Trade, BRC, or Rainforest Alliance. This ensures traceability and compliance with standards related to deforestation, labour practices, and chemical usage (Brand Graphix, 2025).

Large FMCG suppliers operating in India, such as Hindustan Unilever or ITC, have introduced supplier sustainability scorecards assessing water and energy consumption, greenhouse gas emissions, and worker welfare. Procurement teams are trained to evaluate smallholder farmers in India—for example, in tea, coffee, palm oil, or wheat—on sustainable agriculture practices and certification eligibility (Cpluz, 2025). This has led to more local and regional sourcing, reducing transport emissions and stimulating local economies. Governments and NGOs also support producers through capacity-building initiatives, further integrating them into global value chains and enhancing procurement resilience.

The adoption of Voluntary Sustainability Standards (VSS) plays an increasing role, especially in sectors like cotton or palm oil. Brands commit to buying only certified commodities, which encourages suppliers to adopt environmentally friendly practices and helps brands meet both regulatory and consumer expectations (India Retailing, 2024). This reshapes FMCG supply strategies, as procurement becomes a central lever for ecological and social impact.

4.2 Logistics and Distribution Adjustments

Logistics in the FMCG sector is undergoing two major shifts: carbon-efficient transport and route optimisation. Companies are investing in electric and hybrid fleets, particularly for 'last-mile' deliveries in urban centres. Some Indian firms are partnering with railway logistics solutions and cold chain providers to shift freight from road to rail, significantly reducing scope 3 emissions (IMARC Group, 2024).Route optimisation software integrates real-time traffic, fuel consumption, and delivery windows—helping FMCG companies reduce empty miles, improve load factors, and reduce transport-related CO_2 emissions by up to 15% (NetZero India, 2025). Additionally, consolidation centres and urban 'micro-hubs' reduce packaging needs and improve load efficiency, especially in e-commerce.

Green warehousing has gained traction through solar-powered storage units and sustainable materials (e.g., reflective roofing) to reduce energy usage. While the cost of converting warehouses can be high, lifetime energy savings and regulatory incentives have made them financially viable. Carbon labelling and transport tracking—supported by QR code technology—enable brands to disclose environmental impacts to eco-conscious consumers, thus influencing distribution decisions (InductusGlobal, 2025).

4.3 Packaging and Product Innovation

Packaging innovation is at the forefront, driven by regulation and consumer demand. The emergence of biodegradable, compostable, and recycled packaging materials now spans various formats—from flexible sachets to corrugated boxes and films formed from PLA, bagasse, mycelium, or seaweed (NetZero India, 2025; Garvit Green, 2025). ICCAR-CCRI's development of orange-peel-based biodegradable packaging demonstrates India's inventive approach, integrating agricultural residue into circular design, while scientists at IIT Roorkee are pioneering edible cups based on Kodo millet (TOI, 2025).Mono-material laminates—such as PE or PP-based flexible packaging—have simplified recycling processes while preserving barrier performance, enabling compliance with India's EPR rules (India Today, 2025). Meanwhile, multilayer biodegradable packaging with active agents (e.g., antibacterial, antioxidant) extends shelf life and reduces food waste through technologies like electrospinning or chitosan coatings (India Retailing, 2024).

Minimalist design reduces material usage and carbon footprint, enhancing brand appeal (Cpluz, 2025; Brand Graphix, 2025). Smarter

designs incorporate QR codes, NFC, and carbon labels, enhancing transparency and traceability (Packaging Web Wire, 2025; InductusGlobal, 2025). Finally, refillable and reusable systems are gaining traction—especially in personal care—by encouraging repeat consumer involvement and reducing packaging turnover (NetZero India, 2025). These innovations reflect regulatory compliance and competitive differentiation via eco-conscious branding.

4.4 Internal Policy Shifts

Internally, FMCG companies are embedding sustainability into policy and operations. ESG (Environmental, Social, and Governance) goals are now used to define organisational targets, with procurement, logistics, and R&D teams collaborating on reduction plans. Several firms conducting carbon tracking are including scope 1, 2, and increasingly scope 3 emissions to manage lifecycle footprints (Mordor Intelligence, 2025).Dedicated sustainability teams report directly to CEOs or boards, underscoring sustainability's strategic priority. These teams coordinate cross-functional action and collaborate with suppliers, logistics, and design teams. Digital tools such as blockchain, IoT sensors, and carbon calculators provide real-time data—enabling audits, compliance reporting, and increasingly fostering transparency towards regulators and customers (ArXiv, 2023).

To strengthen transparency, some companies have adopted the Task Force on Climate-related Financial Disclosures (TCFD) framework and publish annual sustainability reports detailing progress in energy, water, waste, and packaging metrics. India's SEBI ESG guidelines now obligate such reporting, raising accountability (Reuters, 2025). Therefore, internal policy shifts are transforming sustainability from a compliance task into a core strategic capability that enhances resilience, brand value, and long-term competitiveness.

V. CASE STUDIES AND REAL-WORLD INSIGHTS

5.1 Unilever: Pioneering Circularity and Net-Zero Ambitions

Hindustan Unilever Limited (HUL), the Indian subsidiary of Unilever PLC, stands out for its holistic sustainability strategy. According to its 2024–25 BRSR report, HUL achieved 97% renewable energy in operations, reduced energy intensity by 49%, and achieved a 96% deforestation-free supply chain across palm oil, tea, cocoa, and paper. It also collects more plastic than it uses—making it plastic-positive—and maintains material recovery partnerships across Indian cities with the help of UNDP and local governments (HUL, 2025a).

Digitisation plays a key role in HUL's logistics and planning. AI-powered "Service from Anywhere" supply chains, EV-based last-mile delivery, and predictive analytics for route optimisation have helped reduce carbon intensity while enhancing agility (HUL, 2025b). Its commitment to achieving net-zero emissions by 2039 is anchored in robust internal governance and supplier collaborations, including partnerships with India's RECEIC to shift chemical sourcing to low-GHG alternatives.

5.2 Nestlé: Global Commitments with Local Relevance

Nestlé is implementing its global climate roadmap in India through localised interventions. These include sachet recovery initiatives for Nescafé and Maggi, partnerships with recyclers, and procurement of sustainable cocoa, dairy, and coffee via regenerative agriculture principles. Globally, Nestlé is committed to halving emissions by 2030 and achieving net-zero by 2050.

In India, the company has implemented water-balancing measures in supply regions and piloted refill stations and recyclable mono-material packaging in urban stores. Nestlé's integrated EPR tracking and material labelling efforts align with Indian regulations, while AI-powered demand planning tools improve supply reliability with lower inventory emissions. Nestlé India's strategy shows how global principles can be adapted to local compliance and consumer behaviour challenges.

5.3 Dabur India: Embedding Sustainability in a Heritage Brand

Dabur India exemplifies the integration of traditional values and modern ESG frameworks. It has implemented 100% water-risk assessments at its manufacturing sites and aims for full sustainable sourcing of high-deforestation-risk inputs by FY 2025–26 (Dabur, 2024a). About 53% of its inputs come from MSMEs and local farmers, supported by sustainability codes and SEDEX-aligned audits.

Dabur's supply chain includes four mother warehouses and a wide retail reach across 7,400 towns. Its investments in GPS-based route optimisation, ERP systems, and RPA tools have improved carbon tracking and reduced resource use. Dabur also achieved plastic neutrality and publishes sustainability reports under SEBI's

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BRSR norms (Dabur, 2024b). Initiatives like Project Prakriti and the appointment of a Chief Sustainability Officer demonstrate the institutionalisation of sustainability within a domestic brand.

5.4 ITC: Digital Supply Chain Meets Farm-to-Fork Sustainability

ITC has adopted a comprehensive sustainability model that combines regenerative agriculture, supply chain digitisation, and packaging innovation. Through its Climate Smart Agriculture programme, ITC supports over 1.05 million Indian farmers and manages 2.79 million acres using practices such as zero-tillage and precision irrigation. These initiatives have reduced emissions and enhanced food security (Outlook Business, 2025).

ITC's packaging division uses LCA tools to design FSC-certified mono-material and bio-based solutions, helping the company achieve plastic neutrality since 2022. Digitally integrated "One Supply Chain" systems have shifted transportation to rail and waterways, and introduced EVs in logistics to reduce scope 3 emissions (ITC, 2023). Supplier ESG training and transparent tracking tools have further strengthened its compliance with India's EPR and emission regulations.

5.5 PepsiCo: Regenerative Agriculture and Digital Resilience

PepsiCo's sustainability transformation combines climate-smart sourcing and technology-driven logistics. Globally, it manages over 1.6 million hectares under regenerative agriculture. In India, this supports local sourcing of potatoes and grains, improving biodiversity and reducing input emissions (Reddit, 2024).

Its factories use biogas from food waste, solar panels, and water reclamation technologies. PepsiCo's logistics strategies include EVs, CNG fleets, and warehouse automation using IoT and WMS tools. AI-powered demand forecasting enables weekly inventory planning and real-time tracking, boosting service efficiency while lowering transport emissions (CargoConnect, 2025). These tools ensure compliance with EPR norms and facilitate high-fill-rate deliveries while maintaining carbon visibility across the value chain.

5.6 Comparative Analysis: Converging Paths, Diverse Models

A comparative analysis of these six companies reveals both convergence and strategic divergence in their approach to sustainability:

- **Scale and ambition**: HUL and PepsiCo commit to net-zero by 2039 and 2040 respectively, while Dabur and ITC set phased goals suited to regional realities. Nestlé and PepsiCo focus on agriculture; HUL and ITC target packaging and supply digitisation.
- **Sourcing and procurement**: Dabur and ITC champion local farmer engagement. HUL targets deforestation-free raw materials and collaborates on green chemistry. Nestlé and PepsiCo lead in regenerative farming at scale.
- **Packaging**: All six firms meet or exceed EPR mandates. ITC and HUL offer biodegradable and mono-material innovations. Nestlé pilots refillable systems, and Dabur leads in recycled content usage.
- **Digital integration and logistics**: HUL, ITC, and PepsiCo leverage AI and EV logistics. Dabur and Nestlé focus on system integrations for tracking and demand forecasting.
- **Policy alignment**: All companies comply with Indian EPR, emissions, and water regulations while referencing global frameworks like SDGs and TCFD. Internal sustainability teams and BRSR disclosures further institutionalise these efforts.

Together, these case studies reflect how India-based FMCG supply chains are transforming in response to environmental regulations—balancing compliance with competitiveness and brand equity. Sustainability has moved from being a peripheral obligation to a core driver of operational design and innovation.

VI. CHALLENGES, FUTURE OUTLOOK& RECOMMENDATIONS

6.1 Key Challenges in FMCG Supply Chain Sustainability

Despite notable progress, Indian FMCG companies continue to face substantial hurdles on their sustainability journey. One of the most pressing issues is regulatory and compliance complexity. Frequent updates to guidelines such as EPR mandates, packaging labelling, and emissions reporting have increased operational costs and compliance burdens for both large players and smaller suppliers (Srivastava, 2025).

Supply chain disruptions driven by climate change events (e.g., monsoon variability,

International Journal of Advances in Engineering and Management (IJAEM)
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heatwaves) result in raw material shortages and price volatility—evident in the 2023 tomato crisis that impacted processed food FMCG (Financial Express, 2024). Infrastructure deficits such as limited recycling facilities and underdeveloped logistics in Tier 2 and rural areas further hinder circular supply chain adoption (Amulya Charan, 2025).

Cost inflation in energy, materials, and transport—especially for sustainable alternatives like mono-material or biodegradable packaging—puts pressure on margin-sensitive FMCG players (Financial Express, 2024). Finally, effective integration of digital supply chain tools remains a challenge: while AI-enabled ordering, traceability, and carbon tracking are promising, many smaller FMCG brands lack access to capital, skilled personnel, or standardised data systems necessary for fully embracing these technologies (Indian Retailer, 2025).

6.2 Future Outlook

Looking forward, the Indian FMCG landscape is likely to converge around three key trends: digitalisation, rural and semi-urban integration, and circular economy strategies. Digitisation—incorporating AI, IoT, blockchain-led traceability, and predictive logistics—will enable frontrunners to reduce food waste, optimise last-mile delivery, and ensure regulatory compliance across supply and distribution (BeatRoute, 2025; Economic Times, 2025).

Rising consumption in Tier 2 and Tier 3 markets, which constitute over 50 percent of FMCG growth, will necessitate decentralised manufacturing and micro-hubbing—all requiring sustainable logistics and digital coordination (BeatRoute, 2025). Circular economy adoption—underpinned by EPR, bio-energy valorisation (e.g. Gujarat biofuel initiatives), and packaging innovation—offers opportunities for USD 2 trillion in long-term value and 10–15 million jobs, but requires systemic investment and policy support (Amulya Charan, 2025; Times of India, 2025).

While global frameworks like the SDGs and Paris Agreement create momentum, domestic policy evolution will be critical. Advancements in methane capture, biogas, and biofuel integration can support both FMCG sustainability and rural livelihoods (Times of India, 2025). Strengthening digital circular platforms and formalising informal waste networks will help to operationalise traceability and recycling at scale (Amulya Charan, 2025).

6.3 Policy & Industry Recommendations

To capitalise on this trajectory, the following recommendations emerge:

- **Harmonise and Stabilise Regulation**: Introduce a unified circular economy law to streamline sector frameworks (plastics, e-waste, packaging), standardise EPR tracking, and reduce compliance complexity (Amulya Charan, 2025).
- **Invest in Infrastructure & Technology**: Prioritise recycling plants, waste-management logistics, biogas/CBG systems (such as Gujarat's biofuel initiatives), and digital platforms with Ui-focused support for MSMEs (Times of India, 2025; Amulya Charan, 2025; CEEW, 2025).
- **Foster Public–Private Partnerships**: Encourage FMCG-sector collaboration with government, academia, NGOs, and informal recyclers—similar to ITC and HUL's MRF partnerships—while incentivising innovation engines (e.g. incubators) to promote circular design and farm-to-fork resilience (MDPI, 2025).
- **Support MSME Integration**: Deploy capacity-building, digital traceability, and financing tools for smallholder and supplier inclusion via sustainability standards—mirroring ITC and Dabur's farmer integration programs.
- **Promote Consumer Awareness & Engagement**: Scale labelling initiatives, consumer education campaigns, and refill stations based on Nestlé and PepsiCo pilots—thus reinforcing demand for circular products and reinforcing the sustainability narrative (Arxiv, 2024; Indian Retailer, 2025).
- **Enable Financial Incentives**: Provide subsidies, green bonds, and tax incentives for eco-packaging production, digital investments, and renewable transitions—accelerating adoption and de-risking capital investment.

6.4 Conclusion

In summary, India's FMCG sector stands at a pivotal moment. While regulatory complexity, infrastructure gaps, and fragmented digitisation pose significant challenges, the combined influence of global environmental agreements, rising consumer eco-awareness, and technological innovation is reshaping supply-chain strategies. Leading Indian firms such as HUL, Dabur, ITC, Nestlé, and PepsiCo showcase that environmental regulation can be transformed from a cost centre into a source of resilience, competitive differentiation, and brand legitimacy.

For systemic success, however, alignment across policy, infrastructure, supply chains, and consumer engagement is essential. A cohesive national circular economy framework, digital infrastructure for traceability, and scaled public–private partnerships are critical enablers. When sector leaders embed sustainability into core strategy—as seen through regenerative sourcing, EPR-compliant packaging, smart logistics, and community integration—the FMCG sector can not only meet regulations but also pioneer a green growth model that benefits business, society, and ecosystem alike.

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