

# **Sustainability In FMCG: Energy Efficiency & Green Packaging As Transformative Practices**

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## **Abstract**

In today's global landscape, sustainability has become a strategic imperative, particularly within the Fast-Moving Consumer Goods (FMCG) sector. This study investigates how green packaging and sustainable supply chain practices can enhance both environmental and operational efficiency, positioning businesses for long-term success. Central to this research is the integration of green practices, not only as ethical obligations but as key drivers of competitive advantage. By replacing conventional packaging materials like plastics and Styrofoam with eco-friendly alternatives, companies can significantly reduce environmental impact, align with regulatory standards, and address growing consumer demand for sustainable products. The study highlights the transformative role of sustainable logistics operations, showcasing practices such as energy-efficient material handling, renewable energy utilization, and advanced technology adoption. These initiatives mitigate risks such as pollution and excessive energy consumption while enhancing operational performance and cost-effectiveness. Additionally, the research delves into the critical role of consumer perception in the adoption of green products, emphasizing how strategic marketing can effectively communicate sustainability benefits to eco-conscious consumers. The unique contribution of this research lies in its actionable framework, combining empirical data and consumer behavior analysis to provide FMCG companies with replicable strategies. By integrating green systems and energy-efficient practices, the study demonstrates how businesses can achieve long-term sustainability, meet stakeholder expectations, and drive economic growth. This research underscores that sustainability is not just a corporate responsibility but a transformative opportunity to thrive in an evolving marketplace.

## **Keywords**

Sustainability, Green packaging, Environmental impact reduction, Consumer perception, Operational efficiency.

## **1. Introduction**

In an era where sustainability has become a critical focal point for industries worldwide, the Fast-Moving Consumer Goods (FMCG) sector stands at the forefront of this transformation. In the contemporary global economy, the FMCG (Fast-Moving Consumer Goods) sector occupies a pivotal role, balancing the imperatives of economic growth with the pressing need for environmental stewardship. It is safe to say that probably FMCG industries are the best example to illuminate the situation of "Low margin-high profit" (Singh 2016). As consumers increasingly prioritize sustainable practices in their purchasing decisions, FMCG companies face mounting pressure to adopt strategies that not only optimize operational efficiencies but also minimize environmental impact throughout their value chains. At the heart of this challenge lies the imperative to enhance energy efficiency and integrate green systems across manufacturing, distribution, and packaging processes. Effective management of energy resources not only reduces operational costs but also plays a crucial role in mitigating greenhouse gas emissions and enhancing overall sustainability credentials. In parallel, the adoption of green systems—from renewable energy installations to eco-friendly packaging innovations—positions companies favorably in meeting regulatory requirements and consumer expectations for sustainable products. The sustainability imperative for society is all too clear, and for major companies this presents

both a responsibility and an opportunity. The responsibility is to operate ethically and ensure that products and operations are safe for humans and the environment. (White 2009).

This comprehensive study aims to explore the multifaceted dimensions of driving sustainability within the FMCG industry through energy efficiency enhancements and the integration of green systems. By examining current trends, challenges, and best practices, this research delves into how FMCG companies can navigate the complex landscape of sustainable business practices while maintaining competitiveness and profitability. Through detailed case studies and industry analyses, this paper seeks to provide actionable insights for stakeholders—from executives and policymakers to researchers and consumers—interested in advancing sustainability agendas within the FMCG sector. Over the course of this extensive investigation, we will uncover innovative strategies and technological advancements that enable FMCG companies to achieve substantial reductions in carbon footprints while fostering resilience in the face of evolving environmental regulations and consumer preferences. By synthesizing empirical evidence with theoretical frameworks, this paper endeavors to contribute to a deeper understanding of the transformative potential of energy efficiency initiatives and green systems integration in driving sustainable development within the FMCG industry.

### **1.1 Objectives**

The objectives of this research are:

To evaluate the effectiveness of green packaging in reducing environmental impact in the FMCG sector.

To assess the operational benefits of integrating sustainable supply chain practices.

To analyze consumer perceptions and preferences towards eco-friendly FMCG products.

## **2. Literature Review**

In today's world of looming environmental, economic, and social challenges, businesses are making a step-change in the way they function to realize the ambition of sustainable development by incorporating suitable sustainability strategies into their business practices to ensure long-term future success of the organizations (Chandwaskar 2018). Sustainability has become a cornerstone of strategy for Fast-Moving Consumer Goods (FMCG) companies worldwide, driven by regulatory mandates, consumer demand for eco-friendly products, and the need to enhance operational efficiency. This literature review explores the integration of green packaging and sustainable supply chain practices within the FMCG sector, emphasizing their dual role in environmental stewardship and competitive advantage. The ever growing demand for the adoption of environmentally friendly strategies has changed the focus of social scientists towards sustainability. (Abbasi & Hassan 2013).

Green packaging initiatives focus on reducing environmental impact through the use of biodegradable materials, minimizing packaging waste, and optimizing design for resource efficiency. These efforts not only meet regulatory standards but also resonate with environmentally conscious consumers, enhancing brand reputation and market competitiveness. Similarly, sustainable supply chain practices encompass a range of strategies such as energy-efficient transportation, adoption of renewable energy sources, waste reduction, and ethical sourcing. These practices contribute to cost savings, improve operational efficiency, and position FMCG companies as leaders in sustainable business practices. Consumer perception plays a crucial role in driving the adoption of green products. Companies that align their strategies with consumer values and effectively communicate the benefits of sustainability can attract eco-conscious consumers and differentiate themselves in a competitive market. Overall, integrating sustainability into FMCG operations not only mitigates environmental risks like pollution and energy consumption but also fosters long-term economic growth and meets stakeholder expectations. This literature review underscores the transformative impact of sustainable practices in the FMCG industry, highlighting their role in achieving environmental sustainability while driving business success.

### **2.1 Importance of Sustainability in FMCG Sector**

Combining efficiency, effectiveness and sustainability is crucial for companies to succeed in today's context of fierce competition (Colicchia et al. 2017). The FMCG sector is integral to everyday consumer needs, encompassing products ranging from food and beverages to personal care items and household goods. However, the industry's reliance on conventional packaging materials, such as plastics and Styrofoam, has contributed substantially to environmental degradation. With increasing global awareness and regulatory pressures, FMCG companies are under growing scrutiny to adopt sustainable practices that minimize environmental impact while meeting consumer demand for eco-friendly products. The FMCG sector faces dual pressures: meeting growing consumer demand while mitigating its

environmental footprint. Traditional practices, such as reliance on non-biodegradable packaging materials like plastics and Styrofoam, have led to widespread environmental degradation. As awareness of environmental issues rises among consumers and regulatory bodies worldwide, FMCG companies are increasingly compelled to adopt sustainable practices. Green packaging has been revealed to have an astounding effect on a sustainable environment.(Dantas et al., 2023). These practices not only aim to comply with regulations but also respond to consumer preferences for eco-friendly products, thereby enhancing brand reputation and market competitiveness.



Figure 1. Representation of a Sustainable FMCG System

## 2.2 Evolution of Sustainability Practices

The evolution of sustainability within the FMCG industry can be traced through distinct phases. Initially driven by ecological concerns, early efforts focused on reducing immediate environmental impacts through basic regulatory compliance. Subsequent phases saw a shift towards integrating cleaner technologies and practices into operations, aiming to minimize waste, conserve resources, and optimize energy efficiency. Today, sustainability has emerged as a strategic imperative, with FMCG companies embedding environmental stewardship into their core business strategies to drive innovation and ensure long-term sustainability. Sustainable supply chain practices further enhance operational efficiency and environmental responsibility across procurement, production, and distribution. This includes adopting energy-efficient transportation, utilizing renewable energy sources, implementing waste reduction strategies, and ensuring ethical sourcing practices. Sustainability of resources thus will determine the fate of companies that aspire to have a long-term competitive advantage and thus many firms are eventually engaged in the integration of such practices into their business which will ensure the sustainability of resources.(Pallavi Chandwaskar 2020). By optimizing supply chain operations through sustainability initiatives, FMCG companies can achieve cost savings, improve efficiency, and establish themselves as leaders in sustainable business practices.

Beyond regulatory compliance, the adoption of green packaging and sustainable supply chain practices offers a competitive advantage in a conscientious marketplace. Given all the aforementioned, the concept of supply chain management redesign by incorporating environmental drivers is more than ever in the forefront of the corporate priorities (Trachana et al. 2016). Consumers increasingly favor brands that demonstrate commitment to environmental sustainability, influencing purchasing decisions and fostering brand loyalty. Effective communication of sustainable initiatives can attract eco-conscious consumers and differentiate FMCG companies from competitors, driving long-term growth and resilience in an environmentally aware global economy. Green marketing incorporates a broad range of activities, including product modification, changes to the production process, packaging changes, as well as modifying advertising. Firms use green marketing in an attempt to address cost or profit-related issues (P. B. Singh & Pandey 2012).

In conclusion, embracing sustainability through green packaging and sustainable supply chain practices is not just a moral imperative but a strategic opportunity for FMCG companies. By reducing their environmental footprint, enhancing operational efficiency, and appealing to consumer values, FMCG companies can navigate the evolving landscape of sustainability while fostering innovation and long-term growth.



Figure 2. Sustainable Practices & Global Environment

### 2.3 Directions in FMCG Sustainability

Sustainability has become an increasingly important issue in today's business world. All firms operating in domestic and global business must be cognizant of the myriad aspects of sustainability.(Sarkar, 2012).While the FMCG sector makes strides towards sustainability, several challenges persist, influencing the future direction of industry practices. One significant challenge is the complexity of supply chains, which often span multiple regions with varying environmental regulations and infrastructure capabilities. Coordinating sustainable practices across these diverse contexts requires robust governance frameworks and collaboration with suppliers and partners. In the FMCG sector, sustainability efforts are prominently centered on reducing environmental impact and promoting ethical practices throughout the supply chain. Companies are implementing strategies such as adopting circular economy principles to minimize waste and enhance resource efficiency. This includes redesigning packaging for recyclability, utilizing recycled materials, and launching take-back programs to encourage reuse. Moreover, there's a strong emphasis on reducing carbon footprints by investing in renewable energy sources, optimizing transportation logistics, and improving energy efficiency in manufacturing processes.

Sustainable sourcing practices are also gaining traction, with a focus on responsible sourcing of raw materials to support biodiversity and uphold fair labor standards. Water stewardship is another critical area, with initiatives aimed at reducing water consumption during production, implementing responsible wastewater management, and supporting community water conservation projects. Social impact and ethical considerations are integral, driving efforts to ensure transparent supply chains, promote fair trade practices, and educate consumers about the sustainability credentials of products. Innovations in packaging play a pivotal role, with advancements aimed at minimizing environmental impact through light-weighting, utilizing biodegradable or compostable materials, and designing for recyclability. Consumer education initiatives are also on the rise, empowering consumers with information to make sustainable choices and fostering a culture of environmental responsibility. Looking ahead, the future of FMCG sustainability hinges on continued innovation, collaboration, and stakeholder engagement. Industry leaders must prioritize transparency in reporting environmental impacts and progress toward sustainability goals. Engaging with stakeholders, including consumers, investors, and NGOs, fosters accountability and drives collective action towards a greener future.

### 2.4 Global Challenges & Opportunities

Despite significant strides in sustainability, the FMCG sector confronts formidable challenges in implementing comprehensive environmental initiatives. Managing intricate global supply chains poses logistical complexities, compounded by the need to adhere to diverse regulatory landscapes across regions. Moreover, addressing consumer skepticism regarding greenwashing—where companies overstate their environmental commitments—remains a critical issue. Financial constraints and the high costs associated with adopting green technologies further hinder widespread implementation of sustainable practices. Nevertheless, these challenges present fertile ground for

innovation, collaboration, and strategic differentiation within a competitive market increasingly influenced by environmental concerns. Green logistics operations performance measures the efficiency and commitment of countries to sustainable environmental and healthier economic development policies.(Khan et al. 2020). Companies that successfully integrate sustainable packaging solutions, adopt energy-efficient technologies, and engage in transparent communication stand to not only mitigate their environmental footprint but also bolster operational efficiencies. The integration of sustainable practices across supply chains is found to be a critical driver of operational efficiency and brand reputation in the FMCG sector. In navigating these complexities, FMCG firms can leverage sustainability as a catalyst for growth and market leadership. Green marketing is still in its infancy and a lot of research is to be done on green marketing to fully explore its potential. (Verneker & Wadhwa 2018). By aligning business strategies with evolving regulatory frameworks and consumer expectations, companies can forge a path toward sustainability that enhances brand reputation and consumer trust. Embracing these initiatives not only supports environmental goals but also positions businesses to capitalize on emerging market opportunities driven by eco-conscious consumers. Furthermore, the use of blockchain and AI to enable real-time monitoring of sustainability metrics has largely not been explored in the FMCG sector.

With its inbuilt transparency and inviolability, blockchain technology facilitates a company to trace raw materials from source to final delivery, ensuring adherence to ethical sourcing practices and reducing environmental footprints. These advancements are propelled by the emergence of Internet of Things (IoT) devices. IoT sensors measure energy use, emissions, and materials use in real-time so that companies can quickly spot inefficiencies and take corrective actions. We have the Adaptive – the combination of IoT with AI, which enables systems that can make independent decisions that will improve sustainability across the FMCG value chain. However, the widespread implementation of such technologies is still impeded by various challenges, such as the high cost of implementation, data privacy concerns, and skilled personnel. Overcoming these challenges via effective partnerships between academia, industry and policymakers will be critical to realizing the sustainability potential for these innovations. Addressing these barriers through collaborative efforts between academia, industry, and policymakers is essential to unlocking the full potential of these innovations in sustainable practices. Thus, a proposal to address these challenges and capitalize on opportunities, a robust global framework for sustainable FMCG practices is essential. This framework should encompass strategic pillars aimed at integrating sustainability across all facets of FMCG operation to work accordingly.

### 3. Methodology

The methodology for this research is designed to systematically explore and assess the impact of energy efficiency and green systems on sustainability within the FMCG industry. It involves a multi-phase approach combining qualitative and quantitative research methods, allowing for a comprehensive analysis of sustainable practices.

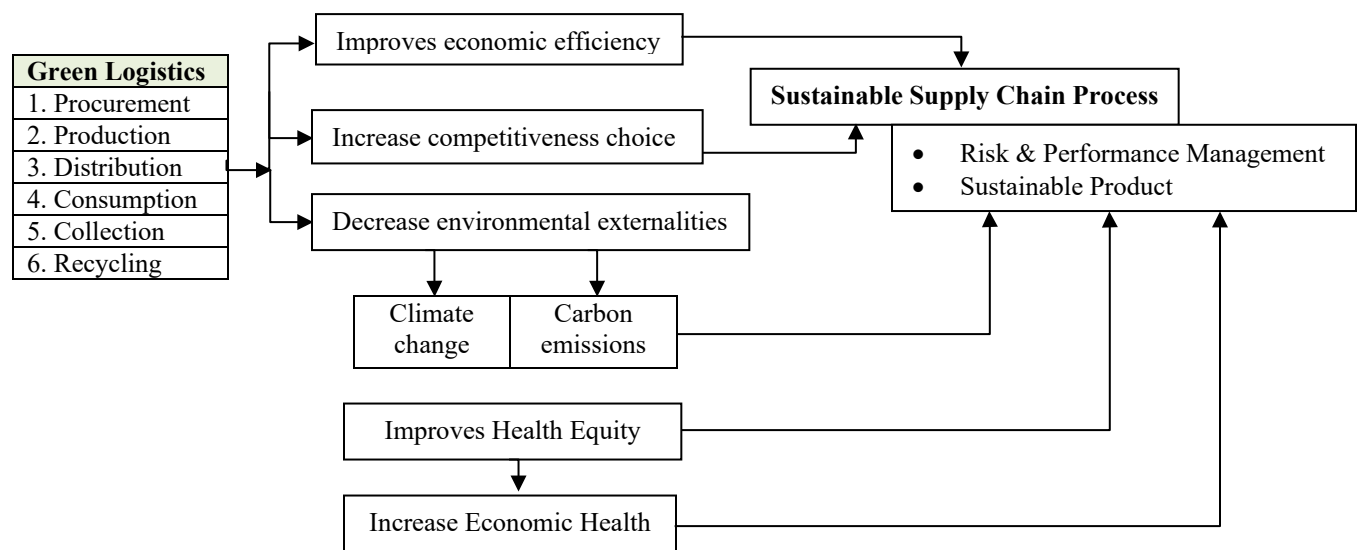


Figure 3. Optimization Model

The study employs a mixed-method approach, combining grounded theory for qualitative insights and regression modeling for quantitative analysis of operational efficiencies. The methodology includes:

- Identifying key stakeholders in the FMCG sustainability ecosystem.
- Utilizing structured interviews and focus groups to derive qualitative insights.
- Conducting lifecycle assessments of green vs. conventional packaging systems

### **3.1 Data Collection:**

**Qualitative:** Interviews with industry experts and analysis of case studies from leading FMCG companies.

**Quantitative:** Surveys to gauge consumer perceptions and operational data on energy usage and supply chain practices.

### **3.2 Data Analysis**

#### **Qualitative Data Analysis:**

##### **Thematic Analysis:**

Identify and categorize key themes from expert interviews and case studies.

Group similar themes together, analyze frequency and intensity, and explore contradictions or inconsistencies.

##### **Narrative Analysis:**

Examine the stories shared by industry experts, identifying patterns, contradictions, and underlying meanings.

Consider the context and dynamics of the narratives to understand how green practices are perceived and implemented in the FMCG sector.

#### **Quantitative Data Analysis:**

##### **Descriptive Statistics:**

Calculate central tendencies (mean, median) and dispersion (standard deviation, range) to summarize operational data on energy use and sustainability outcomes.

Visualize the data with charts to uncover trends and patterns.

##### **Regression Analysis:**

Model relationships between energy efficiency and sustainability outcomes (e.g., reduced emissions, cost savings).

Identify key factors influencing sustainability and assess their significance.

##### **Lifecycle Assessment (LCA):**

Compare the environmental impacts of green vs. conventional packaging.

Evaluate the effectiveness of green packaging systems in reducing environmental footprints.

#### **Mixed-Methods Analysis:**

##### **Data Triangulation:**

Integrate qualitative and quantitative findings to strengthen the validity of results.

Use qualitative data to explain and contextualize quantitative insights.

##### **Case Study Analysis:**

Analyze case studies to identify successful implementation of green practices.

Extract best practices and lessons learned, and generalize findings to the broader FMCG industry.

## **4. Results & Discussions**

The results of this study are driven by comprehensive data collection and analysis, providing insights into critical areas of sustainability within the FMCG sector. Key findings and practical contributions are outlined below:

### **1. Impact of Green Packaging**

The study highlights the tangible benefits of green packaging in reducing environmental impact. Using biodegradable and recyclable materials will not just meet the changing demands of consumers, but can also reduce carbon footprints.

**Practical Contribution:** The companies following green packaging solutions could achieve regulatory compliance and build brand loyalty through green offerings.

## **2. Eco-Friendly Practices in Supply Chain**

Combining these technologies (energy-efficient technologies and, renewable energy sources) in supply chain operations is highlighted to enhance operational efficiency and cost-effectiveness through analysis. While the upfront cost of implementation may be a challenge, they are outweighed by long-term savings.

### **Practical Contribution:**

This approach serves as a replicable framework for reducing the waste of resources, which meets the standards of sustainability across the globe.

## **3. Consumer Behavior and Perception**

The adoption of green practices very much depends upon consumer awareness and subsequent perception. Targeted marketing and clear labeling of sustainability benefits build trust and translate into buying behavior.

**Practical Contribution:** Companies can use consumer insights to create sustainability marketing strategies that would allow companies to target environmentally aware consumers.

## **4. Best Practices and Recommendations**

With successful strategies from case studies, like leveraging blockchain for supply chain transparency and AI for predictive maintenance, other FMCG companies can chart the way forward.

**Practical Contribution:** These scalable strategies will illustrate how to utilize digital transformation to achieve business excellence with an environmentally sustainable focus.

## **5. Industry-Wide Implications**

These findings highlight the importance of industry, policymakers, and research collaboration to overcome challenges including affordability and skills gap, it added.

**Practical Contribution:** By fostering innovation and collaborative networks, the industry can advance sustainable practices and meet global environmental goals.

Rapidly growing competition and changes in customer needs place immense pressure on the FMCG industry to develop business competitiveness and stay ahead of the game in the global market. (Udokporo et al. 2020). Thus the integration of sustainable practices across supply chains is found to be a critical driver of operational efficiency and brand reputation in the FMCG sector.

## **5. Conclusion**

The following study underscores the challenges FMCG companies face in implementing sustainable practices, including navigating global supply chains and diverse regulatory landscapes. Financial constraints and consumer skepticism also pose significant hurdles. However, these challenges present opportunities for innovation and collaboration in a market increasingly focused on environmental concerns. By adopting eco-friendly packaging and integrating renewable energy sources, FMCG companies can enhance sustainability while meeting consumer demand for greener products. Educating consumers about sustainable choices through transparent labeling and awareness campaigns is crucial. Collaborative efforts among industry stakeholders further amplify these initiatives, driving collective action towards shared sustainability goals. Embracing sustainability isn't just about compliance; it's a strategic imperative that allows FMCG companies to reduce their environmental impact, enhance operational efficiency, and meet evolving consumer expectations in a global context.

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## Biographies

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**Adnan Faruk** is an undergraduate student of Industrial and Production Engineering (IPE) under the Department of Mechanical and Production Engineering (MPE) at the Ahsanullah University of Science and Technology (AUST). His academic interests are diverse and include Supply Chain Management, Automation, Blockchain, Lean Manufacturing, and Industry 4.0. These interests drive his commitment to understanding and solving complex



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**Quazi Monjur E-Elahi** is a graduate student of Industrial and Production Engineering (IPE) under the Department of Mechanical and Production Engineering (MPE) at the Ahsanullah University of Science and Technology (AUST). His research interests include the area of Industrial Management, Engineering Management, Supply Chain Management, Quality Assurance & Control, Production Planning and Control, Project & Quality Management, Productivity Engineering, Industrial & Business Management, Advanced Material Processes, Lean Manufacturing, Technology Management and Industry 4.0. He has vast experience in content writing and research, documentation management process, content research, team management. He has proficiency in Microsoft Word and Excel. He is also focused in the research of the aerospace industry and wants to work within such an industry. He also participated in a multiple number of engineering competitions showcasing his ability to solve complex problems and work collaboratively in a team with effective leadership. He was also the former Vice President of IEOM Society AUST Student Chapter. He was also the former Chief Advisor & President of Josephite Chess Club. Furthermore, he worked at Augmedix Bangladesh, across multiple departments during his tenure, most notably as a Project Coordinator.