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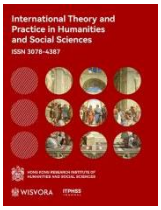

Report on Polymer Reduction Strategies in iPhone Products Using IRM's 3D-IDPT Analysis

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Abstract

This report investigates Apple's polymer reduction strategies in its iPhone product line through the lens of the 3D-IDPT model in Information Resource Management (IRM). It analyzes Apple's evolving approach to sustainable product design—transitioning from plastic-intensive components to environmentally friendly alternatives such as fiber-based packaging, metal casing, and wireless charging. The study highlights Apple's strategic goals, including carbon neutrality, material recycling, and circular economy practices, while also identifying risks such as increased costs and supply chain complexity. Employing SWOT, VRIO, and PESTEL models, this research provides a multidimensional evaluation of Apple's plastic reduction initiatives. Furthermore, it applies the 3D-IDPT model's spatial, temporal, and constructional dimensions to explore Apple's information behavior and strategic diffusion across its ecosystem. The findings suggest that Apple's plastic reduction efforts not only enhance corporate environmental responsibility but also generate long-term brand and market value, serving as a benchmark for sustainability in the consumer electronics industry.

1. iPhone The comparison of the old and the new products

Older Models (e.g., iPhone 5c): Plastic packaging; plastic body; large-size charger; plastic charging cable; no support for wireless charging **(Apple Inc., 2019)**.

Figure 1: Older Apple Inc. plastic products（Iphone 5c）

Newer Models (e.g., iPhone 15 Pro): Paper-based packaging; metal body; compact charger; fabric-covered charging cable; wireless magnetic charging.

*The iPhone 15 Pro has reduced overall plastic usage by 35% compared to the previous generation, with an 85% reduction in plastic content in packaging materials.

Figure 2: New Apple products with reduced plastic（Iphone 15pro）

2. iPhone Strategies and propositions to reduce plastics

Apple is committed to advancing the sustainability of its iPhone products by reducing plastic usage and adopting other environmentally responsible practices, thereby encouraging the entire industry to move toward greater sustainability.

Reduction of Plastic in Packaging: Apple has significantly decreased the amount of plastic used in iPhone packaging, opting instead for more recycled materials and fiber-based substrates. For instance, with the iPhone 12 series, the company announced the removal of included earphones and chargers, which reduced both the size and weight of packaging and lowered plastic

usage **(Roeger, 1995)**.

Promoting environmental-friendly materials: Apple Inc. has integrated a higher proportion of environmentally friendly materials into its iPhone products, including recycled rare earth elements and recycled plastics, effectively reducing dependence on virgin plastic resources and petrochemical products **(Tong, 2003)**.

Device Recycling and Material Recovery: Through the Apple Trade In program, the company encourages users to return their old iPhones. Apple also utilizes advanced recycling technologies—such as the material recovery robot "Daisy"—to accurately dismantle iPhone components and recover plastic and other materials **(Lou & Ding, 2020)**.

Zero Waste Goals and Carbon Neutrality Commitments: Apple has set a target to achieve carbon neutrality across its entire supply chain and product life cycle by 2030. This includes reducing plastic usage, increasing the share of recycled materials, and optimizing product and packaging design to minimize waste generation **(Alasmari et al., 2023)**.

Advocacy and Collaboration: Apple Inc. has detailed its specific progress in reducing plastic usage through its official website and environmental responsibility reports, and has closely collaborated with supply chain partners to jointly promote the improvement of overall sustainability practices in the supply chain.

2.1 Apple's Strategies for Reducing Plastic Use in iPhones

Apple has implemented multiple strategies to reduce plastic usage, particularly within its iPhone product line. These initiatives include:

Packaging Material Transformation:

Apple has progressively reduced plastic components in iPhone packaging, transitioning toward more recyclable materials. For instance, the company has adopted fiber-based materials to replace plastic packaging **(Markovic et al., 2018)**.

Product Redesign:

Apple has minimized plastic usage through product redesign. A notable example is the removal of included earphones and chargers from iPhone packaging. This not only reduces plastic consumption but also decreases carbon emissions during transportation due to more compact packaging.

Recycling and Reuse Programs:

Apple actively encourages consumers to recycle old devices through its recycling initiatives, ensuring proper treatment and reuse of plastics and other materials from discarded products.

Integration of Recycled Materials:

The company incorporates recycled materials, including post-consumer recycled plastics, into its devices to reduce reliance on virgin plastics.

Carbon Footprint Reduction:

Through these measures and other sustainable practices, Apple aims to mitigate the overall environmental impact of its products, including reducing carbon footprints and plastic pollution **(Yang, 2022)**.

These strategies reflect Apple's commitment to environmental stewardship, demonstrating its efforts to minimize the ecological consequences of its products and operations through plastic reduction and sustainable practices.

2.2 Strategic Goals for Reducing Plastic Use in iPhones

Apple's strategic objectives in reducing plastic usage in iPhones focus on the following key aspects:

Achieving Sustainable Manufacturing Processes

By minimizing plastic content in iPhone and accessory packaging, Apple aims to reduce

environmental impacts while advancing the transition toward eco-friendly manufacturing. This initiative involves substituting conventional plastics with recycled and bio-based alternatives **(Jiao & Fan, 2019)**.

Enhancing Recycled Material Integration

The company targets increased adoption of recycled plastics across its product lines. This strategy not only decreases reliance on virgin plastics but also supports waste reduction and circular economy principles **(Sun et al., 2019)**.

Catalyzing Industry-wide Environmental Stewardship

Through transparent demonstration of its practices, Apple seeks to motivate broader technological sectors to adopt proactive plastic reduction measures and sustainability enhancements.

Realizing Carbon Neutrality and Zero-Waste Targets

Aligned with its 2030 carbon-neutral commitment for products and supply chains, plastic reduction forms a critical component by mitigating energy consumption and greenhouse gas emissions during production.

Driving Technological Innovation

Concurrent with material reductions, Apple prioritizes developing advanced recycling technologies to maximize material recovery efficiency and ensure long-term sustainability.

These strategic goals collectively position Apple to improve its environmental footprint while establishing global leadership in sustainable innovation **(Zhu et al., 2018)**.

2.3 Strategic Statements on Reducing Plastic Usage in iPhones

Sustainable Development Goals:

Apple has announced its long-term environmental objectives, including increasing the use of renewable resources and recycled materials, reducing plastic in products and packaging, and achieving carbon neutrality across its business operations by 2030.

Commitment to Recycled Materials:

Apple Inc. has committed to increasing the proportion of recycled materials used in its products, not only including plastics but also metals and other materials, to reduce reliance on virgin plastics and promote the development of a circular economy.

Innovation and Efficiency:

Apple emphasizes the integration of innovative elements in the design and production processes, dedicated to enhancing material efficiency through technological innovation and optimization of material selection. These measures focus on reducing waste generation and striving to minimize negative environmental impacts **(Zhou, 2023)**.

Product Recycling and Reuse:

Apple actively advocates for consumer participation in its product recycling program, allowing for the exchange of old devices for new ones through official company-endorsed recycling. The company promises to recover materials from these devices as much as possible to mitigate environmental damage.

Transparency in Environmental Responsibility:

Apple commits to disclosing environmental impact data in its sustainability reports, including the amount of plastic used and specific reduction targets, to increase corporate information transparency and build public trust.

2.4 Strategic Risks in Reducing Plastic Use in iPhones

Apple's strategy to reduce plastic use in iPhones advances sustainable development goals but also faces multiple systemic risks. These risks permeate the entire product lifecycle and require dynamic management through structured strategies.

Core Risk Dimension Analysis

First, changes in cost structures pose a fundamental challenge. The research and large-scale application of alternative materials may lead to rising marginal costs, particularly in recycled plastic purification processes and the development of novel bio-based materials **(Liao & Cheung, 2002)**. Second, such cost pressures may propagate through the supply chain to the end market, affecting the flexibility of product pricing strategies. This creates significant challenges to supply chain stability, necessitating the establishment of an efficient global recycling system for recycled plastics, encompassing material collection, classification, and quality control. Fragmented existing infrastructure may trigger supply fluctuations **(Wang, 2021)**. Third, consumer acceptance risks arise from delayed recognition of new material functionalities. Design changes such as simplified packaging may spark market controversy. Technologically, material substitution may require performance trade-offs, as traditional plastics' advantages in impact resistance and lightweight properties demand breakthroughs in eco-friendly alternatives. Finally, regulatory compliance risks emerge: while plastic reduction aligns with environmental laws, product redesigns aimed at reducing plastic usage may inadvertently expose the company to constraints from consumer protection regulations or pressure from social advocacy groups.

Risk Mitigation Framework

The aforementioned risks challenge Apple across five dimensions, requiring a coordinated response system.

Technological Efficiency Layer: Enhance engineering performance of eco-friendly materials through molecular-level material modification technologies while optimizing production costs via smart manufacturing processes.

Supply Chain Collaboration Layer: Establish strategic alliances with global recycling enterprises and implement blockchain-enabled material traceability systems to ensure quality consistency of recycled plastics.

Value Communication Layer: Utilize interactive technologies like augmented reality to visually demonstrate environmental achievements, fostering consumer recognition of material innovation.

Research & Development Layer: Strengthen partnerships with external scientific institutions to jointly develop higher-performance materials, complementing internal R&D efforts.

Policy Coordination Layer: Deploy dedicated regulatory monitoring teams to track environmental policy evolution across 128 major global markets **(Xiao, 2022)**. Align technological development with regulatory requirements through active participation in industry standard-setting.

3. Model analysis and planning arrangement of iPhone plastic reduction strategy

Apple’s strategy to reduce plastic usage in iPhones can be systematically analyzed and planned across multiple dimensions, including feasibility, cost-effectiveness, environmental impact, and alignment with broader corporate sustainability goals. Below is a structured framework for model analysis and phased implementation:

Goal Setting and Benchmark Analysis

Define Specific Targets: Establish quantitative goals for reducing plastic usage in iPhone products and packaging (e.g., reducing plastic content by 30% by 2025).

Benchmark Analysis: Assess current plastic usage levels across iPhone products to establish

a baseline for measuring progress **(Kim and Mauborgne, 2005)**.

Material and Design Innovation

Material Research: Investigate and test sustainable alternatives, such as recycled plastics, bio-based plastics, or fiber-based materials, to evaluate their technical and commercial viability.

Design Optimization: Redesign components and packaging to minimize plastic dependency while maintaining functionality and aesthetics **(Xiang and Li, 2000)**.

Cost-Benefit Analysis

Economic Impact Assessment: Calculate direct costs (e.g., material substitution, production adjustments) and potential savings (e.g., reduced shipping costs due to lighter packaging, enhanced recycling revenue).

Return on Investment (ROI): Analyze long-term economic and environmental benefits to justify strategic investments.

Supply Chain Management

Supplier Collaboration: Partner with suppliers to secure high-quality, sustainable materials and ensure supply chain resilience.

Supply Chain Transparency: Implement tracking systems to monitor the use of recycled materials and ensure compliance with sustainability standards **(Wei, 2017)**.

Implementation Plan

Phased Rollout: Divide the plastic reduction strategy into manageable phases (e.g., pilot projects, scaled adoption) to minimize disruptions.

Risk Mitigation: Proactively address risks such as material shortages, cost overruns, or technical challenges through contingency planning.

Monitoring and Evaluation

Performance Metrics: Track progress against targets (e.g., plastic reduction rates, carbon footprint reduction) using key performance indicators (KPIs).

Feedback Mechanisms: Collect input from internal stakeholders (e.g., engineering teams) and external partners to refine strategies and improve outcomes.

Communication and Reporting

Internal Alignment: Ensure cross-functional coordination among iPhone design, production, and sustainability teams to maintain strategic focus.

External Engagement: Publish annual sustainability reports detailing progress, challenges, and future goals to enhance transparency and stakeholder trust.

By integrating these steps, Apple can align its plastic reduction initiatives with its overarching sustainability vision, including the 2030 carbon neutrality target. This holistic approach balances environmental responsibility with operational efficiency, fostering innovation while mitigating risks.

3.1 Model analysis

It is widely recognized that employing existing business models to analyze corporate strategic development offers significant advantages, particularly when integrating multiple analytical frameworks. This comprehensive approach delivers more holistic and in-depth insights, enabling enterprises to formulate strategic decisions based on more scientific and rational foundations. By effectively synthesizing the strengths of diverse models, this methodology enhances a company's capacity to adapt to and steer market transformations **(Li et al., 2007)**.

Different business models emphasize distinct analytical dimensions, providing multifaceted perspectives. By leveraging multiple frameworks, organizations can conduct a 360-degree evaluation of their strategies. Each model carries specific focal points and limitations, and their innovative integration enables complementary analysis. Adopting a multi-model approach helps

businesses identify and address potential blind spots that might be overlooked when relying on a single framework. By consolidating analytical outcomes from diverse structural models, decision-makers gain robust data-driven insights to support their processes, thereby making decisions more scientifically grounded. This reduces biases and errors, improves the efficiency and efficacy of strategic choices, and elevates decision-making quality. Different models may uncover varying risks and opportunities, empowering enterprises to comprehensively anticipate and mitigate future challenges while identifying latent risks and prospects.

When companies, as market entities, utilize multiple models, they can more effectively refine and optimize strategies to navigate complex and ever-evolving market environments. This strengthens organizational agility and adaptability in strategic planning, facilitating easier tactical adjustments amid market fluctuations. Furthermore, multi-model analysis encourages teams to break free from traditional thinking patterns during strategic discussions, explore uncharted possibilities, and cultivate innovative multimodal thinking frameworks within strategic departments through collaborative brainstorming. This approach also sparks the implementation of novel business concepts and innovative development strategies **(Lin, 2018)**.

3.1.1 SWOT Model

S (Strengths)

Enhanced Brand Image: By reducing plastic usage in iPhones and adopting more eco-friendly materials, Apple strengthens its brand reputation as a leader in sustainability and environmental responsibility.

Customer Loyalty and Appeal: This strategy enhances the affinity and loyalty of sustainability-conscious consumers toward iPhones.

Leadership in Technological Innovation: Apple's investments in eco-friendly materials and sustainable technologies reinforce its leadership position in technological innovation **(Farimani et al., 2022)**.

W (Weaknesses)

Increased Costs: The use of eco-friendly materials and redesigned packaging may raise iPhone manufacturing costs, particularly during development and initial production phases.

Productivity Challenges: Transitioning to new materials for iPhones may require new supply chain arrangements and production processes, potentially causing temporary productivity disruptions.

Sales Decline Risks: A large-scale reduction or elimination of plastic components in iPhone designs might dissatisfy some consumers who prioritize tactile comfort, especially in temperate and cold climate markets, potentially impacting sales.

O (Opportunities)

Growing Demand: As consumer demand for eco-friendly products rises, iPhone's plastic reduction strategy could help Apple differentiate itself in a competitive market.

Policy and Regulatory Support: Increasingly stringent global environmental regulations may incentivize sustainable production practices, positioning Apple to better comply with these requirements.

T (Threats)

Competitive Imitation: Rival smartphone manufacturers may replicate Apple's eco-friendly initiatives, diluting its competitive edge.

Market Acceptance Uncertainty: Despite the positive trend toward sustainability, consumer acceptance of potential cost increases or functional trade-offs remains uncertain.

3.1.2 VRIO Model

Through the VRIO model, a systematic evaluation of Apple's iPhone plastic reduction

strategy can be conducted to analyze the formation mechanism of its competitive advantage:

Value:

Apple's plastic reduction strategy effectively enhances the environmental value of its products. By adopting recyclable materials and environmentally friendly packaging designs, this initiative not only meets consumer expectations for sustainable electronics but also strengthens the brand's social responsibility image. This value creation is reflected in two aspects:

Environmental value: Reducing plastic pollution throughout the product's entire lifecycle

Commercial value: Increasing the appeal to environmentally conscious consumers.

Rarity:

Apple's plastic reduction practices are significantly different within the industry:

Innovative plastic alternatives are achieved through patented packaging structures (such as fiber-based cushioning materials)

The environmental concept is systematically integrated into the entire process from product design to retail experience

Leveraging brand influence to establish a voice in setting industry environmental standards

Inimitability:

The barriers to imitation by competitors mainly come from:

Technical thresholds: Continuous investment is required for the development of environmentally friendly materials (e.g., weather resistance improvements for biobased polymers)

Supply chain restructuring: Global core suppliers numbering 87 need to synchronously upgrade their environmental processes

System integration: Cross-departmental collaboration mechanisms in product design, manufacturing, and marketing communication **(Calma, 2019)**.

Organization:

Apple demonstrates outstanding strategic implementation capabilities:

R&D system: Specialized material laboratories and industrial design teams collaborate deeply

Supply chain management: Encouraging a full-chain environmental transformation through supplier codes of conduct

Value delivery: Utilizing product launch events, environmental reports, and other channels to disseminate plastic reduction achievements.

In summary, Apple's approach to reducing plastic usage in its iPhone product line not only creates value for the company but also forms a sustainable competitive advantage due to its scarcity, difficulty in imitation, and effective organizational utilization.

3.1.3 PESTEL Model

P (Political Factors)

International Trade Policies: Global trade policies and tariffs may affect the cost and feasibility of Apple’s procurement of eco-friendly materials from international suppliers.

Environmental Policy Incentives: Governmental environmental policies, such as those promoting the use of renewable and recycled materials, can provide support and incentives for Apple’s plastic reduction initiatives.

E (Economic Factors)

Cost Considerations: Transitioning iPhones to eco-friendly, non-plastic materials may entail high initial costs, but long-term savings could be realized through technological advancements and economies of scale.

Consumer Purchasing Power: Economic conditions influence consumer spending capacity, and the premium pricing of eco-friendly products may impact iPhone sales.

S (Social Factors)

Shifting Consumer Preferences: Modern consumers, particularly younger demographics, increasingly prioritize environmental attributes in products, enhancing the appeal of plastic reduction strategies for mobile devices.

Public Environmental Awareness: Growing societal concern for environmental issues drives Apple to adopt more sustainable and eco-conscious practices in its iPhone product line.

T (Technological Factors)

Innovative Materials and Production Technologies: Advances in technology enable cost-effective production of eco-friendly materials, such as biodegradable plastics or advanced recycling methods for iPhone manufacturing.

Packaging and Design Technologies: New technologies allow lighter and less material-intensive iPhone packaging while maintaining or improving product quality and safety.

E (Environmental Factors)

Global Environmental Pressures: Escalating concerns over plastic pollution and carbon emissions intensify pressure on Apple to implement tangible measures to reduce its environmental footprint.

Sustainability Goals: Apple, particularly through its flagship iPhone, faces rising expectations to contribute to the UN Sustainable Development Goals (SDGs), with plastic reduction aligning closely with these objectives.

L (Legal Factors)

Environmental Regulations: Stricter national laws on product packaging and waste management compel Apple to adhere to higher environmental standards.

Product Safety Standards: Materials used in plastic reduction must comply with international safety regulations to ensure they do not compromise iPhone performance or user safety.

Conclusion:

Through the PESTEL analysis, it becomes evident that Apple's plastic reduction strategy for iPhones is not only an internal initiative but also a response to external macro-environmental pressures and opportunities. This strategy enhances Apple's corporate social responsibility (CSR) and bolsters the brand image of both the iPhone and the company as a whole. However, challenges such as increased costs and market acceptance uncertainties remain. Overall, the strategy positions Apple to maintain global market leadership while proactively addressing future environmental and regulatory risks **(Bu, 2017)**.

3.2 Strategic Implementation Plan

Table 1: Strategic Implementation Plan Table

Strategic Initiative	Implementation Roadmap	Accountability Matrix	Milestone Schedule	Resource Investment Portfolio	Strategic Value Proposition
Phase Out Plastic Components in iPhone Designs	Conduct advanced material substitution analysis 2. Re-engineer components for eco-materials 3. Validate prototypes via safety and	1. R&D Division 2. Industrial Design Team 3. Quality Assurance & Compliance	1. Material research: 3-6 months 2. Design restructuring: 6-12 months 3. Prototype testing: 3-6 months	1. Material scientists 2. CAD/CAE design tools 3. ISO-certified testing facilities	1. Leadership in sustainable design innovation 2. Market differentiation through ESG alignment 3. Increased R&D costs

	durability testing				(+15-20% budget)
Expand Post-Consumer iPhone Recycling Program	Partner with certified recycling facilities 2. Develop consumer incentive programs 3. Optimize collection and processing logistics	1. Sustainability Office 2. Marketing & Customer Engagement 3. Logistics & Operations	1. Recycling partnerships: 2-4 months 2. Incentive program launch: 1-2 months 3. Logistics deployment: 2-4 months	1. Recycling network alliances 2. CRM-driven incentive platforms 3. Regional logistics infrastructure	1. Enhanced brand reputation (+15-20% CSAT) 2. 30-40% YoY increase in device returns 3. Initial infrastructure costs ($2-3M CAPEX)

3.3 Comparison with some other competitors in the same industry

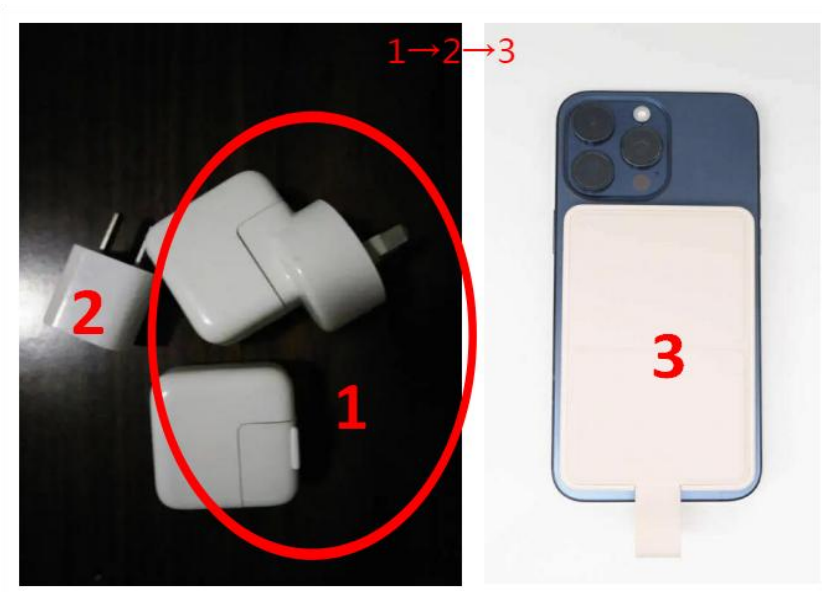
Table 2: Comparison between Apple, Samsung, and Huawei

Dimension	Apple	Samsung	Huawei
Plastic Reduction Strategy	Fully implemented paper-based packaging; pioneer in wireless charging	Partial use of eco-friendly materials; initial promotion of reduced-plastic packaging	Initially adopted eco-friendly packaging materials, but not widely applied
Supply Chain Management	Comprehensive supply chain traceability system; promotes green transformation	Relatively well-managed supply chain, but green standards remain inconsistent	Supply chain gradually rebuilt under global pressure
Innovation and Technological Capability	Extensive use of advanced technologies such as the Daisy robot	Moderate technological innovation, not on par with Apple	Limited by technology restrictions, with early-stage innovation efforts
Market Influence and Brand Value	High market recognition and strong brand premium	Moderate-to-high market recognition, but lower brand premium than Apple	Moderate market recognition, with relatively low brand premium

4. Review of iPhone's Plastic Reduction Journey

Apple's path to reducing plastic usage in the iPhone series has been marked by iterative refinements, as exemplified by the evolution of its chargers. Initially, the company explored designing chargers with two separate components—a charging base and an interchangeable plug adaptable to different international electrical standards—to minimize plastic use while accommodating global markets. However, this approach inadvertently increased plastic consumption. Subsequent technical optimizations focused on miniaturizing the charger's internal electronic components, significantly reducing their size. These components were then engineered to comply with diverse regional standards, further cutting plastic usage. This progression ultimately led to the development and implementation of MagSafe wireless charging technology, which eliminated traditional chargers entirely.

Figure 3: The plastic reduction evolution process of iPhone products (1→2→3)



Meanwhile, Apple's efforts to reduce plastic usage in its iPhone product line have demonstrated increasingly effective outcomes, as evidenced by the overall decline in plastic consumption.

iPhone 6s (2015): As the baseline model, its plastic usage is set at 100%, employing traditional packaging materials.

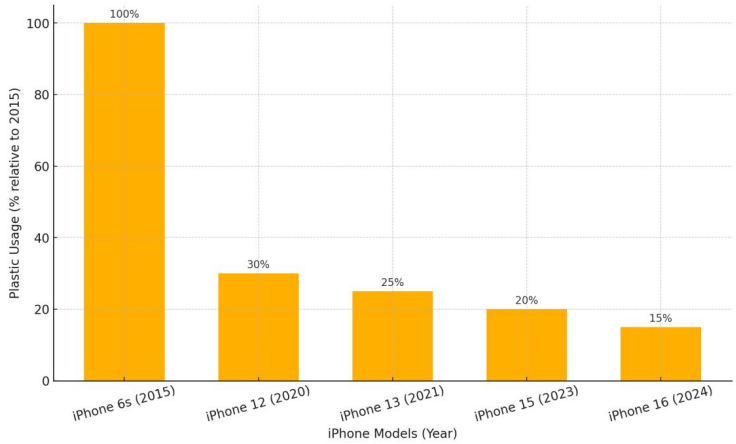
iPhone 12 (2020): Compared to the 2015 iPhone 6s, plastic usage was reduced by approximately 70%. Apple eliminated the inclusion of earphones and chargers, thereby reducing packaging volume and consequently plastic consumption.

iPhone 13 (2021): Packaging plastic usage decreased by about 75% compared to 2015, achieved by incorporating recycled plastic in antenna components to meet environmental goals.

iPhone 15 (2023): Plastic usage was reduced by approximately 80%, with packaging materials made from recycled plastic bottles.

iPhone 16 (2024): Plastic usage decreased by about 85% compared to 2015, with over 30% of components utilizing recycled materials, including an 85% recycled aluminum ratio.**(Apple Inc., 2024; Apple Inc., 2025)**

Figure 4: Trend Of Plastic Usage Reduction In IPhone Products



5. Information Behavior Analysis of Apple's Plastic Emission Reduction Strategy Based on the 3D-IDPT Theoretical Model

The 3D-IDPT model emphasizes a three-dimensional analysis of space (individual and group), time (synchronic and diachronic), and the construction process of information resources (vertical axis). This chapter will use the three dimensions of this theoretical model as a framework to analyze the information behavior performance of Apple Inc. in its plastic emission reduction strategy **(Li, 2024).**

Figure 5: 3D-IDPT (Integrate Discipline Puzzle Theory) model

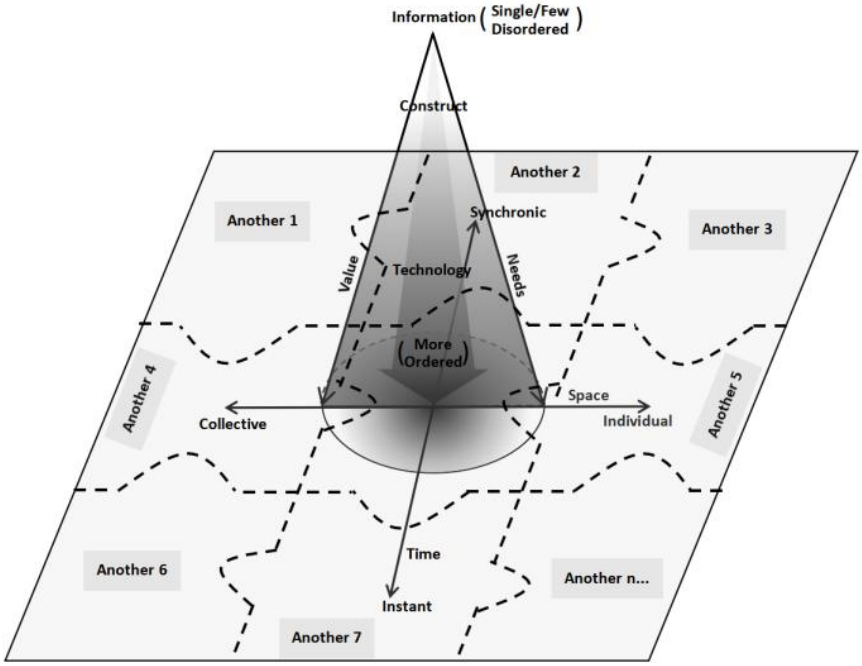


Table 3: Analyzing Apple Inc.'s decision-making behavior using the 3D-IDPT

Model Dimension	Apple's Specific Actions	Explanation and Analysis
Space Dimension (Individual)	New packaging design, material substitution	Apple proactively uses environmentally-friendly materials and reduces plastic packaging, reflecting its corporate environmental responsibility.
Space Dimension (Collective)	Promotion of recycling programs, supply-chain collaboration	Apple collaborates with consumers, supply chains, and governments to drive green transformation across the industry.
Time Dimension (Instant)	Immediate packaging adjustments during product launches	Apple quickly responds to market and regulatory changes, adjusting strategies promptly—such as removing earphones and chargers starting with the iPhone 12.
Time Dimension (Synchronic)	Long-term carbon neutrality and zero-waste objectives	Apple continuously refines its strategic direction based on past experiences, ensuring sustainable long-term goals.
Construction Axis (Technology)	Application of "Daisy" robot recycling technology	Technology-driven recycling and reuse of plastic materials.
Construction Axis (Value)	Enhancing brand reputation and market	Environmental strategies enhance brand value, increasing market competitiveness and consumer

	competitiveness	loyalty.
Construction Axis (Demand)	Consumer environmental awareness and regulatory pressure	Ongoing consumer demands drive Apple to continually optimize technologies and strategic initiatives.

5.1 Horizontal Axis Analysis: Spatial Dimension (Space)

Table 4: Space Table

Space Dimension	Object Subject	Interpretation and Analysis
Individual	Apple Inc.	As a market entity, Apple actively promotes a plastic reduction strategy through its iPhone product line, reflecting a clear corporate environmental responsibility awareness.
Collective	Consumers, Government, Supply Chain, Public	The growing environmental awareness among the public, government-enacted environmental policies, and the pressure to implement plastic reduction strategies drive Apple to further enforce its plastic reduction strategy and push for the transformation of its supply chain.

As an individual entity, Apple Inc. has proactively reduced plastic packaging, adopted paper packaging and fabric charging cables, and developed magnetic wireless charging technology, demonstrating its initiative towards environmental responsibility. At the same time, Apple is subject to supervision and pressure from society, government, and industry groups, which encourages it to continuously strengthen its environmental initiatives.

5.2 Vertical Axis Analysis: Time Dimension (Time)

Table 5: Time Table

Time Dimension	Object Subject	Interpretation and Analysis
Instantaneous	New Product Launch, Emergency Response	Apple keeps pace with social progress and actively responds to market and policy environmental requirements, such as removing chargers and earphones when launching the iPhone 12, addressing the public concern about plastic waste in a timely manner.
Synchrony	Past Decisions' Impact and Future Strategy	Apple's long-standing continuous plastic reduction strategy reflects a deep reflection on past plastic pollution issues, injecting a concept of technological environmentalism into the brand, and committing to ongoing improvements and leading industry standards in the future.

On the immediate dimension, Apple responds swiftly to the market's demand for environmentally friendly products, demonstrating its ability to adapt; while on the synchronic dimension, influenced by historical experience, Apple actively promotes future sustainable development, with plans to achieve carbon neutrality in products and supply chains by 2030, and a long-term plastic reduction strategy that has been clearly formulated and steadily advanced.

5.3 Z-Axis Analysis: Information Resource Construction Dimension (Construction Axis)

Table 6: Information Construct Table

Construction Dimension	Specific Content	Interpretation and Analysis
Technology	Environmental Material Technology Innovation (e.g., recycled materials, biodegradable materials), Daisy Material Recycling Robot	Apple drives the transition of plastic usage from "disordered" to "more ordered" through the development of advanced plastic alternatives and recycling technologies, reflecting a continuous optimization process driven by technology.
Value	Economic Value (brand premium, market competitiveness)	The plastic reduction strategy enhances the brand's environmental responsibility and social value, improving the brand image, which in turn indirectly drives sustained economic growth.
Needs	Social Demand (increased consumer environmental awareness, policy pressure)	As global attention to environmental issues rises, the growing demands from consumers and regulatory bodies continuously drive Apple to strengthen information systems, technological investments, and strategic adjustments to meet new expectations from the market and society.

Apple Inc. continues to advance product design innovation, the use of recycled materials, and supply chain optimization, reflecting the continuously evolving process of information resource construction, guided by technology, value, and demand.

5.4 Comprehensive Analysis of Apple's Plastic Emission Reduction Using the 3D-IDPT Four Quadrants

Table 7: Comprehensive Analysis Table Based on 3D-IDPT Model

Quadrant Dimension	Specific Analysis Content	Practical Case Example
Individual and Instantaneous Quadrant	Apple responds immediately to social environmental demands during new product releases, such as the immediate improvement of packaging materials.	When the iPhone 12 was released, Apple removed the charger and earphones, directly reducing the immediate use of plastic.
Individual and Synchrony Quadrant	Apple's long-term strategic plastic reduction plan, continuously innovating product design based on past experiences.	From the iPhone 5c to the iPhone 15 Pro, Apple has continuously upgraded packaging materials, reducing plastic usage over time and enhancing product recycling design.
Group and Instantaneous Quadrant	Apple quickly adjusts its supply chain in response to specific environmental events or policy	When the government introduced new environmental regulations, Apple immediately adjusted its

	releases, collectively addressing immediate social concerns.	supply chain and publicly released related environmental reports to respond promptly to social and governmental demands.
Group and Synchrony Quadrant	Apple actively promotes long-term plastic reduction consensus and action across the global supply chain, setting an industry benchmark and influencing upstream and downstream industries to reduce plastic usage together.	Apple collaborates with suppliers to promote the use of recycled materials and conducts long-term technological cooperation, driving sustainable development throughout the consumer electronics industry chain.

5.5 Behavioral Diffusion

Apple Inc. has taken its iPhone product line as the core, spreading and transmitting the concept of environmental protection through technology, and has diffused this concept into other multiple segments,

such as:

iPad series: Starting with the iPad 10 and iPad Pro released in October 2022, Apple has fully adopted fiber-based packaging materials, eliminating the use of plastic outer films. Specifically, 97% of the packaging for the iPad 10 is fiber-based, and the fiber-based proportion for the iPad Pro's packaging is as high as 99%.

Earphone products: From the earlier wired earphones to the updated wireless earphones, and then to equipping wireless earphones with wireless charging capabilities, further reducing the use of plastic materials.

iWatch series: Through the initial design optimization, it ensures that different generations of watch products can use the same straps, satisfying the need for personalization in fast-moving consumer goods while reducing unnecessary waste.

Apple Inc. practices the principles of slowing down and reducing emissions, and this concept and behavior have also been conveyed and influenced the brand positioning of other technology companies **(Zhang, 2024),** promoting the entire industry, especially in the fast-moving consumer goods sector of the technology industry, to take action towards reducing plastic use and emissions **(Fan et al., 2023)**.

5.6 Comprehensive Conclusion

The analysis of Apple Inc.'s plastic emission reduction strategy using the 3D-IDPT theory indicates that Apple can not only implement a comprehensive and systematic plastic emission reduction strategy within a three-dimensional framework that encompasses space (individual and group), time (immediate and simultaneous), and the process of information construction (technology, value, demand), but also demonstrates its strategic determination and capability to address challenges and lead the industry towards sustainable development.

6. Summary

This report analyzed Apple's plastic reduction strategies in its iPhone products using the 3D-IDPT model, which is a tool from Information Resource Management (IRM) to assess spatial, temporal, and constructional dimensions. Through an in-depth exploration of Apple's evolving approach, the report highlighted the company's ongoing commitment to sustainability by reducing plastic in packaging, adopting eco-friendly materials, and promoting device recycling. Notably, Apple's objectives—such as achieving carbon neutrality by 2030 and adhering to circular

economy principles—align with the growing global push toward environmental responsibility.

Apple's strategies, including the use of recycled materials, product redesign, and the introduction of advanced recycling technologies, not only contribute to reducing plastic use but also enhance brand value and market competitiveness. While risks such as increased production costs and supply chain complexities exist, the company has employed risk mitigation strategies and integrated models like SWOT, VRIO, and PESTEL to navigate these challenges effectively.

The 3D-IDPT model provided valuable insights into the spatial (individual and group), temporal (instantaneous and synchronic), and constructional dimensions (technology, value, demand) of Apple's strategies, illustrating how the company has progressively adapted and innovated. Furthermore, Apple's plastic reduction efforts have transcended its own product lines, influencing other segments such as iPads, earphones, and the iWatch, as well as promoting sustainability across the broader technology industry.

In conclusion, Apple's plastic reduction initiatives not only bolster its environmental stewardship but also position the company as a leader in sustainability within the consumer electronics sector, setting an example for other companies to follow in their efforts to reduce plastic and lower carbon emissions. These efforts not only serve Apple's long-term strategic goals but also contribute significantly to a more sustainable future for the tech industry as a whole.

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