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Artificial intelligence in green marketing

Authors:

- B Matthew Mineeth
- Anjali Ragineni
- Jai Sankar G.
- Srivalli Vuppala

Affiliation:

Ed_Division, Exafluence INC

Sri Venkateswara University,

Tirupati, India

Presented at: REVA University

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Introduction

The integration of Artificial Intelligence in green marketing is transforming the way businesses approach sustainability and environmental responsibility. It mainly focuses on:

- Green Supply Chain Optimization
- Eco-Friendly Product Recommendation
- Sustainable Marketing Strategies

Literature Review

AUTHOR(S)	KEY POINTS	METHODOLOGY	KEY FINDINGS
[2] Chen & Chang (2013)	Greenwashing affects trust	Survey + structural equation modeling.	• Confusion & ris reduce green tru
[5] Kim & Han (2019)	RS affect trust online	Survey + structural equation modeling.	• Personalized RS trust
[7] Rahman et al. (2015)	Hotel greenwashing harms trust	Customer survey	• Leads to distrust poor loyalty
[12] Goldman Sachs (2022)	ESG misstatements fined	SEC action	• Misleading ESG trust
[13] Keurig (2022)	False recycling claim	Govt probe	• Misleading labe penalties

Problem Statement

Green marketing aims to promote sustainability, but today consumers are often sceptical of it. This is due to misleading or vague sustainability claims often used by companies. The result: fines, lawsuits and damaged reputations.

Real-World context:

Several major brands have faced legal actions or regulatory penalties for environmental claims that lacked evidence.

For example:

- A major auto manufacturer was fined for delayed emissions report.
- Two fashion retailers were investigated for using vague eco-labels like 'conscious choice'.
- A financial firm overstated its ESG criteria and misled investors.

Methodology

- **Problem identification:** Consumer distrust in current green marketing practices, especially due to greenwashing.
- **Conceptual framework development:** such as recommender systems, sentiment analysis, and natural language processing in delivering personalized and authentic sustainability messaging.
- **Metric based evaluation strategy:** Indicators that can assess the effectiveness of A driven strategies in reinforcing brand credibility and ethical sustainability communication.

Proposed Framework

- **Tier 1 – AI-Powered Recommender Systems**
  Personalizes product suggestions based on consumer preferences, browsing behavior, and environmental values.

- **Tier 2 – NLP-Based Greenwashing Detection**
  Uses Natural Language Processing (NLP) to detect vague, misleading, or unverifiable sustainability claims in marketing content.

- **Tier 3 – Sentiment Analysis and Real-Time**
  Employs AI to monitor consumer sentiment from social media and other sources.

Limitations

- **Data Quality Dependency** : Inaccurate and incomplete data
- **Algorithmic bias**: Potential leading to discriminatory marketing practices
- **Consumer skepticism**: Distrust of AI driven marketing
- **Lack of transparency**: Black box nature of Artificial intelligence
- **Limited contextual understanding**: Lack of human intuition

Evaluation Metrics

Trust indicators:

- Brand trust score – measures consumer confidence in sustainability claims.
- perceived authenticity – evaluates clarity and credibility of green messaging.
- certification verification - % of claims backed by trusted third-party standards.

Engagement Metrics:

- click-through rate – engagement with AI recommended green products.
- conversion rate – ratio green product recommendations that result in purchases.

Ethical & compliance metrics:

- transparency score – clarity of AI logic, data sources, and sustainability proofs.
- data privacy compliance – Adherence to GDPR, FTC, and other regulations.

Results

- Increased trust in sustainability claims.
- Higher engagement with green product recommendations.
- Real-time brand reputation management.
- Reduced regulatory risk via NLP-based claim audits.

Conclusion

- Green marketing is vital for promoting sustainable consumption. Ambiguous messaging extensive greenwashing contribute to declining consumers trust which undermines effectiveness of sustainability communication.
- The proposed three-tier artificial intelligence framework aims to individualize g messaging, track public opinion, and validate environmental claims.
- Companies need to move beyond superficial green messaging and focus on transparency, driven strategies and responsiveness.
- AI isn't a fix-all but if applied ethically, it can help companies regain consumer trust in thi of rising green skepticism

Future Scope

Blockchain Integration:

- Incorporating blockchain technology could enhance verification and traceability of green claims, prevent tampering and ensure permanent records of sustainability data.

Behavioral Economics Integration:

- Future models could integrate behavioral insights to predict how different trust cues influen consumer decisions, offering a more human-centered approach to AI-driven marketing.

Ethical AI Tools for SMEs:

- Development of open-source, ethics-oriented AI tools can democratize access for small businesses, enabling them to participate in trustworthy green marketing practices.

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