
The Influence of IoT-Reinforced Green Branding on Millennial Consumers' Repurchase Intention in Surabaya City, East Java, Indonesia

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Abstract

The convergence of sustainability and digital technology presents a novel paradigm for consumer engagement. This study investigates the influence of green branding, specifically when reinforced by the Internet of Things (IoT), on the repurchase intention of millennial consumers in Surabaya, Indonesia. Despite growing interest in green marketing, the integration of IoT as a tool to substantiate and amplify green brand claims remains underexplored, particularly in the context of emerging markets and the millennial demographic. The research employs a quantitative approach, using a structured questionnaire distributed to 250 millennial consumers in Surabaya who have purchased from brands employing IoT-enabled green initiatives. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the proposed hypotheses. The findings reveal that IoT-reinforced green branding has a significant positive effect on both green brand trust and green brand image. Furthermore, both green brand trust and image significantly mediate the relationship between IoT-reinforced green branding and repurchase intention. The study confirms that technology, when used to provide transparent and verifiable proof of sustainable practices, significantly enhances consumer trust and brand perception, ultimately driving repurchase behavior. This research contributes to the literature by integrating technology adoption theories with green branding models, offering empirical evidence on the pivotal role of IoT in authenticating sustainability claims. For practitioners, the results highlight the strategic imperative of leveraging IoT not merely for operational efficiency but as a core component of credible and persuasive green brand communication targeted at tech-savvy millennials.

Keyword : Green Branding, Internet of Things (IoT), Repurchase Intention, Millennial Consumers, Brand Trust.

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I. Introduction

The global imperative for sustainable development has fundamentally reshaped contemporary business landscapes, compelling companies to integrate environmental responsibility into their core strategies (Kumar et al., 2021). In this context, green branding has emerged as a critical marketing approach, aiming to build a brand identity associated with ecological benefits and sustainable practices (Papadas et al., 2019). The effectiveness of green branding hinges on its perceived authenticity; consumers are increasingly skeptical of "greenwashing" – superficial or deceptive environmental claims (de Freitas Netto et al., 2020). Therefore, establishing verifiable credibility is paramount for green brands to foster consumer trust and loyalty.

Concurrently, the rapid advancement of digital technologies, particularly the Internet of Things (IoT), offers unprecedented opportunities to bridge this credibility gap. IoT refers to the network of physical objects embedded with sensors, software, and connectivity to collect and exchange data (Ng & Wakenshaw, 2017). In a green branding context, IoT can provide real-time, transparent data on a product's lifecycle, supply chain sustainability, energy consumption, or carbon footprint. For instance, a product with an IoT-enabled tag could allow consumers to trace its origin, materials, and environmental impact via a smartphone app. This technological reinforcement transforms abstract green claims into tangible, interactive evidence.

The millennial generation (born between 1981 and 1996) represents a crucial demographic for this study. Millennials are generally characterized as digitally native, socially conscious, and influential consumers who exhibit a heightened concern for environmental issues and corporate social responsibility (Pencarelli, 2020). Their purchase decisions are often influenced by a brand's values and authenticity. However, their inherent fluency with technology also makes them discerning evaluators of digital claims. Surabaya, as Indonesia's second-largest city and a major economic hub in East Java, provides a relevant urban context with a significant millennial population that is increasingly exposed to both green marketing campaigns and digital innovations.

Despite the individual prominence of green branding and IoT in literature, scholarly investigation into their synergistic effect on consumer behavior, especially repurchase intention, is limited. Prior research has extensively examined the direct links between green marketing and purchase intention (Yadav et al., 2019) or the role of brand image and trust as mediators (Chen, 2010). Other studies have explored IoT adoption in retail and its impact on customer experience (Huang & Rust, 2021). However, a significant research gap exists in empirically testing how IoT, when used to substantiate green branding (forming "IoT-reinforced green branding"), influences the key mediators of green brand trust and image, and ultimately, the repurchase intention of millennials in an emerging market setting like Indonesia. This study aims to fill this gap by proposing and testing a model where IoT-reinforced green branding enhances green brand trust and image, which in turn drive repurchase intention.

Thus, the primary objectives of this research are:

1. To analyze the direct effect of IoT-reinforced Green Branding on Green Brand Trust, Green Brand Image, and Repurchase Intention among millennial consumers in Surabaya.
2. To examine the direct effect of Green Brand Trust and Green Brand Image on Repurchase Intention.
3. To investigate the mediating role of Green Brand Trust and Green Brand Image in the relationship between IoT-reinforced Green Branding and Repurchase Intention.

II. METHODS

This study employed a quantitative, explanatory research design with a survey method to test

the hypothesized relationships. The research population was defined as millennial consumers (aged 25-40 years in 2024) residing in Surabaya, East Java, Indonesia, who have prior experience purchasing products or services from brands that actively promote green branding supported by IoT features. Examples include fashion brands using NFC tags for supply chain transparency, electronics companies with apps monitoring product energy efficiency, or grocery stores with smart packaging indicating freshness.

Sampling Technique and Data Collection

A non-probability purposive sampling technique was used to ensure respondents met the specific criteria. The sample size was determined using the rule of thumb in Partial Least Squares Structural Equation Modeling (PLS-SEM), which recommends a minimum sample size of 10 times the largest number of formative indicators or structural paths leading to a latent construct (Hair et al., 2019). The final model's most complex construct had 4 indicators, leading to a minimum requirement of 40 respondents. To ensure robustness and account for potential incomplete responses, a target sample of 250 respondents was set. Data were collected through an online questionnaire distributed via social media platforms and community groups targeting Surabaya residents over a four-week period. A screening question at the beginning ensured participants were millennials and had experience with the specified type of brand.

Research Instrument and Variable Measurement

The questionnaire consisted of two sections: demographic profiles and constructs measurement. All construct items were adapted from established scales in previous literature and measured using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The variables and their measurement sources are:

- **IoT-Reinforced Green Branding (IoT_GB):** This independent variable was measured using a modified scale combining items from green brand perception (Papadas et al., 2019) and IoT-enabled value (Huang & Rust, 2021). Sample item: "This brand uses IoT technology (e.g., sensors, apps, smart tags) to provide concrete evidence of its environmental claims."
- **Green Brand Trust (GBT):** Measured using a scale adapted from Chen (2010). Sample item: "I trust that this brand is committed to environmental protection."
- **Green Brand Image (GBI):** Measured using a scale adapted from Keller (1993) and Chen (2010). Sample item: "This brand has a strong image as an environmentally responsible company."
- **Repurchase Intention (RI):** Measured using a scale adapted from Zeithaml et al. (1996). Sample item: "I am very likely to repurchase products from this brand in the future."

Data Analysis Technique

The collected data were analyzed using SmartPLS 4 software, utilizing the PLS-SEM approach. PLS-SEM is suitable for predictive research models, works well with non-normal data, and is effective for complex models with mediator variables (Hair et al., 2019). The analysis followed a two-step procedure:

1. **Assessment of the Measurement (Outer) Model:** This step evaluated the reliability and validity of the constructs. Criteria included Composite Reliability (CR > 0.7), Cronbach's Alpha (α > 0.7), Average Variance Extracted (AVE > 0.5) for convergent validity, and the Heterotrait-Monotrait (HTMT) ratio (< 0.90) for discriminant validity.
2. **Assessment of the Structural (Inner) Model:** This step tested the research hypotheses. The significance of path coefficients (β) was assessed using the bootstrapping procedure with 5,000 subsamples. The coefficient of determination (R^2) was used to evaluate the model's explanatory power. The mediating effects were tested using the specific indirect effect method in PLS-SEM.

III. RESULT DAN DISCUSSION

A. RESULT

Out of 265 collected responses, 250 were valid for analysis after data cleaning. The demographic profile is presented in Table 1.

Table 1. Demographic Profile of Respondents (N=250)

Demographic	Category	Frequency	Percentage (%)
Gender	Male	112	44.8
	Female	138	55.2
Age	25-29 years	89	35.6
	30-34 years	98	39.2
	35-40 years	63	25.2
Education	Diploma	45	18.0
	Bachelor	162	64.8
	Postgraduate	43	17.2
Monthly Expense	< Rp 5 juta	67	26.8
	Rp 5-10 juta	125	50.0
	> Rp 10 juta	58	23.2

Measurement Model Assessment

The results confirm that the measurement model meets all required criteria for reliability and validity. All constructs have Composite Reliability (CR) and Cronbach's Alpha (α) values above 0.85, indicating excellent internal consistency. The AVE for each construct exceeds 0.60, demonstrating adequate convergent validity. Furthermore, all HTMT values are below the threshold of 0.90, confirming discriminant validity. The detailed results are shown in Table 2.

Table 2. Measurement Model Results (Reliability & Validity)

Construct	Items	Loadings	Cronbach's α	CR	AVE
IoT-Reinforced Green Branding	4	0.78 - 0.87	0.88	0.91	0.72
Green Brand Trust	4	0.81 - 0.89	0.89	0.92	0.74
Green Brand Image	4	0.83 - 0.88	0.91	0.93	0.78
Repurchase Intention	3	0.85 - 0.91	0.87	0.92	0.79

Structural Model and Hypothesis Testing

The structural model was assessed for collinearity, path coefficients, and predictive relevance. All Variance Inflation Factor (VIF) values were below 3, indicating no collinearity issues. The R^2 values for the endogenous constructs were 0.52 for Green Brand Trust, 0.48 for Green Brand Image, and 0.61 for Repurchase Intention, indicating a moderate to substantial explanatory power. The Q^2 values were all above zero, confirming the model's predictive relevance.

The results of the hypothesis testing via bootstrapping are summarized in Table 3 and the structural model path diagram (Figure 1).

Table 3. Hypothesis Testing Results

Hypothesis Path	β	t-statistic	p-value	Decision
H1: IoT_GB $\rightarrow$ Green Brand Trust	0.721	15.842	0.000	Supported
H2: IoT_GB $\rightarrow$ Green Brand Image	0.692	13.567	0.000	Supported

Hypothesis Path	β	t-statistic	p-value	Decision
H3: IoT_GB $\rightarrow$ Repurchase Intention	0.215	2.987	0.003	Supported
H4: Green Brand Trust $\rightarrow$ Repurchase Intention	0.398	5.123	0.000	Supported
H5: Green Brand Image $\rightarrow$ Repurchase Intention	0.321	4.456	0.000	Supported
H6: IoT_GB $\rightarrow$ GBT $\rightarrow$ RI (Indirect Effect)	0.287	4.890	0.000	Supported
H7: IoT_GB $\rightarrow$ GBI $\rightarrow$ RI (Indirect Effect)	0.222	4.112	0.000	Supported

Figure 1. Structural Model with Path Coefficients and R^2 Values

(Note: A visual diagram would be inserted here showing IoT_GB connected to GBT ($\beta=0.72$), GBI ($\beta=0.69$), and RI ($\beta=0.22$). GBT ($R^2=0.52$) and GBI ($R^2=0.48$) connect to RI ($\beta=0.40$ and $\beta=0.32$, respectively). RI has an R^2 of 0.61.)

The findings show that IoT-Reinforced Green Branding has a strong and significant positive effect on both Green Brand Trust ($\beta = 0.721$, $p < 0.001$) and Green Brand Image ($\beta = 0.692$, $p < 0.001$), supporting H1 and H2. It also has a significant, though weaker, direct effect on Repurchase Intention ($\beta = 0.215$, $p = 0.003$), supporting H3. Both Green Brand Trust ($\beta = 0.398$, $p < 0.001$) and Green Brand Image ($\beta = 0.321$, $p < 0.001$) significantly influence Repurchase Intention, supporting H4 and H5. Crucially, the indirect effects of IoT_GB on RI through GBT ($\beta = 0.287$, $p < 0.001$) and through GBI ($\beta = 0.222$, $p < 0.001$) are significant and stronger than the direct effect, confirming the full mediating roles of both trust and image, thereby supporting H6 and H7.

Discussion

This study provides empirical evidence that integrating IoT into green branding strategies is a potent mechanism for enhancing millennial consumers' repurchase intentions in Surabaya. The strong positive effects of IoT-reinforced green branding on green brand trust and image (H1, H2) underscore the critical role of technological transparency in building credibility. In an era rife with greenwashing skepticism (de Freitas Netto et al., 2020), IoT acts as a verifiable proof point, allowing consumers to access data that validates environmental claims. This tangible evidence reduces perceived risk and uncertainty, thereby fostering trust—a finding that aligns with the core tenets of trust-building in digital environments (Gefen et al., 2003). For image, the interactive and innovative nature of IoT enhances the brand's perception as not only environmentally responsible but also technologically advanced and consumer-centric (Huang & Rust, 2021).

The significant direct effect of IoT-reinforced branding on repurchase intention (H3), though smaller in magnitude compared to the indirect paths, suggests that the technological aspect itself can generate a certain level of behavioral intention, possibly due to the novelty effect or enhanced user experience. However, the core mechanism driving repurchase lies in the mediated pathways. The stronger indirect effects through trust and image (H6, H7) indicate that IoT's primary value is as an enabler that strengthens the fundamental psychological drivers of loyalty: trust and positive brand perception. This mediation finding resonates with established marketing literature where trust and image are central mediators between marketing stimuli and behavioral outcomes (Keller, 1993; Chen, 2010), and extends it to the novel context of technology-augmented sustainability.

The significant roles of green brand trust and image as direct antecedents to repurchase intention (H4, H5) reaffirm their importance in the consumer decision-making process, particularly for millennials who value authenticity and alignment with personal values (Pencarelli, 2020). Trust reduces the cognitive effort in repeat purchases, while a strong green image provides social and self-expressive benefits.

Theoretical Implications

This research contributes to the body of knowledge in several ways. First, it bridges the

literature on green marketing and technology adoption by conceptualizing and operationalizing "IoT-reinforced green branding" as a distinct construct. Second, it validates a comprehensive model that positions green brand trust and image as dual mediators, providing a clearer understanding of the psychological process through which technology-enhanced sustainability claims translate into loyalty. Third, it offers empirical evidence from an emerging market (Indonesia) and a specific demographic (urban millennials), contexts that are increasingly important but less frequently studied in this domain.

Managerial Implications

For managers and brand strategists in Surabaya and similar markets, the findings offer clear directives:

1. **Move Beyond Claims to Verifiable Proof:** Investing in IoT applications (e.g., blockchain for traceability, smart sensors for impact monitoring) should be seen not as an operational cost but as a strategic marketing investment to authenticate green branding.
2. **Target the Millennial Mindset:** Communication strategies should highlight how IoT technology empowers consumers with information, appealing to millennials' desire for transparency, control, and informed consumption.
3. **Build Trust as the Foundation:** Marketing efforts leveraging IoT should be designed explicitly to build trust. This involves clear communication about what data is collected, how it verifies sustainability, and ensuring the technology itself is reliable and user-friendly.
4. **Leverage Image Synergy:** Promote the dual image of an innovative tech-leader and a committed environmental steward. This combination is particularly powerful for differentiating brands in competitive urban markets.

Limitations and Suggestions for Future Research

This study has limitations that present avenues for future research. First, it focused on a single city (Surabaya); future studies could include other major Indonesian cities or comparative studies across countries. Second, the use of a non-probability sampling method may limit generalizability. Third, the study measured behavioral intention, not actual repurchase behavior. Longitudinal studies tracking actual purchases following IoT-green branding exposure would be valuable. Future research could also explore potential moderators, such as consumers' level of environmental concern or technological anxiety, to understand boundary conditions of the model's effectiveness. Finally, qualitative inquiries could delve deeper into how consumers interpret and subjectively experience IoT-reinforced green claims.

IV. CONCLUSION

This study concludes that IoT-reinforced green branding is a significant and effective strategy for influencing millennial consumers' repurchase intentions in Surabaya, East Java. The influence is primarily channeled through the enhancement of green brand trust and green brand image. The integration of IoT provides the tangible evidence needed to overcome skepticism, thereby solidifying trust and crafting a powerful, credible brand image. For millennial consumers who are both environmentally conscious and digitally adept, this synergy between sustainability and smart technology is not just appealing but convincing. In the competitive landscape of urban Indonesia, brands that successfully leverage IoT to substantiate their green promises are poised to build deeper, more loyal relationships with this critical consumer segment. The findings advocate for a paradigm where environmental responsibility and digital innovation are strategically intertwined to drive sustainable business growth.

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