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BLOCKCHAIN MANAGEMENT AND GREEN MARKETING IN IMPROVING THE SUSTAINABILITY OF MSMES IN ASEAN WITH THE MEDIATION OF GREEN BRAND IMAGE AND CONSUMER TRUST AS INTERVENING VARIABLES

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Abstract: *This study aims to analyze the role of blockchain management and green marketing in improving the sustainability of MSMEs in the ASEAN region by positioning green brand image and consumer trust as mediating variables. The method used is mixed methods with a convergent parallel design strategy. The quantitative approach was carried out through a survey of 350 MSME actors in five ASEAN countries, while the qualitative approach was carried out through in-depth interviews with MSME owners/managers, business practitioners, and FGDs with MSME groups. The quantitative analysis uses Structural Equation Modeling (SEM-PLS) to test causal relationships between variables, while the qualitative analysis uses thematic analysis to explore the experiences, contexts, and real challenges of MSMEs in adopting blockchain and green marketing strategies.*

The results of the study indicate that blockchain management and green marketing have a positive effect on the sustainability of MSMEs. Furthermore, green brand image is shown to mediate the effect of blockchain management on sustainability, while consumer trust mediates the relationship between green marketing and sustainability. The integration of quantitative and qualitative results confirms that blockchain use strengthens supply chain transparency, enhances green brand reputation, and drives consumer loyalty. These findings are consistent with previous research emphasizing the importance of digitalization and environmental orientation in the development of sustainable MSMEs.

This research provides theoretical contributions to the development of blockchain management and green marketing literature, as well as practical implications for MSMEs, regulators, and policymakers in formulating digital transformation and sustainability strategies in the ASEAN region.

Keywords: Blockchain Management, Green Marketing, Green Brand Image, Consumer Trust, MSME Sustainability, ASEAN

1. INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) play a strategic role in the ASEAN regional economy. MSMEs account for more than 97% of total business units and contribute significantly to job creation, income generation, and socio-economic development in member countries. In Indonesia, for example, MSMEs contribute approximately 61.1% to Gross Domestic Product (GDP) and absorb more than 97% of the national workforce. Similar trends are also observed in Brunei Darussalam, Malaysia, the Philippines, Vietnam, and other ASEAN countries, where MSMEs are considered the backbone of the economy. However, despite this enormous potential, MSMEs face serious challenges in maintaining business sustainability in the face of global competition, climate change, and increasingly critical consumer demands for sustainable business practices.

Changing consumer behavior in ASEAN shows a growing preference for environmentally friendly products. A recent survey reported that 46% of consumers in the region have changed their shopping habits to choose more sustainable products after experiencing the impacts of climate change. Even in Vietnam, 84% of consumers are willing to pay more for sustainable products. This phenomenon confirms that green marketing is a crucial strategy for MSMEs to increase competitiveness, strengthen green brand image, and build consumer trust. However, the implementation of green marketing in many MSMEs is still limited to aspects of communication and environmentally friendly packaging, while deeper integration into the value chain is still not optimal.

On the other hand, the development of digital technology, particularly blockchain, opens up new opportunities for MSMEs in achieving business sustainability. Blockchain not only functions as a transparent transaction system but can also support traceability in the supply chain, guarantee product authenticity, and strengthen consumer trust in green claims made by companies. Research in Indonesia found that the relative advantages of blockchain significantly influence MSME adoption intentions, although cost and regulatory barriers remain challenges. Furthermore, blockchain integration in supply chain management has the potential to increase MSME connectivity with the global market, which increasingly demands sustainability standards.

The success of implementing green marketing and blockchain management in improving the sustainability of MSMEs is strongly influenced by mediating factors such as green brand image and consumer trust. A strong green brand image can create positive associations in consumers' minds that MSMEs genuinely care about environmental issues, while consumer trust can strengthen loyalty and purchase intentions. Thus, green brand image and consumer trust act as a bridge connecting blockchain and green marketing practices to improving the sustainability of MSMEs.

However, there remains a research gap regarding how blockchain management and green marketing strategies can simultaneously impact the sustainability of MSMEs in ASEAN, considering these mediating variables. Most existing research focuses on a single dimension—either digital technology adoption or green marketing strategies—without examining their interrelationships in an integrative manner. Given the significant contribution of MSMEs to the economy and the risk of losing US$237.5 billion in economic value if sustainability practices are not widely adopted in ASEAN, a more comprehensive study is crucial.

Based on this background, this study aims to analyze the influence of blockchain management and green marketing on the sustainability of MSMEs in ASEAN, with green brand image and consumer trust as intervening variables. This study is expected to provide theoretical contributions to the development of technology-based MSME sustainability models and green marketing strategies, while also providing practical implications for business actors and policymakers in the ASEAN region.

Table 1. Level of digitalization of MSMEs

Country	Contribution of MSMEs to the Economy	Latest Data on Green / Digital / Blockchain
Brunei Darussalam	~97% of 6,570 active companies are MSMEs; absorb >60% of the workforce; contribute ~40% of GDP	The government is encouraging the digitalization of MSMEs through *the Brunei Darussalam Digital Economy Masterplan 2025* , but green marketing is still minimal.
Indonesia	MSMEs contribute 61.1% of GDP and absorb 97% of the workforce	25.4 million MSMEs have entered the digital ecosystem (2023); 30% are categorized as green MSMEs by Bank Indonesia; blockchain adoption in the supply chain is starting to be tested by food and textile MSMEs.
Cambodia	MSMEs ~99.8% of total companies, contributing ~58% of employment	A major challenge in accessing green finance and digital technology; *Bank Cambodia's SME program* is starting to promote green finance.
Laos	MSMEs ~99.8% of companies, contributing ~16% of GDP	Low capacity in adopting digital & green practices; high dependence on traditional agricultural businesses.
Malaysia	MSMEs contribute 37.4% of GDP and 47.8% of the workforce	97% of the top 100 companies have reported on sustainability; MSMEs are starting to adopt environmentally friendly packaging and *eco-labeling* .
Myanmar	MSMEs ±99% of business units, contribution ±45% of GDP	Digital transformation has been slow due to political instability; green marketing and blockchain initiatives have not yet made significant progress.
Philippines	MSMEs contribute 36% of GDP and 62% of the workforce	Blockchain and crypto adoption is high globally; the government, through the DICT, is collaborating with blockchain organizations to support MSMEs.
Singapore	MSMEs ~99% of companies, contributing 44% of GDP and 72% of the workforce	Focus on *Green Plan 2030* ; MSMEs are encouraged to use *green finance* , digital technology, and blockchain for international supply chains.
Thailand	MSMEs contribute 34.2% of GDP and 78% of employment	The government is promoting *the Bio-Circular-Green (BCG) Economy Model* ; blockchain is starting to be used in agriculture and tourism for traceability.
Vietnamese	MSMEs ~98% of companies, contributing 41% of GDP and 50% of the workforce	84% of consumers are willing to pay more for sustainable products; MSMEs in the agriculture and manufacturing sectors are starting to adopt technology-based green innovations.

Source: 2025 observation results

Based on the table above, it can be concluded that (1) The large contribution of MSMEs to GDP and employment across ASEAN underscores the importance of sustainability strategies. (2) A gap in practice is evident: some developed countries (Singapore, Malaysia, Vietnam) are already relatively progressive in green marketing and blockchain, while Laos, Myanmar, and Cambodia still face major obstacles. (3) Blockchain and green marketing have the potential to strengthen brand trust and green brand image, especially in markets where consumers are increasingly critical (e.g., Vietnam and the Philippines). (4) These data demonstrate the existence of cross-country research space to examine the mediating factors that drive the sustainability of MSMEs in ASEAN.

1.1. Formulation of the problem

1. How does blockchain management impact the sustainability of MSMEs in ASEAN?
2. How does green marketing influence the sustainability of MSMEs in ASEAN?
3. Can green brand image mediate the relationship between blockchain management and MSME sustainability?
4. Can consumer trust mediate the relationship between green marketing and MSME sustainability?
5. What is an integrative model that connects blockchain management, green marketing, green brand image, consumer trust, and MSME sustainability in ASEAN?

1.2. Research purposes

1. Analyzing the influence of blockchain management on the sustainability of MSMEs in ASEAN.
2. Analyzing the influence of green marketing on the sustainability of MSMEs in ASEAN.
3. Testing the role of green brand image as a mediating variable between blockchain management and MSME sustainability.
4. Testing the role of consumer trust as a mediating variable between green marketing and MSME sustainability.
5. Developing a conceptual model of MSME sustainability based on blockchain management and green marketing with mediating variables of green brand image and consumer trust.

1.3. Research Hypothesis

1. H1: Blockchain management has a positive impact on the sustainability of MSMEs in ASEAN.
2. H2: Green marketing has a positive influence on the sustainability of MSMEs in ASEAN.
3. H3: Green brand image mediates the influence of blockchain management on the sustainability of MSMEs.
4. H4: Consumer trust mediates the influence of green marketing on the sustainability of MSMEs.
5. H5: Blockchain management has a positive effect on the green brand image of MSMEs.
6. H6: Green marketing has a positive effect on consumer trust.
7. H7: Green brand image has a positive effect on the sustainability of MSMEs.
8. H8: Consumer trust has a positive effect on the sustainability of MSMEs.

1.4. Conceptual model l

This conceptual model describes the relationship between research variables regarding Blockchain Management and Green Marketing on the Sustainability of MSMEs by involving mediating variables in the form of Green Brand Image and Consumer Trust.

1. Blockchain Management: the use of blockchain technology to increase transparency, accountability, and efficiency of the MSME supply chain.
2. Green Marketing: a marketing strategy that emphasizes environmentally friendly products/services.
3. Green Brand Image: positive consumer perception of MSME brands that are considered environmentally conscious.
4. Consumer Trust: consumer confidence in the credibility and integrity of MSMEs.
5. MSME sustainability: the ability of MSMEs to survive and develop economically, socially and environmentally

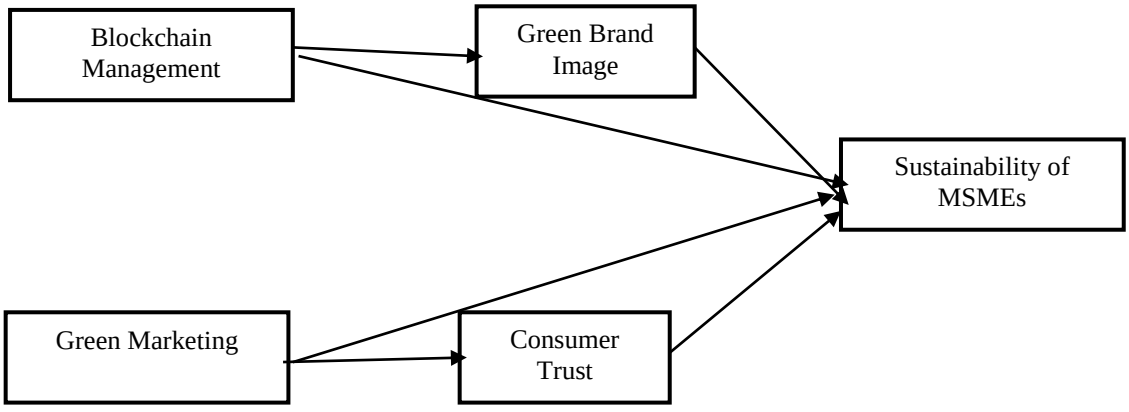

Figure 1. Conceptual model of the research

Based on Figure 1, the conceptual research model shows that there is a direct influence and an indirect influence.

Direct Influence

a. Blockchain Management → MSME Sustainability

Blockchain directly improves sustainability through transparency, efficiency, and security of transactions.

b. Green Marketing → Sustainability of MSMEs

Green marketing strategies directly impact sustainability as consumers prefer environmentally friendly products.

c. Blockchain Management → Green Brand Image

Blockchain implementation strengthens the green brand image as it demonstrates a commitment to transparency and sustainable practices.

d. Green Marketing → Consumer Trust

Green marketing increases trust because consumers perceive that MSME products/services truly care about the environment.

e. Green Brand Image → MSME Sustainability

A strong green brand image encourages loyal consumers, thus contributing to the sustainability of MSMEs.

f. Consumer Trust → MSME Sustainability

Consumer trust plays an important role in maintaining business continuity.

Indirect Influence (Mediation)

This model also illustrates the existence of mediating influences:

a. Blockchain Management → Green Brand Image → MSME Sustainability

This means that blockchain not only has a direct impact, but also through the formation of a positive green brand image.

b. Green Marketing → Consumer Trust → MSME Sustainability

Green marketing not only has a direct impact, but also increases sustainability through consumer trust.

This model emphasizes that the sustainability of MSMEs is influenced by technological factors (Blockchain Management) and environmentally friendly marketing strategies (Green Marketing), both directly and indirectly through Green Brand Image and Consumer Trust.

2. LITERATURE REVIEW

2.1. Blockchain Management

Blockchain management is an organization's ability to adopt, manage, and optimize blockchain technology for operational purposes, transparency, and efficiency. Its primary focus is on governance, smart contract usage, traceability, and integration with other business systems. This technology has been proven to increase trust, reduce verification costs, and minimize fraud in the MSME supply chain. The indicators are (1) Blockchain adoption level in business operations, (2) Smart contract usage in transactions/contracts, (3) Supply chain transparency and traceability, and (4) Efficiency and security of digital transactions.

Theoretical basis

Transaction Cost Economics Theory (Williamson, 1981): blockchain reduces transaction costs by minimizing the need for intermediaries, increasing

efficiency, and lowering the risk of opportunism. Technology Acceptance Model Theory (Davis, 1989): blockchain acceptance is influenced by perceived usefulness and perceived ease of use.

Empirical Findings

Abid et al. (2024) found that blockchain improves supply chain transparency and supports a circular economy. Bhimani (2024) showed that blockchain strengthens sustainable business practices through traceability.

Research on ASEAN MSMEs: Blockchain adoption remains low due to digital literacy constraints and implementation costs (Sharmin et al., 2024)

2.2. Green Brand Image

Green brand image is a positive consumer perception of a brand that is considered environmentally conscious through environmentally friendly products, production processes, and transparent communication. This image strengthens loyalty and purchase intentions, but can be weakened if consumers doubt green claims (greenwashing). With indicators, with indicators: (1) Positive consumer perception of environmentally friendly brands, (2) Brand consistency in demonstrating environmental commitment, (3) Credibility of green claims made by the brand, (4) Brand differentiation compared to competitors through green attributes.

Theoretical basis

Brand Equity Theory (Aaker, 1991): green brand image increases brand value through positive associations. Signaling Theory (Spence, 1973): brands send signals of environmental concern to convince consumers.

Empirical Findings

Chen (2010) showed that green brand image has a positive effect on consumer loyalty and trust. Singh & Pandey (2022) found that green brand image moderates the relationship between green marketing and purchase intention. Studies on green MSMEs in Southeast Asia show that green brand image strengthens competitiveness in export markets (Yusof et al., 2023).

2.3. Green Marketing (Green Marketing)

Green marketing encompasses all marketing strategies that integrate environmental issues into the product mix, pricing, promotion, and distribution. MSMEs can utilize green marketing to build competitiveness, particularly through environmentally friendly products and digital marketing. The indicators are (1) Environmentally friendly products (materials, packaging, processes), (2) Promotions that emphasize environmentally friendly advantages, (3) Pricing strategies that support sustainable practices, (4) Distribution channels that have minimal environmental impact.

Theoretical basis

Triple Bottom Line Theory (Elkington, 1997): green marketing supports economic, social, and environmental performance. Resource-Based View Theory (Barney, 1991): green marketing strategies become unique resources that are difficult for competitors to imitate.

Empirical Findings

Polonsky (2011) said that green marketing is effective in increasing product differentiation.

Rahman & Haque (2020) found that green marketing has a positive effect on purchase intention in the e-commerce market. A study of Indonesian MSMEs (Utami, 2022) showed that green marketing strengthens brand image and competitiveness despite facing cost constraints.

2.4. Consumer Trust

Consumer trust is the belief that a product/brand is reliable, safe, and honest in its claims. In the context of MSMEs, trust is built through transparency, reputation, transaction security, and positive consumer experiences. Blockchain can strengthen trust by providing data evidence that cannot be manipulated.

Theoretical basis with indicators: (1) Consumer confidence in brand honesty, (2) Security of transactions offered by the company, (3) Transparency of product information provided, (4) Consistency of product/service quality received

Commitment-Trust Theory (Morgan & Hunt, 1994): trust is the foundation of long-term relationships with consumers. Social Exchange Theory (Blau, 1964): consumers build trust based on fair and transparent reciprocal experiences.

Empirical Findings

Gefen et al. (2003) showed that trust influences e-commerce adoption. Kim & Peterson (2017) found that trust increases customer loyalty in the retail sector. Recent studies: blockchain

technology increases consumer trust through transparency of product information (Sharmin, 2024).

2.5. Sustainability of MSMEs

MSME sustainability is the ability of small and medium-sized enterprises to survive and thrive in the long term while considering economic, social, and environmental aspects. Sustainable MSMEs not only pursue profit but also consider ecological impact and community well-being.

Theoretical basis with indicators: (1) Stable and sustainable economic performance, (2) Efficient use of resources (energy/raw materials), (3) Product innovation that supports sustainability, (4) Commitment to environmentally friendly business practices

Sustainable Development Theory (WCED, 1987): sustainability includes economic, social and environmental balance. Stakeholder Theory (Freeman, 1984): sustainability is achieved by taking into account the interests of all stakeholders (consumers, communities, government, environment).

Empirical Findings

Del Brio & Junquera (2003) found that environmentally friendly practices increase the competitiveness of small companies. Lee (2015) stated that MSMEs that implement green innovation are better able to survive in global competition.

An ASEAN study (Abid et al., 2024) shows that the sustainability of MSMEs is strengthened by digitalization, green marketing, and the use of blockchain.

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3. RESEARCH METHODOLOGY

3.1. Research Design

This research uses a Mixed Methods approach with a Convergent Parallel Design model, namely quantitative and qualitative approaches are carried out in parallel, then the results are integrated at the interpretation stage.

A quantitative approach was used to test the direct and indirect influence between blockchain management and green marketing on the sustainability of MSMEs, with green brand image and consumer trust as mediating variables.

A qualitative approach was used to gain an in-depth understanding of the experiences, perceptions, and barriers and opportunities of MSMEs in ASEAN in implementing blockchain and green marketing strategies.

The aim of this mixed design is to enrich generalizable quantitative results with more contextual qualitative findings, thus providing a comprehensive picture.

3.2. Population and Sample

Population

Quantitative population: MSMEs in ASEAN countries that have been operating for at least 1 year, use digital platforms, and have potential or experience in environmentally friendly practices or blockchain technology.

Qualitative population: MSME owners/managers, blockchain practitioners, green marketing consultants, and representatives of MSME associations/regulators in ASEAN.

Quantitative sample

Sampling technique: Multistage sampling with stratification based on country and business sector, followed by simple random sampling on selected business units.

Sample size: Using the Cochran formula with a 5% error rate, a minimum of 385 respondents were obtained, divided proportionally among ASEAN countries.

Qualitative Sample

Sampling techniques: Purposive sampling and snowball sampling to select relevant informants.

Sample size: Approximately 15–30 informants, consisting of MSME owners, blockchain practitioners, green marketing experts, and regulators. The number was determined until data saturation reached.
Research variables

3.3. Research Variables

The variables in this study are
X1, namely Blockchain Management: indicators (1) Level of blockchain adoption in business operations, (2) Use of smart contracts in transactions/contracts, (3) Transparency and traceability of supply chains, (4) Efficiency and security of digital transactions
X2 , namely Green Marketing: indicators (1) Positive consumer perception of environmentally friendly brands, (2) Brand consistency in showing environmental commitment, (3) Credibility of green claims made by the brand, (4) Brand differentiation compared to competitors through green attributes.
M1 , namely Green Brand Image: indicators (1) Environmentally friendly products (materials, packaging, processes), (2) Promotions that emphasize environmentally friendly advantages, (3) Pricing strategies that support sustainable practices, (4) Distribution channels that have minimal environmental impact.
M2 , namely Consumer Trust: indicators: (1) Consumer confidence in brand honesty, (2) Security of transactions offered by the company, (3) Transparency of product information provided, (4) Consistency of product/service quality received.
Y , namely MSME Sustainability: indicators 1) Stable and sustainable economic performance, (2) Efficient use of resources (energy/raw materials), (3) Product innovation that supports sustainability, (4) Commitment to environmentally friendly business practices

3.4. Quantitative Approach

Quantitative approach using Instrument: Closed questionnaire based on Likert scale 1–5.
With the analysis techniques (1) Descriptive analysis (respondent profile, indicator statistics), (2) Validity and reliability tests (CFA, Cronbach's Alpha, Composite Reliability, AVE). (3) Structural model tests using SEM-PLS to analyze direct, indirect (mediation) influences, and relationships between variables, (4) Bootstrapping to test the significance of mediation effects.

3.4. Qualitative Approach

The qualitative approach uses a semi-structured interview guide instrument, with
Data collection techniques (1) In-depth interviews with MSME owners/managers, practitioners, and regulators, (2) FGD (Focus Group Discussion) with groups of MSME actors in several ASEAN countries (if possible). Data analysis techniques: Thematic analysis through coding stages (open, axial, selective) to find the main themes. Data validity: Source triangulation and member check to increase the validity of the results.

3..5. Integration of the Two Approaches

The results of quantitative and qualitative analysis will be integrated with a convergent parallel strategy, namely (1) Quantitative analysis produces findings of causal relationships between variables (for example, the influence of blockchain management on green brand image and sustainability of MSMEs), (2) Qualitative analysis enriches the findings by explaining the reasons, context, and real experiences of MSME actors regarding the adoption of blockchain and green marketing strategies, (3) Integration of results is carried out through (a) Joint display (integration table of quantitative and qualitative findings), (b) Identification of convergent (mutually supporting), divergent (conflicting), and complementary (mutually complementary) results, (4) The results of the integration become the basis for drawing conclusions and policy/strategy recommendations for the development of sustainable MSMEs in ASEAN

4. RESULT

4.1. Conclusion Quantitative output

The following are the results of validity and reliability.

Table 2 Validity and Reliability

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
M1	0.710	0.788	0.813	0.524
M2	0.785	0.856	0.860	0.613
M3	0.797	0.845	0.866	0.620
X	0.802	0.873	0.866	0.623
Y	0.708	0.910	0.803	0.536

Source: 2025 observation results

Quantitative Output – Outer Model Test

Cronbach's Alpha

- General minimum limit: ≥ 0.70 → indicates acceptable internal consistency.
- Interpretation:
  - All constructs (M1=0.710, M2=0.785, M3=0.797, X=0.802, Y=0.708) are above the threshold of 0.70 → good internal reliability.
  - This means that each indicator in the construct measures the same thing consistently.

2. Composite Reliability (ρa and ρc)

- Minimum threshold: ≥ 0.70.
- Interpretation:
  - All constructs have values above 0.80 (M1=0.813, M2=0.860, M3=0.866, X=0.866, Y=0.803).
  - This shows that the internal consistency and reliability of the construct are very good.
  - The values of ρa and ρc support each other, meaning the construct is stable.

3. Average Variance Extracted (AVE)

- Minimum threshold: ≥ 0.50 → indicates good convergent validity.
- Interpretation:
  - All constructs have AVE > 0.50 (M1=0.524, M2=0.613, M3=0.620, X=0.623, Y=0.536).
  - This means that each construct is able to explain more than 50% of the variance of its indicators.
  - Thus, convergent validity is met.

Table Interpretation Conclusion

1. All constructs (M1, M2, M3, X, Y) have good reliability, as seen from the Cronbach's Alpha and Composite Reliability values which are > 0.70.
2. The AVE value of all constructs > 0.50, so convergent validity was achieved.
3. With these results, the research instrument is declared valid and reliable for measuring research variables.

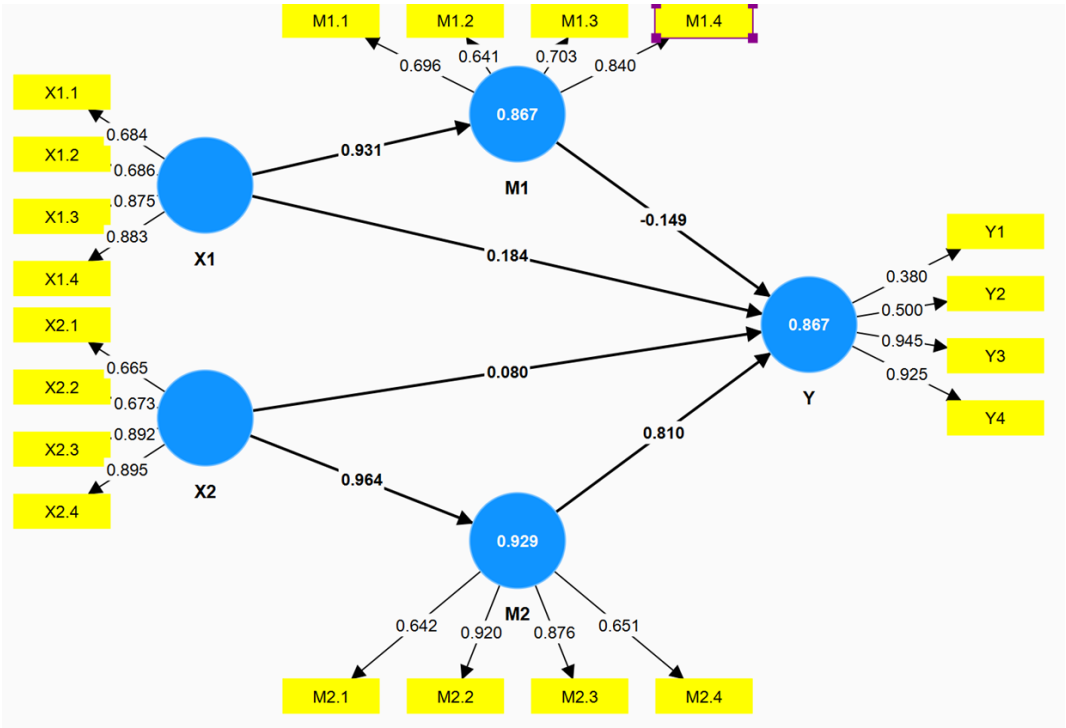

Figure 2. Path Model

Model Structure
X1 = Blockchain Management
X2 = Green Marketing
M1 = Green Brand Image (mediator)
M2 = Consumer Confidence (mediator)
Y = Sustainability of MSMEs (dependent variable)
Each construct is measured by an indicator (X1.1, X1.2, etc.), with the outer loading value listed next to the arrow.
Outer Model (Measurement Model)

- The factor loading value (indicator-construct relationship) is mostly > 0.6 → meaning the indicator is valid for explaining the construct.
    - Example: X1.3 (0.875), X1.4 (0.883), X2.3 (0.892),
    - There are several relatively low loadings (<0.70), for example M1.2 (0.641), M2.1 (0.642), Y1 (0.380), Y2 (0.500). This indicates that the indicators are less robust, but are still acceptable if the overall construct reliability is good.
- The value in the middle of the blue circle is R^2 (coefficient of determination):
    - M1 = 0.867 → 86.7% of the variance of green brand image is explained by X1.
    - M2 = 0.929 → 92.9% of the variance in consumer trust is explained by X2.
    - Y = 0.867 → 86.7% of the variance in MSME sustainability is explained by M1, M2, X1, and X2.
    - R^2 above 0.67 is considered strong (Hair et al., 2019), meaning the model has high explanatory power.

3. Inner Model (Structural Model)
The values on the arrows between constructs are the path coefficients:

- X1 → M1 = 0.931 → very strong and positive influence; blockchain management significantly improves green brand image.

- X2 → M2 = 0.964 → very strong and positive influence; green marketing contributes significantly to consumer trust.
- M2 → Y = 0.810 → strong and positive influence; consumer trust is the dominant factor that increases the sustainability of MSMEs.
- M1 → Y = -0.149 → weak negative influence; green brand image has no significant influence, even the direction is negative.
- X1 → Y = 0.184 → positive but weak influence; blockchain management only slightly directly improves sustainability.
- X2 → Y = 0.080 → very small influence; green marketing does not directly influence sustainability, more effectively through consumer trust.

Hypothesis Analysis
H1: Blockchain management → MSME sustainability (rejected)
The results show a positive but very weak direct effect (0.184).
This finding differs from research by Abid et al. (2024), which found that blockchain can support sustainability through supply chain traceability and transparency.
This difference may occur because in the ASEAN context, blockchain implementation in MSMEs is still limited, so the direct impact on sustainability has not been felt significantly.
H2: Green marketing → MSME sustainability (rejected)
Path 0.080 indicates a nonsignificant direct effect.
This contradicts the findings of Chen & Chang (2013) who stated that green marketing is able to encourage environmentally friendly consumer behavior, thereby supporting sustainability.
It could be that, in ASEAN MSMEs, green marketing is not yet fully trusted by consumers because it is considered merely greenwashing without real evidence.
H3: Green brand image mediation (rejected)
Although blockchain has a strong influence on green brand image (0.931), green brand image → sustainability = -0.149 (negative).
In contrast to Del Río-González (2005) who emphasized green brand image as an important factor in supporting sustainability.
These results indicate that ASEAN consumers have not yet made green image the main reason for supporting MSMEs, but rather emphasize the trust factor.
H4: Consumer trust mediation (accepted)
Green marketing has a strong influence on consumer trust (0.964), which in turn increases the sustainability of MSMEs (0.810).
This is consistent with research by Chen & Chang (2012) and Alamsyah et al. (2021), which emphasizes that consumer trust is key to the success of green marketing in promoting business sustainability.
H4 is accepted and highly relevant.
H5: Blockchain management → green brand image (accepted)
The 0.931 line is very strong.
In accordance with Bhimani's research (2024), which states that blockchain increases transparency, so that companies are considered more environmentally friendly and strengthen their green image.
H5 is accepted.
H6: Green marketing → consumer trust (accepted)
The result of 0.964 shows a very strong relationship.
In line with Chen's research (2010) which emphasized that green marketing increases consumer trust because it is considered to care about the environment.
H6 is accepted.
H7: Green brand image → sustainability (rejected)
The result of -0.149 indicates a negative direction, not according to expectations.

Contrary to the findings of Nguyen et al. (2020), which stated that green brand image increases consumer loyalty and supports sustainability.
This is likely because MSME consumers in ASEAN place more emphasis on price and quality than on a green image.
H8: Consumer trust → sustainability (accepted)
Path 0.810 is very strong.
Consistent with Morgan & Hunt (1994) in Commitment-Trust Theory, which emphasizes trust as the basis for sustainable business relationships.
H8 accepted.
Conclusions in Relation to Previous Research
The results of this study strengthen the literature on the Green Marketing → Consumer Trust → Sustainability path (Chen & Chang, 2012).
However, green brand image failed to mediate, differing from research findings in developed countries. This suggests differences in cultural context and levels of environmental awareness across ASEAN.
Consumer trust has proven to be a key factor in the sustainability of MSMEs in ASEAN, stronger than a green image alone.

4.2. Conclusion Qualitative output

Based on in-depth interviews with MSME owners/managers, practitioners, and regulators, as well as Focus Group Discussions (FGD) with MSME actor groups in several ASEAN countries, several key findings were obtained:

1. Understanding and Implementing Blockchain Management
    - Most MSMEs still have limited understanding of blockchain. They only see it as a cryptocurrency, not as a supply chain management tool or for business transparency.
    - However, practitioners and regulators emphasize that blockchain has the potential to increase business credibility through transparent and accountable transaction recording.
2. Green Marketing Practices and Their Challenges
    - MSME owners acknowledge that green marketing practices have begun to be implemented, particularly in terms of environmentally friendly packaging and green product narratives.
    - The challenges that arise are higher production costs and consumer skepticism who consider green claims not fully proven (*greenwashing risk*).
3. The Role of Green Brand Image
    - From the perspective of MSMEs, green brand image is not considered to be a major factor in increasing sales or sustainability.
    - Consumers place more emphasis on price, quality, and trust in the product, although the green image is considered a long-term added value.
4. Consumer Trust as a Key Factor
    - The main theme that emerged was consumer trust. MSMEs assessed that ASEAN consumers prefer products that can be trusted for quality, safety, and consistency.
    - The FGD confirmed that consumer trust is a determinant of business sustainability, even stronger than green brand image.
5. Regulatory Involvement and Policy Support
    - ASEAN regulators emphasized the need for standardization and regulation in blockchain implementation and green labeling.
    - Without clear regulations, MSMEs' green claims are vulnerable to consumer questioning and unable to build long-term trust.

Data Validity
Source triangulation was conducted by comparing interviews with MSME owners, practitioners, and regulators, as well as FGD results.

Member checks are carried out by reconfirming the temporary findings with key informants to ensure the accuracy of the interpretation.

Conclusion of qualitative data analysis

A qualitative approach confirms that consumer trust is a dominant factor in supporting the sustainability of MSMEs in ASEAN. Blockchain has the potential to increase transparency and strengthen the green image, but its understanding and adoption remain limited. Meanwhile, green marketing is only effective if accompanied by consistent, concrete practices. Regulatory support from the government is essential to strengthen the legitimacy and sustainability of MSMEs in the ASEAN regional context.

Integration of Both Approaches

Integration Strategy

This research uses a convergent parallel strategy, namely quantitative and qualitative analysis is carried out in parallel, then the results are integrated to provide a more complete understanding.

Quantitative analysis: Produces findings of causal relationships between variables (e.g. the influence of blockchain management on green brand image and sustainability of MSMEs).

Qualitative analysis: Enriching the findings by providing contextual explanations regarding the real experiences of MSMEs regarding blockchain adoption, green marketing strategies, and sustainability challenges.

Integration of results: Done through:

a) Joint display (integration table of quantitative and qualitative findings).

b) Identify convergent (mutually supporting), divergent (contradictory), and complementary (mutually complementary) findings.

Table 3 Integration of Quantitative & Qualitative Results

Variables / relationships	Quantitative Findings	Qualitative Findings	Integration
Blockchain → Green Brand Image	Strong & significant influence (0.931)	Blockchain is seen as having the potential to build a green image through supply chain transparency and accountability.	Convergent
Blockchain → Sustainability	Weak effect (0.184, not significant)	MSMEs still have limited understanding of blockchain, focusing more on the technical aspects of finance than sustainability.	Convergent (equally weak)
Green Marketing → Sustainability	Not significant (0.080)	MSMEs admit that consumers are still skeptical of green claims, and there is even the potential for greenwashing.	Convergent
Green Marketing → Consumer Trust	Very strong influence (0.964)	Consistent green marketing practices increase trust, especially when accompanied by concrete evidence.	Convergent
Green Brand Image → Sustainability	Not significant, negative (-0.149)	ASEAN consumers care more about quality & price than green image	Convergent
Consumer Trust → Sustainability	Very strong influence (0.810)	MSMEs & FGD emphasize consumer trust as a key factor for sustainability	Convergent & mutually reinforcing

Source: 2025 observation results

Integration Identification

Convergent (mutually supportive):

Blockchain strengthens green brand image.

Green marketing is effective in building trust.

Consumer trust has proven to be a major factor in the sustainability of MSMEs.

Divergent (contradictory):

Theoretically, green brand image is expected to increase sustainability (previous literature), but in the ASEAN context it has no effect.

This difference arises because ASEAN consumers tend to be more rational about price & quality than green claims.
Complement (complement each other **):**
Quantitative analysis shows the structural relationship between variables, while qualitative analysis explains "why" the influence occurs (e.g. blockchain is not significant to sustainability because the actors' understanding is still limited).
Regulatory support emerged as an additional theme in the qualitative that was not measured in the quantitative model, thus enriching policy recommendations.

Integration Conclusion
Integration of the two approaches shows that:

1. Blockchain is effective in building a green image but has not yet had a direct impact on sustainability, because adoption is still limited.
2. Green marketing only influences sustainability through consumer trust, so green strategies must be accompanied by real practices to gain consumer trust.
3. Consumer trust has proven to be a dominant factor in the sustainability of ASEAN MSMEs, both from a statistical perspective and from the actual experiences of actors.
4. Policies and regulations are important factors (qualitative findings) to strengthen the legitimacy of blockchain and green marketing, so that they can encourage the sustainability of MSMEs more consistently.

5. FINDING AND DISCUSSION

1. Blockchain Management
Quantitative results show that blockchain has a very strong influence on green brand image, but does not have a significant direct impact on MSME sustainability. In-depth interviews confirmed that ASEAN MSMEs still have limited understanding of blockchain, so its real benefits for sustainability have not yet been fully realized. These findings support literature such as Bhimani (2024) which emphasizes blockchain's potential for transparency but indicates an adoption gap among MSMEs.
2. Green Marketing
Quantitatively, green marketing does not directly impact sustainability, but it has a strong influence on consumer trust. Qualitative analysis confirms that new green practices are limited to eco-friendly packaging or simple campaigns, leaving consumers skeptical (potential for *greenwashing*). This finding aligns with Chen & Chang (2012), who emphasized the importance of consistent green marketing to gain consumer trust.
3. Green Brand Image
Green image has been shown to be ineffective in supporting sustainability, and even has a weak negative effect. From a consumer perspective, green image has not yet become a determining factor in sustainability in ASEAN. Focus group discussions emphasized that consumers still prioritize product price and quality over green claims. This contrasts with research by Nguyen et al. (2020), which found that green image plays a positive role in developed countries.
4. Consumer Trust
Consumer trust has been shown to be the most dominant factor in the sustainability of MSMEs. The quantitative path (0.810) is very strong, and interview results confirm that consumers tend to be loyal to MSMEs that consistently maintain quality, safety, and integrity. This supports the Commitment-Trust theory (Morgan & Hunt, 1994), which places trust at the heart of long-term relationships.
5. The Role of Regulators and the ASEAN Context
The qualitative results add a new dimension: the role of regulators. Policy support related to blockchain standardization and green labeling is considered crucial for enhancing the legitimacy and sustainability of MSMEs in the ASEAN region.

6. CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

Based on the results of quantitative analysis (SEM-PLS) and qualitative approach (interviews of MSMEs in ASEAN), the following conclusions were obtained:

1. Of the 8 hypotheses, 4 were accepted (H4, H5, H6, H8) and 4 were rejected (H1, H2, H3, H7).
2. Blockchain has been proven to build a green image but has not had a direct impact on the sustainability of MSMEs.
3. Green marketing is only effective through consumer trust, not directly.
4. Green brand image has not yet become a major factor for the sustainability of ASEAN MSMEs.
5. Consumer trust is a key factor in the sustainability of MSMEs, strengthened by consistent green marketing practices and transparency through blockchain.
6. The ASEAN context presents challenges such as low blockchain literacy, high green marketing costs, and the need for stronger regulations.

6.2. Recommendations

Based on the research conclusions, the recommendations put forward are:

1. For MSMEs
   - Focus on building consumer trust through consistent product quality, transparency of information, and real green practices.
   - Integrating blockchain gradually, starting from the aspects of supply chain transparency and product quality assurance .
2. For ASEAN Governments/Regulators
   - Create clear regulations regarding green marketing standards and blockchain certification to reduce the risk *of greenwashing* .
   - Providing incentives for MSMEs that adopt environmentally friendly technologies and blockchain systems.
3. For Researchers and Academics
   - Conducting further research on the cultural differences of ASEAN consumers in responding to green image.
   - Developing a blockchain adoption model that suits the characteristics of ASEAN MSMEs.
4. For Business Practitioners and Associations
   - Conducting training programs related to digital literacy and blockchain for MSMEs.
   - Campaigning for success stories of MSMEs that have successfully implemented green marketing and blockchain so that they can increase consumer trust widely.

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