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Green Accounting and Intellectual Impact on MSMEs Sustainability in Medan

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Abstract

This study examines the influence of green accounting and green intellectual capital on MSME sustainability in Medan City. Environmental pressures and regulatory requirements necessitate sustainable business practices among small enterprises. A quantitative approach using survey methodology was employed with 120 MSMEs from trade, service, and manufacturing sectors. Data were collected through structured questionnaires and analyzed using Partial Least Square Structural Equation Modeling (PLS-SEM). Results demonstrate that green accounting significantly influences MSME sustainability ($\beta = 0.332$, $p < 0.001$), indicating that environmental-based financial recording enhances resource efficiency and regulatory compliance. Green intellectual capital shows stronger influence ($\beta = 0.430$, $p < 0.001$), highlighting the strategic role of environmental knowledge and innovation capabilities. The model explains 45.7% of sustainability variance. These findings suggest that integrating green accounting practices with environmental intellectual capital development can significantly enhance MSME competitiveness and sustainability performance.

Keywords: Green Accounting, Green Intellectual Capital, Sustainability, MSMEs, Environmental Management.

Introduction

Sustainability issues have gained prominence in modern business as awareness of economic activities' environmental impact increases. Micro, Small, and Medium Enterprises (MSMEs) are increasingly required to integrate sustainability principles into their operations, despite facing unique challenges in environmental management. MSMEs contribute significantly to Indonesia's economy, representing 60.5% of Gross Domestic Product (GDP) and employing over 97% of the workforce (BPS, 2024). However, many MSMEs struggle with environmental impact management, including waste production, inefficient energy consumption, and limited awareness of environmentally friendly business practices.

Green accounting emerges as a relevant approach to address these challenges by integrating environmental costs and benefits into financial reporting systems (Putri & Rahman, 2023). This concept not only helps companies comply with regulations but also promotes resource efficiency, reduces operational costs, and enhances corporate image among environmentally conscious consumers. Additionally, green intellectual capital, encompassing environmental knowledge, skills, and innovation capabilities, significantly influences sustainability implementation success (Chen, 2011).

Medan City, as North Sumatra's largest economic center, hosts over 170,000 MSMEs across various sectors including trade, culinary, manufacturing, and services (Medan City Cooperatives and SMEs Service, 2024). However, many MSMEs in the city face constraints in implementing environmentally friendly practices. For instance, some food processing industries in Medan reportedly discharge cooking oil waste and plastic directly into water channels, causing pollution and community complaints. Low adoption of green accounting and

limited green intellectual capital management capabilities constitute primary barriers to sustainability achievement.

Previous research has examined relationships between green accounting, green intellectual capital, and business sustainability. Yadiati and Mubarok (2017) found that green accounting implementation significantly contributes to environmental and economic performance improvement. Chen (2011) demonstrated that green intellectual capital plays a crucial role in creating sustainability-based competitive advantage. Alhaddi (2015) showed that integrating environmental aspects into business strategy enhances long-term performance. However, most studies focused on large companies or specific industries, leaving research on MSMEs in urban contexts like Medan relatively limited.

This study aims to empirically examine the influence of green accounting and green intellectual capital on MSME sustainability in Medan City. The results are expected to enrich literature on environmental accounting and green intellectual capital while providing strategic recommendations for MSME actors, local government, and policy makers.

Literature Review

Green accounting represents an integrated approach incorporating environmental factors such as waste management costs, pollution control, and resource conservation into organizational financial statements. This approach enhances transparency, operational efficiency, and supports environmentally oriented decision-making (Etty et al., 2024). International studies published in the Journal of Cleaner Production and Ecological Economics demonstrate that organizations implementing green accounting typically report reduced energy consumption and waste generation while gaining market recognition from environmentally conscious consumers.

The theoretical foundation for green accounting rests on stakeholder theory and legitimacy theory. Stakeholder theory suggests that companies must consider environmental impacts on various stakeholder groups, while legitimacy theory indicates that environmental reporting helps maintain social acceptance and operational license. These theoretical perspectives support the notion that green accounting practices contribute to sustainable business performance.

Green intellectual capital (GIC) encompasses green human capital (environmental knowledge and skills), green structural capital (systems and culture supporting green innovation), and green relational capital (stakeholder relationships for environmental objectives). Research demonstrates that GIC plays an important role in developing green innovation and environmental performance (Hassan et al., 2020). High GIC levels indicate superior green innovation capabilities, including ambidextrous innovation combining exploration and exploitation, directly impacting environmental performance improvement.

Studies published in the Sustainability journal highlight GIC as an intangible resource enabling companies to develop more adaptive and responsive environmental strategies to external pressures, including customer demands and environmental regulations. The Resource-Based View (RBV) theory provides theoretical support for GIC's strategic importance, suggesting that rare, valuable, inimitable, and non-substitutable environmental capabilities create sustainable competitive advantages.

The relationship between green accounting, GIC, and sustainability is conceptualized through the Natural Resource-Based View (NRBV), which extends RBV theory to include environmental considerations. NRBV suggests that environmental capabilities, including green accounting practices and intellectual capital, constitute

strategic assets that can generate sustainable competitive advantages while contributing to environmental protection.

Based on theoretical foundations and empirical evidence, this study proposes:

H1: Green accounting positively influences MSME sustainability

H2: Green intellectual capital positively influences MSME sustainability.

Methods

This study employs a quantitative approach with explanatory research design, aiming to test causal relationships between Green Accounting (GA), Green Intellectual Capital (GIC), and MSME Sustainability variables. This design was chosen because the study focuses on hypothesis testing based on established theory and previous research, using statistical analysis as the primary testing tool.

The population consists of all Micro, Small, and Medium Enterprises (MSMEs) operating in Medan City with at least three years of business experience. Purposive sampling technique was used with the following criteria: (1) MSMEs implementing accounting practices according to basic standards; (2) MSMEs having activities or policies related to environmental sustainability; (3) Owners/managers willing to complete research questionnaires. The sample size was determined using the Slovin formula with a 5% error rate, resulting in 120 respondents from trade, service, and manufacturing sectors.

Green Accounting is measured using indicators of environmental cost reporting, environmentally friendly investment, and environmental information disclosure (Burritt & Schaltegger, 2010). Green Intellectual Capital is measured based on Human Capital, Structural Capital, and Relational Capital dimensions oriented toward environmental concerns (Chen, 2008). MSME Sustainability is measured using economic, social, and environmental sustainability indicators following the Triple Bottom Line framework (Elkington, 1998).

Data collection techniques included: (1) Closed questionnaires using a 1-5 Likert scale; (2) Brief interviews for response clarification; (3) Documentation related to financial reports and MSME environmental activities. All instruments underwent validity and reliability testing before data collection.

Data were analyzed using Partial Least Square Structural Equation Modeling (PLS-SEM) with SmartPLS software through: (1) Outer Model Test including convergent validity, discriminant validity, and composite reliability; (2) Inner Model Test including determination coefficient (R^2), path coefficient significance testing, and predictive relevance (Q^2); (3) Hypothesis Testing through bootstrapping with 5% significance level.

Results and Discussion

Measurement Model Assessment

Convergent Validity

Factor loading analysis indicated that all indicators achieved loading values exceeding 0.7 after eliminating items with insufficient loadings. Average Variance Extracted (AVE) values for all constructs exceeded 0.5: Green Accounting (0.643), Green Intellectual Capital (0.634), and MSME Sustainability (0.650), confirming convergent validity.

Discriminant Validity

Cross-loading analysis demonstrated that each indicator loaded higher on its intended construct than on other constructs. The Fornell-Larcker criterion was satisfied, with AVE square roots exceeding inter-construct correlations: Green Accounting (0.802), Green Intellectual Capital (0.796), and MSME Sustainability (0.806).

Composite Reliability

All constructs demonstrated adequate reliability with Composite Reliability values exceeding 0.7: Green Accounting (0.915), Green Intellectual Capital (0.912), and MSME Sustainability (0.918). Cronbach's Alpha values also exceeded 0.6, confirming internal consistency reliability.

Structural Model Assessment

The structural model achieved adequate explanatory power with $R^2 = 0.457$, indicating that green accounting and green intellectual capital explain 45.7% of MSME sustainability variance. This represents moderate explanatory capacity according to Cohen's (1988) guidelines.

Hypothesis Testing Results

Table 1. Path Coefficient Results

Relationship	Original Sample (β)	Standard Deviation	T-Statistics	P-Values	Decision
Green Accounting → Sustainability	0.332	0.074	4.478	0.000	Supported
Green Intellectual Capital → Sustainability	0.430	0.067	6.413	0.000	Supported

H1: Green Accounting → MSME Sustainability

Results support H1 with $\beta = 0.332$, $t = 4.478$, $p < 0.001$. This indicates that each unit increase in green accounting implementation increases MSME sustainability by 0.332 points. The positive relationship demonstrates that environmental-based financial recording and reporting enhance resource efficiency and regulatory compliance, supporting long-term sustainability.

H2: Green Intellectual Capital → MSME Sustainability

Results support H2 with $\beta = 0.430$, $t = 6.413$, $p < 0.001$, showing stronger influence than green accounting. Each unit increase in green intellectual capital increases MSME sustainability by 0.430 points. This finding emphasizes the strategic importance of environmental knowledge, skills, and innovation capabilities in driving MSME competitiveness and sustainability.

Discussion

The finding that green accounting significantly influences MSME sustainability aligns with previous research (Al-Homaidi et al., 2022) showing that green accounting practices improve MSMEs' ability to manage resources and strengthen environmental performance, particularly when combined with strong environmental orientation.

Green accounting provides systematic frameworks for identifying, measuring, and reporting environmental costs and benefits, enabling better decision-making and resource allocation.

Green intellectual capital's stronger influence on sustainability supports resource-based view theory (Barney, 1991), suggesting that environmental knowledge, skills, and innovation capabilities constitute strategic assets driving MSME competitiveness and sustainability (Kumar & Rahman, 2019). The superior effect of GIC compared to green accounting indicates that human capital and innovation capabilities may be more critical for sustainability achievement than formal accounting practices alone.

These findings reinforce evidence that green innovation serves as a key mediator between GIC and sustainability. Recent studies (Ahmed et al., 2023) report that GIC encourages green innovation in MSMEs, subsequently improving environmental performance significantly. The combination of environmental knowledge and systematic accounting practices creates synergistic effects that enhance overall sustainability performance.

From the Natural Resource-Based View (NRBV) perspective, results support the idea that good environmental capabilities in measurement (green accounting) and intellectual capital (GIC) constitute strategic assets that can strengthen sustainability-based competitive advantages. The significant effects of both variables suggest their complementary nature in achieving comprehensive sustainability outcomes.

For MSMEs, strengthening green accounting implementation through internal reporting systems and waste management training is crucial. Additionally, developing GIC through human resource capacity improvement and product innovation will strengthen business resilience in increasingly competitive markets prioritizing sustainability. The integration of both approaches can create sustainable competitive advantages while contributing to environmental protection.

Conclusion

This study demonstrates that implementing green accounting and managing green intellectual capital significantly impact MSME sustainability in Medan City. Green accounting serves not only as a financial reporting instrument but also as a strategic means to increase resource efficiency, reduce environmental impact, and strengthen business reputation. Green intellectual capital, encompassing environmental knowledge, skills, and innovation capabilities, proves capable of driving sustainable innovation and increasing MSME competitiveness.

The integration of both approaches shows synergy capable of creating economic value while maintaining environmental sustainability. Practically, these results recommend that MSME actors in Medan City enhance their capacity in implementing green accounting and optimally utilizing green intellectual capital. Local governments and supporting institutions should provide training, incentives, and regulations encouraging transformation toward sustainable business practices.

The study's limitations include cross-sectional data collection, which cannot capture long-term dynamics, and focus on a single geographic location limiting generalizability. Future research should consider longitudinal designs and multi-location comparisons to strengthen findings' robustness. Additionally, investigating mediating mechanisms between green practices and sustainability outcomes would provide deeper insights into causal relationships.

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