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ANALYSIS OF THE APPLICATION OF GREEN DIGITAL ACCOUNTING IN IMPROVING THE SUSTAINABILITY PERFORMANCE OF MSMES IN THE CULINARY SECTOR IN MEDAN CITY

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Abstract: *This study aims to analyze how the implementation of Green Digital Accounting (GDA) can enhance sustainability performance among Micro, Small, and Medium Enterprises (MSMEs) in the culinary sector of Medan City. GDA integrates digital technology with sustainability principles to create an efficient, transparent, and environmentally responsible financial management system. This research employs a qualitative approach with a multiple case study design, involving three selected culinary MSMEs as research subjects. Data were collected through semi-structured interviews, direct observations of business operations, and document analysis. The data were then analyzed using thematic analysis with data triangulation to ensure the validity and reliability of the findings. The results indicate that the adoption of GDA improves operational efficiency, financial reporting accuracy, and sustainable resource management. The use of digital applications enables real-time recording and reporting, reduces resource waste, and enhances environmental transparency to stakeholders. In addition, green financing support plays an essential role in encouraging MSMEs to invest in eco-friendly technologies and accelerate their digital transformation. Overall, this study concludes that Green Digital Accounting contributes not only to economic efficiency but also to social responsibility and environmental preservation, positioning it as a key strategy to promote an inclusive and sustainable green economy in Indonesia.*

Keywords: *green digital accounting, sustainability, MSME, green financing*

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Introduction

The rapid development in the digital era has fundamentally transformed the way businesses operate worldwide, creating extraordinary opportunities for increased efficiency and innovation. Alongside this transformation, there has also been a growing global awareness of the importance of sustainable development, as reflected in the United Nations' Sustainable Development Goals (SDGs). Among the 17 interrelated goals, several are directly relevant to business practices, including SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). These goals emphasize the vital role of businesses in promoting inclusive economic growth while minimizing negative environmental impacts.

Micro, Small, and Medium Enterprises (MSMEs) serve as the backbone of Indonesia's economy. In major cities such as Medan, the culinary sector is rapidly growing and significantly contributes to community welfare and the formation of local cultural identity. However, MSMEs continue to face challenges in implementing sustainable business practices due to limited resources, technical capabilities, and low environmental awareness. Traditional accounting systems commonly used by MSMEs, although important for financial reporting, fail to capture the social and environmental impacts of business activities. This limitation makes it difficult for MSMEs to measure, manage, and report their contributions to sustainable development, thereby hindering their alignment with national and global sustainability agendas.

The concept of Green Digital Accounting (GDA) emerges as a solution to bridge this gap. GDA integrates environmental and social performance indicators into traditional financial accounting systems by utilizing digital technology for data collection, analysis, and reporting. Through the application of GDA, culinary MSMEs in Medan can obtain a more comprehensive view of their operations, identify opportunities for resource efficiency such as reducing food waste or optimizing energy use, and enhance supply chain transparency to minimize ecological impacts. The implementation of this concept not only supports SDG 12 through responsible consumption and production practices but also contributes to SDG 13 by reducing emissions and waste. Furthermore, improved transparency and operational efficiency strengthen business competitiveness and sustainability in the long term, in line with SDG 8, which emphasizes inclusive and sustainable economic growth.

Recent studies indicate that the adoption of sustainable production systems brings significant benefits to culinary MSMEs, not only in mitigating environmental impacts but also in improving operational efficiency (Alfarizi et al., 2023). This finding aligns with the essential role of Accounting Information Systems (AIS) in helping MSMEs record transactions accurately and produce reliable financial reports to support decision-making (Laia et al., 2024). However, the level of AIS implementation among culinary MSMEs in Medan remains relatively low, necessitating innovation through the adoption of green digital accounting to improve resource management and enhance sustainability performance.

Research conducted by Izzati, Kurnia Ningsih, and Lubis (2025) reinforces this perspective by showing that the use of digital-based financial applications positively and significantly affects the performance of MSMEs in Medan Johor District. Through applications such as *Buku Warung*, MSME owners can manage finances more efficiently, from transaction recording to real-time cash flow reporting. This digitalization of accounting not only improves accuracy and efficiency but also enhances business transparency and accountability. However,

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the study also highlights barriers such as limited digital literacy and inadequate internet infrastructure, indicating the need for government support and continuous training to ensure the optimal implementation of digital technology (Izzati et al., 2025)

In addition to strengthening digitalization, the implementation of sustainability principles can also be facilitated through green financing approaches. According to Hakim, Ar Rahmah, and Harahap (2024), green financing provides opportunities for MSMEs in Medan to access funding for environmentally friendly projects such as energy efficiency, waste management, and low-carbon technology adoption. The study found that MSMEs receiving green financing experienced improvements in operational cost efficiency and reductions in carbon emissions. However, low awareness and understanding of green financing among MSME owners, as well as complex application procedures, remain significant obstacles. Therefore, collaboration among the government, financial institutions, and business actors is necessary to develop an inclusive and accessible sustainable financing ecosystem (Hakim et al., 2024).

The integration of green digital accounting practices and green financing becomes a crucial strategy for culinary MSMEs to enhance performance and strengthen their contributions to sustainable development goals. Beyond promoting economic efficiency, this approach encourages transparency, social responsibility, and compliance with environmental regulations. Thus, digital-based green practices not only help reduce operational costs but also open new market opportunities by enhancing environmentally friendly brand images in the eyes of consumers (Alfarizi & Sari, 2024).

Culinary MSMEs that implement the concept of green digital accounting are able to maximize resource utilization, reduce operational costs, and increase efficiency throughout their supply chains. As explained by Sari et al. (2023), digital platforms assist entrepreneurs in managing inventories, allocating resources, and monitoring waste in a more structured and efficient manner. Consequently, the application of green digital accounting not only improves economic efficiency but also enhances transparency regarding environmental practices to stakeholders (Risakotta & Sapulette, 2024).

Other studies indicate that adopting green approaches within accounting systems can enhance competitiveness and expand market acceptance, particularly as consumers increasingly prioritize sustainability when choosing products (Reniati & Faisal, 2024). Moreover, culinary MSMEs that integrate eco-friendly innovations into their accounting systems can minimize cost inefficiencies while improving profitability (Nursyabani et al., 2023). This reinforces the idea that financial and sustainability aspects are not separate, but rather complementary and mutually reinforcing in creating sustainable business growth (Latifah & Soewarno, 2023).

Overall, the implementation of green digital accounting among culinary MSMEs in Medan holds great potential to simultaneously improve both economic and environmental performance. This initiative aligns with the spirit of the SDGs, which position sustainability as the foundation of economic development. This study aims to explore how the integration of sustainability-based accounting practices can enhance environmental outcomes and strengthen the economic resilience of culinary MSMEs. The findings of this research are expected to serve as the basis for developing a strategic framework that can be adapted by MSMEs across various sectors and provide guidance for policymakers in promoting green and inclusive economic growth in the future (Khanra et al., 2021).

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Method

This study employs a qualitative approach aimed at exploring in depth the implementation of green digital accounting among culinary MSMEs in Medan City. The qualitative approach was chosen because it allows the researcher to understand phenomena holistically through the perspectives of business owners directly involved in the adoption of the system. The study applies a multiple case study design, focusing on three selected culinary MSMEs as research objects. This design was chosen to enable the researcher to gain a more comprehensive and nuanced understanding of the experiences, perceptions, challenges, and factors influencing the adoption process of green digital accounting within the context of business sustainability.

Data for this research were collected using several techniques, including semi-structured interviews, direct observation, and document analysis. Semi-structured interviews were conducted with the owners, managers, or key decision-makers of each MSME to gain first-hand insights into the implementation of green digital accounting, perceptions of its benefits, and the obstacles encountered. Additionally, direct observations of operational activities and digital financial recording processes were carried out to obtain factual depictions of green digital accounting practices in the field. These data were further complemented by document analysis, including financial records, internal reports, and other relevant supporting materials related to the research focus.

The collected data were analyzed using thematic analysis. This method involves a systematic process of identifying, analyzing, and interpreting key patterns or themes that emerge from interviews, observations, and documents. The analysis process was conducted through stages of data coding, theme categorization, and drawing conclusions aligned with the research objectives. To ensure data validity, this study employed triangulation techniques by comparing and verifying findings from various data sources to ensure consistency, credibility, and reliability of the research results.

Results and Discussion

The Concept of Green Digital Accounting

Green Digital Accounting (GDA) plays a vital role in enhancing the performance and sustainability of Micro, Small, and Medium Enterprises (MSMEs) by integrating digital accounting practices with environmental preservation initiatives. The implementation of GDA not only streamlines financial processes but also aligns MSMEs with sustainable business practices key factors in their long-term viability and operational efficiency. Essentially, GDA extends beyond financial transaction tracking to encompass the ecological footprint and social impact of organizational operations. It involves the use of digital tools, software, and platforms to collect, process, analyze, and report data related to energy consumption, waste generation, water usage, carbon emissions, and social responsibility initiatives.

The “green” aspect of GDA emphasizes a proactive commitment to minimizing negative environmental impacts and promoting resource efficiency. It shifts the focus from merely reporting past performance to providing actionable insights that drive sustainable operational change. For instance, by digitally tracking energy consumption patterns, businesses can identify peak usage times and implement energy-saving measures, directly contributing to reduced utility costs and lower carbon emissions (Wu, 2024). Similarly, digital tools can monitor waste streams, identifying areas where reduction or recycling efforts can be maximized. The “digital” component makes this integrated approach both feasible and

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powerful, leveraging technologies such as cloud computing, big data analytics, artificial intelligence (AI), and blockchain to automate data collection, ensure data accuracy, facilitate real-time reporting, and provide advanced analytical capabilities. This digitalization streamlines processes that are typically labor intensive and error-prone, making sustainability reporting more accessible and reliable especially for resource-constrained businesses. Digital platforms can link diverse data sources, from utility bills and inventory management systems to supplier sustainability certifications, creating a comprehensive and traceable audit trail for environmental and social performance (Gao & He, 2021).

The concept of Green Digital Accounting integrates environmentally sustainable practices within the accounting framework, specifically tailored for MSMEs. This innovative approach is crucial in fostering responsible economic behavior while addressing environmental impacts. Green Digital Accounting incorporates environmental metrics such as resource usage, waste generation, and carbon emissions into financial reporting, enabling MSMEs to measure their environmental performance alongside traditional financial results. By utilizing digital tools such as accounting software and cloud-based platforms, businesses can streamline financial processes, ensure real-time monitoring, and facilitate more efficient decision-making. Enhanced transparency through sustainability reporting not only promotes accountability but also attracts environmentally conscious consumers, ultimately strengthening market competitiveness. Furthermore, improving financial literacy among MSME operators is essential, as it empowers them to effectively apply digital accounting practices. This holistic approach positions MSMEs as key contributors to the Sustainable Development Goals (SDGs) while simultaneously improving resilience and operational efficiency in a rapidly changing economic landscape (M & Anisyah, 2024; Shen et al., 2023; Zafar et al., 2024; Zhou et al., 2024).

The study by Izzati, Kurnia Ningsih, and Lubis (2025) provides empirical evidence that implementing digital-based financial systems significantly enhances the efficiency and performance of MSMEs in Medan. Their research indicates that using financial applications such as *Buku Warung* helps entrepreneurs record transactions in real time, monitor cash flows, and minimize reporting errors. These findings reinforce the GDA concept since digital integration not only improves economic efficiency but also creates opportunities for MSMEs to manage environmental impacts through more transparent recording and reporting practices.

Similarly, Hakim, Ar Rahmah, and Harahap (2024) highlight the importance of green financing in strengthening GDA implementation. Green financing enables MSMEs to invest in environmentally friendly technologies such as digital reporting systems, energy-efficient equipment, and sustainable operational infrastructure. Their study found that MSMEs with access to green financing are more capable of adopting technology-based financial systems and accounting practices aligned with sustainability principles. The combination of accounting digitalization and green financial support positions GDA as an integrated strategy that focuses not only on financial performance but also on long-term business sustainability.

Sustainability Performance

Sustainability performance for MSMEs has become a crucial focus in contemporary business practices, particularly as consumer demand grows for environmentally responsible products. Key strategies for improving sustainability performance include adopting green marketing and digital strategies, as demonstrated in studies of MSMEs across regions, including Indonesia and Malaysia. Rachmawati et al. (2023) emphasize that integrating green marketing with

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digital marketing strategies significantly contributes to business sustainability, confirming that effective marketing performance can directly influence the sustainability of culinary MSMEs in the digital economy. On a broader scale, the implementation of technology-based accounting systems has been shown to improve financial performance and operational efficiency, as noted by Komariyah (2024). These findings highlight the need for MSMEs to invest in digital transformation as a means to enhance sustainability performance and secure competitive advantages.

Innovation and environmentally friendly practices are also key contributors to sustainability performance. Zameer et al. (2020) stress the crucial role of environmental orientation in driving green innovation initiatives, showing that MSMEs actively pursuing green strategies are better positioned to achieve competitive advantages. Recent studies confirm a strong relationship between green IT adoption and MSME performance. Kusuma and Subowo (2018) argue that environmentally oriented business practices improve performance, building green competitive advantages increasingly essential in today's markets. Various other studies also underline the transformative potential of green marketing in generating sustainable business practices and strengthening competitive positioning (Ardianingsih et al., 2024; Bestari & Butarbutar, 2021).

The Model of Green Digital Accounting Implementation for Enhancing MSME Sustainability Performance

The model for implementing Green Digital Accounting (GDA) to improve MSME sustainability performance integrates several strategic components aligning financial management with environmental responsibility. This model emphasizes the integration of digital technology, financial literacy, innovative practices, and government support as the key drivers of sustainable development.

1. Digital Technology Integration

The foundation of GDA relies heavily on adopting digital technologies that streamline accounting processes and improve data accuracy. Research shows that e-commerce and digital marketing can significantly enhance financial performance and sustainability outcomes for MSMEs (Gao & He, 2021). By adopting cloud-based accounting systems, MSMEs can effectively track both financial and environmental metrics, enabling real-time reporting and better resource utilization decisions. Digital transformation is also recognized as a cultural catalyst for sustainability (Gómez-Trujillo & González-Pérez, 2021).

2. Financial Literacy Empowerment

Enhancing financial literacy among MSME operators is crucial for successful GDA implementation. Training programs designed to improve understanding of green accounting practices enable MSMEs to plan growth strategies and manage financial challenges effectively (Dwyanti, 2024). Investing in such knowledge not only leads to greater operational efficiency but also encourages responsible financial behavior aligned with sustainability goals.

3. Innovative Accounting Practices

Emphasizing innovative accounting practices that incorporate eco-efficiency measures is essential for GDA. Vărzaru (2022) suggests that managerial accounting should evolve to include sustainability metrics that inform decision-making, thereby strengthening organizational commitment to responsible practices. Furthermore, the interaction between

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digital transformation and green innovation significantly drives sustainable performance in enterprises (Lü, 2024).

4. Green financing

Green financing plays a vital role in encouraging MSMEs to adopt GDA practices, promoting sustainability and environmental responsibility. Several factors contribute to the successful integration of green financing in this context, helping MSMEs overcome challenges and capitalize on opportunities for sustainable growth.

5. Sustainability Reporting and Monitoring

A key aspect of GDA is the establishment of sustainability reporting frameworks aligned with international standards. MSMEs should engage in regular sustainability assessments to monitor environmental impacts, enhancing accountability and building stakeholder trust (Lisnawati et al., 2024). Integrating green accounting practices into these reports facilitates communication of sustainability efforts to customers, investors, and regulators, reinforcing business commitment to responsible operations.

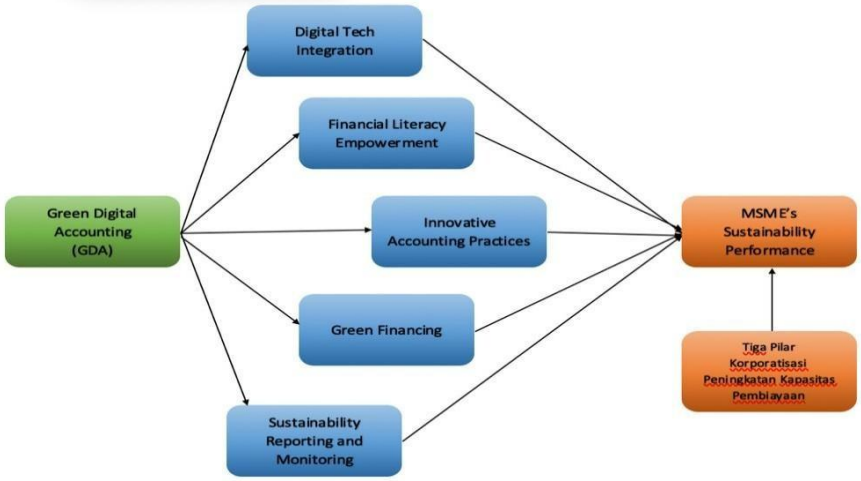

Figure 1. Model of Green Digital Accounting Implementation in Enhancing MSME Sustainability Performance

The successful adoption of GDA by MSMEs depends on several critical factors:

1. **Leadership and Commitment**

Strong leadership and unwavering commitment from top management or business owners are the most crucial elements. Without a clear vision, dedication, and willingness to champion the initiative, GDA implementation struggles to gain traction (Afifah et al., 2024). This includes setting explicit sustainability goals, allocating necessary resources, and cultivating a culture that values both financial performance and environmental/social responsibility.

2. **Technological Readiness and Infrastructure**

Successful GDA implementation depends on the right technological foundation, including access to appropriate digital accounting software that integrates financial and non-financial (environmental and social) data. The software must be user-friendly and scalable to meet evolving MSME needs. Reliable internet connectivity and basic digital infrastructure are essential for seamless data input, processing, and reporting. Integration of GDA systems with other operational systems (such as inventory or production management) can further enhance efficiency and data accuracy (Du & Li, 2019).

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3. Human Resource Development

The capabilities of people within MSMEs are fundamental. This includes improving employees' digital literacy and accounting skills, especially those responsible for data entry and analysis. Training programs that cover environmental metrics, sustainability reporting standards, and effective GDA software use are essential. Willingness to learn and adapt to new processes and technologies among staff is also a significant success factor (Setyowarni & Prihatiningtyas, 2022).

4. Financial Considerations

Although GDA can generate long-term cost savings, it requires initial investment. Adequate financial resources for software acquisition, training, and infrastructure upgrades are necessary (Gunawan & Pulungan, 2023). However, perceived cost-benefit analysis must justify implementation; MSMEs should clearly see how GDA yields tangible benefits such as waste reduction, lower energy consumption, or improved access to green financing that outweigh initial expenses. Government incentives or subsidies for green technology adoption can also act as strong motivators.

5. External Support Systems

MSMEs rarely operate in isolation, and external support can greatly facilitate GDA adoption. This includes access to expert advice and consultations from professionals in green accounting or sustainability. Support from government agencies, industry associations, and academic institutions in the form of training programs, workshops, best practice sharing, and networking opportunities provides invaluable guidance. Moreover, a supportive regulatory environment that encourages or rewards sustainable practices can motivate MSMEs to invest in GDA (Gross-Gołacka, 2020).

Further analysis by Izzati et al. (2025) clarifies that the integration of digital technology within the GDA model serves as a foundational element in accelerating accounting processes and improving reporting accuracy. Cloud-based applications enable MSME actors to manage both financial and non-financial data efficiently, expediting sustainability reporting. Meanwhile, Hakim et al. (2024) reveal that green financing acts as a catalyst enhancing MSMEs' ability to implement GDA effectively. Green financing provides capital support for entrepreneurs to invest in digital tools, eco-friendly infrastructure, and human resource training that promotes sustainability. The combination of digital system implementation and green financing not only enhances MSME competitiveness but also expands social impact through the creation of jobs focused on sustainable innovation. Integrating these two aspects strengthens GDA as a comprehensive strategy bridging digital transformation and sustainability practices while optimizing MSMEs' contributions to achieving the SDGs at both local and national levels.

Conclusion

The implementation of Green Digital Accounting (GDA) in culinary MSMEs (Micro, Small, and Medium Enterprises) in Medan City plays a significant role in improving business efficiency while promoting social and environmental responsibility. Through the integration of digital technology with sustainability principles, GDA helps MSME actors manage their finances more efficiently, transparently, and accurately. This system enables real-time transaction recording, monitoring of resource usage, and waste reduction, leading to lower operational costs. With faster and more measurable information, business owners can make decisions that are not only profit-oriented but also environmentally conscious, creating a balance between economic performance and sustainability in business management.

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In addition to digitalization, green financing also plays an essential role in strengthening GDA implementation. Access to environmentally friendly financing provides opportunities for MSMEs to invest in energy-efficient technologies, digital-based accounting systems, and human resource training that supports the transition toward sustainable business. Collaboration between digital technology adoption and green financing enhances MSMEs' ability to develop their businesses responsibly and competitively. The success of GDA implementation is also influenced by internal factors such as management commitment, infrastructure readiness, and financial literacy, as well as external factors including government policy support, financial incentives, and cooperation with financial institutions and academia. With sustainability-oriented leadership and awareness, MSMEs can become more adaptive to digital transformation while maintaining social and environmental responsibility.

Overall, Green Digital Accounting is not merely an innovation in financial reporting systems but also a strategic pathway toward inclusive, efficient, and sustainable economic development. The implementation of this concept helps MSMEs achieve a balance between economic efficiency, social responsibility, and environmental preservation. In a broader context, GDA can serve as a vital instrument in accelerating the transition toward a resilient and globally competitive green economy. To achieve this, strong collaboration among governments, financial institutions, academia, and business actors is crucial in developing policies, improving digital and financial literacy, and strengthening supporting infrastructure. With such synergy, MSMEs have the potential to become innovative and adaptive drivers of the green economy, contributing significantly to sustainable development in Indonesia.

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