



Sustainability Analysis of Green MSMEs of the Bali Agung Weaving Group Collection Fostered by KPWBI Bali Province

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ABSTRACT

Indonesia's economic growth is currently supported mainly by the real sector, especially Micro, Small, and Medium Enterprises (MSMEs). In the context of sustainability, the transformation of MSMEs towards a green business model is crucial, especially in the traditional handicraft sector such as Balinese *endek* weaving. This study employs a mixed-methods approach, utilizing the Multiaspect Sustainability Analysis (MSA) method, which encompasses four primary aspects: ecological, economic, social, and institutional. The results of the analysis indicate that the sustainability status of green MSMEs falls into the "very sustainable" category, with an index value of 83.67. The most sensitive attribute in the ecological aspect is the source of production energy, the economic aspect is the availability of key raw materials, and the institutional aspect is sustainability reporting. No dominant sensitive attributes were found in the social aspect. The improvement scenario successfully increased the sustainability status to 83.67 and 93.15. These findings affirm the importance of green indicator-based policy interventions in strengthening the competitiveness of MSMEs, particularly those with a local cultural focus and an export orientation, within the context of a green economy.

INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) play a strategic role in Indonesia's economic development. In 2023, MSMEs are expected to contribute approximately 61% to the national Gross Domestic Product (GDP), equivalent to IDR 9,580 trillion, and employ around 97% of the national workforce (Coordinating Ministry for Economic Affairs of the Republic of Indonesia, 2023). The dominance of MSMEs in the economic structure makes them the backbone of financial resilience, especially in the face of global and domestic crises. However, this major contribution is also accompanied by significant challenges in the context of sustainability, particularly in terms of the environmental impact of the production process, which still employs a conventional approach and lacks environmental friendliness (Laila, 2024).

In the context of global climate change and the commitment to the Sustainable Development Goals (SDGs), transforming MSMEs towards green business practices is a necessity. Green MSMEs are defined as business units that integrate circular economy principles, energy efficiency, and social responsibility throughout their business value chains (Bank Indonesia, 2024). Bank Indonesia, as the monetary authority, has also encouraged the acceleration of this transformation through the green MSME program, including through pilot projects in the traditional textile handicraft sector in Bali.

One of the important case studies in this context is the Bali Collection Great Weaving Group in Jhem Village, Bangli Regency. This group has been fostered by the Bank Indonesia Representative Office (KPwBI) of Bali Province since 2022, with a focus on integrating green practices in the production of endek woven fabrics based on natural dyes, energy efficiency, and social engagement (Bank Indonesia, 2023). However, this group also faces various challenges, including limited natural raw materials, rising production costs, and the need to regenerate the traditional weaving workforce.

Based on this, this study is important for analyzing the extent to which the sustainability status of green MSMEs has been achieved, as well as the factors or attributes that most significantly affect sustainability. This understanding will be instrumental in developing more measurable and contextual sustainability improvement strategies based on field data.

The objectives of this study are: (1) to analyze the sustainability status of green MSMEs of the Bali Collection Great Weaving Group; (2) identify sensitive attributes in ecological, economic, social, and institutional aspects that affect the sustainability of these MSMEs; and (3) develop strategic scenarios for improving sustainability status based on multifaceted analysis (MSA).

This research is expected to make practical contributions to policymakers, MSME actors, and stakeholders in sustainable development, particularly in the local culture-based handicraft sector, by developing measurement and intervention models for green MSMEs. Theoretically, this research also contributes to the scientific body of knowledge in the fields of green economy, sustainable entrepreneurship, and MSME innovation, particularly in the context of developing countries.

LITERATURE REVIEW

Green Economy

The concept of the green economy emerged in response to environmental pressures generated by conventional economic systems that are growth-oriented, yet overlook the ecosystem's carrying capacity. The United Nations Environment Programme (UNEP, 2011) defines a green economy as an economic system that results in human well-being and social justice, while significantly reducing environmental risks and resource scarcity. In Indonesia, this concept is strengthened through commitments to the 2015 Paris Agreement and various low-carbon development policies, such as the National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GHG) (Limanseto, 2022).

The implementation of the green economy in the MSME sector still faces significant challenges, including low institutional capacity, limited awareness among business actors, and inadequate fiscal incentives (Parluhutan, 2022; Nhamo, 2023). However, the green economy remains the future paradigm for sustainable development, integrating social, economic, and ecological aspects.

Triple Bottom Line Theory

The concept of the *Triple Bottom Line (TBL)*, introduced by Elkington (1997), has become an evaluation framework used in various sustainability studies. TBL emphasizes that the success of an entity is not only determined by economic benefits (profit), but also by its impact on the environment (planet) and society (people) (Sentanu et al., 2021). In the context of MSMEs, the implementation of TBL encourages business actors to minimize ecological impacts, increase social empowerment, and maintain economic viability.

In the institutional context of Indonesia, the TBL principle has begun to be incorporated into regulations, such as Law No. 32 of 2009 concerning Environmental Protection and Management and POJK No. 51/POJK.03/2017 concerning Sustainable Finance.

Sustainability Aspects in MSMEs

The sustainability of MSMEs is an integration of four main dimensions, namely: (1) ecology, through energy efficiency and waste management; (2) economic, in the form of cost efficiency and stability of raw materials; (3) social, through local workforce empowerment, gender equality, and workforce regeneration; and (4) institutions, including the implementation of green SOPs, financial record-keeping, and the use of digital channels (Franco, 2019; Muizu, 2023).

A study by Baeshen (2021) reveals that MSMEs that adopt green innovations tend to be more adaptable to market changes and exhibit higher competitiveness. In Indonesia, the most significant challenges to MSME sustainability include the limited availability of natural raw materials, the lack of digital literacy, and the need for the regeneration of traditional business actors (Wibowo, 2024; Octaviani, 2023).

Green MSMEs and the Role of Bank Indonesia

Bank Indonesia develops a green MSME business model based on the classification of *eco-adopters*, *eco-entrepreneurs*, and *eco-innovators* (Bank Indonesia, 2024). The assessment is conducted through indicators in the areas of production, marketing, human resources, and finance. This initiative is supported by

mentoring, financing facilitation, and the development of an MSME digitalization ecosystem. Implementation in the handicraft sector, such as weaving, is a form of local adaptation to the circular economy and sustainable consumption (GIZ, 2017).

Multiaspect Sustainability Analysis (MSA) Method

MSA is an analytical approach based on *the Rapid Appraisal Process (RAP)* method, which is used to assess the level of sustainability of a system or entity from various aspects simultaneously and in an integrated manner (Kavanagh & Pitcher, 2004). In this study, MSA is employed to assess the sustainability of green MSMEs from ecological, economic, social, and institutional perspectives. The assessment is carried out by setting indicator scores based on input from key informants, then visualized in the form of a *sustainability index* graph.

METHODOLOGY

Research Design

This study employs a mixed-methods approach, which combines quantitative and qualitative methods simultaneously to achieve comprehensive analysis results (Creswell, 2014). A quantitative approach is used to calculate the sustainability value of green MSMEs based on predetermined indicators, through questionnaires distributed to key informants. On the other hand, a qualitative approach is employed to understand the social, economic, ecological, and institutional context of the MSME business process by delving deeper into information through interviews and documentary studies. The combination of these two approaches enables researchers not only to quantify sustainability conditions but also to analyze the meaning and dynamics behind these conditions.

Research Location and Time

The research location is in Jhem Village, Bangli Regency, Bali Province, where the green MSMEs of the Bali Collection Weaving Group are based. This group is one of the initiatives fostered by the Bank Indonesia Representative Office (KPwBI) in Bali Province and was selected as a pilot project to implement the green MSME model in the textile and handicraft sector. The data collection was conducted from January to April 2025, coinciding with the active phase of the production and promotion activities of the weaving group.

Types and Data Sources

This study utilizes two types of data: primary data and secondary data. Primary data were obtained through the distribution of questionnaires and in-depth interviews with key informants, including MSME owners, craftsmen, MSME companions, and KPWBI as coaches. Meanwhile, secondary data were obtained from various supporting documents, including the guidelines for the green MSME model from Bank Indonesia, the group's internal sustainability report, scientific articles, and government policies related to the development of environmentally friendly MSMEs.

Research Variables and Indicators

This study classifies variables based on the four main dimensions of green MSME sustainability, namely:

1. Ecological aspects, which include indicators such as energy sources used, methods for obtaining primary raw materials, waste management methods, innovations to reduce environmental impact, and environmental cost allocation.
2. The Economic Aspect comprises the availability of primary and supporting raw materials, types of packaging, product prices, primary sources of revenue, promotional materials, and the level of digitalization in the production process.
3. Social Aspects include: motivation of actors to apply environmentally friendly principles, empowerment of vulnerable groups (such as people with disabilities), gender equality, origin of the workforce (local/outside), and training on sustainability.
4. Institutional aspects include: the existence of green SOPs, ownership of Intellectual Property Rights (IPR), the use of digital marketing channels, sustainability reporting, financial recording, and digital payment methods (Bank Indonesia, 2024).

Data Analysis Technique: Multiaspect Sustainability Analysis (MSA)

To analyze the data, this study employs the Multiaspect Sustainability Analysis (MSA) approach, a method based on the principles of the Rapid Appraisal Process (RAP) that enables sustainability assessments to be carried out quickly, systematically, and multidimensionally (Kavanagh & Pitcher, 2004). MSA was chosen because it can integrate various indicators from different aspects and provide visualization of sustainability levels through graphs and composite indices.

Scoring was carried out by key informants for each indicator using a scale of 0–4, by Bank Indonesia's guidelines, which distinguish between *mandatory* and *complementary indicators*. The collected data is then normalized and processed using Microsoft Excel software to calculate the *sustainability index* per aspect and as a whole.

The main steps in this MSA are as follows:

1. Indicator scoring is conducted by informants based on their operational experience with MSMEs.
2. Data normalization, to equalize the scale between different indicators.
3. Calculation of the sustainability index to obtain the sustainability status of each aspect.
4. Sensitive attribute analysis, using leverage analysis to identify the indicators that have the most effect on fluctuations in sustainability values.
5. Preparation of strategic scenarios by modifying the value of sensitive attributes to simulate future improvements in sustainability scores.

The final results of this analysis are visualized in the form of *sustainability radar graphs* and improvement scenario graphs, which can serve as considerations for stakeholders, MSME actors, and policy coaches in developing evidence-based sustainability strategic interventions.

RESULT AND DISCUSSION

Sustainability Status of Green MSMEs

The assessment of the sustainability status of green MSMEs is conducted using the Multiaspect Sustainability Analysis (MSA) approach, which enables comprehensive measurement based on four main dimensions of sustainability: ecological, economic, social, and institutional. Based on the results of primary data processing, the Agung Bali Collection Weaving Group achieved an aggregate sustainability value of 83.67, which falls into the "Very Sustainable" category according to the score classification established by Bank Indonesia (2024). Details of the scores per aspect are presented in Table 1.

Table 1. The Sustainability Value of Green MSMEs Based on Aspects

Aspects	Sustainability Values	Category
Ecology	82,5	Very Sustainable
Economics	80,0	Very Sustainable
Social	88,0	Very Sustainable
Institutional	66.67	Sustainable
Average	83,57	Very Sustainable

Source: Primary Data Processed, 2025

In general, all aspects of sustainability have achieved a score above 80, indicating that these MSMEs have consistently and multidimensionally applied sustainability principles. The social aspect recorded the highest score (88.0), indicating success in building local community participation, promoting gender equality, and including disabled groups. In addition, the high involvement of women and the existence of weaving regeneration training are key indicators of the social strength of this group. However, there are challenges to youth workforce regeneration that still need to be addressed through community-based training and incentive programs.

In the ecological (80.00) and economic (87.63) aspects, a high score indicates a fairly reasonable resource management effort, as well as support for production and sales. However, the use of LPG-based energy is still a weak point in the ecological dimension, and the availability of raw materials still needs to be considered for sustainability.

Meanwhile, the institutional aspect recorded the lowest score (66.67) compared to other aspects, due to the lack of a sustainability report, which still needs to be considered in the institutional aspect. Therefore, institutional aspects are one of the priority interventions in the scenario of increasing sustainability discussed in the next section.

Identify Sensitive Attributes

Within the framework of the Multiaspect Sustainability Analysis (MSA) approach, leverage analysis is used to identify the attributes of the indicators that have the most significant influence on the sustainability index in each aspect. Leverage analysis is performed by calculating changes in the total sustainability score if one attribute is hypothetically modified (Kavanagh & Pitcher, 2004). The results of the attribute identification are presented in Table 2.

Table 2. Sensitive Attributes of Each Aspect

Aspects	Key Sensitive Attributes
Ecology	Production energy sources
Economics	Availability of key raw materials
Social	No dominant attributes
Institutional	Implementation of Sustainability Report

Source: Leverage Analysis Results, 2025

These results indicate that, from an ecological perspective, the attributes of production energy sources are the primary determinants of sustainability scores. This is because most MSME production processes, including weaving and yarn dyeing, still rely on fossil energy sources such as LPG, which has a high carbon footprint. The shift to renewable energy sources such as solar power or local biomass will have a significant impact on improving ecological sustainability scores.

In the economic aspect, the most sensitive attribute is the *availability of key raw materials*, especially natural yarns and dyes. Price fluctuations and the limitations of the supply chain of raw materials cause vulnerability to production stability, thus having a significant impact on the economic sustainability index. Interventions on this side, such as partnerships with dye crop farmers or local downstream programs, are important strategies.

Interestingly, in the social aspect, no attributes were found that had dominant leverage. This indicates that social indicators, such as gender equality, disability involvement, training, and labor origin, have been relatively stable or have low variation between informants, making them not a leverage point in sustainability simulations.

Meanwhile, in the institutional aspect, the attributes of *implementing sustainability reports* are a critical point. The lack of documentation of sustainability reporting (both from an environmental, social, and economic perspective) causes this aspect not to reach its maximum value. Sustainability reports play a crucial role in enhancing transparency, accountability, and the attractiveness of green investment in MSMEs, as suggested in the *Green Economy Policy Framework* by Bappenas (2022).

Thus, the identification of these sensitive attributes provides a strong empirical basis for developing escalation scenarios, where interventions are focused on the highest-leveraged indicators to maximize policy efficiency and ensure on-target results.

Increased Sustainability Scenarios

To identify strategic directions for strengthening the sustainability performance of green MSMEs, particularly the Bali Collection Great Weaving Group in Jehem Village, two simulation-based scenarios were prepared to enhance the value of sensitive attributes. This strategy follows the principle of leverage-based optimization as introduced in the Multiaspect Sustainability Analysis (MSA) approach (Kavanagh & Pitcher, 2004).

The scenario of increasing sustainability in this study is presented through one scenario and two *driving factors*.

Table 3. Simulation of Sustainability Values Based on Scenarios

Aspects	Existing	Skenario
Ecology	80,00	93,40
Economics	87,63	95,88
Social	100,00	100
Institutional	66.67	83,33
Average	83,57	93,15

Source: Primary Data Processed, 2025

The scenario simulates an increase in the score of sensitive attributes without massive intervention, but through a realistic and affordable approach. Examples:

1. Ecological Aspect: switching part of LPG to biomass energy or small-scale solar power as an energy source for business activities.
2. Economic Aspect: establishing partnerships with local farmer groups to ensure the sustainable supply of natural raw materials (e.g., *tarum* leaves and *ketapang*).
3. Institutional Aspect: Start compiling a simple sustainability report that records emissions, waste, and energy use, assisted by facilitators or interns.

The simulation results show that the implementation of this scenario was able to significantly increase the sustainability index from 83.57 to 93.15, with the most striking increase in the institutional aspect (rising from 66.57 to 83.33). The social aspect remained stable as no sensitive attributes were identified as leverage on the dimension.

This means that strategic interventions based on sensitive attributes are effective in improving the sustainability structure of MSMEs. Simultaneous increases in ecological, economic, and institutional value not only raise index scores but also strengthen business resilience in the face of environmental, market, and institutional challenges.

Thus, the above scenario provides an analytical basis for policymakers, Trustee institutions, as well as MSMEs themselves, to choose the best improvement strategy for local resources and context. The implementation of sustainability status ratings is carried out in stages as a sustainable and inclusive approach in the medium term.

Implications and Discussion

These findings show that efforts to improve sustainability in MSMEs do not necessarily require a comprehensive change, but rather focus on sensitive attributes that have a systemic impact. For example, diversifying energy to renewable sources such as biomass or small-scale solar power plants can reduce emissions while reducing long-term operational costs (Baeshen, 2021).

On the other hand, partnerships with research institutions or local governments to ensure the sustainable availability of local raw materials will have a direct impact on cost stability and product quality. Meanwhile, from an institutional aspect, training and assistance in preparing sustainability reports are important steps to increase transparency and accountability of green businesses.

CONCLUSIONS

The results of the study show that the green MSMEs of the Agung Bali Collection Weaving Group in Jehem Village, Bangli Regency, have generally been in the "Very Sustainable" category with a sustainability index value of 83.67. This sustainability is obtained through achievements in three main aspects, namely ecological, economic, and social, all of which have a score above 80. The social aspect recorded the highest score (100.0), reflecting strong local community participation, gender equality, and cultural preservation efforts through the regeneration of weaving artisans. The institutional aspect has a value of 66.67 which is an aspect that needs to be improved in its sustainability status.

However, the analysis also identified several critical challenges that require attention. The institutional aspect, classified as "Sustainable", shows the lowest score (66.67) due to the lack of a sustainability report. On the other hand, the economic aspect faces constraints due to the limited supply of raw materials and dependence on sources of income that have not been fully digitized. The ecological aspect still relies on fossil energy sources, such as LPG, despite an initial awareness of environmentally friendly production practices.

Through leverage analysis, three key sensitive attributes were identified that significantly affected the sustainability score: (1) production energy sources (ecology), (2) the availability of key raw materials (economy), and (3) the implementation of sustainability reports (institutional). Meanwhile, in the social aspect, no critical attributes were identified.

Simulation of the upgrade scenario shows that if all sensitive attributes are optimized (in the scenario), the sustainability value can increase to 93.15 under ideal conditions. This shows that a targeted and data-driven improvement strategy can have a significant impact on the sustainability performance of green MSMEs.

RECOMMENDATIONS

Based on the above conclusions, some strategic recommendations that can be proposed to improve the sustainability of green MSMEs, especially for the Bali Collection Agung Weaving Group, are as follows:

1. Green energy transition policies and incentives are needed to encourage the conversion from fossil energy to renewable energy sources, such as solar panels or local biogas, thereby reducing the carbon footprint and improving production efficiency.
2. Diversification and Security of Raw Material Supply. Local governments and development partners, such as Bank Indonesia, need to facilitate access to sustainable alternative raw materials by strengthening local supply chains, forming partnerships with natural dye farmers, and establishing natural fiber yarn gardens.
3. Digitalization and Economic Innovation Strengthening the capacity of MSMEs in digital marketing, e-commerce, and certification of environmentally friendly products is essential to expand the market and increase the added value of traditional woven products. Implementation of Sustainability Reports: MSME groups are encouraged to prepare

- sustainability reports periodically as a means of transparency and accountability to consumers, the government, and their supporting partners.
4. Institutional Strengthening and Supporting Regulations Local governments are advised to formulate special regulations related to incentives for green MSMEs, as well as institutional development through sustainable business management training and access to green funding.
 5. Replication of the MSA Model for Other MSMEs The Multiaspect Sustainability Analysis (MSA) based sustainability evaluation model has been proven to provide a holistic picture and can be replicated by other green MSMEs in Bali and other regions as a data-driven decision-making tool.

This recommendation aims not only to improve the internal sustainability of MSMEs but also to encourage a more resilient, environmentally friendly, and sustainable local business ecosystem in the long term, based on the principles of the green economy and the triple bottom line, which serve as the primary foundation for this study.

FURTHER STUDY

This research makes an initial contribution in measuring and analyzing the sustainability of green MSMEs based on traditional woven fabrics using the Multiaspect Sustainability Analysis (MSA) approach. However, some limitations need to be considered, as well as further research opportunities that can be developed to enrich these findings.

First, this research was only conducted on one MSME unit, namely the Bali Collection Great Weaving Group in Jehem Village, Bangli. Therefore, the generalization of the findings is still limited. Further studies can be conducted by involving more samples of green MSMEs from various subsectors, such as bamboo handicrafts, organic agriculture, or the locally based food processing industry, to obtain a broader comparison and mapping of sustainability.

Second, although the MSA approach has provided a comprehensive picture through a four-aspect analysis (ecological, economic, social, and institutional), there is still room for integration with advanced quantitative approaches such as regression analysis, structural equation modeling (SEM), or social return on investment (SROI) measurement to strengthen the validity and precision of decision-making.

Third, this study has not examined in depth the local cultural and spiritual factors that are the strength of tradition-based MSME identity in Bali. Advanced studies can expand the approach by incorporating transdisciplinary methods that combine aspects of the green economy with business ethnography, production anthropology, or cultural ecology, in order to understand how local values, such as Tri Hita Karana, contribute to sustainable business models.

Finally, in response to global dynamics, further research can also explore the integration of digital technology and blockchain in MSME sustainability reporting systems, including the adoption of e-certification systems for green products and the development of micro carbon trading platforms based on MSMEs.

By expanding the geographical scope, methodological approach, and dimensions of local values and technology, it is hoped that future research can

support the formulation of more inclusive, adaptive, and contextually relevant green MSME development policies that address the challenges and opportunities of sustainable development at the regional and national levels.

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