Economics, Business, Accounting & Society Review
Volume 4, Nomor 3, p. 397 – 411
ISSN 2810 - 0115

Integrating Economic, Environmental, and Social Dimensions: A Green Accounting Framework for Local Food-Based MSMEs

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ARTICLE INFO
Article history:
Received 03 August 2025
Revised 13 August 2025
Accepted 02 October 2025
Available Online 15 October 2025

Keywords:
Green Accounting
Creative Economy
MSMEs
Food Security
Participatory Action Research

Cite as:
Hidayat, M. F., Supriyadi, S., & Wellem, K. A. (2025). Integrating Economic, Environmental, and Social Dimensions: A Green Accounting Framework for Local Food-Based MSMEs. Economics, Business, Accounting & Society Review, 4(3). https://doi.org/10.55980/ebasr.v4i3.267

ABSTRACT
This study aims to develop and validate a Green Accounting Model designed to strengthen the capacity of local food-based micro, small, and medium enterprises (MSMEs) in South Konawe Regency to support sustainable economic development and regional food security. The model was created through a combination of Research and Development (R&D) and Participatory Action Research (PAR), ensuring both methodological rigor and active engagement of MSME actors throughout the research process. Data were collected using surveys, interviews, focus group discussions (FGDs), participatory observation, and model trials with five selected MSMEs representing diverse food sectors. Initial findings reveal that MSMEs predominantly relied on simple cash inflow–outflow records and lacked systematic documentation of environmental costs, resource use, and social contributions. The proposed Green Accounting Model integrates economic, environmental, and social components into a modular and user-friendly structure. After expert validation and revision, the model was tested in the field over one month. The results show a substantial improvement in MSME recordkeeping capacity, indicating an effectiveness level of 78.2%. Qualitative insights further demonstrate enhanced sustainability awareness, routine documentation practices, and increased attention to resource efficiency. User perception scores averaged 86.2%, reflecting strong acceptance and the potential for long-term adoption. The findings confirm that a contextually adapted, simple, and integrative accounting tool can effectively bridge the gap between sustainability principles and daily MSME operations. Research implications include opportunities for broader model adoption across MSME sectors, integration into local sustainability policies, and further digitalization to enhance accessibility and impact.

1. Introduction

The role of MSMEs is becoming increasingly important due to the challenges of food security and sustainable economic growth (Endris & Kassegn, 2022; Orellana-Rojas et al., 2022). This role positions MSMEs as a key component in regional development strategies (Monroy-Gomez et al.,

2022). In regions such as South Konawe Regency, local food-based MSMEs not only play a pivotal role in meeting community food needs but also contribute significantly to the creative economy. However, despite their strategic role, most MSMEs continue to rely on simple bookkeeping practices that focus only on cash inflows and outflows, without incorporating environmental costs such as energy consumption, water usage, or waste management. This condition creates a gap between the potential contribution of MSMEs to sustainability and their actual practices in the field (Nzama et al., 2022).

Green accounting has emerged as a strategic approach to bridge this gap by integrating economic, social, and environmental dimensions into business records (Nofita et al., 2024)(Chamorro et al., 2023; Maama & Appiah, 2019). The adoption of such practices aligns with the Triple Bottom Line (Profit–People–Planet) and Environmental Management Accounting (EMA) principles (Appannan et al., 2023; Mukwarami et al., 2023; Qian et al., 2018). These frameworks emphasize that sustainable business growth requires accountability not only in financial performance but also in environmental stewardship and social responsibility (Merlin Berlian et al., 2023)(Bellandi, 2023; Marco-Fondevila et al., 2018; Oprean-Stan et al., 2020). Nevertheless, existing models of green accounting are often too complex and not contextually adapted to the capacity and needs of local MSMEs, particularly those in the food sector.

This research addresses these challenges by developing a green accounting model tailored to the characteristics of food MSMEs in South Konawe Regency. Using a combination of Research and Development (R&D) methodology, and the cyclical, collaborative nature of Participatory Action Research (PAR), the study ensures that the resulting model is both academically robust and practically applicable. The model is designed to be simple, flexible, and integrative, enabling MSMEs to record not only their financial activities but also their environmental and social impacts.

The contribution of this study is twofold: first, to provide MSMEs with a practical management instrument that enhances their sustainability awareness and operational efficiency; and second, to support regional food security through the strengthening of the creative economy (UNCTAD, 2022). By situating local MSMEs as active partners in the research process, this study seeks to produce a green accounting model that is not only theoretically valid but also relevant, contextual, and ready for long-term adoption.

2. Methods

This research employed the Research and Development (R&D) method combined with a Participatory Action Research (PAR) approach. The R&D method was selected because it systematically produces a model through the stages of development, validation, and evaluation (Turkmen & Topcu, 2021). Meanwhile, PAR was chosen for its cyclical and collaborative nature (Huang, 2010), which enables the direct involvement of local food MSMEs throughout the entire research. Participatory action research (PAR) is a collaborative social process in which groups work together to reflect, learn, and take action to change shared practices in their social context (Brydon-Miller et al., 2003; Salman & Ramsis, 2025). Thus, the integration of R&D and PAR not only ensures that the model is theoretically and technically valid but also relevant, contextual, and applicable to MSMEs in South Konawe Regency.

The research stages were carried out by integrating R&D steps with the PAR cycle, as follows:

1. Identification of potentials and problems, conducted jointly with MSME actors to explore actual conditions and field needs.
2. Design validation, involving accounting experts, MSME practitioners, and relevant stakeholders to assess the feasibility of the model.
3. Design revision, conducted based on feedback from the validation process.
4. Model trial, implemented with selected MSMEs to examine the effectiveness and applicability of the model in practice.
5. Result interpretation, assessed the success of the implementation of green accounting model by combining the quantitative, qualitative, and perception data
6. Model refinement, carried out through joint reflection and evaluation of the trial results.

Through these stages, the research addressed not only academic challenges but also the practical needs of MSMEs in responding to sustainability issues. The green accounting model developed is expected to serve as a sustainable management instrument grounded in environmental

data while simultaneously supporting food security by strengthening the local creative economy (Rasyid et al., 2024). The data were collected using a triangulation strategy that combined participatory observation, in-depth interviews, focus group discussions (FGDs), and questionnaires in order to obtain comprehensive, valid, and reliable findings. The focus encompassed environmental, social, and economic aspects. The data validation sheet included the following dimensions:

Table 1. Aspects in Data Validation Sheet

Aspect	Indicators
Accounting Aspect	Completeness of records, accuracy, ese of use
Environmental Sustainability Aspect	Waste of management, energy efficiency, use of local materials
Social Ascpect	Engagement of local labor, social contributions to the community
Economic Aspect	Attention to and impact of business activities on the environment such as waste management and use of eco-friendly materials
Perception of the model	Suitability with MSME capacity, adaptability, sustainability of the model

Data analysis techniques were aligned with a mixed-methods approach (qualitative and quantitative) and followed the stages of model development within the Research and Development (R&D) framework based on Participatory Action Research (PAR). Similar research on MSMEs has also adopted mixed methods and participatory procedures to measure green economy performance and to integrate sustainability dimensions in MSME operational models (Pangarso et al., 2022).

For qualitative data, the focus was on exploring meaning, understanding context, and explaining the relationships among non-numerical variables. The process included data collection, condensation, presentation, and conclusion drawing based on the Miles & Huberman model (Miles & Huberman, 1984). This model consists of four interactive and simultaneous components.

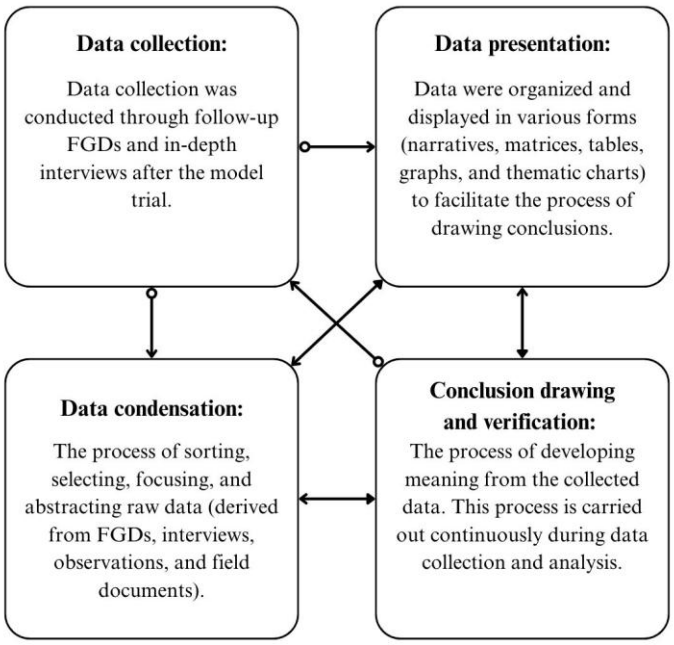

Figure 1. Miles & Huberman Model

For quantitative data, objective measurement was carried out through effectiveness testing and perception surveys using a Likert-scale questionnaire with systematic scoring and percentage calculations. The results were then tested for validity and reliability.

The effectiveness of the model was calculated using the following formula:

$$\text{Effectivity} = \frac{\text{Posttest Score} - \text{Pretest Score}}{\text{Maximum Score}} \text{ X } 100\%$$

Interpretation criteria:
- ≥ 80% = Very Effective
- 66–80% = Effective
- 51–65% = Moderately Effective
- < 50% = Ineffective

Meanwhile, perceptions of MSMEs toward the model were measured using the following formula:

$$\text{Final Score} = \frac{\text{Total Score Obtained}}{\text{Maximum Score}} \text{ X } 100\%$$

Interpretation criteria:
- 86–100% = Very Good
- 70–85% = Good
- 55–69% = Fair
- < 55% = Poor

3. Results

This research presents the results of the research implementation in accordance with the stages outlined in the proposal. All outcomes are systematically presented, ranging from model design, validation, pilot testing, evaluation, to model refinement. The data presentation encompasses survey findings, results from focus group discussions (FGDs), pre-test/post-test analyses, and other relevant research outputs. The following are the results of the analysis based on each research stage:

Identification of MSME Potentials and Challenges

The initial stage of the research focused on designing a Green Accounting Model tailored to the characteristics of local food MSMEs in South Konawe Regency. The design process employed a Participatory Action Research (PAR) approach, which enabled researchers to engage MSMEs from the early stages of the research to ensure that the solutions developed are practical and contextually relevant. This stage began with the identification of needs through an initial survey and in-depth interviews conducted with five MSMEs in South Konawe Regency, purposively selected to represent the diversity of local food sectors. The findings indicate that all participating MSMEs still rely on basic cash inflow–outflow recording, have never accounted for environmental costs such as water, energy, and waste, and lack strategies for efficient use of raw materials (Indriastuti & Mutamimah, 2023). The list of MSMEs can be seen in the table below:

Table 2. List of MSMEs for Research

No	MSMEs Type	Main Product	Location
1	Home industry	Tempe & Soy-based products	Konda District, South Konawe Regency
2	Local Food Processing	Sago Flour and Sinonggi	Kolono District, South Konawe Regency
3	Modern Agriculture	Hydroponic Vegetables	Landoono District, South Konawe Regency
4	Oil production	Coconut Copra Oil	Kolono District, South Konawe Regency
5	Creative Food Industry	Assorted Banana Chips	Konda District, South Konawe Regency

The survey results revealed several key findings, including:
1. Financial Recording: All MSMEs (100%) relied solely on simple cash inflow–outflow records without formal profit and loss statements.

2. Environmental Costs: None of the MSMEs separately recorded water usage, electricity, or waste-related expenses.
3. Raw Materials: All MSMEs (100%) utilized local raw materials; however, their usage efficiency remained unmonitored.
4. Sustainability Awareness: Only 40% of business actors demonstrated an understanding of the importance of environmentally friendly accounting practices.

These findings underscore the necessity of developing a more comprehensive recording system characterized by the following:
1. Simplicity and Practicality: Designed to match the capacity and capabilities of MSMEs.
2. Integrative Approach: Encompassing economic, social, and environmental aspects in line with the Triple Bottom Line (TBL) concept (Elkington, 1998) and Environmental Management Accounting (EMA) principles (Jasch, 2003).
3. Flexibility: Applicable across various sectors (tempe, sago, hydroponics, copra, and banana chips) without requiring major modifications (Parmar et al., 2010).

In response to the above findings, the research team developed a preliminary design of the Green Accounting Model, intended as a solution to the recording issues identified. This design refers to Stakeholder Theory and the principles of Participatory Action Research (PAR) to ensure active MSME involvement throughout the development process.

The initial model was structured following an input → process → output → outcome framework, as follows:

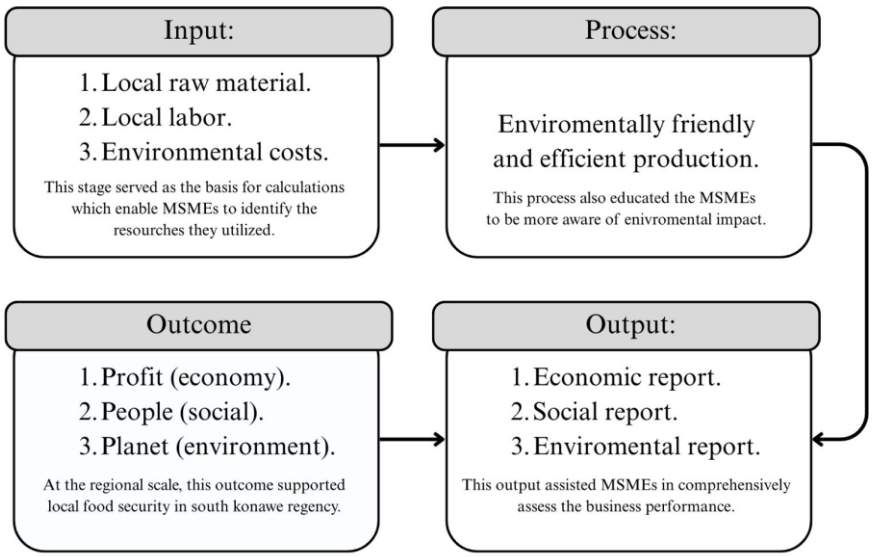

Figure 2. Initial Model Design

This model design served as the foundation for the subsequent validation stage. By involving MSMEs from the outset, the resulting model was expected to be not only academically relevant but also practical, user-friendly, and effective in promoting the sustainability of local food businesses.

Model Design Validation

This stage aimed to ensure that the designed model met user needs, was practical, and had strong potential for field implementation through a Focus Group Discussion (FGD) (Rasyid et al., 2024). The FGD involved two accounting academics, one agricultural practitioner, and MSME actors identified through the initial survey. Their participation was crucial to provide theoretical, technical, and practical perspectives, ensuring that the resulting model could be fully adopted by MSMEs. As Morgan (1997) notes, FGDs are particularly effective in capturing diverse stakeholder insights within participatory research. The FGD was conducted in two sessions:

1. Initial Model Presentation: The research team presented the model prototype, including recording components (economic, social, and environmental), the input–process–output–outcome framework, and sample filling tables.
2. Structured Discussion & Assessment: Participants provided written and oral feedback and completed a validation form designed using a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) (Almomani et al., 2020).

The aspects validated included:

Table 3. Validation Results of the Green Accounting Model

Assessment Aspect	Academics	Practitioner	Average	Category
Material Appropriateness	3.20	3.40	3.30	Very Feasible
Relevance to MSME Practice	3.40	3.50	3.45	Very Feasible
Ease of Use	3.30	3.30	3.30	Feasible
Integration of Environmental Aspects	3.10	3.20	3.15	Feasible
Clarity of Table Format	3.30	3.40	3.35	Very Feasible
Implementation Potential	3.40	3.50	3.45	Very Feasible
Average	3.28	3.38	3.33	Very Feasible

Based on the assessment, the model received an average score of 3.33 (categorized as Very Feasible), indicating that it is sufficiently ready for field testing. In addition to providing quantitative scores, FGD participants also offered qualitative feedback. The FGD results indicate that the developed model is feasible for implementation with several refinements. The feedback provided by the validators was subsequently addressed during the Model Revision stage, resulting in a more concise table format, more concrete filling examples, and a more practical guide.

Model Design Revision

The model revision stage was conducted after receiving detailed feedback and assessment results from both the FGD sessions and the formal validation process. The primary objective of this stage was to refine the Green Accounting Model so that it became simpler, more practical, and easier to implement in real MSME settings. Particular attention was given to ensuring that the model could be effectively used by MSME actors with diverse educational backgrounds and varying levels of accounting literacy, allowing the tool to function as an inclusive and accessible instrument for supporting local food security.

The design revision was carried out systematically following the improvement flow recommended by the validators. The research team held a series of internal review sessions to examine each suggestion in detail, assess its level of urgency, and determine the most appropriate modifications to incorporate into the model. During these sessions, the team compared the initial design with the practical challenges identified in the field and prioritized changes that would enhance usability, clarity, and relevance for MSME actors. As a result, the revisions centered on three essential aspects. First, the recording table format was simplified and reorganized to ensure that users with varying accounting literacy levels could complete it easily and consistently. Second, concrete examples and step-by-step guidance were added to illustrate how each section of the table should be filled, thereby reducing uncertainty among MSME users. Third, the completeness of environmental and social indicators was strengthened to better capture sustainability dimensions, including resource use, waste management, labor involvement, and community contributions.

The FGD results indicate that the developed model is feasible for implementation with several refinements. The feedback provided by the validators was subsequently addressed during the Model Revision stage, resulting in a more concise table format, more concrete filling examples, and a more practical guide. The revisions resulted in version 2.0 of the Green Accounting Model, which is more practical, intuitive, and ready for field testing. The model is designed for both manual use (printed sheets) and potential digital implementation (Excel or simple applications) in the future.

Table 4. Comparison of the Model Before and After Revision

Source of Feedback	Suggestion/Input	Revisions Implemented
Accounting Academics	Include examples of environmental cost calculations (electricity, water, waste management) for accurate computation.	The model guide was revised by adding example tables for environmental cost calculations with simple formulas.
Agricultural Practitioner	Integrate local raw material data recording (sago, soy, banana, etc.) into production records.	The model table was expanded to include columns for recording raw material quantities, supporting food security analysis.
MSME Actors	a. Request a simpler table format with fewer columns and more visually appealing design. b. Request step-by-step filling instructions as some participants were unsure how to complete the tables.	a. The model template was simplified using a modular design with simple icons to facilitate data entry. b. Practical step-by-step guides (1–5 steps) were added for each table section.
All Validators	Recommend that field testing be conducted over a sufficient period so that MSMEs become familiar with filling out the records.	The mentoring schedule was extended to one month, with two monitoring visits.

The revised prototype of the Green Accounting Model is structured as a modular table with three main components:

1. Economic Component: Revenue, raw material costs, production costs, gross profit, and net profit.
2. Environmental Component: Volume of water usage (m^3), electricity consumption (kWh), and waste management costs.
3. Social Component: Number of employees, training hours, and social contributions (CSR, donations, community involvement).

Table 5. Comparison of the Model Before and After Revision

Aspect	Initial Model	Revision
Table Format	More columns, less modular, relatively complex.	Simplified, grouped modularly, with visual icons.
Example Filling	No concrete example of environmental cost calculations.	Added example tables for calculating water, electricity, and waste management costs.
Example Filling	No concrete example of environmental cost calculations.	Added example tables for calculating water, electricity, and waste management costs.
Step-by-Step Guidance	No instructions for filling in columns.	Practical instructions added for each column.
Environmental & Social Indicators	Limited to general expenditures.	Expanded: local raw materials, labor, social contributions.
Ease of Use	Relatively difficult for MSMEs with low literacy levels.	More user-friendly, facilitating routine data entry.

The revisions resulted in version 2.0 of the Green Accounting Model, which is more practical, intuitive, and ready for field testing. The model is designed for both manual use (printed sheets) and potential digital implementation (Excel or simple applications) in the future.

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Model Trial

This stage aimed to test the revised green accounting model in the field. The trial was conducted to assess ease of use, integration of records, and its impact on the managerial capacity of MSMEs. The trial was implemented over one month with direct assistance from the research team. Prior to the model implementation, a pre-test was administered to evaluate the MSMEs' initial ability in financial record-keeping, environmental awareness, and understanding of green accounting concepts.

Table 6. Pre-test Score Distribution

Score Range	Number of MSMEs	Percentage	Category
> 80	0	0%	Good
60 – 79	3	60%	Fair
< 59	2	40%	Poor
Average	5	–	**56.2 (Fair)**

The pre-test results indicate that all MSMEs started from a relatively similar baseline, allowing the trial to be carried out simultaneously. Subsequently, the research team proceeded with the implementation stage, which included initial training, weekly assistance, and periodic monitoring. A summary of the trial implementation is presented below.

Table 7. Summary of Green Accounting Model Implementation

Component	Implementation
Trial Participants	Local food MSMEs: a. Household Industry (Tempe) b. Local Food Processing (Sago) c. Modern Agriculture (Hydroponics) d. Oil Production (Copra) e. Creative Food Industry (Banana Chips)
Duration	1 month implementation (2 monitoring visits)
Initial Activities	Socialization of the model & training on filling in the recording tables

After one month of implementation and mentoring, a post-test was conducted to measure the improvement in understanding and recording skills. A comparison of pre-test and post-test results is presented below.

Table 8. Pre-Test and Post-Test Results

MSME	Pre-test	Post-test	Effectiveness (%)	Category
Household Industry (Tempe)	55	80	76.7	Effective
Local Food Processing (Sago)	58	83	78.3	Effective
Modern Agriculture (Hydroponics)	60	85	79.2	Effective
Oil Production (Copra)	50	78	77.5	Effective
Creative Food Industry (Banana Chips)	58	81	77.1	Effective
Average	**56.2**	**81.5**	**78.2**	**Effective**

Following one month of implementation and mentoring, a post-test was administered to evaluate the enhancement of understanding and recording competencies. The comparative results of the pre-test and post-test are summarized in the table below.

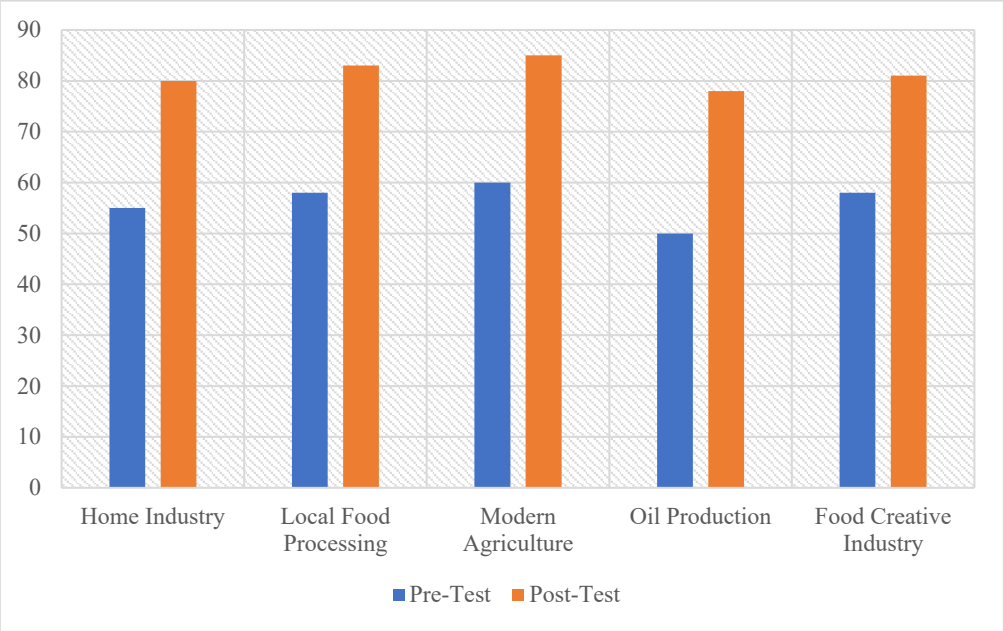

Figure 3. Bar Chart of Pre-Test and Post-Test Results

There was an average increase of 25.3 points, and all MSMEs achieved the effective category (>75%). These findings indicate that the model successfully improved recording skills while simultaneously strengthening MSMEs' sustainability awareness. The green accounting model proved effective in enhancing MSMEs' recording capacity and sensitivity toward environmental costs. The implementation was well received by all partner MSMEs, providing a strong foundation for the refinement of the final model and serving as a basis for future research directions, including broader implementation across other MSME sectors, digital model development, and integration of this model into sustainable development policies. These results are consistent with (Indraswari et al., 2024), who found that entrepreneurs' understanding and awareness levels significantly influence the implementation of green accounting. This reinforces that the designed model is capable of bridging the gap between theoretical knowledge and practical recording in the field.

Interpretation of Results

This stage was carried out to comprehensively assess the success of the green accounting model implementation by integrating quantitative data (pre–post test), qualitative findings (interviews and observations), and user perceptions. Such triangulation ensures that the results are valid, comprehensive, and academically accountable. The pre-test and post-test results indicated a significant improvement in recording skills and sustainability awareness among the five participating MSMEs, as follows:

1. The average score increased from 56.2 to 81.5 (+25.3 points).
2. All MSMEs achieved the "effective" category (>75%).
3. The effect size was classified as high, confirming that the intervention through the model had a substantial impact on behavioral change in record-keeping.

This model facilitated MSMEs in understanding the importance of recording environmental costs, integrating social aspects, and managing their businesses based on the principles of the Triple Bottom Line (Profit–People–Planet). Findings from interviews and field observations revealed that:

1. Ease of Use: MSMEs reported that the table format was easy to understand after being simplified.
2. Environmental Awareness: Entrepreneurs began to conserve water/electricity and pay attention to production waste.
3. Discipline in Record-Keeping: Records began to be maintained routinely rather than only at the end of the month.
4. Challenges: Some MSMEs struggled to allocate electricity/water costs per product; thus, the research team provided examples of allocation calculations.

A perception questionnaire was administered after the trial to evaluate user acceptance of the model.

Table 9. User Perception Evaluation

Assessment Aspect	Score (%)	Category
Ease of Use	82	Good
Relevance to Business	85	Good
Benefits for Efficiency	88	Very Good
Benefits for Sustainability	90	Very Good
Average	**86.2**	**Very Good**

The average score of 86.2 indicates a very positive user acceptance of the model. Respondents perceived the model as particularly beneficial for improving business efficiency and ensuring long-term sustainability.

Data Triangulation

To strengthen the conclusions, data from three primary sources were synthesized, as presented in the following table:

Table 10. Summary of Data Triangulation

Data Source	Key Findings	Confirmation / Support
Quantitative (Pre–Post Test)	Average score increased by +25.3 points → Effective category	Supports the claim that the model enhances recording skills
Qualitative (Interviews & Observation)	MSMEs began to keep records regularly, became aware of environmental costs, and practiced resource savings	Reinforces the evidence that behavioral changes occurred in practice
User Perception (Questionnaire)	Average score of 86.2 (Very Good)	Confirms user acceptance and the potential for long-term adoption of the model

The consistency across these three sources demonstrates that the green accounting model is valid, practical, and capable of driving behavioral change among MSMEs. The model has proven effective in enhancing recording skills and sustainability awareness. These findings are consistent with those of Indraswari et al. (2024), who showed that MSME actors' understanding and concern significantly influence the success of green accounting implementation (Indraswari et al., 2024). Furthermore, the results align with previous research that confirmed a positive relationship between the application of green accounting and the growth of the green economy in MSMEs (Wahyudi et al., 2025).

Finalization of the Model

The model finalization stage represents the concluding step of this research. After undergoing FGD, validation, field trials, and evaluation, the research team refined the green accounting model to ensure that it is simpler, more applicable, and ready for sustainable use by MSMEs. The refinement process was guided by three key considerations:

a. Findings from FGD & Validation: the need to simplify the format, provide sample calculations of environmental costs, and include step-by-step filling instructions.
b. Findings from Field Trials: challenges related to allocating electricity and water costs per product, as well as the need for more intensive monitoring.

c. Findings from Evaluation: the necessity to improve the use of symbols, add optional columns for flexibility, and adjust the structure to facilitate long-term usability.

Based on these inputs, the model was finalized with four primary areas of improvement.

Table 11. Summary of the Final Version of the Green Accounting Model

No	Aspect	Improvement Implemented
1	Table Format	Structured in modular groups (Economic–Environmental–Social), color-coded, and with clarified symbols.
2	Guidelines & Examples	Concrete examples of water, electricity, and waste costs were added, accompanied by step-by-step guidance at the top of the sheet.
3	Additional Indicators	A new column was introduced to record social contributions (CSR, employee training) and resource savings (liters of water, kWh of electricity).
4	Digitalization	The model was prepared in Excel format to allow digital input and is ready for further development into a simple application.

As the final outcome, the model is visualized in the form of a flow consisting of input → process → output → outcome.

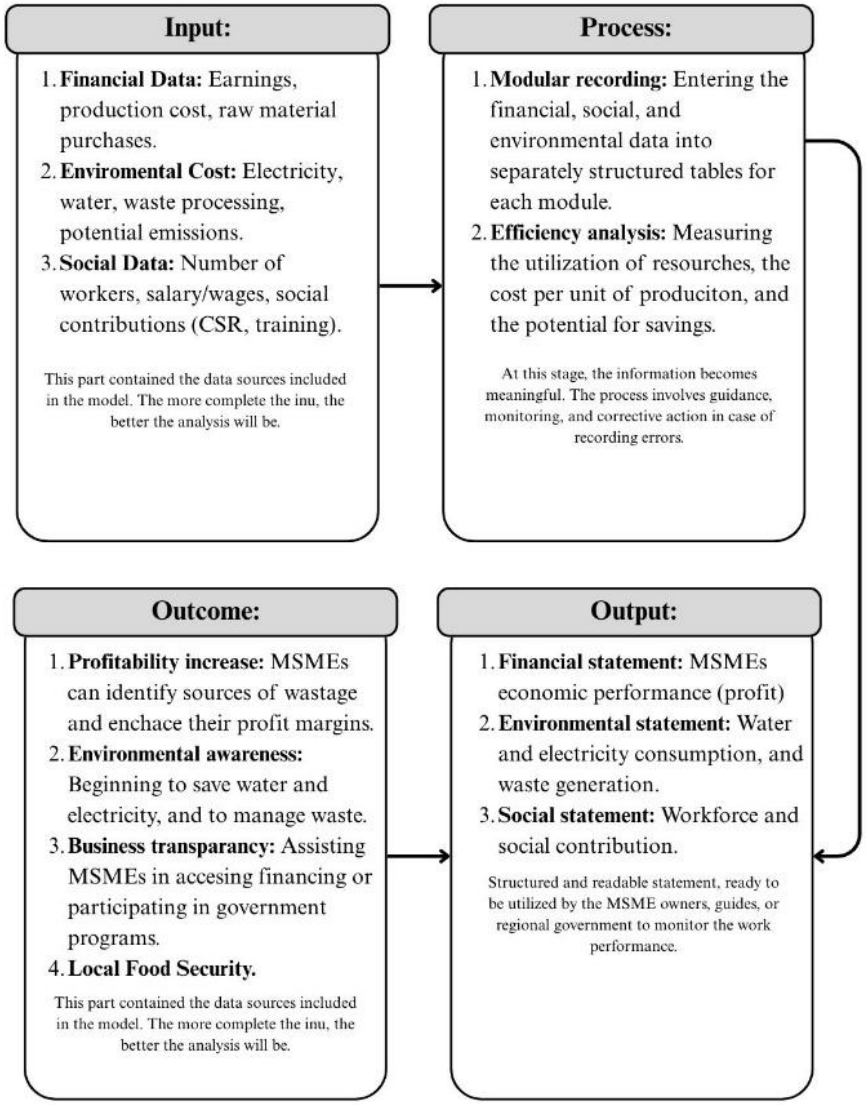

Figure 4. Final Version of the Green Accounting Model

This visualization aligns with the concept of Environmental Management Accounting (EMA) (Schaltegger et al., 2008), which emphasizes the integration of environmental information into decision-making, thereby enabling the model to serve as a sustainable management tool for MSMEs. The iterative approach is consistent with the principles of Participatory Action Research (PAR), which highlights repeated reflection until the model fully meets field needs (Herr & Anderson, 2015). The final outcome reinforces the literature that underscores the significance of green accounting as an instrument of accountability and sustainability (Indraswari et al., 2024).

4. Discussion

The findings of this study demonstrate that the development of a Green Accounting Model based on Participatory Action Research (PAR) can significantly enhance both the recording capacity and sustainability awareness of local food-based MSMEs in South Konawe Regency. The discussion highlights three main aspects: the relationship of the findings to prior studies, the practical implications for MSMEs, and the academic contributions and novelty of the research.

Effectiveness of the Model in Enhancing MSME Capacity

The results of the pre-test and post-test indicate an average improvement of 25.3 points, from 56.2 (categorized as "fair") to 81.5 (categorized as "effective"). All MSMEs achieved effectiveness scores above 75%, signaling the success of the model intervention. This improvement demonstrates that a simplified yet integrative accounting approach—covering economic, environmental, and social dimensions—can be both accessible and applicable for MSME actors with diverse levels of accounting literacy.

These findings align with Indraswari et al. (2024), who emphasized the critical role of entrepreneurs' understanding and awareness in the successful implementation of green accounting. Moreover, they corroborate with (Thi Uong, 2025) who reported a positive relationship between the application of green accounting and the advancement of green economy practices among MSMEs. Thus, this study provides empirical evidence that the developed model bridges the gap between the theoretical concept of green accounting and its practical application in the field.

User Acceptance and Perceptions

Qualitative evidence from interviews and field observations revealed that MSME participants experienced tangible benefits from the model. The simplified tabular format, the inclusion of step-by-step guidance, and worked examples of environmental costs made recordkeeping easier to conduct on a routine basis. Respondents reported beginning to implement water and electricity conservation practices and paying greater attention to production waste. These outcomes suggest that the model not only influences administrative practices but also fosters behavioral changes that promote business sustainability.

The evaluation of user perceptions reinforced these findings, with an average score of 86.2% (categorized as "very good"). The most highly valued aspects were the model's contribution to business efficiency (88%) and long-term sustainability (90%). Accordingly, user acceptance of the model can be considered high, providing a strong indicator of its potential for long-term adoption.

Practical Implications for MSMEs

The implementation of the model offers several practical implications: a simple yet comprehensive accounting system enables MSMEs to manage economic, social, and environmental dimensions simultaneously (Hasnidar et al., 2025).

a. A simple yet comprehensive accounting system enables MSMEs to manage economic, social, and environmental dimensions simultaneously.
b. Heightened environmental awareness was reflected in the documentation of water, electricity, and waste costs that were previously overlooked.
c. The digitalized version prepared in Excel format opens opportunities for the development of a simple application, allowing for more efficient and cross-platform recordkeeping.
d. The model aligns with Environmental Management Accounting (EMA) concepts, suggesting strong potential for integration into regional sustainable development policies.

5. Conclusion

This study provides strong empirical evidence that a Green Accounting Model developed through the combined approaches of Research and Development (R&D) and Participatory Action Research (PAR) can substantially enhance the recording capacity, sustainability awareness, and managerial practices of local food-based MSMEs in South Konawe Regency. The model's implementation resulted in significant improvements in MSME recordkeeping skills, as shown by the increase in average scores from 56.2 to 81.5, alongside clear behavioral changes related to environmental cost awareness and resource-efficiency practices. These findings confirm that a simplified, modular, and contextually grounded accounting tool can effectively bridge the gap between sustainability principles and daily business operations among MSMEs. From a theoretical perspective, the study strengthens the literature on green accounting by demonstrating how sustainability-oriented accounting systems can be operationalized within low-literacy, resource-constrained business environments. The integration of economic, environmental, and social components within a single management instrument extends the practical applicability of the Triple Bottom Line (TBL) and Environmental Management Accounting (EMA) frameworks. Moreover, the PAR-based development process supports theories emphasizing stakeholder engagement and iterative model refinement as determinants of successful sustainability adoption. Moreover, the model offers a viable solution for improving MSME accountability and efficiency while supporting broader regional goals of food security and creative economy development. The digital-ready structure of the model, especially its Excel-based version, opens pathways for future deployment through simple mobile or desktop applications. Policymakers and local development agencies can adopt this model as part of MSME empowerment programs, sustainability training, and environmental reporting initiatives.

While the study provides valuable insights, its limitations should be acknowledged. The research was conducted within a limited geographic area and involved a relatively small number of MSMEs, which may influence the generalizability of the findings. The trial period was also relatively short, which may not fully capture longer-term behavioral changes or challenges in sustained implementation. However, these limitations do not diminish the study's significance; rather, they highlight opportunities for further research involving broader samples, cross-sectoral comparisons, and extended implementation periods. This article makes a substantive contribution by producing a theoretically grounded and empirically validated Green Accounting Model that is simple, flexible, and ready for practical adoption. The study advances scholarly understanding of sustainability accounting in MSMEs while providing a concrete tool capable of supporting green economic transformation at the local level.

6. References

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