

Developing a Sustainable Performance Measurement Model for Food and Beverage MSMEs: An Exploratory Factor Analysis Approach

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Abstract

This study develops a preliminary sustainable performance measurement model for Food and Beverage (F&B) Micro, Small, and Medium Enterprises (MSMEs) by identifying context-specific sustainability dimensions through an exploratory quantitative approach. Existing sustainability measurement frameworks are predominantly designed for large corporations and fail to capture the operational realities of micro-enterprises characterized by informality, limited resources, and high dependence on communal resources. A survey of 85 F&B MSME owners and managers was conducted from March to June 2026 using a structured five-point Likert questionnaire comprising 17 initial indicators derived from the Triple Bottom Line and Natural-Resource-Based View frameworks. The questionnaire was distributed electronically via Google Forms to participants attending training programs organized by the Cooperatives and MSMEs Office of Yogyakarta. Purposive sampling was applied with eligibility criteria requiring businesses to have operated for at least three years, participated in official training, and implemented basic waste management practices. Data were analyzed using Exploratory Factor Analysis with Principal Axis Factoring extraction and Varimax rotation. The data were suitable for factor analysis (KMO = 0.768; Bartlett's Test, $p < 0.001$). Four factors with eigenvalues greater than one were retained, collectively explaining 66.98% of the total variance, representing economic performance (4 indicators), environmental performance (5 indicators), social performance (5 indicators), and digital adaptation and innovation (3 indicators). Cronbach's alpha values ranged from 0.833 to 0.882, indicating satisfactory internal consistency. The findings suggest that sustainable performance in F&B MSMEs is multidimensional and extends beyond conventional financial indicators by incorporating environmental stewardship, community-oriented social responsibility, and digital capabilities. Theoretically, this study extends the Triple Bottom Line framework by identifying digital adaptation as an empirically distinct factor and highlights the role of local cultural values in shaping social performance. Practically, the proposed framework offers a contextual assessment tool for business operators, incubators, and government agencies to monitor sustainability contributions towards the 2030 Sustainable Development Goals. However, the proposed model remains exploratory and requires further validation using larger samples and Confirmatory Factor Analysis before broader application.

Keywords: *Sustainable Performance Measurement, Food and Beverage MSMEs, Exploratory Factor Analysis, Digital Adaptation, Sustainability Assessment*

INTRODUCTION

The rapid growth of the Food and Beverage (F&B) Micro, Small and Medium Enterprises (MSMEs) sector in Yogyakarta, as the epicentre of the creative economy, faces a major paradox between economic growth and environmental degradation. MSMEs in Yogyakarta are highly vulnerable to shocks, such as during a pandemic or rises in the price of staple goods (Santoso et al., 2024). However, the measurement of sustainable performance in this sector is often trapped in the

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oversimplification of financial indicators. Externalities such as supply chain emissions, food waste management, and the exploitation of local water resources tend to be overlooked (Caldera et al., 2019; Santos & Martins, 2021).

The root of the problem lies in the dominance of global measurement instruments that are top-down and overly administrative in nature, thereby failing to capture the operational realities of MSMEs in Yogyakarta, which are characterised by informality, limited production scale, and high dependence on communal resources (Dari, 2024; Juergensen et al., 2020). This problem is further exacerbated by the fact that most existing sustainable performance measurement frameworks are designed for large corporations, making them ill-suited for application to MSMEs with limited resources and managerial capacity (Sarfo et al., 2026). As dominant financial indicators such as turnover and profit fail to capture information on resource efficiency or ecological footprints, it is impossible to ascertain whether Yogyakarta is moving towards green growth or merely shifting the environmental burden to the future and other regions.

Theoretically, this discourse is rooted in the Triple Bottom Line (TBL) model, which calls for a balance between profit, people, and the planet (Elkington, 1997), and is reinforced by the Natural-Resource-Based View (NRBV), which positions environmental capabilities as a source of competitive advantage (Hart, 1995; Singh et al., 2021). However, the implementation of this grand theory within F&B MSMEs often faces a disconnect, as these theories were originally developed for large corporate entities with established governance structures (Barney, 1991; Mishra et al., 2024). In the context of Yogyakarta, there is a need to integrate a more inclusive Stakeholder Theory to capture how social capital and kinship ties, which characterise local businesses, can be quantified as part of sustainable social performance (Freeman et al., 2010; Siregar & Pinagara, 2022). Without theoretical reconceptualisation, sustainable performance indicators will merely become an administrative burden rather than a strategic tool for MSME operators.

A theoretical gap arises from the scarcity of literature integrating the variables of local wisdom and digital transformation as determinants of sustainable performance, which are in fact the main pillars of MSMEs' competitiveness in Yogyakarta (Leesatapornwongsa et al., 2023; Liu et al., 2024). Empirically, previous research has largely focused on large-scale manufacturing industries or the service sector in general. Consequently, there is a data gap regarding the effectiveness of sustainability indicators for micro-enterprises, which face seasonal fluctuations in raw material supply and capital constraints (Inigo & Albareda, 2019; Saunders et al., 2020). The urgency of this research is reinforced by the fact that Yogyakarta has set ambitious targets for low-carbon development. However, the sustainability performance evaluation tools for F&B MSMEs as the largest contributors to organic waste have not yet been empirically validated, creating uncertainty in data-driven policy-making (Bappenas, 2021; Fawaid et al., 2026).

Given this complexity, the main research problem is the absence of a sustainable performance measurement model capable of accommodating the hybrid characteristics between digital modernity and cultural tradition within F&B MSMEs in Yogyakarta. The objective of this research is to identify and preliminarily structure context-specific sustainable performance indicators that measure not only economic output but also the efficiency of resource circularity and social impacts on the community. Theoretically, this research will enrich the literature on small-business-based sustainability management in developing countries. Practically, it will provide an assessment tool for governments and business operators to monitor tangible contributions towards the 2030 SDGs. Therefore, this research is crucial to ensure that the growth of the culinary sector in Yogyakarta remains within the framework of inclusive and responsible sustainability.

LITERATURE REVIEW

Prior Empirically Derived Sustainability Measurement Instruments for SMEs

Several sustainability measurement instruments for SMEs have been developed using diverse approaches, yet the majority are designed for medium-to-large enterprises or the manufacturing sector, rendering them less suitable for micro-scale F&B MSMEs. [Caldera et al., \(2019\)](#) developed a lean and green framework for manufacturing SMEs focusing on operational efficiency, while [Moore & Manring \(2009\)](#) emphasized value network resilience without accommodating the characteristics of micro-enterprises that heavily depend on perishable raw materials with short shelf lives. [Santos and Martins \(2021\)](#) focused on food waste management but oriented their instrument toward medium-to-large food processing companies, whereas [Siregar & Pinagara \(2022\)](#) adapted green supply chain management for Indonesian SMEs without specifically addressing the F&B sector. [Leesatapornwongsa et al. \(2023\)](#) developed a sustainability metric for innovation in the food industry designed for medium-to-large enterprises with formal R&D capacity. [Widijastuti et al. \(2026\)](#) developed a circular economy model for F&B MSMEs in Central Java, revealing low circularity levels, yet their instrument remains diagnostic and has not yielded a comprehensive dimensional structure. [Primadasa et al. \(2025\)](#) identified 16 indicators for halal-sustainable supply chain management, but their approach remains conceptual and has not been empirically tested using EFA at the micro-enterprise level. [Trequattrini et al. \(2025\)](#) developed a Digital-Sustainability Readiness Index (DSRI) for industrial SMEs measuring digital-sustainability readiness, yet it was designed for medium-scale enterprises (50-499 employees).

Collectively, these instruments suffer from fundamental limitations: first, they have not been empirically validated at the micro-enterprise level using EFA, raising questions about their construct validity ([Hair et al., 2019](#); [Sarfo et al., 2026](#)); second, they overlook the operational realities of micro-enterprises characterized by informality and reliance on communal resources ([Dari, 2024](#); [Juergensen et al., 2020](#)); third, they have not adequately integrated local wisdom and digital adaptation as determinants of sustainable performance, despite both being key pillars of SME competitiveness in Yogyakarta ([Leesatapornwongsa et al., 2023](#); [Liu et al., 2024](#)); and fourth, they have not measured contextual indicators such as managing environmental impacts in densely populated settlements (I13) or social contributions rooted in local traditions (I14). These gaps justify the need for research that develops a contextual sustainable performance measurement model for micro-scale F&B MSMEs through an EFA approach capable of identifying empirically grounded dimensional structures while accommodating the hybrid characteristics of digital modernity and cultural tradition in Yogyakarta.

Conceptualisation of Sustainable Performance and Criticism of the Corporate Approach

Fundamentally, the concept of sustainable performance is rooted in the Triple Bottom Line (TBL) framework, which calls for a balanced integration of economic, social and environmental aspects into an organisation's operational activities ([Elkington, 1997](#); [Moore & Manring, 2009](#)). As the concept has evolved, much of the literature views sustainable performance as a manifestation of a company's ability to minimise negative environmental and social impacts whilst continuing to pursue competitive profit growth ([Caldera et al., 2019](#); [Saunders et al., 2020](#)). However, there is a systemic tendency for these indicators to be formulated within the context of large corporations that possess formal reporting structures and abundant resources ([Juergensen et al., 2020](#)). Consequently, the measurement models currently available are often overly complex and rigid, and thus fail to capture the unique dynamics of MSMEs, particularly in the food and beverage (F&B) sector, which is heavily reliant on the intensive use of raw materials and close social interaction with local consumers ([Dari, 2024](#); [Santos & Martins, 2021](#)).

The Natural-Resource-Based View (NRBV) as a Source of Competitive Advantage

The Natural-Resource-Based View (NRBV) provides a theoretical foundation that sustainable performance is not merely a cost burden, but a strategic capability with the potential to create a competitive advantage (Hart, 1995; Singh et al., 2021). This theory proposes three main pillars: pollution prevention, responsible product management, and sustainable development. These three pillars require mastery of resources that are difficult for competitors to replicate (Barney, 1991; Hart, 1995). Within the SME ecosystem, the implementation of NRBV enables businesses to improve operational efficiency through waste reduction and energy optimisation, which in turn strengthens their market position through an environmentally friendly brand image (Inigo & Albareda, 2019; Liu et al., 2024). Therefore, sustainable performance can be understood as a manifestation of an organisation's ability to manage its dependence on natural resources in an intelligent and regenerative manner (Hart, 1995; Leesatapornwongsa et al., 2023).

The Dynamics of Sustainability in the Food and Beverage (F&B) SME Sector

Unlike multinational corporations, MSMEs in the F&B sector operate with limited capital, technology, and managerial capacity, which often hinders the systematic implementation of sustainable practices (Moore & Manring, 2009; Siregar & Pinagara, 2022). Despite these resource constraints, the F&B sector faces significant public and regulatory pressure regarding key issues such as food waste management, the use of plastic packaging, and energy wastage (Bappenas, 2021; Santos & Martins, 2021). In addition to environmental dimensions, social aspects such as food safety and the welfare of local workers are key determinants of long-term business sustainability (Freeman et al., 2010). This phenomenon underscores that measuring the sustainability performance of F&B MSMEs requires indicators that are more contextual, simpler, and capable of reflecting on-the-ground realities without losing sight of the comprehensive essence of the sustainability dimension itself (Caldera et al., 2019; Dari, 2024).

Item Formulation for Empirical Testing (EFA)

To date, approaches to measuring sustainable performance have remained dominated by ESG (Environmental, Social, and Governance) metrics and top-down normative reporting standards (Inigo & Albareda, 2019; Juergensen et al., 2020). These approaches have a fundamental weakness as they often do not undergo rigorous empirical validation at the micro-enterprise level, thereby calling into question their construct validity (Hair et al., 2019; Saunders et al., 2020). In other words, there is a methodological gap whereby the literature still lacks studies that utilise exploratory statistical techniques such as Exploratory Factor Analysis (EFA) to identify the latent structure of sustainability indicators that are truly relevant to MSMEs (Hair et al., 2019; Leesatapornwongsa et al., 2023). EFA is a crucial approach as it enables researchers to reduce a complex set of indicators to a few key dimensions based on empirical correlation patterns identified directly in the field (Hair et al., 2019; Singh et al., 2021). Based on the literature review above, the following is the proposed formulation of sustainable performance instrument items to be tested using EFA to assess their suitability for the context of F&B MSMEs in Yogyakarta:

Table 1. Formulation of Sustainable Performance Measurement Items

CODE	INDICATOR DESCRIPTION	SOURCE
I1	Consistent efforts to achieve growth in sales volume through the integration of offline sales channels and digital platforms	Liu et al., 2024
I2	The company prioritises the use of raw materials from local suppliers in the DIY region to reduce logistics costs and supply risks	Siregar & Pinagara, 2022

CODE	INDICATOR DESCRIPTION	SOURCE
I3	Efforts to optimise the use of raw materials, thereby minimising costs arising from expired or damaged materials	Leesatapornwongsa et al., 2023
I4	Businesses have contingency funds allocated to ensure operational continuity in the event of market shocks	Moore & Manring, 2009
I5	Businesses systematically implement procedures for separating organic (food waste) and inorganic waste in production areas	Santos & Martins, 2021
I6	Efforts to manage waste so as not to pollute the surrounding drainage system	Bappenas, 2021
I7	Efforts to use biodegradable product packaging or to encourage consumers to bring their own containers	Inigo & Albareda, 2019
I8	Efforts to implement water and electricity efficiency practices in food processing to reduce the ecological footprint	Caldera et al., 2019
I9	Active efforts to innovate menus to utilise parts of raw materials that are usually discarded (upcycled food)	Leesatapornwongsa et al., 2023
I10	Efforts to ensure hygiene and food safety standards (including Halal/PIRT certification) to protect consumer health	Freeman et al., 2010
I11	Efforts to provide flexible working arrangements and a safe working environment for employees, even within a simple organisational structure	Dari, 2024
I12	Efforts to involve local residents in the production or distribution process as a form of local economic empowerment	Siregar & Pinagara, 2022
I13	Efforts to maintain environmental order (regarding noise pollution, cooking odours and parking) so as not to disturb the comfort of local residents	Moore & Manring, 2009
I14	Efforts to contribute voluntarily to social or traditional activities in the area where the business operates	From, 2024
I15	Efforts to use point of sale or inventory applications to monitor raw material stock levels precisely to prevent food loss	Liu et al., 2024
I16	Efforts to utilise social media to educate consumers about the sustainability values of products (e.g. 'minimise plastic' campaigns)	Fawaid et al., 2026
I17	Efforts to adopt cashless payment systems to improve financial transparency and accountability	Liu et al., 2024

RESEARCH METHODOLOGY

Research Design and Sample

This study employed an exploratory quantitative design using purposive sampling, focusing on MSMEs in the Food and Beverage (F&B) sector in Yogyakarta, which was selected due to the uniqueness of its economic structure and local sustainability challenges ([Dari, 2024](#)). The data collection was conducted over four months, from March to June 2026. The questionnaire was distributed electronically via Google Forms by sending a direct link to participants who attended training programs organized by the Cooperatives and MSMEs Office of the Special Region of

Yogyakarta (Dinas Koperasi dan UMKM DIY). The purposive sampling technique was applied with the following eligibility criteria: (1) the business had been operating for at least three years; (2) the business owner or manager had participated in training programs conducted by the Cooperatives and MSMEs Office; and (3) the business had implemented basic waste management practices. The respondents were owners or managers of F&B MSMEs who were directly involved in business management. All questionnaires were completed properly, as the data collection was conducted immediately after the training sessions, during which respondents were guided through the questionnaire and encouraged to provide thoughtful responses. Data were collected using a structured five-point Likert questionnaire covering economic, environmental, social, and digital adaptation dimensions, designed to capture the specific operational realities of small businesses (Saunders et al., 2020). This sample size yielded a 5:1 respondent-to-item ratio from 17 initial indicators, which represents a minimum level and is acknowledged as a limitation; however, it was considered appropriate for this preliminary instrument development stage to identify correlation patterns and carry out item refinement before testing on a larger scale (Hair et al., 2019; Tabachnick et al., 2019). Participation was voluntary, respondents provided informed consent before completing the questionnaire, and all responses were anonymized to ensure confidentiality.

Data Analysis Technique

Data analysis was carried out using Exploratory Factor Analysis (EFA) with Principal Axis Factoring (PAF) extraction and Varimax rotation to reduce the indicators to a more concise and meaningful dimensional structure. The analysis was performed using IBM SPSS Statistics. Before factor extraction, data quality was assessed using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy with a minimum threshold of 0.60, as well as the significance of Bartlett's Test of Sphericity ($p < 0.05$), to ensure the data possessed sufficient correlation for factor analysis (Hair et al., 2019; Watkins, 2018). The number of factors to be retained was determined based on the Kaiser criterion, which retains factors with eigenvalues greater than one (Kaiser, 1960), supported by examination of the scree plot to ensure the stability of the factor structure (Cattell, 1966).

The decision criteria for retaining items were based on a minimum factor loading of 0.50, whereby items with low factor loadings (below 0.50) or those exhibiting cross-loading (loadings above 0.40 on two or more factors) were eliminated sequentially to maintain construct validity (Field, 2024; Hair et al., 2019). This iterative procedure involves eliminating one item at a time, followed by re-running the factor analysis after each elimination, until all remaining items exhibit a clean factor structure with loadings above the established threshold and no substantial cross-loadings (Tabachnick et al., 2019). The internal consistency of the retained factors was further assessed using Cronbach's Alpha coefficient, with a minimum acceptable threshold of 0.70 for each extracted dimension, to ensure adequate reliability of the measurement instrument (Nunnally & Bernstein, 1994). This approach is expected to yield an empirically and contextually valid model for measuring sustainable performance within the F&B SME ecosystem in Yogyakarta. The resulting factor structure serves as a preliminary measurement framework that requires further validation through Confirmatory Factor Analysis (CFA) using larger samples before broader application (Sarfo et al., 2026; Hair et al., 2019).

Respondent Characteristics

The demographic profile of the 85 respondents is presented in Table 2. The majority of respondents were female (65.9%), reflecting the dominance of women entrepreneurs in the F&B MSME sector in Yogyakarta. Most respondents were aged between 31 and 45 years (48.2%), indicating that the F&B sector is primarily managed by individuals in their productive prime. In terms of education, the majority held a senior high school diploma (44.7%), followed by bachelor's

degree holders (25.9%), suggesting moderate formal education levels among business operators. Regarding business characteristics, more than half of the enterprises (54.1%) had been operating for 3-10 years, indicating relatively established businesses. In terms of business scale, micro-enterprises (≤ 5 employees) dominated the sample (62.4%), confirming the focus on micro-scale F&B businesses. The majority of businesses (57.6%) reported monthly revenues between IDR 5-20 million, reflecting the typical turnover range of micro-enterprises in the F&B sector. Nearly half of the respondents (48.2%) operated home-based businesses, confirming the high level of informality in the sector.

Table 2. Respondent Characteristics

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	29	34.1
	Female	56	65.9
Age	18-30 years	22	25.9
	31-45 years	41	48.2
	>45 years	22	25.9
Education	Elementary/Junior High	15	17.6
	Senior High School	38	44.7
	Diploma	10	11.8
	Bachelor's Degree	22	25.9
Business Age	<3 years	22	25.9
	3-10 years	46	54.1
	>10 years	17	20.0
Business Scale	Micro (≤ 5 employees)	53	62.4
	Small (6-19 employees)	24	28.2
	Medium (20-99 employees)	8	9.4
Monthly Revenue	< IDR 5 million	19	22.4
	IDR 5-20 million	49	57.6
	> IDR 20 million	17	20.0
Business Location	Home-based	41	48.2
	Rental Shop/Stall	35	41.2
	Others	9	10.6

Source: Primary data processed (2026)

FINDING AND DISCUSSION

KMO and Bartlett's Test

The results of the factor analysis suitability test showed a KMO value of 0.768 (> 0.5) and a significant Bartlett's Test of Sphericity ($\chi^2 = 614.135$; $df = 136$; $p < 0.05$). Consequently, the data are adequate and suitable for further analysis using factor analysis techniques. The results of the factor analysis suitability test are shown in Table 3:

Table 3. KMO and Bartlett's Test results

KMO	Chi-Square	df	Sig.
0.768	614.135	136	0.000

Total Variance Explained

The results of the factor analysis indicate that four principal factors were identified, each with an eigenvalue greater than 1. Collectively, these four factors account for 66.982% of the total variance. This suggests that the resulting model is well-suited to representing the data structure. The results for total variance are shown in Table 4:

Table 4. Total Variance Explained

Factor	Eigenvalue	% Variance	Cumulative %
1	3.624	21.316	21.316
2	3.231	19.005	40.321
3	2.913	17.133	57.454
4	1.620	9.528	66.982

Parallel Analysis

Parallel analysis was conducted to determine the number of factors to retain. The results supported a four-factor solution, as the observed eigenvalues of the first four factors exceeded their corresponding 95th percentile random eigenvalues. The detailed results are presented in Table 5, while the parallel analysis and scree plot are illustrated in Figure 1.

Table 5. Parallel Analysis

Factor	Observed eigenvalue	95th percentile random eigenvalue	Decision
1	3.624	2.059	Retain
2	3.231	1.809	Retain
3	2.913	1.635	Retain
4	1.62	1.505	Retain
5	0.703	1.382	Do not retain
6	0.663	1.274	Do not retain

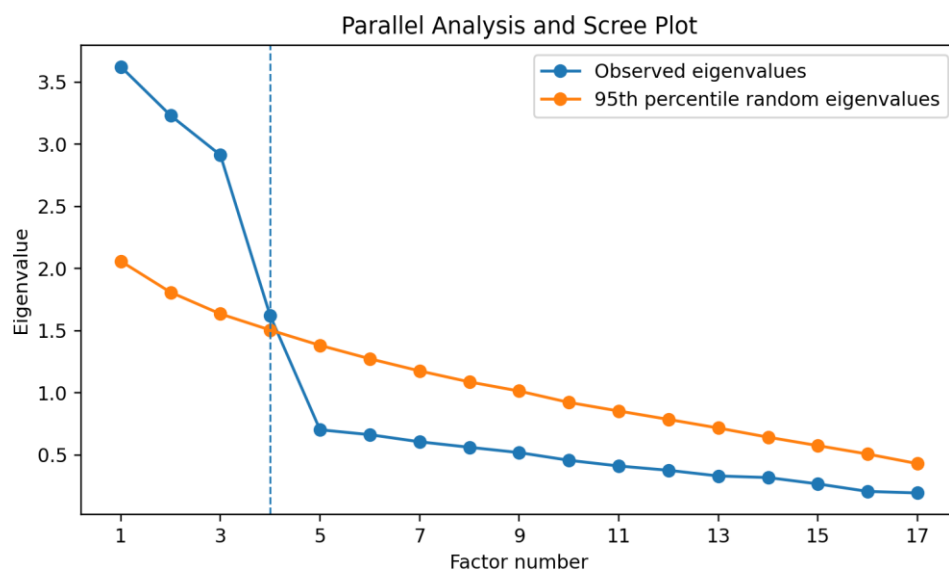


Figure 1. Parallel Analysis and Scree Plot

PAF Factor Structure and Reliability

The Principal Axis Factoring (PAF) results revealed four dimensions of sustainable performance, with factor loadings ranging from 0.673 to 0.848 and communalities ranging from 0.459 to 0.727. The Cronbach's alpha values ranged from 0.833 to 0.882, indicating satisfactory internal consistency across the retained factors. The detailed results are presented in Table 6.

Table 6. PAF Factor Structure and Reliability

Factor	Item	Loading	Communality	Cronbach's α
Social Performance	I10	0.767	0.596	0.882
Social Performance	I11	0.801	0.665	
Social Performance	I12	0.771	0.612	
Social Performance	I13	0.734	0.551	
Social Performance	I14	0.794	0.636	
Environmental Performance	I5	0.720	0.529	0.833
Environmental Performance	I6	0.762	0.596	
Environmental Performance	I7	0.699	0.501	
Environmental Performance	I8	0.691	0.512	
Environmental Performance	I9	0.673	0.459	
Economic Performance	I1	0.775	0.628	0.873
Economic Performance	I2	0.848	0.727	
Economic Performance	I3	0.823	0.688	
Economic Performance	I4	0.740	0.562	
Digital Adaptation & Innovation	I15	0.691	0.489	0.688
Digital Adaptation & Innovation	I16	0.547	0.385	
Digital Adaptation & Innovation	I17	0.697	0.516	
Overall instrument	I1–I17	—	—	0.729

All retained items show primary loadings above 0.50. The four-factor structure corresponds to Economic Performance (I1–I4), Environmental Performance (I5–I9), Social Performance (I10–I14), and Digital Adaptation & Innovation (I15–I17). Cronbach's alpha was calculated from the 85-response dataset.

Variance Explained by the PAF Solution

The PAF results showed that the four retained factors collectively explained 56.78% of the total variance. Social Performance accounted for 18.10%, followed by Economic Performance (15.56%), Environmental Performance (15.27%), and Digital Adaptation and Innovation (7.85%). The detailed variance explained by each factor is presented in Table 7.

Table 7. Principal Axis Factoring (PAF)

Factor	Eigenvalue (PAF)	% Variance	Cumulative %	Items
Social Performance	3.239	18.10	18.10	I10, I11, I12, I13, I14
Environmental Performance	2.759	15.27	33.37	I5, I6, I7, I8, I9
Economic Performance	2.536	15.56	48.92	I1, I2, I3, I4
Digital Adaptation & Innovation	1.118	7.85	56.78	I15, I16, I17
Total retained	9.652	56.78	56.78	17 items

Rotated Component Matrix (Varimax Rotation)

The results of the Varimax rotation show that the indicators cluster clearly into four main factors with strong loading values (>0.5). The first factor represents the social dimension, the second the environmental dimension, the third the economic dimension, and the fourth the digital adaptation and innovation dimension. No significant cross-loadings were found, so the factor structure can be considered stable. The following are the four main factors based on the EFA results:

a. Economic Factors

Economic factors encompass indicators relating to business growth, operational efficiency, the optimisation of resource utilisation, and a business's ability to maintain financial stability and resilience. There are four items included in the economic aspect, namely items I1, I2, I3 and I4.

b. Environmental Factors

Environmental factors include waste management practices, the efficient use of resources (water and energy), and the use of environmentally friendly packaging. This dimension indicates the extent to which MSMEs integrate the principles of environmental sustainability into their operational activities. The items included in the environmental factor are items I5, I6, I7, I8, and I9.

c. Social Factors

Social factors cover indicators relating to employee welfare, workplace safety, community engagement, and the business's social contribution to the surrounding environment. This dimension emphasises that MSMEs function not only as economic entities but also as social actors with a responsibility towards society. The items included in this factor are I10, I11, I12, I13, and I14.

d. Digitalisation Factors

The digitalisation factor reflects the level of technology adoption in business operations, such as the use of point-of-sale systems, cashless payments, and the use of social media for communication and consumer education. Items included in this factor are I15, I16, and I17.

Discussion

The factor structure derived from the EFA confirms that the measurement of sustainable performance in F&B MSMEs cannot be reduced solely to financial indicators, but requires a multidimensional approach that reflects the operational realities of resource-intensive, community-oriented small businesses (Caldera et al., 2019; Dari, 2024). The following is a detailed description of each indicator:

Economic Performance Dimension (4 indicators: I1, I2, I3, I4)

The economic dimension in this study measures not only short-term profitability but also resilience and sustainable operational efficiency. Indicator I1 (sales volume growth through the integration of offline and digital channels) reflects the ability of MSMEs to utilise market diversification to maintain income stability, which is consistent with the findings of Liu et al. (2024) that the digitalisation of sales channels enhances business resilience against fluctuations in demand. Indicator I2 (prioritising raw materials from local suppliers in DIY) demonstrates a strategy to reduce logistics costs and supply risks, whilst strengthening the local circular economy (Siregar & Pinagara, 2022). Indicator I3 (optimisation of raw material usage to minimise losses due to expiry) directly reduces food loss and increases profit margins, which is a key practice in sustainable supply chain management (Leesatapornwongsa et al., 2023). Finally, I4 (allocation of reserve funds to cope with market shocks) represents long-term financial capacity, which forms the foundation of resilience, as emphasised by Moore & Manring (2009) in the context of SMEs.

Thus, the identified economic dimensions go beyond traditional turnover indicators and point towards the concept of sustainable economic resilience.

Environmental Performance Dimension (5 indicators: I5, I6, I7, I8, I9)

The environmental dimension is the factor with the highest number of indicators, confirming that ecological pressures on the F&B sector are particularly significant in Yogyakarta. Indicator I5 (separation of organic and inorganic waste) represents a foundational waste management practice. Indicator I6 (efforts to manage waste so as not to pollute the surrounding drainage system) addresses liquid waste management, particularly used cooking oil, as unmanaged F&B waste contributes to drainage pollution and methane emissions (Santos & Martins, 2021; Bappenas, 2021). Indicator I7 (the use of biodegradable packaging or 'bring your own' schemes) addresses the plastic waste crisis whilst building a green brand image (Inigo & Albareda, 2019). Indicator I8 (water and electricity efficiency) reduces both the ecological burden and operational costs, in line with the principle of eco-efficiency within the NRBV framework (Hart, 1995). Indicator I9 (active efforts to innovate menus to utilise parts of raw materials that are usually discarded, or upcycled food) demonstrates creativity in utilising parts of raw materials that are usually discarded, such as fruit peel or tofu residue, which not only reduces waste but also creates added value for the product (Leesatapornwongsa et al., 2023). Collectively, these five indicators measure the extent to which SMEs have internalised the principles of the circular economy, which is an absolute prerequisite for environmental sustainability in densely populated urban areas such as Yogyakarta (Bappenas, 2021).

Social Performance Dimension (5 indicators: I10, I11, I12, I13, I14)

The social dimension captures stakeholder aspects that are often marginalised in conventional measurements. Indicator I10 (guarantees of hygiene, food safety, and Halal/PIRT certification) forms the basis of consumer trust and regulatory compliance, which, in stakeholder theory, is key to business legitimacy (Freeman et al., 2010). Indicator I11 (workplace flexibility and a safe environment for employees) reflects the welfare of informal workers, who in Yogyakarta are often excluded from formal social security schemes (Dari, 2024). Indicator I12 (involvement of residents in production/distribution) demonstrates practices of local economic empowerment that strengthen social capital and reduce inequality (Siregar & Pinagara, 2022). Indicator I13 (maintaining environmental order: noise pollution, cooking odours, parking) is highly specific to the context of F&B MSMEs located in densely populated residential areas; the inability to manage these disturbances can trigger community conflicts that threaten business sustainability (Moore & Manring, 2009). Indicator I14 (voluntary contributions to social/traditional activities) embodies the value of 'Hamemayu Hayuning Bawana' (enhancing the beauty of the world), a form of local wisdom that distinguishes the Yogyakarta context (Dari, 2024). Thus, the social dimension in this study measures not only responsibility but also strategies for integration with the community.

Digital Adaptation & Innovation Dimension (3 indicators: I15, I16, I17)

The fourth dimension reflects the role of digital technology as an enabler of sustainability. Indicator I15 (c/inventory applications for precise stock monitoring) directly prevents food loss resulting from forecasting errors, which is a major source of waste in small-scale MSMEs (Liu et al., 2024). Indicator I16 (the use of social media to educate on the value of sustainability, for example, 'minimise plastic' campaigns) demonstrates that MSMEs not only sell products but also build collective awareness, which is in line with the concept of green marketing (Fawaid et al., 2026). Indicator I17 (cashless payment systems) enhances cash flow transparency and financial accountability, which is crucial for SMEs that previously relied on manual record-keeping (Liu et

al., 2024). Interestingly, the digitalisation dimension is separate from the economic dimension within the EFA framework, indicating that technology adoption is not merely a tool for increasing profits, but a strategic capability in its own right that supports the other three dimensions of sustainability (Sarfo et al., 2026). This finding reinforces the argument that digital transformation is a key factor in the sustainable performance of SMEs in the post-pandemic era.

The four-dimensional structure identified in this study both converges with and departs from existing sustainability measurement frameworks for SMEs. In terms of convergence, the economic and environmental dimensions align closely with the *lean and green* framework proposed by Caldera et al. (2019), which emphasizes operational efficiency and waste reduction as core sustainability practices for manufacturing SMEs. Similarly, the social dimension resonates with the stakeholder-oriented approach advocated by Freeman et al. (2010) and the community engagement practices identified by Siregar and Pinagara (2022) in the Indonesian MSME context. However, this study departs from existing frameworks in two significant ways. First, the emergence of digital adaptation and innovation as a distinct empirical factor extends the conventional Triple Bottom Line (TBL) model, which typically treats technology as a cross-cutting enabler rather than a standalone sustainability dimension. This finding is consistent with recent studies highlighting the transformative role of digitalization in MSME sustainability (Liu et al., 2024; Sarfo et al., 2026), but it challenges frameworks that subsume digital capability under economic or operational performance (Caldera et al., 2019). Second, the social dimension in this study incorporates locally grounded indicators such as contributions to traditional activities (I14) and maintaining environmental order in residential areas (I13), reflecting the cultural value of *Hamemayu Hayuning Bawana* in Yogyakarta. This contextual specificity departs from generic social performance frameworks that emphasize formal corporate social responsibility (CSR) reporting, which is largely irrelevant for micro-enterprises in informal settings (Dari, 2024; Moore & Manring, 2009). These departures underscore the need for sustainability measurement frameworks that are sensitive to local institutional and cultural contexts, particularly in developing economies where informal norms shape business practices.

Overall, the four dimensions derived from the EFA provide a more contextual measurement model compared to top-down global ESG metrics. This model successfully accommodates the characteristics of informality, reliance on communal resources, and the local cultural values of Yogyakarta (Hair et al., 2019; Juergensen et al., 2020). The empirical validity obtained through the KMO test (0.768) and a significant Bartlett's test confirms that this instrument is suitable for assessing the sustainable performance of F&B MSMEs in regions with similar characteristics.

CONCLUSION AND FURTHER RESEARCH

This study developed a preliminary sustainable performance measurement framework for Food and Beverage (F&B) Micro, Small, and Medium Enterprises (MSMEs) by identifying the underlying factor structure of 17 sustainability indicators using Exploratory Factor Analysis (EFA). The objective of this research, to identify and preliminarily structure context-specific sustainable performance indicators for F&B MSMEs in Yogyakarta, has been fulfilled. The findings reveal a preliminary four-factor structure comprising economic performance (4 indicators), environmental performance (5 indicators), social performance (5 indicators), and digital adaptation and innovation (3 indicators), collectively explaining 66.98% of the total variance. The adequacy of the data for factor analysis was supported by the Kaiser-Meyer-Olkin (KMO = 0.768) measure and a significant Bartlett's Test of Sphericity ($p < 0.05$). However, consistent with the exploratory nature of this study, the proposed framework requires further validation through Confirmatory Factor Analysis (CFA) using larger samples before it can be considered a fully validated measurement instrument. These findings suggest that sustainable performance in F&B MSMEs extends beyond

conventional financial measures by incorporating environmental stewardship, community-oriented social responsibility, and digital capabilities that support operational transparency and resource efficiency.

From a theoretical perspective, this study extends the application of the Triple Bottom Line (TBL) framework ([Elkington, 1997](#)) within the context of F&B MSMEs by identifying digital adaptation and innovation as an empirically distinct factor. Rather than replacing the traditional economic, environmental, and social dimensions of TBL, digital adaptation is better interpreted as an enabling capability that strengthens organizations' capacity to achieve sustainability outcomes across all three dimensions. Furthermore, the findings support the Natural Resource Based View (NRBV) ([Hart, 1995](#)) by confirming that environmental practices, particularly waste management and resource efficiency, constitute a source of competitive advantage for microenterprises. However, the emergence of social performance as a distinct dimension, encompassing local community engagement and traditional values (for example, Hamemayu Hayuning Bawana), complicates the conventional TBL application by demonstrating that in the Yogyakarta context, sustainability is deeply embedded in sociocultural obligations rather than purely voluntary corporate responsibility. This finding underscores the need for sustainability measurement frameworks that are sensitive to local cultural contexts, particularly in developing countries where informal institutions and communal norms shape business practices ([Dari, 2024](#); [Freeman et al., 2010](#)). This finding contributes to the growing sustainability literature by suggesting that digital transformation should be incorporated into future sustainable performance frameworks for MSMEs, particularly in resource-constrained business environments.

The practical implications of this study should be interpreted with appropriate caution. As the proposed framework is based on exploratory evidence from a relatively small sample, it should be regarded as a preliminary assessment framework rather than a fully validated measurement instrument. Following further validation using larger and more diverse samples, the framework may provide a useful basis for self-assessment by F&B MSMEs, assist business incubators in designing sustainability capacity-building programmes, and support government agencies in developing contextual sustainability evaluation frameworks for MSMEs ([Caldera et al., 2019](#); [Bappenas, 2021](#); [Santoso et al., 2024](#)). However, these applications require additional empirical confirmation before broader implementation.

Future research should validate the proposed four-factor structure through CFA using larger samples (for example, $n > 200$) to examine its stability and generalizability. Longitudinal studies are also needed to investigate whether improvements in digital adaptation, particularly digital inventory management, contribute to measurable reductions in food loss over time ([Sarfo et al., 2026](#)). Furthermore, comparative studies across different regional contexts could provide deeper insights into the influence of local sociocultural characteristics on sustainable performance measurement and clarify whether digital adaptation consistently functions as an enabling capability or evolves into an independent sustainability dimension.

LIMITATIONS

This study should be interpreted in light of several limitations. First, the findings are based on a relatively small non-probability sample of 85 Food and Beverage (F&B) MSMEs, yielding a 5:1 respondent-to-item ratio (85 respondents for 17 items). While this ratio meets the minimum threshold for Exploratory Factor Analysis ([Hair et al., 2019](#)), it remains at the lower boundary of acceptability and limits the statistical generalizability of the identified factor structure. Second, the number of factors retained was determined using the eigenvalue-greater-than-one criterion ([Kaiser, 1960](#)). This criterion is known to potentially over-extract factors, particularly in exploratory studies with limited sample sizes; therefore, the four-factor solution should be

interpreted with caution and subjected to further validation using alternative methods such as parallel analysis or scree plot examination (Cattell, 1966; Watkins, 2018). Third, the study is susceptible to common method bias, as a single respondent per firm answered a single cross-sectional instrument measuring their own sustainability practices. This design, combined with self-reported data, may artificially inflate observed relationships and compound the social desirability bias already acknowledged (Podsakoff et al., 2003). Fourth, the study was conducted within a single regional context (Yogyakarta), and the resulting sustainability dimensions may reflect contextual characteristics that differ from those of MSMEs operating in other regions. Fifth, although the study included MSMEs, the representation across micro, small, and medium enterprise categories may not be fully balanced, potentially limiting the applicability of the findings to all business sizes. Methodologically, the study employed Principal Component Analysis (PCA) as the extraction method within an exploratory framework to identify the preliminary factor structure. Consequently, the resulting model should be regarded as an exploratory measurement framework rather than a finalized instrument. Furthermore, the absence of comprehensive reliability assessment and Confirmatory Factor Analysis (CFA) means that the stability, internal consistency, and construct validity of the proposed measurement model have not yet been fully established. Accordingly, the instrument should be interpreted as a preliminary framework requiring further empirical validation before broader application.

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