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Strategic Resource Management for Sustainability Performance: Sequential Mediation of Farmer Empowerment and ESG Practices in Agriculture

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A B S T R A C T

The agricultural sector faces growing pressure to achieve food security while improving economic, social, and environmental sustainability, particularly in developing countries where smallholder farmers face resource, technological, and institutional constraints. This study examines the effects of resource management strategies, farmer empowerment, and Environmental, Social, and Governance (ESG) practices on sustainability performance, including the sequential mediating roles of farmer empowerment and ESG practices, and identifies strategic priorities using Importance–Performance Map Analysis (IPMA). Using an explanatory quantitative approach, we collected data through a cross-sectional survey of 138 agricultural actors in Indonesia's food crop and horticultural sectors, using purposive sampling. We analysed the data using PLS-SEM in SmartPLS 4.0 and IPMA. The findings show that resource management strategies, farmer empowerment, and ESG practices significantly improve sustainability performance. Farmer empowerment and ESG practices partially mediate the relationship between resource management and sustainability outcomes, including sequential mediation. IPMA identifies resource management strategy as the most critical factor. Theoretically, the study extends the Resource-Based View and capability approach by demonstrating that sustainability depends not only on resource availability but also on how resources are transformed through empowerment and sustainable governance. Practically, it highlights the need to strengthen resource management, farmer capacity, and ESG integration among agricultural actors, farmer organisations, and agribusiness communities.

Contribution to Sustainable Development Goals (SDGs):
SDG 2: Zero Hunger
SDG 8: Decent Work and Economic Growth
SDG 12: Responsible Consumption and Production
SDG 13: Climate Action

1. INTRODUCTION

1.1. Research Background

The global agrifood system faces the dual imperative of ensuring food security and reducing environmental and social burdens. Agriculture must increase the availability, accessibility, and stability of food for a growing population; however, it must do so amid intensifying climate variability, biodiversity loss, soil degradation, water scarcity, and socioeconomic inequality [1–3]. Agrifood systems contribute substantially to planetary greenhouse gas emissions and are highly vulnerable to climate-related disruptions, which threaten prolonged agricultural productivity and nutritional security [1,4]. At the production level, excessive dependence on chemical inputs, inefficient water and energy use, land conversion, and inadequate waste management continue to degrade ecological systems and weaken

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farming communities' adaptive capacity [5–8]. These interconnected pressures indicate that agricultural performance can no longer be evaluated solely by productivity and profitability. Instead, sustainability performance must reflect the immediate achievement of economic viability, environmental integrity, social well-being and institutional accountability.

Indonesia, an agrarian country with substantial agricultural potential, plays an essential role in supporting national economic growth and food systems. The agricultural sector continues to contribute significantly to employment and economic activity, particularly in food crop and horticulture production. However, the transition toward sustainable agriculture in Indonesia continues to face considerable structural challenges, particularly among smallholder farmers, who often have inadequate access to technology, financial capital, agricultural advisory services, and market integration [9,10]. In several production areas, conventional farming practices remain dominant, characterized by intensive chemical inputs, low resource-use efficiency, and limited adoption of environmentally responsible innovations [11]. These conditions limit the environmental sustainability, durability, and resilience of agricultural structures. Therefore, strengthening sustainability performance in agriculture requires more effective resource strategies, stronger farmer empowerment, and responsible governance practices to support sustainable agricultural transformation.

Resource Management Strategy constitutes a central foundation for this transition because agricultural production depends on the coordinated use of land, water, labour, capital, knowledge, inputs, infrastructure, networks, and technology. From a resource-based and resource orchestration perspective, sustainability does not arise simply from possessing productive resources. It depends on the capacity to acquire, structure, combine, allocate, and reconfigure resources in response to environmental change. An Effective Resource Management Strategy can increase input efficiency, reduce production losses, support technology adoption, improve adaptive capacity, and minimise environmental damage [3,12]. Previous studies have emphasized that sustainable agricultural development depends on the ability to manage resources efficiently while balancing economic viability, environmental protection, and social welfare [10,13,14]. Under increasing climatic and economic uncertainty, the ability to adapt resource allocation and reorganize production processes is particularly relevant for maintaining long-term agricultural performance [15]. Therefore, the Resource Management Strategy can be considered not only an operational function but also a core competence that shapes the economic, environmental, and social outcomes of agricultural systems and their long-term sustainability.

Nevertheless, effective resource management strategies and sustainability in agriculture cannot be achieved solely through accessibility and allocation of productive resources. The effectiveness of agricultural resource utilisation largely depends on farmers' potential to access, manage, and transform available resources to support sustainable agricultural practices. In this context, farmer empowerment is increasingly important as a strategic process to strengthen farmers' capacities by enlightening access to information, technology, financial resources, organized support, and participation in decision-making [10,16]. Empowered farmers tend to demonstrate greater adaptive capacity and are better positioned to embrace agricultural innovations and sustainable farming approaches that support long-term resilience [17]. Empowerment also shifts farmers' position from passive recipients of agricultural assistance to active decision-makers who can determine how resources should be used to achieve livelihood and sustainability, serving as a capability-building mechanism through which resource management strategies can produce broader economic, environmental, and social outcomes [10].

The perception of Environmental, Social, and Governance (ESG) was initially developed for large corporations, capital markets, and corporate sustainability disclosures[18][13][19]. However, applying it in the small agricultural sector requires adaptation based on institutional characteristics, limited resources, and farmers' management practices. ESG is not only a formal obligation but also a range of operational approaches that reflect farmers' ability to manage resources responsibly and sustainably. Farmers play a key role in integrating resource efficiency, economic resilience, social responsibility, and strengthening local institutions [20,21]. Therefore, this study adapts ESG to the agricultural sector through three main dimensions: Environmental, which includes input use efficiency, soil and water conservation, environmental impact reduction, waste management, and climate change adaptation; Social, which includes farmer empowerment, welfare, job safety, community relations, and inclusive access to resources; and Governance, which is translated through local governance mechanisms such as transparency of farmer groups, division of roles, collective decision-making, recording of farming activities, simple traceability of products, and accountability of resource use[22][23][24].

Despite the growing scholarly attention to sustainability in the tourism industry. important gaps remain in explaining how sustainability performance is achieved within agricultural systems. Extensive research has documented the direct connections between strategies for resource management, farmers' empowerment, ESG practices, and sustainability performance [14,21,25,26]. ESG-oriented approaches have increasingly been linked to sustainability outcomes through environmental responsibility, social inclusion, and governance quality [13,17]. Conversely, examining these relationships in isolation has largely led to a disconnected understanding of the pathways through which sustainability performance emerges in agrarian systems. In addition, empirical findings on ESG practices remain inconclusive across agricultural contexts, particularly in sectors dominated by smallholder farmers and institutional limitations [1,26], where inconsistencies in ESG relationships imply that ESG practices do not affect operational and financial performance. An Effective Resource Management Strategy has been associated with improved productivity and resilience, whereas farmer empowerment enhances farmers' adaptive capacity and participation in sustainable agricultural practices. However, farmer empowerment is still studied separately from agricultural management and sustainability research, with prior research often assessing empowerment as a result of technological and social adoption [26–28].

Research on agricultural sustainability, resource management strategies, farmer empowerment, ESG practices and sustainability performance has grown rapidly. However, important gaps remain in explaining the mechanisms that link resource management strategies, farmer empowerment, ESG practices, and agricultural sustainability performance in an integrated manner. Most previous studies still tend to test the

direct or partial relationship between Resource Management Strategy, farmer empowerment, ESG practices, and sustainability performance, thus providing no comprehensive understanding of the process of transforming resources into sustainable performance in the agricultural system [29–32]. In addition, research on ESG in the agribusiness sector remains dominated by the context of large companies and agribusinesses listed on capital markets, making it less representative of the actual conditions of smallholder farmers in developing countries, who have inadequate access to capital, technology, and institutions [33,34]. ESG studies also show inconsistent results regarding sustainability performance, indicating the presence of important mediating variables that have not been widely explored, especially the role of farmer empowerment as a connecting mechanism between Resource Management Strategy, ESG, and sustainability implementation [35–37]. However, studies on smallholder empowerment are still often treated as an outcome of development interventions or technology adoption, rather than as a key process that transforms resources into sustainable practices [17,27,28].

This study offers conceptual and empirical novelty by developing an integrative model that explains that sustainability performance in the agricultural sector is not solely determined by resource elements or ESG policies but by a sequential transformation process involving resource management strategies, farmer empowerment, and ESG practices simultaneously. In contrast to previous studies, which tended to be partial and focused on the direct relationship between variables. This study places farmer empowerment as a micro-foundation that bridges the transformation of resources into farmer capacity, while ESG is an institutional and operational capability at the level of farming businesses, especially in small agricultural systems. Sustainability governance is realised more through the capacity of farmers and agricultural organisations to collectively manage information, technology, social relations, and production resources. From this perspective, ESG in this study is situated as a strategic mechanism that encompasses Resource Management Strategy, farmer empowerment, and sustainability performance achievement in the context of small-scale agriculture. Thus, this study expands the perspectives of the Resource-Based View and competence-based approach by emphasising that agricultural sustainability depends not only on the availability and efficiency of resource management strategies but also on social, institutional, and governance capabilities to translate them into effective ESG practices. In addition, the methodological involvement of this research is bolstered through the amalgamation of PLS-SEM analysis and Importance–Performance Map Analysis (IPMA), which not only explains the causal relationships between variables but also identifies the strategic priorities of the factors that most influence improving sustainability performance. Hence, this study offers new insights into the literature on sustainability performance in agriculture through a sequential mediation model approach among smallholder farmers in developing countries and provides more applicable policy implications for strengthening sustainable agricultural systems in developing countries.

1.2. Literature Review

1.2.1 Agricultural Sustainability Performance

Sustainability performance refers to the level of success of farming businesses in increasing economic benefits, maintaining environmental quality, and improving social welfare simultaneously. Agricultural performance is measured not only by farmers' productivity and income but also by economic dimensions, including productivity, income, profit, cost efficiency, production stability, market access, risk management, and sustainability. Environmental dimensions include soil health, water efficiency, reduced chemical use, waste reduction, biodiversity protection, and adaptability to climate change. Social dimensions that include farmers' welfare, job security, inclusion, food security, gender equality, quality of community relations, and institutional sustainability of agriculture [38–40]

The application of sustainable agriculture can increase input-use efficiency and reduce production risk [41]. In addition, a community-based farmer participation system has the potential to increase economic feasibility and support agroecological production [42].

1.2.2. ESG Practice

ESG practice is understood as the solicitation of Environmental, Social, and Governance standards. In this study, the concept of ESG was contextualised according to the characteristics of smallholder agricultural practices. In contrast to the implementation of ESG in large companies, which is generally oriented towards sustainability disclosure, regulatory compliance, and formal governance structures[43][13], ESG in smallholder agriculture places more emphasis on operational practices that enable farmers to responsibly manage agricultural resources, social relationships, and institutions. Thus, ESG is not seen as a corporate reporting mechanism but as the capability of farmers and agricultural organisations to incorporate environmental, social, and governance responsibilities to improve the sustainability of farming systems [20,33].

In the Environmental dimension, ESG includes the capability of farmers to efficiently manage the use of water, soil, fertilisers, pesticides, energy, and agricultural waste to reduce ecological stress, improve input efficiency, maintain productivity, and strengthen the resilience of farming to climate change through the adoption of sustainable technology and environmental adjustment approaches [7,11]. The social dimension of ESG relates to farmers' welfare, job safety, social relations in agricultural communities, involvement of farmer groups, and inclusive access to information, technology, and economic opportunities[44][45]. Meanwhile, the Governance dimension does not use corporate governance indicators such as the structure of the board of directors, formal audits, or sustainability reports because it is not in accordance with the characteristics of smallholders. Governance of smallholders through local governance mechanisms, such as the transparency of farmer organisations, division of roles and responsibilities, participation of members in decision-making, recording of farming activities, simple traceability of products, and accountability of resource use [26][30]. The Resource-Based View (RBV) and dynamic capabilities perspective, which asserts that sustainability is not only determined by resource ownership, but also the ability of local thespians to organize, survive, and reconfigure resources through contextually appropriate institutional mechanisms[29,30,46]

H_1: ESG Practice has a substantial and meaningful consequence on farmer empowerment

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1.2.3. Farmer Empowerment

Farmer empowerment is the process of improving farmers' ability to control resources, make decisions, access information and markets, participate in institutions, and determine the direction of farming development. Farmer empowerment is not only about improving technical skills but also about developing non-technical skills, such as confidence, leadership, time management, decision-making, and farmers' bargaining position [16].

Therefore, resource strategies must be accompanied by capacity building, changes in norms, and farmer participation to be effective. Farmer empowerment is directed toward creating farmers who are professionals in managing businesses, responding to the market, and utilising technology to support sustainable agriculture [47].

H_2: Farmer empowerment has a substantial and meaningful consequence on ESG Practices

H_3: Farmer empowerment has a substantial and meaningful consequence on Agricultural Sustainability Performance

H_8: Farmer empowerment positively and significantly influences Sustainability Performance, sequentially mediated by ESG Practice

1.2.4. Resource Strategies in Sustainable Agriculture

The concept of the Resource Management Strategy describes the process of managing agricultural resources to simultaneously produce economic, social, and environmental value. The Resource Management Strategy is defined as the decisions and actions taken by farmers to acquire, integrate, develop, and utilise financial, human, technological, natural, relational, and institutional resources to assist the sustainability of agricultural enterprises. This concept is based on a resource-based view that an organisation's excellence is determined by its ability to manage resources [48].

In the agricultural sector, resource strategies are not limited to land, capital, production tools, seeds, fertilizers, and infrastructure but can also provide greater access to information, technology, markets, financing, and institutional networks. Technology must be supported by human resource capacity, financing, governance, institutional support, and farmers' ability to adapt to local conditions [49]. These resources support sustainability [29].

H_4: Resource Management Strategy has a substantial and meaningful impact on ESG Practice

H_5: Resource Management Strategy has a substantial and meaningful consequence on farmer empowerment

H_6: Resource Management Strategy has a substantial and meaningful effect on sustainability performance

H_7: Resource Management Strategy positively and significantly affects ESG Practice mediated by Farmer Empowerment

H_9: Resource Management Strategy positively and significantly determines sustainability performance, mediated by Farmer Empowerment

H_{10}: Resource Management Strategy positively and significantly determines Sustainable Performance mediated by ESG Practice

H_{11}: Resource Management Strategy positively and significantly affects ESG Practice, sequentially mediated by Farmer Empowerment and ESG Practice

1.3. Research Objective

This study seeks to accomplish the following: (1) evaluate the direct effects of resource management strategies, farmer empowerment, and ESG practices on sustainability performance; (2) examine the sequential mediating roles of farmer empowerment and ESG practices; and (3) identify strategic priority factors influencing sustainability performance using the Importance–Performance Map Analysis (IPMA) approach.

2. MATERIALS AND METHODS

A quantitative explanatory study scheme was used to scrutinise the relationships between sustainability performance, ESG practices, farmer empowerment, and resource management strategies in the agricultural industry. An explanatory technique was deemed appropriate because this study sought to observe both direct and indirect relationships among latent variables within an integrated conceptual framework. To document participants' opinions on agricultural sustainability techniques and resource management strategies, this study used a cross-sectional assessment approach, in which data were acquired at a specific moment. A systematic questionnaire managed via an online survey platform (Google Forms) was used to obtain primary data directly from the respondents. The use of primary data enabled the study to obtain contextual information and perception-based assessments from respondents directly involved in agricultural activities in the region. The instrument consisted of two segments: respondent descriptions and construct measurement. All measurement items were derived from the relevant literature and measured using a Likert scale to evaluate the respondents' opinions concerning the variables under investigation.

The population in this study consisted of agricultural thespians involved in the food crop and horticulture sectors in Indonesia. Based on the research focus on sustainability performance, the respondents included individuals directly involved in agricultural management and decision-making processes, particularly farmers, farmer cooperative administrators, and agribusiness participants. This study used a purposive sampling technique with a criterion-based approach to ensure that the respondents were suitable for the research ideas of this study. The criteria for respondents included active involvement in agricultural activities related to food crops or horticulture, a role in managing farming or agricultural decision-making, and willingness to complete the questionnaires.

Considering the intricacy of the structural model and the number of measurement indicators, the sample size was determined based on the threshold criterion for PLS-SEM. Following the recommendation of Hair and Alamer [50], the minimum sample size should be at least five times the number of indicators in the measurement model. Given that there were 24 measuring items in this study, a minimum sample size of 120 respondents was required. A total of 138 valid responses were obtained and included in this study sample.

Measurement indicators from the extant literature were used to operationalise the research variables to ensure construct validity and conceptual relevance of the measurement tools. Indicators linked to resource planning, allocation efficiency, and monitoring and control were used to gauge Resource Management Strategy plans and technology utilisation in

agricultural activities [8,46,51]. Farmer empowerment was assessed using indicators reflecting access to information, resources, and capital, and contributions to agricultural decision-making processes [10,28,52,53]. ESG practices were measured based on three principal dimensions: environmental, social, and governance practices in agricultural management [20,22,33]. Indicators reflecting economic, social, and environmental factors have been used to evaluate sustainability performance [1,26,40]. Respondents indicated their level of agreement with each statement using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) for all measurement items. The measurement scale was selected because it is widely applied in perception-based studies and provides adequate variability for examining latent constructs in structural equation modelling.

Partial Least Squares Structural Equation Modelling (PLS-SEM) and SmartPLS 4. The program was used for the data analysis. PLS-SEM was chosen because it is well-suited for examining byzantine relationships among latent variables, including mediation effects, while accommodating relatively small sample sizes and predictive-oriented research models [54,55]. The analysis was performed in two steps: assessing the measurement model (external model) first. Internal uniformity reliability was estimated using composite reliability and Cronbach's alpha, whereas indicator reliability was checked using outer loading values. Discriminant validity was gauged using the Fornell–Larcker criterion, whereas convergent validity was evaluated using the Average Variance Extracted (AVE). The second phase evaluated the structural (inner) model to test the proposed relationships among the variables. Structural model evaluation entailed the coefficient of determination (R^2), direct and indirect effect testing, and the model's predictive relevance. To further identify strategic priorities for improving sustainability performance, this study employed Importance–Performance Map Analysis (IPMA). IPMA classified variables and indicators with high importance but relatively low performance, providing practical implications for strategic interventions in agricultural sustainability.

3. RESULT AND DISCUSSION

3.1. Respondent Characteristics

To provide a gestalt of the report of agricultural thespians engaged in this study, the respondents' demographic descriptions were examined. The respondent profile included gender, age, occupation, farming experience, commodity type, and participation in farmer organisations. Table 1 presents the allocation of respondents' characteristics.

Table 1. Respondent Characteristics

Characteristics	Category	Frequency	Percentage (%)
Gender	Male	62	45
	Female	76	55
Age	< 25 years	78	57
	26–35 years	41	30
	36–45 years	6	4
	46–55 years	8	6
	> 55 years	5	4
Occupation	Farmer	79	57
	Farmer cooperative management	49	36
	Agribusiness company	10	7
Farming Experience	< 5 years	100	72
	6–10 years	27	20
	11–20 years	6	4
	> 20 years	5	4
Commodity Type	Food crops	81	59
	Horticulture	57	41
Participation in Farmer Organizations	No	36	26
	Yes, active	69	50
	Yes, inactive	33	24

Source: First-hand data evaluated using SmartPLS 4.0 (2026)

Table 1 presents the profiles of the survey participants. A total of 138 respondents participated, with female respondents constituting the majority (55%). Most respondents were below 35 years of age (87%), indicating a relatively young and productive agricultural workforce. By occupation, farmers were the largest group (57%), followed by actors involved in farmer cooperative management and agribusiness-related activities. Most respondents reported fewer than five years of farming experience. (72%), suggesting that a substantial proportion of agricultural actors were in the early stages of agricultural management and business development. Food crop farming accounted for the largest share of agricultural commodities (59%), followed by horticultural commodities (41%). These characteristics indicate that this study represents young farmers, new farm managers, and progressive agribusiness actors, who tend to be more open to technology, learning, capacity building, and implementing ESG practices.

The dominance of young respondents can influence the relationships between resource management strategies, farmer empowerment, ESG practices, and sustainability performance. Young agricultural actors generally have a relatively higher entrepreneurial orientation, digital literacy, openness to innovation, and adaptability than traditional farmers. Therefore, the results of this study cannot be directly oversimplified to all

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smallholders in Indonesia, especially elderly farmers, subsistence farmers, farmers who are not members of organisations, and farmers with limited exposure to digital capital, technology, and extension services. Nevertheless, these respondents' characteristics still contribute meaningfully to explaining the process of sustainability transformation among the new generation of agricultural actors.

Measurement Model

Before examining the structural relationships among the variables, we assessed the measurement model to evaluate the validity and reliability of the constructs used in this study. We evaluated convergent validity using outer loading values and average variance extracted (AVE), and construct reliability using Cronbach's alpha and composite reliability (CR). According to [50], outer loading values above 0.70 indicate adequate indicator reliability, CR values above 0.70 demonstrate internal consistency, and average variance extracted (AVE) values above 0.50 confirm convergent validity. Table 2 reports the measurement model assessment results.

Table 2. Measurement Model Evaluation

Variable / Indicator	Outer Loading	Cronbach's Alpha	Composite Reliability (*rho_c*)	AVE	Remarks
ESG Practice					
ESGP1	0.753	0.896	0.921	0.661	Meets criteria
ESGP2	0.830				
ESGP3	0.887				
ESGP4	0.783				
ESGP5	0.861				
ESGP6	0.754				
Farmer Empowerment					
FE1	0.833	0.902	0.924	0.672	Meets criteria
FE2	0.861				
FE3	0.727				
FE4	0.755				
FE5	0.847				
FE6	0.883				
Sustainable Performance					
SP1	0.790	0.915	0.934	0.703	Meets criteria
SP2	0.791				
SP3	0.868				
SP4	0.878				
SP5	0.829				
SP6	0.871				
Resource Management Strategy					
SRM1	0.839	0.901	0.924	0.671	Meets criteria
SRM2	0.889				
SRM3	0.801				
SRM4	0.711				
SRM5	0.864				
SRM6	0.797				

Source: First-hand data evaluated using SmartPLS 4.0 (2026)

Table 2 presents the measurement model assessment results. Overall, all constructs fulfilled the recommended criteria for convergent validity and reliability, as indicated by outer loading values higher than 0.70, Cronbach's alpha values above 0.70, composite reliability values greater than 0.70, and average variance extracted (AVE) values beyond the minimum threshold of 0.50. These findings indicate that all gauges were statistically reliable and valid for measuring their respective constructs; therefore, no indicators were eliminated from the models used.

Among the constructs, Sustainable Performance demonstrated the highest convergent validity, with outer loadings ranging from 0.790 to 0.878 and an AVE of 0.703. SP4 had the strongest indicator contribution (0.878), while SP1 had the lowest loading (0.790). Meanwhile, ESG Practice showed outer loadings alternating from 0.753 to 0.887, confirming that all indicators adequately represented ESG-related practices. For Farmer Empowerment, outer loadings ranged from 0.727 to 0.883, with FE6 showing the strongest contribution. Furthermore, the Strategy Resource Management Strategy demonstrated satisfactory measurement properties, with outer loadings ranging from 0.711 to 0.889, signifying that all indicators were appropriate for measuring the Resource Management Strategy in agricultural settings.

Structural Model

The structural model was assessed to analyse the proposed relationships among the variables and to assess the model's ability to explain the observed outcomes. The evaluation included direct effect testing, mediation analysis, and the coefficient of determination (R^2) to examine the extent to which resource management strategies, farmer empowerment, and ESG practices contribute to the agricultural sustainability performance. Hypothesis testing was performed based on path coefficients (original sample), T-statistics, and p-values. A relationship was deemed statistically significant whenever the T-statistic exceeded 1.96, and the p-value was below 0.05.

Table 3. Results of Direct Effect Testing

Relationship	β	T Statistics	P Values	Remarks
ESG Practice → Sustainable Performance	0.432	3.872	0.000	Hypothesis accepted
Farmer Empowerment → ESG Practice	0.577	5.850	0.000	Hypothesis accepted
Farmer Empowerment → Sustainable Performance	0.608	6.826	0.000	Hypothesis accepted
Resource Management Strategy → ESG Practice	0.668	6.984	0.000	Hypothesis accepted
Resource Management Strategy → Farmer Empowerment	0.508	4.376	0.000	Hypothesis accepted
Resource Management Strategy → Sustainable Performance	0.629	6.553	0.000	Hypothesis accepted

Source: First-hand data evaluated using SmartPLS 4.0 (2026)

Table 3 demonstrates that all hypothesised relationships among the variables are constructive and statistically significant, postulating robust empirical support for the suggested model. This finding is evidenced by the positive path coefficients, t-statistics exceeding the 1.96 threshold, and p-values below 0.05.

ESG practices have been shown to positively influence sustainable performance ($\beta = 0.432$, $T = 3.872$, $p < 0.001$), implying that implementing environmental responsibility, social inclusion, and transparent governance mechanisms makes a real contributes to agricultural sustainability performance. These results are consistent with the Resource-Based View (RBV), which posits that an organisation's ability to manage resources in an environmentally friendly and efficient manner strengthens sustainability outcomes [56]. The results of this study are consistent with those of [33], who found that ESG performance contributes to improving agricultural sector performance. These findings are also reinforced by [57], who showed that ESG improves the green development of agricultural and forestry companies through green innovation, resource allocation efficiency and improved quality of human capital. The outcomes of this study show that ESG principles apply not only to large companies but also to small farming systems through contextual practices. The positive influence of ESG on sustainability performance does not come from formal sustainability reporting mechanisms as a company's ESG practices but from the ability of farmers to implement operational behaviours that are responsible for the environment, community, and farm management. Thus, ESG in the smallholder agriculture sector serves as an institutional capability mechanism that helps farmers convert available resources into sustainable farming practices.

Farmer empowerment significantly improves ESG practices ($\beta = 0.577$, $T = 5.850$, $p < 0.001$) and sustainability performance ($\beta = 0.608$, $T = 6.826$, $p < 0.001$). These outcomes support the multidimensional empowerment literature that emphasises the integration of resource access, decision-making capacity and individual agency [16]. Farmers empowered through access to information, capital, technology, and involvement in strategic decision-making are better able to adopt environmentally friendly, socially inclusive, and accountable practices. This is aligned with the outcomes [1,17] that 4.0 technologies, such as sensors, digital applications, and monitoring systems, enable farmers to increase their adaptation to ESG practices. Access to technology can support sustainable agricultural practices through improved information flow, market linkages, and access to economic opportunities[58].

The key findings indicate that the Resource Management Strategy has the strongest influence on ESG practices ($\beta = 0.668$, $T = 6.984$, $p < 0.001$), suggesting that effective resource allocation and management are critical for implementing environmentally and socially responsible agricultural practices. These outcomes are in line with the Resource-Based View (RBV) literature, thereby confirming that an organisation's ability to allocate resources strategically, equitably, and long-term is fundamental to the success of sustainability strategies [11,36].

Resource Management Strategy also significantly affected sustainable performance ($\beta = 0.629$, $T = 6.553$, $p < 0.001$) and farmer empowerment ($\beta = 0.508$, $T = 4.376$, $p < 0.001$). These results confirm that the Resource Management Strategy not only develops production efficiency but also strengthens agricultural and socio-economic capacity by providing access to technology, training, and institutional networks that encourage involvement in decision-making. This strengthens the position of farmers as central actors in sustainable agricultural systems [59], and A Good Resource Management Strategy, by ensuring the availability of capital, labour, technology, information, land, water, facilities, and institutions, can improve sustainability performance activities [29]. The results of this study are concordant with studies steered by [30] that human, natural, and social capital contribute to agricultural efficiency,

Overall, these findings confirm that agricultural sustainability performance is influenced not only by the availability and allocation of resources but also by farmer empowerment and interrelated ESG practices. The respondents were predominantly young agricultural actors with relatively limited farming experience and high engagement with agricultural organisations. Younger farmers may be more open to technology adoption, organizational participation, and sustainability practices, which may influence the observed relationships between resource management strategies, farmer empowerment, ESG practices, and sustainability performance. Previous studies [1,24] emphasise the direct interconnection among resource management strategies, farmer empowerment, and ESG practices, providing empirical evidence that effective sustainability strategies require the integration of resource capacity, strengthening of social actors, and adoption of sustainability-oriented governance. Therefore, the importance of

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a systemic approach, rather than focusing on a single dimension, lies in improving sustainable agriculture performance.

Thus, strategies to improve sustainable performance should focus on optimising Resource Management and empowering farmers through access to models and information, participation, and the implementation of ESG, which emphasises environmental efficiency, social inclusion, and transparent governance. Together, these three factors will create an agricultural system that is economically, socially, and environmentally resilient, adaptive, and sustainable.

Table 4. Results of Indirect Effect Testing

Indirect Relationship	Original Sample (β)	T Statistics	P Values	Remarks
Resource Management Strategy → Farmer Empowerment → ESG Practice	0.293	4.120	0.000	Hypothesis accepted
Farmer Empowerment → ESG Practice → Sustainable Performance	0.249	3.111	0.002	Hypothesis accepted
Resource Management Strategy → Farmer Empowerment → Sustainable Performance	0.182	2.762	0.006	Hypothesis accepted
Resource Management Strategy → ESG Practice → Sustainable Performance	0.162	2.587	0.010	Hypothesis accepted
Resource Management Strategy → Farmer Empowerment → ESG Practice → Sustainable Performance	0.127	3.219	0.001	Hypothesis accepted

Source: First-hand data evaluated using SmartPLS 4.0 (2026)

Table 4 demonstrates that wholly indirect relationships are positive and statistically substantial, indicating that farmer empowerment and ESG practices serve as important mediating mechanisms for translating resource management strategies into sustainable performance. These findings confirm that sustainability performance in agriculture is driven not only by direct resource allocation but also by social- and governance-oriented pathways that strengthen farmers' capacity and sustainability practices.

Resource Management Strategy positively and significantly influenced ESG practices through farmer empowerment ($\beta = 0.293$, $T = 4.120$, $p < 0.001$). This pathway shows that efficiency and resource allocation will have a greater impact if farmers' capacities are strengthened. Organisations' ability to mobilise sustainable resources is the main factor in increasing farmers' empowerment, enabling effective implementation of ESG practices. These results align with existing studies [11,27] showing that farmer empowerment strengthens the adoption of sustainability practices by increasing decision-making capacity, enabling farmers to respond to environmentally and socially oriented farming practices. Farmer empowerment is shaped by the provision of assets, advisory services, education, group membership, and involvement in decision-making[30]. These findings are reinforced by [29], who suggests that farmer empowerment can enable the development of resources into ESG in accordance with local conditions.

Farmer empowerment indirectly affects sustainable performance through ESG practices ($\beta = 0.249$, $T = 3.111$, $p = 0.002$). This shows that agricultural empowerment does not directly drive sustainability performance but rather does so through increased adoption of ESG practices. These findings show that farmer empowerment not only increases farmers' knowledge and participation but also affects their operational behaviour and actions. Industry 4.0 technologies, such as IoT sensors and digital programs, provide social (improving food safety and quality), economic (reducing production costs), and environmental (reducing pollution and fertiliser use) benefits. A study [1,60] confirmed that IoT capabilities are crucial for verifying sustainability practices and compliance with ESG standards. These results are also supported by [32], who emphasised that social capital and community capabilities are only effective when accompanied by ESG strategies.

The Resource Management Strategy's effect on sustainable performance was evident through farmer empowerment ($\beta = 0.182$, $T = 2.762$, $p < 0.005$). The Resource Management Strategy's efficiency and quality will not improve sustainability performance without farmer empowerment. These findings confirm that resources do not produce sustainable performance if only capital, technology, land, information, and production facilities are available to improve farmers' capabilities. These findings are reinforced by [20], who emphasised that resource management strategies focused solely on production inputs are less effective without the capabilities and autonomy of field actors. Thus, farmers' welfare and capacity link the Resource Management Strategy to achieving sustainability. These findings are reinforced by research conducted by [31], which states that a collective Resource Management Strategy can strengthen empowerment and improve the sustainability performance of farming businesses.

The Resource Management Strategy also significantly affects sustainable performance through ESG practices ($\beta = 0.162$, $T = 2.587$, $p < 0.005$). This illustrates that resource management strategies enhance ESG sustainability. The Resource Management Strategy provides the material and organizational capacity for the implementation of ESG. In addition, technology can support the use of water, energy, and inputs. Human competence also plays a role in supporting workplace safety and record keeping. Integrating ESG into an organisation's internal management strategy constitutes achieving the Triple Bottom Line (social and environmental economics). [13] ESG in the agricultural sector is inseparable from business thespians' capacity to manage resources and meet stakeholders' needs. In this context, ESG practices focus on using resources that generate economic value while reducing social and environmental risks [57]. Without this pathway, the Resource Management Strategy for sustainability is limited to the organisation's operational level.

The sequential mediation analysis showed that the Resource Management Strategy affected sustainable performance

through sequential farmer empowerment and ESG practices (β = 0.127, T = 3.219, p < 0.001). These outcomes confirm that the combination of farmer empowerment and ESG practices is the main mechanism for transforming the RMG strategy into sustainable performance. The findings expand on the RBV. These results also support the dynamic capabilities perspective, as farmers need the capacity to learn, adapt, integrate knowledge, and reconfigure resources in light of market, climate, and innovation-related changes [29]. This model supports the prior literature, suggesting that effective agricultural sector sustainability is a multilevel framework integrating resource efficiency, local actors' capabilities, and responsive governance frameworks. Thus, sequential mediation serves as a mechanism for sustainability management, linking resource distribution and sustainability performance outcomes.

The results corroborate that agricultural sustainability is achieved through interrelated processes in which resource management strategies increase farmers' capacity, encourage the adoption of ESG practices, and ultimately yield sustainable performance. Efficiency and resource management strategies increase farmers' capacity, drive ESG, and ultimately deliver sustainable performance. Practical strategies to improve sustainability performance include optimising sustainable management, empowering farmers through access to capital, information, and participation, and implementing ESG practices that emphasise environmental efficiency, social inclusion, and transparent governance.

Table 5. Coefficient of Determination (R^2)

Variable	R-Square	R-Square Adjusted
ESG Practice	0.694	0.689
Farmer Empowerment	0.259	0.253
Sustainable Performance	0.727	0.720

Source: First-hand data evaluated using SmartPLS 4.0 (2026)

The results of the determination coefficient test showed that the research model had a strong ability to explain Sustainability Performance (R^2 = 0.727) and ESG Practice (R^2 = 0.694), while Farmer Empowerment (R^2 = 0.259) was relatively moderate. Although these values are still acceptable in social and behavioural research, these results suggest that Resource Management Strategy only partially explains the variation in the process of empowering farmers. This condition can be assumed because farmer empowerment is a multidimensional construct that is influenced not only by the availability of resources but also by the external and internal factors of farmers.

In smallholder agriculture, several factors influence farmer empowerment. Internal factors that influence include farmer capacity, education level, and digital literacy. External factors such as institutional support, extension services, social networks, access to technology, culture, the environment and socio-economic conditions of farmers, quality of services, financing, connection to the market, social capital, participation in farmer organisations, government support, and local leadership capacity of extension also have the potential to affect the smooth empowerment of farmers. Therefore, the relatively moderate R^2 value does not indicate the weakness of the model but illustrates the complexity of the farmer empowerment process involving various mechanisms beyond Resource Management Strategy.

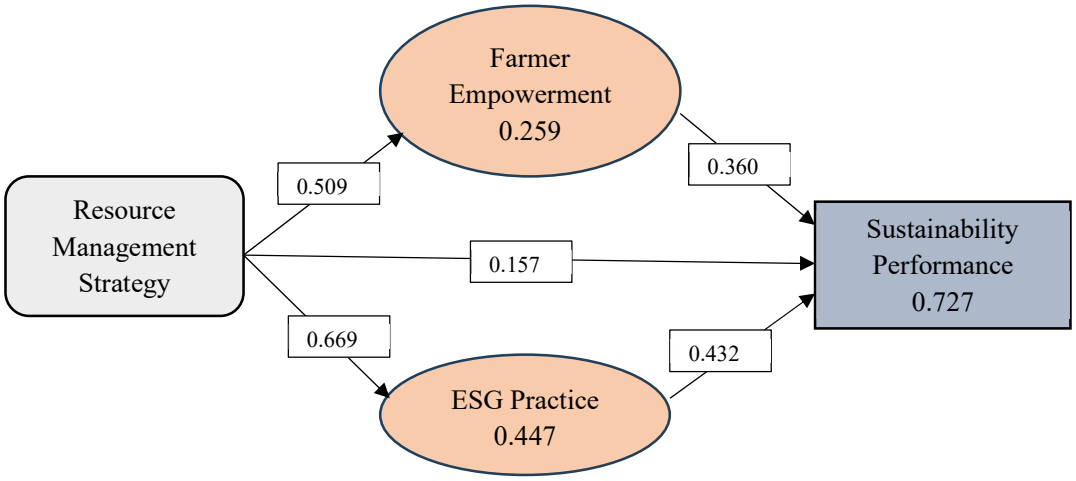

Figure 1. Structural Analysis Result

Importance–Performance Map Analysis (IPMA)

IPMA was employed to ascertain the strategic priority areas for improving the sustainability performance of agricultural systems. Unlike conformist structural model analysis, IPMA explains total effects by simultaneously considering construct performance. This approach enables the identification of variables and indicators that are of substantial importance but have hitherto exhibited relatively low performance, thereby offering practical guidance for managerial and policy interventions to improve sustainability. Tables 6 and 7 present the

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construct-level IPMA results, and Figure 3 illustrates the importance–performance relationship.

Table 6. Construct Total Effect for Sustainable Performance

Construct	Total Effect
ESG Practice	0.432
Farmer Empowerment	0.608
Resource Management Strategy	0.629

Source: First-hand data evaluated using SmartPLS 4.0 (2026)

Table 7. Construct Performance for Sustainable Performance

Construct Performance

Construct	Performance
ESG Practice	82.609
Farmer Empowerment	78.978
Resource Management Strategy	82.992

Source: First-hand data evaluated using SmartPLS 4.0 (2026)

The IPMA standings indicated that the Resource Management Strategy had the highest total effect on sustainable performance (0.629), followed by farmer empowerment (0.608) and ESG practices (0.432). These findings suggest that the Resource Management Strategy is the primary strategic driver of sustainability in agricultural systems. In addition to being the most important, the Resource Management Strategy also showed a relatively high performance score (82.992), indicating that efficient resource allocation, technology utilisation, and agricultural input management have been implemented relatively well and continue to strongly affect sustainability outcomes. These findings correspond with the preceding literature [11,39], which shows that a strategic and efficient Resource Management Strategy is the key to the success of sustainable farm performance through the use of important indicators mapped using the IPMA.

In contrast, ESG practices demonstrated relatively high performance (82.609), although their total effect on sustainable performance was lower than that of Resource Management Strategy and farmer empowerment. This suggests that ESG-related agricultural practices have been implemented relatively well; however, their contribution to sustainability performance remains contingent upon effective resource management strategies and enhanced farmer capacity. [13] emphasised that ESG functions as a governance mechanism that ensures sustainability practices are applied consistently and accountably, while [44] showed that ESG serves as an enabler, integrating resource efficiency, local actors' capabilities, and sustainable agricultural practices.

Farmer empowerment showed a high total effect but relatively lower performance (78.978) than the other constructs. This finding indicates strategic opportunities to strengthen sustainability performance through interventions that improve farmers' information provision, resource inputs, collective participation, and decision-making capacity. Given its strong influence on sustainable performance, improving farmer empowerment may yield substantial sustainability gains, particularly in food crop and horticultural agricultural systems. This is supported by a study by [61], who emphasised that farmer empowerment is a vital mediator in transforming resource efficiency into sustainable performance. Improvement strategies include training programs, technology provision, and policy support to strengthen farmers' decision-making capacity.

Integrating the IPMA results with indicator contributions shows that the strategic path to improving sustainable performance should focus on indicators that are highly important but currently perform poorly. In this study, indicators of farmer empowerment and Resource Management Strategy are the main priorities for intervention through pilot programs, technology provision, and increasing farmer decision-making capacity [61]. This finding supports the finding that farmers. Empowerment plays an important role in transforming resource efficiency into sustainable practice. The IPMA findings also reinforce a structural model showing that Resource Management Strategy and farmer empowerment are the main drivers of sustainable performance, while ESG practices serve as a governance mechanism.

4. CONCLUSION

This study shows that sustainability performance in the agricultural sector cannot be understood as a stand-alone outcome but as a transformation process shaped by the linkage between resource management strategies, farmer empowerment, and ESG practices. The analysis reveals that the strategic Resource Management Strategy is integral to enhancing agricultural sustainability. This enhancement is achieved directly and indirectly through farmer empowerment and the implementation of Environmental, Social, and Governance (ESG) practices. This confirms that agricultural resources are valuable not only because of their availability but also because effective management encourages farmers' capacity and independence.

Furthermore, farmer empowerment has proven to be a key mechanism that bridges the transformation of resources into sustainable practices, which are influenced by institutional, socioeconomic, technological, and other supporting environmental factors. Greater access to information, capital, and decision-making involvement strengthen farmers' ability to manage farming adaptively and sustainably. Conversely, ESG practices serve as an operational instrument that guides agricultural behaviour towards a production system that is more environmentally responsible, socially inclusive, and transparent in governance. The findings of the sequential mediation also confirm that agricultural sustainability is achieved through a gradual process, from Resource Management Strategy and farmer capacity building to the implementation of ESG practices that result in optimal sustainability performance.

Methodologically, PLS-SEM provides empirical evidence of the direct and indirect relationships between variables, while Importance–Performance Map Analysis (IPMA) reinforces the

findings by identifying Resource Management Strategy as the most important factor in improving sustainability performance. Conceptually, this study extends the Resource-Based View and capability approach by emphasising that agricultural sustainability results from the interaction among resources, human capabilities, and governance mechanisms. In practical terms, the findings offer stronger implications for emerging farmers, farmer organisations, and agribusiness actors who are relatively prepared to adopt sustainable practices, while their applicability to the wider population of traditional smallholder agriculture requires further investigation.

5. LIMITATION AND FUTURE STUDY

This study has shortcomings, including the use of purposive sampling, which made respondents more representative of young and relatively progressive agricultural actors, including farmers, farmer cooperative administrators, and agribusiness actors involved in agricultural development. Therefore, the results of this study cannot be directly generalised to the entire population of smallholder farmers in Indonesia, who have more distinct characteristics in terms of age, farming experience, business scale, and access to technology, institutions, and markets. Although the research model shows a strong ability to explain sustainability performance and ESG practices, the R^2 value for Farmer Empowerment (0.259) shows that farmer empowerment is a complex construct and is shaped by various contributing factors separate from the study framework, such as extension services, education levels, digital literacy, social capital, access to financing, market connectivity, institutional support, and government policies. Therefore, further research should use a more heterogeneous sample and include social, institutional, and technological factors to better understand the mechanisms of farmer empowerment and the achievement of sustainable agriculture.

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